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**CONCEPTUAL DESIGN AND DEVELOPMENT MODEL OF  
ASSISTIVE COURSEWARE FOR YOUNG LOW VISION LEARNERS  
(AC4LV)**



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2015**

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## Abstrak

Fokus kajian ini adalah berkaitan teknologi (perkakasan dan perisian) yang dibangunkan khusus untuk golongan kelainan upaya (OKU), yang dikenali sebagai Teknologi Asistif (AT). Dapatan sebelum ini mendedahkan kajian yang berkaitan kandungan pendidikan di dalam koswer adalah tersangat kurang, terutamanya kepada pelajar-pelajar berpenglihatan terhad. Juga, kebanyakan model rekabentuk konsep bagi koswer yang sedia ada mempunyai kekurangan dari segi keperluan khas dan bukti empirikal yang dapat memenuhi keperluan pelajar-pelajar berpenglihatan terhad. Kajian-kajian awal membuktikan aplikasi kandungan sedia ada gagal memenuhi keperluan pelajar-pelajar berpenglihatan terhad dari segi keupayaan capaian maklumat, keupayaan navigasi, dan keupayaan menghibur. Oleh itu, kajian ini mengusulkan sebuah model rekabentuk konsep bagi koswer untuk pelajar-pelajar berpenglihatan terhad yang dinamakan sebagai *Assistive Courseware for Low Vision (AC4LV)*. Empat (4) objektif dibentuk. Metodologi Kajian Sains Rekabentuk telah diadaptasi. Lapan (8) komponen Model Rekabentuk Konsep AC4LV telah dibina dan diintegrasikan: struktur, komposisi kandungan, elemen AC4LV, teori pembelajaran, pendekatan pembelajaran, proses pembangunan, model rekabentuk pengajaran, dan teknologi. Model yang diusulkan telah dinilai dan dikomen oleh 12 orang pakar dan disahkan melalui pembangunan prototaip. Hasil penilaian menunjukkan, model yang diusulkan dapat diterima baik oleh pakar tempatan dan antarabangsa. Pembangunan prototaip mengimplikasikan model tersebut adalah berguna untuk dirujuk oleh pembangun baru dan kurang kemahiran teknikal. Selain itu, dapatan daripada pengujian pengalaman pengguna menunjukkan AC4LV dapat memenuhi keperluan pelajar-pelajar berpenglihatan terhad dari segi keupayaan capaian maklumat, keupayaan navigasi, dan keupayaan menghibur. Semua dapatan ini menunjukkan bahawa Model Rekabentuk Konsep AC4LV memperlihatkan pembangunan yang berguna untuk aplikasi kandungan serta memberi sumbangan dari sudut teori dan praktikal. Kajian ini menyediakan garis panduan untuk membangunkan kandungan pendidikan di dalam koswer yang dapat memenuhi keperluan pelajar-pelajar berpenglihatan terhad supaya kumpulan istimewa daripada OKU ini mendapat peluang pembelajaran yang sama rata.

**Kata kunci:** Teknologi Asistif (AT), Masalah penglihatan, Kandungan kreatif, Model rekabentuk konsep, Koswer.

## Abstract

The focus of this study relates to technology (hardware and software) that is purposely designed for people with disabilities (PWDs), which is called Assistive Technology (AT). Previous findings reveal that studies related to educational content in courseware is highly lacking, particularly for low vision learners. Also, many existing conceptual design models of courseware lack of specific requirements and empirical evidences to cater the needs of low vision learners. Preliminary studies have proven that available content applications fail to cater the needs of low vision learners in terms of information accessibility, navigationability, and pleasurability. Hence, this study proposes a conceptual design model of courseware for low vision learners, named as Assistive Courseware for Low Vision (AC4LV). Four (4) specific objectives are formulated. The Design Science Research Methodology has been adopted. Eight (8) components of Conceptual Design Model of AC4LV have been constructed and integrated: structural, content composition, AC4LV element, learning theories, learning approaches, development process, instructional design model, and technology. The proposed model has been reviewed by 12 experts and validated through prototyping. It was found that the proposed model has been well-accepted by local and international experts. Prototyping has implicated that the model is useful to follow by novice and non-technical developers. On top of that, the findings of user experience testing indicate that the AC4LV is able to fulfill the needs of the low vision learners in terms of information accessibility, navigationability, and pleasurability. All these findings demonstrate that the Conceptual Design Model of AC4LV exhibits useful development for content application as well as providing theoretical and practical contributions of the study. This study provides guidelines for developing educational content in courseware that caters the need of low vision learners so that this particular group of PWDs may gain equal opportunities of learning.

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**Keywords:** Assistive Technology (AT), Creative content, Low vision learners, Conceptual design model, Courseware.

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Nurulnadwan Aziz

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## **List of Abbreviations**

<b>AAC</b>	Augmentative and Alternative Communication
<b>AC</b>	Assistive Courseware
<b>AC4LV</b>	Assistive Courseware for Low Vision
<b>ACS</b>	American Community Survey
<b>ADDIE</b>	Analysis Design Development Implementation
<b>ASHA</b>	American Speech Language Hearing Association
<b>AT</b>	Assistive Technology
<b>CAI</b>	Computer-assisted Instruction
<b>CAL</b>	Computer-assisted Learning
<b>CBT</b>	Computer-based Training
<b>CCTVs</b>	Closed Circuit Televisions
<b>CD</b>	Conceptual Definition
<b>CDHL</b>	Center for Childhood Deafness and Hearing Loss
<b>CDM</b>	Courseware Development Model
<b>EBU</b>	European Blind Union
<b>FCTD</b>	Family Center on Technology and Disability
<b>GRIT</b>	Global Research Innovation and Technology
<b>GUIDE</b>	General User Interface for Disorder of Execution
<b>GPS</b>	Global Positioning System
<b>IDEA</b>	Individuals with Disabilities Education Act
<b>ICT</b>	Information and Communication Technology
<b>IPO</b>	Input-Process-Output

<b>ID</b>	Instructional Design
<b>ISD</b>	Instructional System Development
<b>ILO</b>	International Labor Office
<b>JAWS</b>	Job Access With Speech
<b>KAIMal</b>	Kemahiran Asas Individu Masalah Penglihatan
<b>LD</b>	Learning Disabilities
<b>LFC</b>	Leveraged Freedom Chair
<b>MAB</b>	Malaysian Association for the Blind
<b>ML</b>	Meaningful Learning
<b>MOE</b>	Ministry of Education
<b>MI</b>	Multiple Intelligence
<b>NECIC</b>	National Early Childhood Intervention Council
<b>NICHCY</b>	National Dissemination Center for Children with Disabilities
<b>ODI</b>	Office for Disability Issues
<b>OD</b>	Operation Definition
<b>PWDs</b>	People with Disabilities
<b>PDA</b> s	Personal Digital Assistants
<b>PERS</b>	Personalized Emergency Response Systems
<b>PBL</b>	Problem-based Learning
<b>RLM</b>	Reality Learning Media
<b>SGD</b>	Speech Generating Devices
<b>TDD</b>	Telecommunication Device for the Deaf
<b>TTY</b>	Teletypewriter

<b>TC</b>	Typical Courseware
<b>UK</b>	United Kingdom
<b>UNESCO</b>	United Nations Educational Scientific and Cultural Organization
<b>UCD</b>	User Centred Design
<b>VI</b>	Visual Impairment
<b>VI</b>	Visually-impaired
<b>VOCA</b>	Voice Output Communication Aids
<b>WHO</b>	World Health Organization



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## List of Publications and Awards

### Journals:

- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2014). A comparative analysis on conceptual design model of Assistive Courseware (AC) for visually-impaired learners (AC4VI). *Australian Journal of Basic and Applied Sciences*, 8(4), 75–80. Retrieved from <http://ajbasweb.com/old/ajbas/2014/Special/75-80.pdf>
- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2014). Critical analysis in proposing a conceptual design model of assistive courseware for low vision (AC4LV) learners. *International Journal of Computer Applications*, 92(10), 18–25. doi:10.5120/16044-5173%0A
- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2014). The design principles of Assistive Courseware for Low Vision (AC4LV) learners. *ARNP Journal of Engineering and Applied Sciences*, 3 (10), 1447–1456. Retrieved from [http://www.arnpjournals.com/jeas/research\\_papers/rp\\_2015/jeas\\_0215\\_1614.pdf](http://www.arnpjournals.com/jeas/research_papers/rp_2015/jeas_0215_1614.pdf)
- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2015). Expert review on conceptual design model of Assistive Courseware for Low Vision (AC4LV) Learners. *International Journal of Conceptions on Management and Social Sciences*, 3(2), 35–39. Retrieved from <http://www.worldairco.org/IJCMSS/May2015Paper14.pdf>

### Chapter in Book:

- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2013). Preliminary investigation on creative educational content for visually-impaired (VI) learners. In H. Badioze Zaman, P. Robinson, O. Patrick, T. K. Shih, & S. Velastin (Eds.), *Advances in Visual Informatics* (3rd ed., pp. 408–417). Switzerland: Springer International Publishing. doi:10.1007/978-3-319-02958-0

### Conference Proceedings:

- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2013). A comparative analysis on conceptual design model of Assistive Courseware (AC) for visually-impaired learners (AC4VI). *Proceedings of the International Conference on Engineering and Technology (ICET '13)*, 75–80.
- **Nurulnawati, A., Ariffin, A. M., & Siti Mahfuzah, S.** (2014). Reviews and critiques on learning theories towards proposing a conceptual design model of assistive courseware for low vision (AC4LV) learners.

*Proceedings of the 7th Knowledge Management International Conference (KMICe '14)*, 760–765.

- **Nurulnadwan, A.**, Ariffin, A. M., & Siti Mahfuzah, S. (2014). Conceptual design model of Assistive Courseware for Low Vision (AC4LV) Learners. *Proceedings of the International Conference on Advances in Educational Technology (ICAET '14)*, 44–53.
- **Nurulnadwan, A.**, Ariffin, A. M., & Siti Mahfuzah, S. (2014). Integrating Multimedia Learning Theory in Assistive Courseware for Low Vision (AC4LV) Learners. *Proceedings of the 3rd International Conference on Interactive Digital Media (ICIDM' 14)*.
- **Nurulnadwan, A.**, Ariffin, A. M., & Siti Mahfuzah, S. (2014). The design principles of Assistive Courseware for Low Vision (AC4LV) learners. *Proceedings of the Advancement in Information Technology International Conference (ADVCIT' 14)*, 222-230.
- **Nurulnadwan, A.**, Ariffin, A. M., & Siti Mahfuzah, S. (2015). First cycles of user experience on Assistive Courseware for young Low Vision (AC4LV) learners. *Proceedings of the 5<sup>th</sup> International Conference on Computing and Informatics (ICOCI '15)*, 180-186.

#### Awards:

- **Bronze Medal** at the Malaysian Technology Exhibition 2013 (MTE 2013), Kuala Lumpur:
  - Project Title: *Assistive Learning Materials for Low Vision Learners*
  - Project Members: Ariffin Abdul Mutalib, **Nurulnadwan Aziz**, Siti Mahfuzah Sarif
- **Best Paper Award**
  - 3rd International Conference on Interactive Digital Media (ICIDM 2014) 2-4 December 2014.
  - The Pacific Sutera Hotel @ Sutera Harbour Resort Kota Kinabalu, Sabah.
  - Title: Integrating Multimedia Learning Theory in Assistive Courseware for Low Vision (AC4LV) Learners.
  - Author: **Nurulnadwan Aziz** , Ariffin Abdul Mutalib , Siti Mahfuzah Sarif.
- **Silver Medal** at the National Innovation and Invention Competition Through Exhibition 2015 (iCompEx '15), Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS):
  - Project Title: *Assistive Courseware for Low Vision Children*
  - Project Members: **Nurulnadwan Aziz**, Ariffin Abdul Mutalib, Siti Mahfuzah Sarif



# CHAPTER ONE

## INTRODUCTION

### 1.1 Overview

This introductory chapter provides some background of study which deliberates on issues that lead to the motivation aspects of the study, specification of the problem, preliminary investigation, extraction of research gap, and formulation of research objective. It also discusses the scope and limitations of the study, significance of study, theoretical and research framework, as well as operational definitions of terms used throughout the study.

### 1.2 Background of Study

Everybody is gifted with certain ability. It depends on how far a person can explore their potentials to utilize the abilities optimally. It is similar with disabled people but the approach is definitely dissimilar. In the process of exploring the potentials, learning should take place. However, it is not an easy task for disabled people especially the school-aged children to grasp new knowledge fluently as normal children. Eventhough it is not an easy task, generating knowledge is very important to everybody including the disabled because only knowledge could develop and differentiate the level among people. It is emphasized in the Quran clearly through Surah Az-Zumar [verse: 9]:

The contents of  
the thesis is for  
internal user  
only

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