Research Journal of Applied Sciences, Engineering and Technology 7(12): 2475-2482, 2014
DOI:10.19026/rjaset.7.555
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: July 22, 2013 Accepted: August 12, 2013 Published: March 29, 2014

**Research Article**

# Learning Objects Reusability Effectiveness Metric (LOREM)

Torky Ibrahim Sultan, Mona Mohamed Nasr and Sara El-Sayed Amin
Information Systems Department, Faculty of Computers and Information,
Helwan University, Cairo, Egypt

**Abstract:** In this research we aim to propose an advanced metric to evaluate the effectiveness of learning objects in order to be reused in new contexts. By the way learning objects reusability is achieving economic benefits from educational technology as it saving time and improving quality, but in case of choosing unsuitable learning object it may be less benefit than creating the learning object from scratch. Actually learning objects reusability can facilitate systems development and adaptation. By surveying the current evaluation metrics, we found that while they cover essential aspects, they enables all reviewers of learning objects to evaluate all criteria without paying attention to their roles in creating the learning object which affect their capability to evaluate specific criteria. Our proposed Approach (LOREM) is evaluating learning objects based on a group of Aspects which measure their level of effectiveness in order to be reused in other contexts. LOREM classifies reviewers into 3 categories; 1. Academic Group: (Subject Expert Matter "SME" and Instructor). 2. Technical Group: (Instructional Designer "ID", LO Developer and LO Designer). 3. Students group. The authorization of reviewers in these several categories are differentiated according to reviewer's type, e.g., (Instructor, LO Developer) and their area of expert (their expertise subjects) for academic and students reviewers.

**Keywords:** Evaluation metrics, learning objects, learning objects evaluation, reusability, reusability effectiveness

## INTRODUCTION

The increasing of learning objects reusability popularity became very observable nowadays; it can be evidenced by the large number of learning objects repositories which became available (Falcão de Berredo and Soeiro, 2007). Sampson and Papanikou (2009) defined Learning Objects Reusability as "the extent to which a LO can operate effectively for a variety of users in a variety of learning contexts over time in order to achieve the same or a different objectives from that envisaged by its supplier".

The proposed metric (LOREM) is a system evaluating learning objects according to some criteria, some of these criteria have been used before in other significant metrics like LORI and MERLOT metrics while some other criteria we suggest after researching and conducting meetings with professional education specialists.

This system enables only registered users to evaluate LO based on their areas of expert as they fill in the registration form. In addition to that every question has "not applicable" answer which reviewer can use if he/she isn't sure of answer.

The proposed metric supposed to help educational organizations, trainers, LO developers and any one working in learning objects filed by giving them evaluation to the effectiveness of reusable learning objects to help in the selection of reusable educational materials from repositories on the web and it can be also used in a certain organization to evaluate its created learning objects which saved in its repository to be reused afterwards in other contexts. We expect that this metric would be an approach to make managerial decisions regarding to Learning Objects Reusability.

**Learning object evaluation:** There are some initiatives approached the evaluation of learning objects to offer an estimation of the guaranteed quality. According to MERLOT (http://www.merlot.org/merlot/index.htm), objects are classified into 7 categories: Arts, Economy, Education, Humanities, Mathematics, Science and Technology. It depends on collection of experts and users evaluation on three dimensions (content quality, usability and effectiveness as a learning tool) on a 1-5 scale, while LORI (www.elera.net) using more extended technology which includes more aspects that it includes 9 aspects, every one of them is assessed on 1-5 scale, using collaborative evaluation scheme depends on evaluation of group of experts (Rodríguez *et al*., 2008).

Both of MERLOT and LORI will be discussed in more detailed in the following section.

**Corresponding Author:** Torky Ibrahim Sultan, Information Systems Department, Faculty of Computers and Information, Helwan University, Cairo, Egypt

## SURVEY

**Current approaches of measuring learning object reusability effectiveness:**

**Multimedia Education Resource for Learning and Online Teaching (MERLOT):** MERLOT is an open-access repository which provide user with both of evaluated and unevaluated learning objects, in descending order of quality rating, with unevaluated objects at the end of the list.

**MERLOT evaluation criteria:** According to MERLOT approach there are 3 categories of evaluation standards:

**Quality of content:** Focus on:

- Valid (correct) concepts, models and skills; to evaluate these elements, reviewers depend on their expertise
- Educationally significant concepts, models and skills for the discipline to evaluate these element reviewers rely on the following guidelines:
  - LO covers the essential knowledge of the domain which it specialized in
  - LO contains data difficult to learn and teach
  - LO contains data requested as introductory Level of advanced material

**Potential effectiveness as a teaching-learning tool:** It's the most difficult element in MERLOT Evaluation criteria. This element requires actual use by real students and teachers. In this element reviewers are asked to judge based on their experience on answering some questions addressed by MERLOT to determine whether the learning object can improve the process of teaching and learning in ways faculty and students can use.

**Ease of use:** The issue of this aspect is how the evaluated learning object is easy to be used for the first time by students and teachers.

**Learning Object Review Instrument (LORI):** According to Nesbit *et al*. (2004) LORI is an online instrument, has been developed as a service on (www.elera.net) website for evaluating the learning objects in learning objects repositories.

In LORI, reviewers state their rating and comments based on nine items to evaluate learning object:

- **Content quality:** Veracity, accuracy, balanced presentation of ideas and appropriate level of detail
- **Learning goal alignment:** Alignment among learning goals, activities, assessments and learner characteristics
- **Feedback and adaptation:** Adaptive content or feedback driven by differential learner input or learner modeling
- **Motivation:** Ability to motivate and attract the interest of learners
- **Presentation design:** Design of information is enabling users to learn efficiently
- **Interaction usability:** Ease of use and interact with the object and quality of the interface help features
- **Accessibility:** Design of controls and presentation formats to accommodate disabled and mobile learners
- **Reusability:** Ability to use in varying learning contexts and with learners from differing backgrounds
- **Standards compliance:** Adherence to international standards and specifications

The rating scale of every item of these nine items is consisting of 5 levels. If learning object is not relevant to the specific criterion or reviewer are unable to evaluate it according to that criterion, it signed as "not applicable".

**Using of LORI:** LORI can be used for both of individuals or panel reviewers. When LORI is used by a review panel, it's recommend to use the convergent participation model for collaborative evaluation. Evaluation results supposed to be listed as a set of averaged rating, one per item, while it may be summarized as a single average covering all the items which have been used in the evolution. All comments recorded by reviewers should be reported (Nesbit *et al*., 2004).

**The convergent participation model:** This model is mainly depending on LORI that it's done through two stages; at the first stage experts evaluate learning object according to LORI principals. This stage is supposed to take few days.

In the other stage; reviewers are meeting each other in a virtual conference controlled by a moderator where they discusses their evaluation and comments, during this conference objects are discussed in order as objects with more inter-rating variety are discussed before object with less inter-rating variety.

Finally at the last stage, on the fifth day, participant re-evaluate the sets in both of the previous stages and fill a questionnaire asks about participants' opinions on a range of topics related to the research goals of the study (Vargo *et al*., 2003).

## PROPOSED METHODOLOGY

**Learning Objects Reusability Effectiveness Metric (LOREM):** LOREM is our proposed metric that based on dynamic evaluation application filled by 6 types of reviewers, criteria of evaluation in this questioner is classified in 8 categories and clarified by guidelines gotten through analytical study to the factors which affect reusability of learning objects in order to

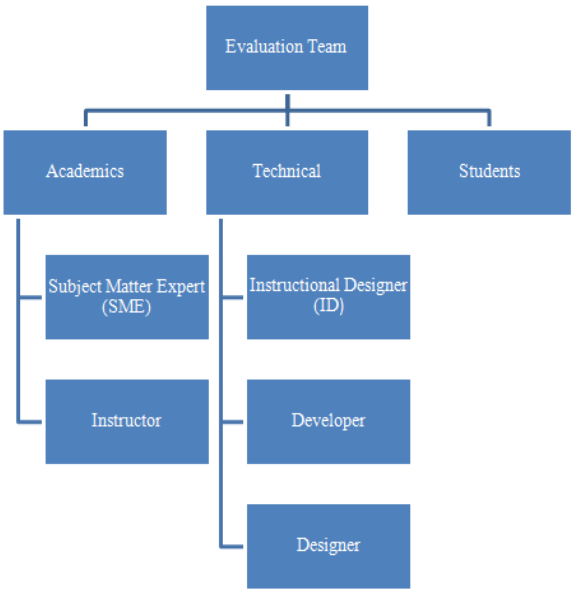


Fig. 1: Hierarchy of evaluation team

facilitate the evaluation process for reviewers. Reviewers of this system are divided into three categories:

- Academic Group (Subject Expert Matter "SME" and Instructor)
- Technical Group (Instructional Designer "ID", LO Developer and LO Designer)
- Students group: This group consists of students only (Fig. 1)

When these reviewers register in LOREM system they fill their occupation which determine their authorization on the website, that there are some elements must be filled by specialized persons only, for example there are pedagogical elements must be filled by teaching team only, other categories of reviewers can't give accurate judgment.

Evaluation method is differentiated from category to another; most of categories are rating scale consisting of five levels, one other category is check box and the last type of categories is "3 choices radio buttons". Every criterion in the rating scale has minimum acceptable value, when reviewer assigns less value; he/she gets notification message asking him/her to leave comments and suggestions. Table 1 explains criteria in the eight categories, the authorized reviewer for every criterion and the minimum accepted value.

**The evaluation criteria:**

**Retasking and repurposing:** Retasking; where the LO is used as it is but in another context for objectives other than the objectives which LO is created for, while in Repurposing; some changes are done to the LO to be used in another context for other objectives. If the LO is qualified for repurposing logically it would be qualified for retaking too. Below are 8 characteristics should be found in LO to can be repurposed.

**Evaluation criteria:** Rating scale consisting of 5 levels for each element. This category has 6 evaluation points; everyone is evaluated by specific reviewers:

- **Self-contained:** It shouldn't depend on any technical or educational object to work effectively. (Reviewers; SME, Instructor and ID, Minimum Rating Scale "5"; in this context we focus on the word "any" of Palmer and Richardson (2004) as LO may be unable to work because of depending on very simple external object, so the idol LO should take 5 points to be accepted otherwise reviewer has to mention the needed objects).
- **Date and time independent:** Doesn't depend on special external events. (Reviewers; SME, Instructor and Developer, Minimum Rating Scale "4").
- **Location independent:** Doesn't depend on special location to work effectively (Reviewers; ID, Developer and Designer, Minimum Rating Scale "4").
- **Generic:** Can be reused in any educational context as is "context free". (Reviewers; SME and Instructor, Minimum Rating Scale "3").
- **Differentiated:** Can be used for different levels of education (Reviewers; SME, Instructor and ID, Minimum Rating Scale "3").
- **Modifiable:** Has the possibility to be modified according to its new objectives (Reviewers; MSE, Instructor and ID, Minimum Rating Scale "3").

**Gender:** The second evaluated aspect is "Gender". As there are essential differences in learning between males and females; from the perspective of performance, participation and outcomes (Collins, Kenway and McLeod (2000)), we are keen to know whether LO is suitable for one gender more than the other or it's suitable for both, (Evaluation Criteria: Radio buttons with three choices; 1. Males, 2. Females 3. Both, Reviewers; Instructor, ID and Student).

**Accessibility:** The category "Accessibility" is responsible of determining how it is easy for people even people with disabilities to use the learning object. We divide the disabilities into 3 types:

- People who have sensory or mobility disabilities
- Deaf or hearing-impaired users
- Blind or visually impaired users

**Evaluation criteria:** Reviewers will determine if the learning object is accessible for people with each type

Table 1: Evaluation criteria in LOREM

| Evaluated aspect | Evaluation points | Allowed reviewer | Minimum accepted rating | Evaluation method |
|---|---|---|---|---|
| Retasking and repurposing | Self-contained/ (interoperability) | SME, instructor, ID | 5 | Rating scale consisting of 5 levels for each element |
| | Date and time independent | SME, instructor and developer | 4 | |
| | Location independent | ID, developer and designer | 4 | |
| | Generic/ (concept) | SME and instructor | 3 | |
| | Differentiated | SME and instructor, ID | 3 | |
| | Modifiable | SME, instructor and ID | 3 | |
| Gender | Males, females or both | Instructor, ID and student | | Radio buttons with three choices; 1. males, 2. females 3. both |
| Accessibility | Sensory or mobility disabilities | Instructor, ID, developer and student | 3 | Each one of the three elements has a checkbox, by checking it, 5 radio buttons rated from 1:5 are activated to enable reviewer rating this element |
| | Hearing-impaired users | Instructor, ID, developer and student | 3 | |
| | Blind or visually impaired users | Instructor, ID, developer, designer and student | 3 | |
| Appropriateness | Conformity to its topic | SME and instructor and ID | 3 | Rating scale consisting of 5 levels for each element |
| | Suitability to the designed audience | SME, instructor and students and ID | 3 | |
| Content quality | Overall content quality | All reviewers | 3 | Rating scale consisting of 5 levels for each element |
| | Significant of the learning object topic and appropriate level of details | SME and instructor, ID | 3 | |
| | Clarity | SME, instructor, ID and students | 3 | |
| | Accuracy | SME, instructor, ID and students | 3 | |
| | Architecture-in terms of separation of data | SME, instructor and ID | 3 | |
| | Logics | SME, instructor, ID and students | 3 | |
| | Presentation design | Instructor, ID, designer, student | 3 | |
| | Implementation of interaction interfaces | Instructor, ID, developer, designer, student | 3 | |
| Metadata | Traceable | all reviewers | 4 | Rating scale consisting of 5 levels |
| Motivation | Goal achieving | SME, instructor and ID | 4 | Rating scale consisting of 5 levels for each element |
| | Proper diffusely | SME, instructor and student | 3 | |
| | Feedback | Instructor, ID and student | 3 | |
| | Multimedia and graphic usage | Instructor, ID, designer and student | 2 | |
| | Narration | Instructor, ID, designer and student | 2 | |
| Usability | Easy of playing/viewing learning object | Instructor, developer, designer and student | 4 | Rating scale consisting of 5 levels for each element |
| | Ease of use learning object | All reviewers | 4 | |

of disabilities or not, if it's accessible, he/she will check a checkbox that would activate a rating list consist of 5 radio buttons. Reviewer will evaluate the accessibility based on the principles of IMS Guidelines for Developing Accessible Learning Applications. Following are guidelines helping reviewers evaluate the "Accessibility". Every point in this element is evaluated by the suitable reviewers:

- **Accessible to people who have sensory or mobility disabilities:** According to (IMS Guidelines) for Developing Accessible Learning Applications, there have to:
  - Allow for customization based on user preference
  - Provide equivalent access to auditory and visual content based on user preference
  - Provide compatibility with assistive technologies and include complete keyboard access
  - Provide context and orientation information
  - Follow IMS specifications and other relevant specifications, standards and/or guidelines

- Consider the use of XML. (Reviewers; Instructor, ID, Developer and Student, Minimum Rating Scale "3") (http://www.imsglobal.org/ accessibility/ accessiblevers/)
- **Accessible to deaf or hearing-impaired users:** At this point reviewer evaluate how learning object is providing access to auditory aspects learning technologies to be accessible for deaf or hearing-impaired users. For LO to be accessible to those with hearing impairments, it should:
- Caption auditory content
- Provide a text transcription of auditory content (Reviewers; Instructor, ID, Developer and student, Minimum Rating Scale "3")
- **Accessible to blind or visually impaired users:** At this point reviewer evaluate how learning object is providing access to visual aspects of learning technologies to be accessible for blind or visually impaired users. LO should:
- Has text descriptions (alternative text or alt-text) to all static images (e.g., pictures, logos, charts, links, other graphics) so the text can then be read by a screen reader or output to a Braille display
- Has utilization of the "longdesc" attribute for images that have useful content and require more lengthy descriptions
- Has an audio description track for multimedia, describing visual aspects of the content. (Reviewers: Instructor, ID, Developer, Designer and student, Minimum Rating Scale "3")

**Appropriateness:**
**Evaluation criteria:** Rating scale consisting of 5 levels for each element. This category has only 2 evaluation points:

- Conformity to its topic (Reviewers: SME, Instructor and ID, Minimum Rating Scale "3").
- Suitability to the designed audience (Reviewers; SME, Instructor, ID and Students, Minimum Rating Scale "3") (Rahman and Tech, 2003).

**Content quality:** Evaluation Criteria: Rating scale consisting of 5 levels for each element. This category has 8 evaluation points:

- Overall content quality (Reviewers: all reviewers, Minimum Rating Scale "3")
- Significant of the learning object topic and appropriate level of details (Reviewers: SME, Instructor and ID, Minimum Rating Scale "3")
- Clarity (Reviewers: SME, Instructor, ID and Students, Minimum Rating Scale "3")
- Accuracy (Reviewers: SME, Instructor, ID and Students, Minimum Rating Scale "3"
- Architecture-in terms of separation of data (Reviewers; SME, Instructor and ID, Minimum Rating Scale "3")
- Logics (Reviewers: SME, Instructor, ID and Students, Minimum Rating Scale "3")
- Presentation Design **(**Reviewers; Instructor, ID, Designer, Student, Minimum Rating Scale "3")
- Implementation of Interaction Interfaces (Reviewers: Instructor, ID, Developer, Designer and Student, Minimum Rating Scale "3") (Nesbit *et al*., 2004; Paulsson and Naeve, 2007; Rahman and Tech, 2003)

**Metadata:** Metadata is data about objects. The purpose of metadata is facilitating several processes like; searching using and evaluating LO, it also facilitates sharing and exchange LOs. (IEEE, 2002) and by the way the reusability of learning object is dependent on the quality of its metadata (Garcı´a-Barriocanal *et al*., 2006) (Evaluation Criteria; rating scale consisting of 5 levels). There is one point only in this aspect; Traceable*:* Learning object should be well identified by suitable metadata, metadata should include; name, explanation, size, order, example, datatype, knowledge objects, educational objects, knowledge chunks, digital objects and digital educational computer programs (IEEE Review Committee, 2002; Nash, 2005) (Reviewers: All reviewers, Minimum Rating Scale "4").

**Motivation:**
**Evaluation criteria:** Rating scale consisting of 5 levels for each element. This category has 5 evaluation points:

- **Goal achieving:** Learning object must meet the goals of students (Reviewers; SME, Instructor and ID, Minimum Rating Scale "4").
- **Proper diffusely:** Learning object should be neither very difficult nor very easy. **(**Reviewers; SME, Instructor & Student, Minimum Rating Scale "3").
- **Feedback:** Learning object should evaluate the level of learners however this character isn't offered in all learning objects. Reviewers should determine the capability of the LO to do that. (Reviewers; Instructor, ID and Student, Minimum Rating Scale "3").
- **Multimedia and graphic usage:** Learning object is rich in multimedia and graphic that supports its educational goals, (Reviewers: Instructor, ID, Designer and student, Minimum Rating Scale "2").
- **Narration:** [http://www.lifestyle-homeschool.com/ Narration.html] defined it as: "Narration is a technique which at its simplest means "telling back". Though in its fullest educational benefit there is more happening than simply comprehension" reviewer should evaluate the

effectiveness of narration for the assigned learning object. (Reviewers: Instructor, ID, Designer and student, Minimum Rating Scale "2").

**Usability:** Evaluation Criteria: Rating scale consisting of 5 levels for each element. This category has 2 evaluation points:

- **Easy of playing/viewing learning object:** Learning object shouldn't need special software or hardware requirements to be used effectively. (Reviewers: Instructor, Developer, Designer and Student, Minimum Rating Scale "4").
- **Ease of use learning object:** In this point reviewer should evaluate how it is easy and clear for user to use the learning object. The interface should inform user how to interact with the learning object. (Reviewers: All reviewers, Minimum Rating Scale "4".

## RESULTS AND DISCUSSION

**Analysis of results:** By Evaluating 100 learning object we got some notes about the criteria of evaluation and their relation with the types of learning objects. Table 2 is giving a summary to the results of 100 evaluated learning object. Following is analysis to all of evaluation criteria:

- **Retasking and repurposing:**
  - **Self-contained/ (interoperability):** By analyzing 100 LO, we found that all of them are completely self contained as they are essentially created to be used isolated. So all of them got high marks
  - **Date and time independent:** In general most of learning objects are date and time independent so it's usually expected that this evaluation get high mark, in evaluating the 100 LO, all of them got the highest mark "5"
  - **Location independent:** As it's mentioned before for LO to be location independent it should not be tied to a particular place and they were extremely location independent
  - **Generic:** This element wouldn't be essential if the learning object is mainly created for specific curriculum of educational stage as it's supposed to be dependent on the curriculum of the previous stage or on other learning objects in a course, however in some cases we found that a learning object in a series can be used isolated or even modified to represented in another context, Most of the 100 evaluate learning object got marks between 4 and 5

Table 2: Results of evaluation for 100 learning object

| Evaluated aspect | Lowest mark | Highest mark | Evaluation points | Lowest mark | Highest mark |
|---|---|---|---|---|---|
| Retasking and repurposing | | | Self-contained / (interoperability) | 4.67 | 5 |
| | | | Date and time independent | 5 | 5 |
| | | | Location independent | 4.67 | 5 |
| | | | Generic/ (concept) | 2.50 | 5 |
| | | | Differentiated | 1 | 5 |
| | | | Modifiable | 2 | 5 |
| Gender: both | | | Males | | |
| | | | Females | | |
| Accessibility | | | Sensory or mobility disabilities | Escaped | Escaped |
| | | | Hearing-impaired users | 2.67 | 5 |
| | | | Blind or visually impaired users | 1 | 4.75 |
| Appropriateness | | | Conformity to its topic | 2.50 | 5 |
| | | | Suitability to the designed audience | 3.25 | 5 |
| Content quality | | | Overall content quality | 2.67 | 4.83 |
| | | | Significant of the learning object topic and appropriate level of details | 3 | 5 |
| | | | Clarity | 3.75 | 5 |
| | | | Accuracy | 3.75 | 5 |
| | | | Architecture-in terms of separation of data | 3 | 5 |
| | | | Logics | 3.75 | 5 |
| | | | Presentation design | 2.50 | 4.67 |
| | | | Implementation of interaction Interfaces | 1 | 5 |
| Metadata | | | Traceable | 1 | 4.50 |
| Motivation | | | Goal achieving | 3.67 | 5 |
| | | | Proper diffusely | 3 | 5 |
| | | | Feedback | 1 | 5 |
| | | | Multimedia and graphic usage | 2 | 4.50 |
| | | | Narration | 3 | 5 |
| Usability | | | Easy of playing/viewing learning object | 4.50 | 5 |
| | | | Ease of use learning object | 3.50 | 5 |

- **Differentiated:** As many of the 100 learning objects are mainly target specific education levels so they wouldn't be suitable for different educational levels, it was observed that the learning objects of kids got very low mark as they can't be used for different education levels. We conclude that if the designed audiences are assigned in the description, this evaluation element can be escaped
- **Modifiable:** As learning is presented for evaluation in its final status so it can't be evaluated for technical modification, in LOREM system the capability of LO to be modified is only evaluated from pedagogically perspective. As the topic of any learning object is usually applicable for updating so this evaluation element is accepted to usually get high marks and that exactly what happened for the many of the 100 evaluated LO however some leaning LOs got low marks as their contexts were heritage texts so there were no way to modify them

- **Gender:** After evaluating the 100 learning object, it found that 99 of them are suitable for both of males and females and only one learning object called "Grammar Girl's Quick and Dirty Tips to Better Writing" is more suitable for females than males
- **Accessibility:**
  - **Sensory or mobility disabilities:** All of evaluated learning objects are not applicable to "Sensory or mobility disabilities"
  - **Hearing-impaired users:** There were 2 learning objects dedicated for hearing-impaired students in the evaluated learning objects, they are called; "Alphabetic for deaf students" and "numbers of deaf students", these 2 LOs got the highest mark "5". Through the evaluations of the chosen learning object, it's found that some learning objects can be suitable for hearing-impaired users even if they aren't mainly created for these category of users, these learning objects can be from the types; animations, assessment, presentation and book. Other LOs are targeting normal students but can be slightly used by deaf students
  - **Blind or visually impaired users:** There is only learning object in the 100 LO is dedicated for blind student, it's called "Teaching the Holy Quran for blind students" took mark "5". Some other learning objects target normal students but have audio description so they would be somewhat useful for blind students
- **Appropriateness:**
  - Conformity to its topic; all of the 100 LO got high mark at this point as all of them are confirmable to their topics
  - Suitability to the designed audience; in this point we got different result from LO to another one, Some learning objects got high marks as they are very appropriate for the targeted students while other LOs didn't get high marks as their methodology is rough for the target students and may be suitable for much older students
- **Content quality:**
  - **Overall content quality:** The average of this point for most of the 100 LO was about 3:4
  - **Significant of the learning object topic and appropriate level of details:** This point got high mark in most of learning objects
  - **Clarity:** Most of the 100 learning objects are clear, the least mark is gotten by a LO called "Math of Kids" and it got "3.75" as this LO is a little but vague for kids
  - **Accuracy:** Actually some learning objects of the 100 were accurate enough to get the full mark while there others have several errors like; misspelling, errors in questions, etc., so they got low marks
  - **Architecture:** In terms of separation of data; this point got average 3:4 marks and was applicable for all learning objects
  - **Logics:** This point got high average and was applicable for all learning objects
  - **Presentation design:** The mark of this point is ranking from low marks to high marks. This is applicable for all learning objects
  - **Implementation of interaction interfaces:** Got high marks in some learning objects like; while other learning object were not applicable for this evaluation criteria, by the way there are some types of learning objects are not applicable for this criteria like; some types of presentation, some types of simulation, some types of tutorials like video, books in some formats like pdf format
- **Metadata:**
  - **Traceable:** Many of the 100 evaluated learning objects are not applicable for this criterion as they don't support user with any information about the learning object but in general this point got marks between 1:4
- **Motivation:**
  - **Goal achieving:** However goals aren't identified in all of LOs but they can be concluded and evaluated, goals are clearly identified some learning objects and they completely achieved so this criterion got the full mark in those learning objects
  - **Proper diffusely:** By revising the comments on this point in the results of the 100 learning objects we found that some of them got low marks and have been described as a very difficult to the designed audience, while other got lower marks. Logically this point should be evaluated taking into account the designed audiences. This criterion is applicable for all LOs
  - **Feedback:** By evaluating the 100 learning object, it's found that some of them enable student to answer question cover the lesson and check the

answers while other don't give any feedback, so the mark of this criterion ranking from 1:5. This criterion can be applicable for all LOs

- **Multimedia and graphic usage:** The results of evaluation is ranking from low to high marks while there are some learning objects are inapplicable to this criterion, like; image, figure, graph, table and book
- **Narration:** The mark of this criterion is ranking from low to high marks depends on the method of narration in the learning object. Some of learning objects types are inapplicable to this criterion like; assessments, games, puzzles, image, exercise, diagram figure, graph, table, text and exam

- **Usability:**
  - **Easy of playing/viewing learning object:** This criterion got high marks in all of the 100 evaluated LOs as the required programs for these LOs to work effectively are easily downloaded and played. This criterion is applicable for all LOs
  - **Ease of use learning object:** Results of evaluation for this criterion are differentiated from LO to another one as they are some LOs very easy to be used and navigated while the other learning objects a little bit vague and don't provide user with clear guidelines about using them

## CONCLUSION

The main objective of this study is offering a new model as a metric to evaluate the effectiveness of learning objects in order to be reused in other contexts. This research was done though three stages; beginning by searching the current models and analyzing them, followed by assigning the new proposed model with its new criteria of evaluation and finally test the model by evaluating some research samples.

The new proposed model depends on the reviewers' evaluation to the several aspects of learning objects. It classifies reviewers into 3 categories; academic, technical and students. With six types of reviewers; Subject Matter Expert, Instructor, Learning Object Developer, Learning Object Designer, Instructional Designer and student, the authorization for evaluating the several aspects of learning object is differentiated from types of reviewer to another type.

Aspects of evaluation are divided into 8 categories; every category has some internal points; every point has its own evaluation as a ranking from 1:5 and the average of points in every category is represented by stars from 1 to 5. The whole average of all categories is also represented by stars from 1 to 5.

## REFERENCES

Falcão de Berredo, R. and A. Soeiro, 2007. A Proposal for Benchmarking Learning Objects. eLearning Papers, No. 3, ISSN: 1887-1542. Retrieved from: http://elearningeuropa.info/sites/default/files/old/media12071.pdf.

Garcı´a-Barriocanal, E., M. Sicilia and M. Lytras, 2006. Pedagogical clasification frameworks for learning objects: A case study. J. Comput. Hum. Behav., 23(2007): 2641-2655.

IEEE Review Committee, 2002. Draft Standard for Learning Object Metadata. Institute of Electrical and Electronics Engineers (IEEE) Inc., Retrieved from: http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf, (Assessed on: July 12, 2002).

Nash, S.S., 2005. Learning objects, learning object repositories and learning theory: Preliminary best practices for online courses. Interdi. J. Knowl. Learn. Objects, 1: 217.

Nesbit, J., K. Belfer and T. Leacock, 2004. Learning Object Review Instrument (LORI). User Manual, Version 1.5. Retrieved from: www.elera.net.

Palmer, K. and P. Richardson, 2004. Learning object reusability-motivation, production and use. Proceeding of the 11th International Conference of the Association for Learning Technology (ALT), University of Exeter, Devon, England, September 14-16.

Paulsson, F. and A. Naeve, 2007. Establishing Technical Quality Criteria for Learning Objects. IOS Press, ISBN: 1-58603-682-3.

Rahman, S. and V.D. Tech, 2003. Digital library network for engineering and technology. Virginia Tech, Alexandria Research Institute.

Rodríguez, J.S., J.M. Dodero and S. Snchez-Alonso, 2008. Aprioristic learning object reusability evaluation. Proceedings of the SIIE'2008.

Sampson, D.G. and C. Papanikou, 2009. A framework for learning objects reusability within learning activities. Proceeding of the 9th IEEE International Conference on Advanced Learning Technologies.

Vargo, J., J.C. Nesbit, K. Belfer and A. Archambault, 2003. Learning object evaluation: Computer-mediated collaboration and inter-rated reliability. Int. J. Comput. Appl., 25(3).