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☐ M (Master's Thesis)☒ D (Dissertation)**Personal Information**

Last Name Okoth Middle Name or Initial O.

First Name David Country (ies) of Citizenship KENYA

Degree & Dissertation Information

Title of Dissertation/Thesis Design and Development of a Metadata Management Tool for Learning Objects

Institution conferring degree Virginia Polytechnic Institute and State University Degree awarded (abbreviate; e.g., Ph.D.) Ph.D.

College, School, or Division School of Education Year degree awarded 2019

Department or Program Instructional Design and Technology Year manuscript completed 2019

Advisor/Committee Chair Dr. Ken Potter

Committee Member Dr. Barbara Lockee Committee Member

Committee Member Dr. Aaron Bond Committee Member

Committee Member Dr. Alicia Johnson Committee Member

Language of manuscript English

Primary Subject Category: Enter the 4-digit code and category name from Guide 2 that most closely describes the disciplinary area of your research. Code 0447 Category Instructional Design

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Code 0710 Category Educational Technology Code 0515 Category Education

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Learning Objects Reuse Metadata

Instructional Design Technology Design and Development

Current Contact InformationCurrent Email Address okoth@vt.eduStreet Address (line 1) 300 McDonald St Apt 33a

Street Address (line 2) _____

City Blacksburg State/Province VA Daytime Phone +1 (540) 951 7012Country USA Postal Code 24060 Evening Phone +1 (540) 951 7012**Permanent Contact Information**

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Street Address (line 1) 300 McDonald St Apt 33a

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Institution conferring degree Virginia Polytechnic Institute and State University _____

This page must accompany your manuscript and the rest of the submission materials.

Design and Development of Metadata Management Tool for Learning Objects

David O. Okoth

Dissertation submitted to the faculty of Virginia Polytechnic Institute and State

University

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

In

Curriculum and Instruction

Kenneth Potter, Chair

Barbara Lockee

Mark Bond

Alicia Johnson

November 13, 2019

Blacksburg, Virginia

Keywords: Learning Objects, Reuse, Metadata, Development, Instructional Design,

Technology

Design and Development of Metadata Management Tool for Learning Objects

David O. Okoth

ABSTRACT

Learning objects (LO) reuse is one topical area in instructional design that is gaining popularity in the education economy. It hinges on high hopes and promises to transform how learning occurs in the information age. This study attempted to identify and interrogate the core characteristics of reusable learning objects and conceptualize them as innovations in the curriculum development process. The goal was to synthesize existing knowledge on learning objects, weave streams of literature and research to focus on core arising issues, and then develop an instructional design tool that can help learners easily and effectively find reusable learning objects. The learning objects could be categorized and deconstructed to the levels of their instructional design transformations with regard to macro and micro-level reusability. The researcher used combinatorial developmental research with integrative literature review methodologies to design and develop a metadata management tool. This study involved an in depth review of literature on learning objects, reusable learning objects and their associated metadata management schemes through the integrative literature review approach. Results and data from the integrative literature review were then utilized to design and develop a tool addressing meta-tagging schemes, metadata management, search, and access of learning objects. The researcher identified characteristics of learning objects within the reuse process and discussed best practices, reuse procedures and modeling, based on the analysis of existing cases such as the Open-Knowledge-Initiative (OKI) projects to aid in the tool development. Integrative analysis running concurrently with the development process allowed for rigorous identification and alignment of key factors in the learning objects reuse universe. If fully developed, the

development. Integrative analysis running concurrently with the development process allowed for rigorous identification and alignment of key factors in the learning objects reuse universe. If fully developed, the metadata management tool could contribute to effective metadata management for learning objects often reused by learning designers, deliverers, and consumers.

Design and Development of Metadata Management Tool for Learning Objects

David O. Okoth

GENERAL AUDIENCE ABSTRACT

Learning Objects (LO) reuse is gaining popularity in the field of instructional design. This is because it could transform how learning occurs in today's information age. In this study, I outlined the important characteristics of reusable learning objects and set them up as creative and re-creative products in the curriculum development process. My goal was to combine and reproduce existing literature on LOs that would allow me to develop an instructional design tool to help learning content designers, deliverers, and consumers to easily tag, search, then find reusable learning objects. I reviewed literature on learning objects, reusable learning objects and their associated metadata management schemes then used this data to design and develop the tool addressing meta tagging schemes, metadata management, search, and accessibility of learning objects. The tool allows LO categorization and deconstruction to the largest and smallest granular levels of their instructional reusability. I combined a developmental research method with an integrative literature review method to design and develop the prototype of a tool known as metadata management tool (mmt) for reusable learning objects. If successful, the metadata management tool developed could contribute to an effective metadata management for learning objects often reused by learning designers, deliverers, and consumers.

IRB Approval Letter



Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-3732 Fax 540/231-0958
email irb@ut.edu
website <http://www.irb.ut.edu>

MEMORANDUM

DATE: December 12, 2018
TO: Ken Potter, David O Okoth
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)
PROTOCOL TITLE: Design and development of a reuse tool to support the use of open source learning objects
IRB NUMBER: 14-628

Effective December 7, 2018, the Virginia Tech Institutional Review Board (IRB) approved the Continuing Review request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<https://secure.research.vt.edu/external/irb/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
Protocol Approval Date: **December 22, 2018**
Protocol Expiration Date: **December 21, 2019**
Continuing Review Due Date*: **December 7, 2019**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

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The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irb@vt.edu) immediately.

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Learning objects repository reuse concept diagram incorporating SAMR/iSAMR models. Adapted from *SAMR: Thoughts for design*, by R. Puentedura. 2012. Adapted courtesy of the Creative Commons Attribution-Noncommercial-Share Alike 3.0 License, by Ruben Puentedura.

Figure 3. Learning Objects Repository Reuse Concept Elemental Alignment

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Figure 4. Taxonomy for Learning Objects Granularity [Creative Commons]

Figure of proposed extended ontology sourced from EnCoMpaSS, 2002. Adapted from Johnson, K., & Hall, T. (2007). Granularity, reusability and learning objects. In A. Koohang & K. Harman (Eds.), *Learning objects: Theory, praxis, issues and trends (Vol. I)*, (pp.181-207). Santa Rosa: CA: Informing Science Press. p.200. Adapted courtesy of Creative Commons Attribution-Noncommercial-ShareAlike 3.0 Unported License.

Figure 5. Mapping Two Taxonomies to Each Other [Creative Commons]

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Figure 6. IEEE LOM Tree Structure [Creative Commons]

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Figure 8. Combining the XML Languages of LOM and Dublin Core

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Illustration of combining the XML languages of LOM and Dublin Core. Reprinted from Nilsson, M., Johnston, P., Naeve, A., & Powell, A. (2007). The future of learning object metadata interoperability. In K. Harman, & A. Koohang, (Eds.), *Learning Objects: Standards, metadata, repositories, and LCMS (Vol. II)*, (pp.255-313). Santa Rosa: CA: Informing Science Press, p.275. Reprinted courtesy of Creative Commons Attribution+NonCommercial+ShareAlike 3.0 Unported License.

Figure 9. Unit Metadata [Creative Commons]

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Figure 10. Schematic of the Collaborative Design and Development Process

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Figure 11. Combined Granularity Sequencing Model and Learning Self-Directed Paths [Creative Commons]

Illustration of combined granularity sequencing model and learning self-directed paths to show layer of granularity during a resource search sequence. Adapted from Farrell, K., & Carr, A. E. (2007). A blended model of instructional design for learning objects. In A. Koohang, & K. Harman, (Eds.), *Learning Objects: Learning objects and instructional design (Vol. III)*, (pp.359-405). Santa Rosa, CA: Informing Science Press. pp. 375-378. Adapted courtesy of Creative Commons Attribution+NonCommercial+ShareAlike 3.0 Unported License.

Figure 12. Example of Learning Environment Ontology [Creative Commons]

Illustration of example of learning environment ontology. Reprinted from Taylor, J., Slay, J., & Kurzel, F. (2007). An ontological approach to learning objects (Doctoral dissertation). In K. Harman, & A. Koohang, (Eds.), *Learning objects: Applications, implications, and future directions (Vol. IV)*, (pp. 35-61). Santa Rosa, CA: Informing Science Press. p. 48. Reprinted courtesy of Creative Commons Attribution+NonCommercial+ShareAlike 3.0 Unported License.

Figure 13. Learning Object Review Instrument Data [Used with Permission]

Nesbit, J. C., Belfer, K., & Leacock, T. L. (2010). Learning object review instrument (LORI): User manual. E-Learning Research and Assessment Network. Retrieved from (personal communication from John Nesbit Sent: Tuesday, April 15, 2014 at 12:46), attached

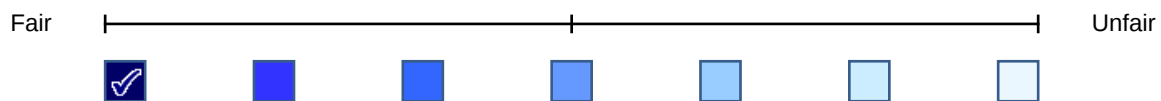
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Institution:	Virginia Tech
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Copyright Holder:	Rory McGreal
Publication Status:	Published
Publisher:	International Journal of Instructional Technology and Distance Learning
Place of Publication:	Canada
Publication Year:	2004
Description of Work:	Figure 1: Figure showing terminology for learning objects. McGreal, R. (2004, September 4). Learning objects: A practical definition. International Journal of Instructional Technology and Distance Learning (IJITDL), 9(1). Retrieved September 24, 2004, from http://www.itdl.org/Journal/Sep_04/article02.htm
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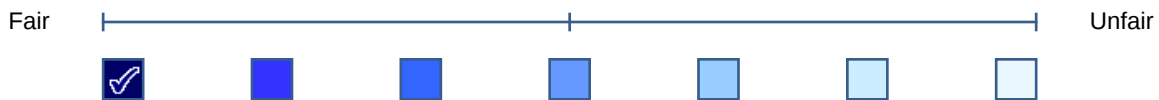
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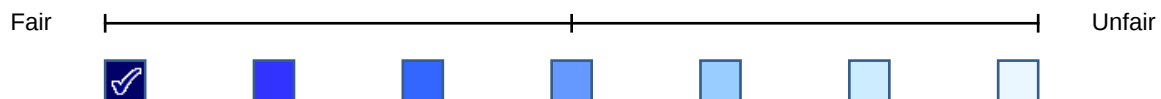
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Copyright Holder:	Ruben R. Puentedura
Publication Status:	Published
Publisher:	http://hippasus.com/rrpweblog/
Place of Publication:	US
Publication Year:	2012
Description of Work:	Figure 2: Learning Objects Repository Reuse Concept Diagram showing an adaptation of four general steps associated with design-based approaches for incorporating reusable learning objects into instruction http://www.hippasus.com/rrpweblog/archives/2012/09/03/SAMR_ThoughtsForDesign.pdf
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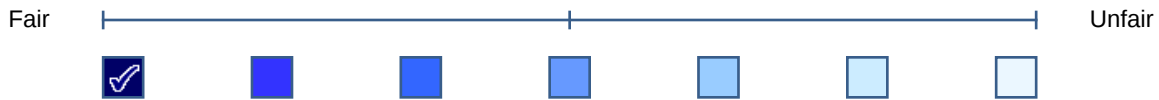
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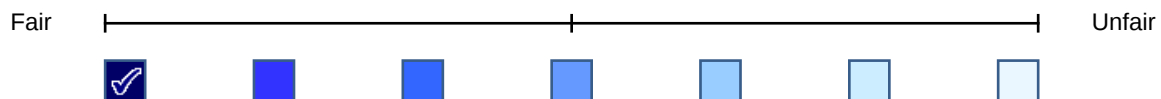
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Name:	David Okoth
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Publication Status:	Published
Publisher:	http://hippasus.com/rrpweblog/
Place of Publication:	US
Publication Year:	2012
Description of Work:	Figure 3. Learning Objects Repository Reuse Concept Elemental Alignment showing an adaptation of four general steps associated with design-based approaches for incorporating reusable learning objects into instruction http://www.hippasus.com/rrpweblog/archives/2012/09/03/SAMR_ThoughtsForDesign.pdf
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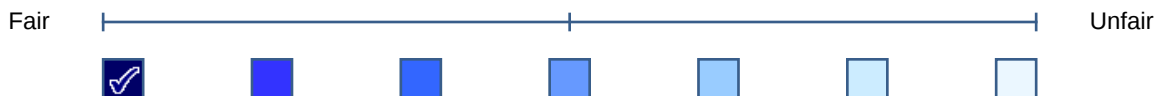
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Communication Request to Use LORI I

On 4/14/2014 12:37 PM, Okoth, David wrote:

TO: Tracey L. Leacock; John C. Nesbit

RE: Request to use Learning Object Review Instrument

Hello Drs. Tracey L. Leacock & John C. Nesbit:

My name is David Okoth, an Instructional Design and Technology doctoral student at Virginia Tech. I am requesting permission to use Learning Object Review Instrument (LORI) in my study. I am working on my dissertation titled: "Open Online Courseware Repositories Reuse as Innovative Educational Product for Developing Countries."

Given the rigor of work you did in evaluating the framework for evaluating the quality of multimedia learning resources of this version (LORI 1.5); I request your written permission to use a contextualized version in my current reuse study.

I believe the Items in LORI 1.5 (Nesbit, Belfer, & Leacock, 2004) will enable me to evaluate the quality of e-learning resources when it comes to reuse of courseware repositories and the Instructional Design Model I will develop. I am in the guidance of four faculty committee members under the chairmanship of Dr. Ken Potter. Please let me know if there may be a latest version compared to the one I've cited above.

I thank you in advance for your consideration of my request and look forward to your reply.

Best Regards
David Okoth

Ph.D. Candidate &
Instructional Technology Team Member
College of Engineering
Virginia Tech

<http://eng.vt.edu/it/insttech>

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=====

Communication Request to Use LORI II

From: 'John Nesbit'

Sent: Tuesday, April 15, 2014 12:46

To: Okoth, David

Cc: 'Tracey L. Leacock'

Subject: Re: Request to use Learning Object Review Instrument

Dear David:

You are welcome to use LORI for your research. Contextualization, by which I understand to be the modification of items to fit the specific evaluation task presented to evaluators, often results in greater predictive validity. For that reason, we also approve contextualization of LORI. However, unless you have identified reasons to use the older 9-item version (LORI 1.5), we recommend that you use the current 8-item version, LORI 2.0. I have attached LORI 2.0. Please appropriately cite the instrument and related publications when you report your results.

Regards

John Nesbit
Professor
Faculty of Education
Simon Fraser University

=====

From: Okoth, David

Sent: Tuesday, April 15, 2014 15:55

To: 'John Nesbit'

Cc: 'Tracey L. Leacock'

Subject: RE: Request to use Learning Object Review Instrument

Thank you very much Dr. Nesbit for your kind and enlightening response.
I appreciate you and Dr. Leacock's contributions in our field of knowledge.

Best Regards,
David Okoth

Ph.D. Candidate &
Instructional Technology Team Member
College of Engineering
Virginia Tech
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Communication Request to Use EDUCATE Experimental Server

Okoth, David

To: Kibong Song
Subject: RE: Requesting experimental use of Virginia Tech educate server

From: Kibong Song
Sent: Wednesday, June 22, 2016 17:21
To: Okoth, David
Subject: Re: Requesting experimental use of Virginia Tech educate server

Good morning, David.

2pm works for me.

Kibong

On Wednesday, June 22, 2016 9:00 AM, "Okoth, David" wrote:

Hello Drs. Potter, Kibong:

I would like us to meet briefly today about possible experimental use of Virginia Tech Educate Server (www.educate.vt.edu)

If possible with everyone's schedule, I could come by at 2.00PM to meet at Dr. Potter's Office in Symth.

Please let me know if today or any other day will work.

Thank You,
David

From: Okoth, David
Sent: Thursday, June 16, 2016 20:04
To: Ken Potter
Subject: Re: Requesting experimental use of Virginia Tech educate server

Yes Dr. Potter. That'll be great. I'll shoot for some time Wednesday and let Kibong know of these plans.

Best Regards,

David

On Jun 16, 2016 10:25 PM, "Potter, Ken" wrote:

David, I think we can utilize space on the educate server for your project. I do think it would be helpful for us to meet with Kibong to discuss the possible structure of the database and the types of variables that will be included in the database tables. Maybe sometime around the middle of next week?

Certificate of Completion

CERTIFICATE *of* COMPLETION

of the

Survey of Earned Doctorates
Questionnaire

This certifies that David Okoth,
a student at Virginia Polytechnic Institute Graduate School,
has completed the Survey of Earned Doctorates
on 11/15/2019.

Confirmation Code:233921PPNX

