ITERATIVE MODEL-BASED SYSTEM FOR LEARNING OBJECT REVIEW

by

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ABSTRACT

In learning object review, reviewers can write reviews by commenting or rating review rubrics or categories. Besides learning object review, another demand in education activities is a learning tool to help students to complete assignments by writing summaries or answering questions on designated research papers (or simulation software). Compared with learning object review, this process has the similar steps, but with rubrics. Elorp, my thesis project, is developed by sharing some ideas with the learning object review process and is implemented on top of eLera [3]. Elorp introduces an iterative review model with support of state-control and provides two scenarios for students and faculty.

In order to get feedback on iterative review models and system design, an evaluation experiment is conducted. The evaluation result showed that the design for Elorp has been successfully implemented and the iterative review model is helpful for students to complete review/summary assignments.

DEDICATION

To my wife Leia and my son Jonathan.

ACKNOWLEDGEMENTS

I would like to thank my senior supervisor Marek Hatala and Vive Kumar who served on my supervisory committee for their guidance. I would also like to thank John Nesbit for providing a valuable feedback for improving my thesis work.

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CHAPTER 1
INTRODUCTION OF LEARNING OBJECT REVIEW

Finding a pedagogical model to conduct educational practice is always a challenge for educators and learners. With enormous amounts of available resources, especially on the internet, we have to efficiently evaluate learning objects with proven evaluation methods. This chapter introduces the learning object and the relevant evaluation methods.

1.1 Definition and Characteristics of Learning Objects

Generally speaking, a learning object is a digital educational resource that can be reused, scaled and shared from a central repository in the support of instruction, which consists of knowledge, learning resources, online materials, and instructional components. .Netg, a major e-Learning provider, defines a learning object as a resource with three parts: a learning objective, a learning activity, and a learning assessment [1]. Further, taking a broader perspective on a Learning Object, it's defined as "Any entity, digital or non-digital, that can be used, re-used or referenced during technology-supported learning" [2]. Therefore, Learning Objects on the Internet usually include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, web-based learning systems and collaborative learning environments [2].

The diversity in types of Learning Objects is especially indicated by three properties as following: aggregation level, interactive type and resource type [2]. Aggregation level is the functional granularity of the learning object. Typically, the smallest level of aggregation is raw media data or fragments [14]. Interactive type describes how the learning object which includes text, video and audio clips, graphics,

and hypertext linked documents. And resource types typically include: exercises, simulations, questionnaires, diagrams, figures, graphs and so on. In some practical projects, like eLera [3], Learning Objects usually are represented as web documents, online communities and simulation java applets, which are aggregation level, interactive type and resource type, respectively.

1.2 Definition of Learning object review

Evaluation is integral to every aspect of designing instruction with learning objects. Evaluation helps in clarifying audiences and their values, identifying needs, considering alternative ways to meet needs, conceptualizing designs, developing prototypes and actual instructional units with various combinations of learning objects, implementing and delivering instruction, managing the learning experience, and improving the evaluation itself [5].

Evaluation must assemble all the standards associated with objects, learners, instructional theories, and other stakeholder values and estimate the quality of the instruction in terms of those standards both to formatively improve the instruction (for development purposes)and to assess its value summatively (for accountability purposes), as well as determining degrees of compliance with technical standards.

Basically, criteria for learning object review include reusability, repurposability, granularity, instructional or learning value, existence and quality of metadata, ability to adjust to the needs of the context in which they are being used, fundamentality, spirit of the learning object idea, philosophy of the learning management system in which the learning object is being reused, agreement among collaborators on units of measurement, architecture, and approach, sequencing and scope issues [4]. One of the first major tasks of evaluation involves exploring alternative values and clarifying which

will be used in a given evaluation of an object. Usually, the first step of evaluation is to clarify who wants to evaluate and use it. Next, how the users define the learning object and the criteria they have need to be clarified so it is clear what they expect the learning object to do. Finally, data about how the learning object measures up to those criteria need to be collected and used to make evaluative judgments in accordance with established meta-evaluation standards.

Although many different groups of people may have an interest in learning objects, the two most obvious user groups are instructors and students. A third group we will consider in this chapter are instructional support people (including instructional designers, librarians, technical support personnel, etc.) because people in these disciplines are more involved in the learning object community than most instructors and students at this time. Instructors/teachers are the primary users of learning objects because they often design their own instruction and draw upon objects of all kinds to do so. Instructors vary in their needs as users of learning objects as they vary in experience, the age level they teach, the subject matter, the instructional needs they are trying to address, their instructional technique, and so on. Students or learners are some of the most important users of learning objects. And students vary in their needs and values even more than instructors do because there are more of them.

1.3 Literature Review of Learning Object Evaluation

Evaluation of learning object has emerged to help faculty, professors and instructional designers to select pedagogical learning objects that meet their requirements from a set of similar learning objects. The learning objects involved in this evaluation can be digital or non-digital resources which are used to support learning. Compared to evaluation of learning objects, evaluation of resources is a broader evaluation of mass resources without similar topics. In considering some approaches to

evaluating Learning Objects, I will use the classification scheme described in [4]. In summary, there are 4 major approaches: consumer-oriented, expertise-oriented, objectives-oriented, and participant-oriented evaluations.

Consumer-oriented evaluation

The consumer-oriented approach to evaluation is predominantly a summative evaluation approach. The importance of consumer-oriented evaluation seems to have been first recognized during the mid to late 1960s as new educational products began to flood the market [4]. Scriven (1967) made a major contribution to this approach with his distinction between formative and summative evaluation. The consumer oriented evaluation criteria are:

- Describe the characteristics
- Analyze its rationale and objectives
- Consider its content
- Consider the instructional theory and teaching strategies
- Form overall judgments

Scriven's evaluation criteria predate the evaluation of learning objects. However, by examining the above evaluation criteria, consumer-oriented evaluation addresses four aspects of learning objects: process, content, transportability, and effectiveness.

Expertise-oriented evaluation

The expertise-oriented approach to evaluation depends primarily upon professional expertise to judge an institution, program, product, or activity. There are four ways to implement this kind of evaluation: a formal professional review system, an informal review system, an ad hoc panel review, or an ad hoc individual review [4].

Generally, formal professional review systems have an organization established to conduct periodic reviews with the judgments of several experts. As noted in [4], expertise –oriented evaluation has been broadly used by both national and regional accreditation agencies. Other uses of this evaluative approach are university internal-review systems. This kind of review is not only useful in making internal decisions and reallocating funds in periods of financial austerity but also may deflect suggestions that such programs should be reviewed by higher-education boards [12].

Collectively, expertise-oriented approaches to evaluation have emphasized the central role of expert judgment and human wisdom in the evaluative process and have focused attention on such important issues as whose standards should be used when rendering judgments about programs. This approach fosters excellence in education through the development of criteria and guidelines for assessing institutional effectiveness.

Objective-oriented evaluation

The distinguishing feature of an objective-oriented evaluation approach is that the purpose of an activity is specified, and then the evaluation focuses on the extent to which that purpose is achieved [4]. A typical objective-oriented evaluation follows the following steps:

1. Establish broad goals or objectives
2. Classify the goals or objectives
3. Define objectives in behavioral terms
4. Find situations in which achievement of objectives can be shown
5. Develop or select measurement techniques
6. Collect performance data
7. Compare performance data with behaviorally stated objectives

It's obvious that the greatest strength of the objective-oriented approach to evaluation lies in its simplicity. This approach has stimulated so much technological development over the years that the process of specifying objectives and developing or finding appropriate instruments has been finely honed. A pervasive problem of the objective-oriented evaluative approach is the fact that many program directors have not articulated objectives for their programs in any interpretable form.

Participant-oriented evaluation

As evaluation developed, more and more practitioners began to publicly question whether many evaluators really understood the phenomena that underlie their numbers, figures, charts, and tables [4]. Compared to the evaluative approaches depicted above, participant-oriented evaluation stresses firsthand experience with program activities and settings. Generally speaking, this approach includes the following characteristics:

1. It depends on inductive reasoning
2. It uses a multiplicity of data
3. It does not follow a standard
4. It records multiple rather than single realities.

Participant-oriented approaches use both qualitative and quantitative methods. The advantages of this method are its flexibility, attention to contextual variables, and its encouragement of multiple data-collection techniques that are designed to provide a view of less tangible, but still crucial, aspects of human and organizational behavior. In addition, this approach can provide rich and persuasive information that is credible to audiences who see it as reflecting a genuine understanding of the inner workings and intricacies of a program.

1.4 Current Approaches and eLera (LORI)

The primary purpose of learning object review is to find out how a given learning object differs from others. Some reviewers have pointed out that reusability is critical in learning object review [8]. Others have significantly emphasized content and technical features [9]. The American Society for Training and Development (ASTD) has developed a set of standards for certifying web-based education courseware [10]. These include interface standards, compatibility standards, production quality standards, and instructional design standards. These standards are designed to meet legal and certification requirements of various learning models and subjects, embody current knowledge of key characteristics, and to help users to identify and select quality web-based training courses.

Vargo et al. [5] thought that some existing evaluations didn't provide numerical ratings that would allow quick comparison among resources or quality-based sorting of search results. MERLOT [11] offers an example of mass application of learning object review in web-based education because it better supports evaluation by providing numerical ratings of learning objects. With comments and ratings on a five-point scale, MERLOT users and appointed peer reviewers can evaluate three general properties: quality of content, potential effectiveness as a teaching-learning tool and ease of use.

eLera (E-Learning Research and Assessment Network)

eLera, E-Learning Research and Assessment Network, is a current approach to review models that deploys numerical rating rubrics. As a distributed group, eLera researches and evaluates e-learning objects. The specific interests of eLera include learning objects, e-portfolios and learning design specifications and related topics. The goals of eLera are to:

- improve the quality of online learning resources through better design and evaluation
- develop effective pedagogical models that incorporate learning objects
- help students, teachers, professors, instructional designers and others to select pedagogical models and digital resources that meet their requirements

In order to achieve the above proposes, eLera provides a web-based learning object review system that innovatively introduces 9 learning object review items (LORI) [6] with numerical ratings. eLera maintains a database of learning object reviews, and supports communication and collaboration among researchers, evaluators and users of online learning resources. As a learning object system, eLera provides a community for reviewers to conduct individual or peer reviews of learning objects. LORI is actually a set of review criteria specified in eLera. Reviewers write reviews by following the 9 learning object review criteria.

LORI (Learning Object Review Instrument)

As mentioned in previous section, LORI [6] is used to evaluate the quality of e-learning resources and to help users to select for quality and suitability. LORI is an online form consisting of rubrics, rating scales and comment fields. The current version of LORI available from eLera is version 1.5. LORI provides nine items with numerical rating for reviewers to rate and comment on a learning object. They are: Content Quality, Learning Goal Alignment, Feedback and Adaptation, Motivation, Presentation Design, Interaction Usability, Accessibility, Reusability, and Standards Compliance.

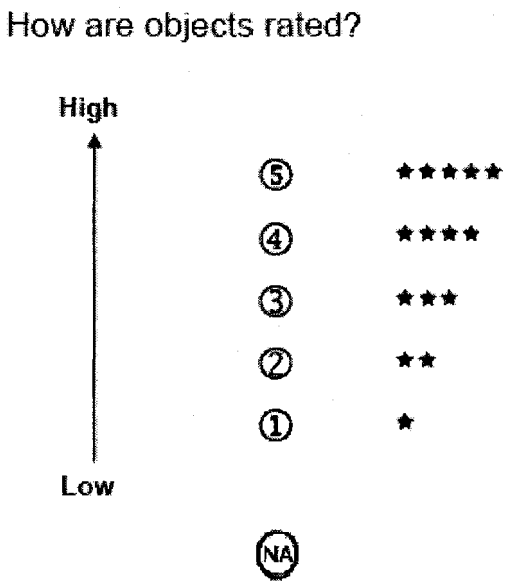

Figure 1.1 Rating scale of LORI (reprinted from [6] with permission)

In eLera, each item listed above is evaluated on a rating scale consisting of five levels as showed in figure 1.1. These five scales indicate the level of quality that the reviewer judges that criterion to possess. Scale 5 is the highest score and correspondingly scale 1 is the lowest one. If the reviewer does not feel qualified to judge a criterion or the reviewer thinks that it is not relevant to the learning object, then the reviewer may opt out of the item by selecting "Not applicable", which is showed as "NA" without the numeric level.

Some issues of eLera

Typically, eLera (technically LORI) may be used for either individual or panel reviews. Individual review is usually conducted by experienced reviewers in the eLera community. These active reviewers evaluate various learning objects based upon their background and knowledgeable skills. They can not only independently pick and evaluate learning objects to enrich the eLera repository but participate in panel reviews,

which will be depicted later. Compared to individual review, panel review is typically launched by a review administrator and who calls for other reviewers to join the panel. Review moderators can also invite more reviewers to evaluate specific or similar learning object(s) through panel review. Reviewers who are invited can accept the review invitation or reject it. With greater participation of reviewers, the panel review becomes more valuable to users trying to find quality learning objects.

In both review methods discussed above, eLera conducts review activities by offering learning object storage and management through a database. Pedagogically, eLera and LORI are designed for experienced reviewers or professionals, such as faculty, instructional designers and learning object harvesters. They are not suitable for junior learning object reviewers or students who are new to learning object review. Because of the strong specialty of reviewers, eLera emphasizes the review instrument instead of workflow. Ideally, eLera, by providing learning object reviews, helps learners or others to select qualified pedagogical models and learning objects that meet their requirements. New features that are promised to be released, such as a conferencing system and other community features are all endeavors that will enrich or strengthen eLera.

CHAPTER 2
SYSTEM REQUIREMENT OF ELORP

Learning object review is conducted to evaluate the quality of learning objects by rating or commenting on specific rubrics that are classified to categories. Besides learning object review, another demand in education activities is a learning tool that helps students to complete assignments by writing summaries or answering questions on a designated research paper (or simulation software). Compared to learning object review, this process has similar steps. For instance, this learning process is implemented by answering questions or writing descriptions of designated topics. Background study and testing, especially for simulation software, are all required before starting these two processes. Based on the similarity of these two processes, the ideas of learning object review can be referenced by the design of learning tools. This chapter will describe this demand with a real case and then summarize the system requirement of my thesis project.

2.1 Sharable research summary (SRS) in Douglas College

The SRS, Sharable Research Summary, [13] in Douglas College is a typical way of introducing undergraduate students to learning object review. The basic idea of the Sharable Research Summary is to speed up the communication of new findings in psychology to a much broader audience by making a research summary in the form of a learning object that can be used by both instructors and students to share psychology research. A sharable research summary can be a formal review of a published research article and is an opportunity for the advanced student to teach others about interesting research articles in psychology.

One of goals of the sharable research summary is to share psychology research to a much broader audience than just disciplinary producers (psychology students and faculty). Typically, the disciplinary consumers on sharable research summary consist of following:

- High school instructors teaching science courses in biology and psychology (perhaps other social sciences)
- College and university instructors teaching introductory science courses in psychology and biology
- Grade 12 students in introductory science courses (biology and psychology)
- College and university students in college introductory science courses in psychology and biology
- College and university students in post introductory science courses in psychology and biology
- Undergraduate students in business, life sciences, social sciences
- Student advisors with content harvesters/aggregators

SRS is a real case of conducting a summary assignment of a psychology paper. Compared to learning object review, SRS focuses on the summaries of a research paper. In total, there are 26 steps involved in the process of SRS [13].

2.2 What's Elorp

Elorp, Educational Learning Object Review Process, is structured on top of eLera and is designed as a learning tool to help students and faculty to complete review/summary assignments. Elorp offers an iterative review cycle to help undergraduate students to learn course content. Compared to eLera, Elorp offers more workflow controls to manage the iterative review cycle. Besides the basic review cycle offered in eLera, a state-control mechanism in Elorp can effectively drive the interaction between students and faculty. For example, in Elorp, different states will drive

corresponding actions. If a state is set to "New", that means the students are required to make a new review by following the review introduction and requirements . Generally established on top of eLera, Elorp offers a pedagogical educational practice to help undergraduate students to completing review/summary assignments.

2.3 Iterative Review Model

Compared to SRS which focuses on psychology and biology, Elorp is designed to extend to multiple disciplines and offers a practical approach to completing review/summary assignments for undergraduate students. Typically, the consumers of Elorp consist of following:

- College and university instructors teaching introductory science courses in multiple disciplines
- College and university students in college introductory science courses in multiple disciplines
- College and university students in post introductory science courses in multiple disciplines

The basic disciplinary producers are the students and faculty involved in Elorp. With the guidance of faculty, students are required to write reviews on research papers or simulation software. This review follows a customized format, which is based on the discipline upon which the review is conducted. Table 2.1 shows the sample rubrics of review on an operating system simulator (Deadlock).

Table 2.1 Sample review rubrics of Elorp

Summary Criteria	Description of rubrics
Background	Describe how deadlock occurs?
Example Case	Describe a sample case of deadlock.
Avoidance of Deadlock (before using simulator)	How do you think the deadlock can be avoided?
Software Simulation	How would you design a deadlock simulator?
Quality of Simulator	What do you think of the simulator? (ease of use, instructions, clarity of output, error handling, etc.).
Effectivity of Simulator	Do you think this simulator is flexible to involve multiple simulations? For example, does it allow you to input different threads and resources to test?
Explanation of Test 1	Describe the Test 1 as per assignment, report your results, and explain what happened.
Explanation of Test 2	Describe the Test 2 as per assignment, report your results, and explain what happened.
Explanation of Test 3	Describe the Test 3 as per assignment, report your results, and explain what happened.
Avoidance of Deadlock (after using simulator)	What have you learned about the techniques to avoid deadlock?
Summary	Summarize your work.

These rubrics, listed in table 2.1, can be customized based on different topics or disciplines. For example, the first rubric listed in table 2.1 is typically applied to software installation and is customized to a specific operating system simulator.

There are also 10 steps recommended in Elorp to produce a review described in table 2.2 as following:

Table 2.2 10 Steps of Elorp

10 steps in Elorp	
1.	Faculty designates a topic (Learning Object) in a discipline of which the review is taken.
2.	Faculty Assigns the review assignment to students, the faculty will provide review descriptions
3	Students start to examine the designated learning object, including reading (paper or related documents), installation (software) or testing (software or application), and so on.
4.	Students start to write the review assignment
5.	Students do a draft of the review assignment
6.	Students submit the faculty the draft of the review assignment and wait for feedback from faculty
7.	Faculty or TA writes feedback and comments on students' review assignment
8.	Students revise the review the assignment based on the feedback and comments
9.	Students finally submit the review assignment and await the assignment marking
10.	Faculty or TA mark the review assignment and then list the grade

As a learning tool, Elorp offers a process cycle to complete review/summary assignments. At any point during this cycle, either students or faculty are required to participate. As described in table 2.2, faculty trigger the first iteration by assigning a new review/summary assignment. The second iteration is triggered after faculty provide feedback. The model used in this project is called the iterative review model. With the inclusion of two iterations, this model helps students to get feedback or comments from faculty before they finally submit an assignment.

2.4 Workflow of Elorp

It's obvious that users defined in Elorp consist of reviewers: students and faculty. As this model is designed for students who are new to learning object review, it should have essential evaluation criteria to implement the specific learning object review. The basic workflow of this project is depicted in figure 2.1 as following.

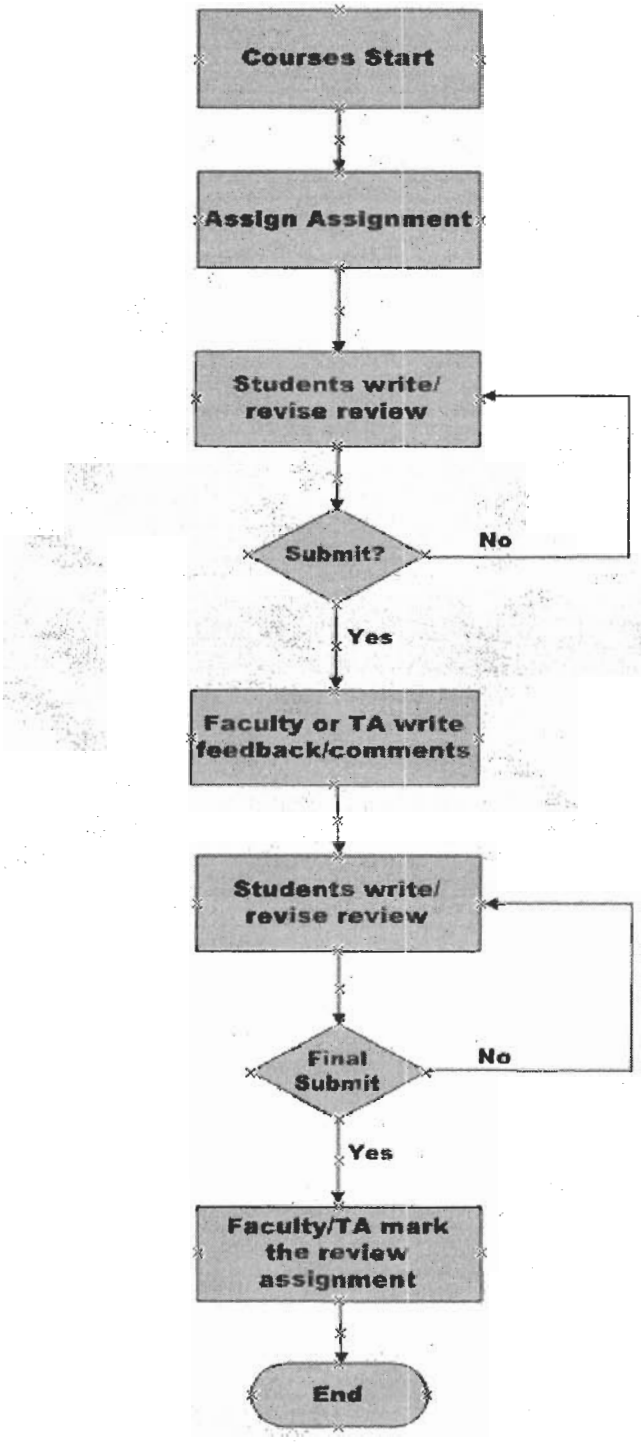

Figure 2.1 Workflow of Elorp

By examining the workflow listed above in figure 2.1, it's obvious that there are two complete review cycles in this project. One cycle is the learning object review done

by students. The other one is the evaluation of students' work, which is offered by faculty for grading and further research. The most productive aspect of Elorp is the part of "Faculty or TA write feedback/comments". After the draft review is made by students, faculty or TA are required to provide feedback on improving the review. Upon receiving the feedback, students can complete the review both in content and structure. This is an effective interactive way to help students, who are new to course or learning object review assignments to improve their knowledge by reviewing a learning object.

Elorp is developed to help students who are new to learning object review. In order to approach the review cycle, the feedback and comments of faculty are very helpful for students. Actually, faculty are another group of participants who are involved in review. The review object for faculty is the review written by students. The feedback written by faculty uses their professional expertise to judge a review assignment.

CHAPTER 3
SYSTEM DESIGN AND DEVELOPMENT OF ELORP

Technically, Elorp is constructed on the Zope application system. Zope (http://www.zope.org) is an open source web application server primarily written in the Python programming language. It features a transactional object database which can store not only content and custom data, but also dynamic HTML templates, scripts, a search engine, and relational database (RDBMS) connections and code. It features a strong *through-the-web* development model, allowing you to update web a site from anywhere in the world.

In this chapter, the implementation of this project will be described. In terms of functionality, there are three main parts to the project. The first part is a management component, the second is a core review (which implements the complete review), and the final part is a grading component (Optional).

3.1 System Overview

Elorp is designed on an iterative model to support learning object review. Therefore there are two scenarios which apply to two different groups of participants in Elorp. Figure 3.1 shows the workflow diagram of Elorp for a student scenario. The first phase is that students login and check the state of the assignment and decide what to do. For instance, a student gets a new assignment with the sign "New" and the action "Create Review" once faculty have assigned the assignment. Students can keep revising the review assignment as long as the review assignment is not submitted. The next step for students is to submit to faculty the draft review assignment if it is done. As soon as feedback/comments from faculty have been received, students can revise their review

assignment according to the feedback. Eventually, students submit review assignments in a final version and check the grade later when it's available in Elorp.

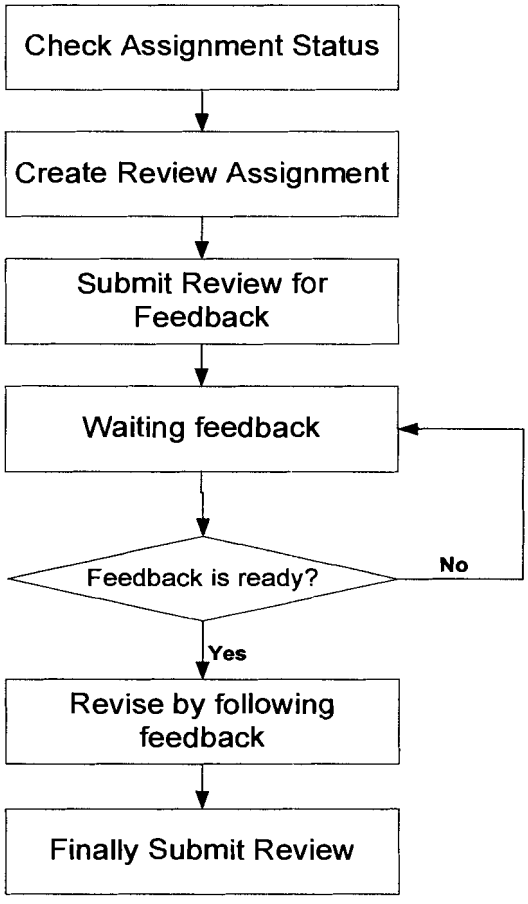

Figure 3.1 Workflow Diagram of Assignment in Elorp (Students)

As depicted in chapter 2, faculty and teaching assistants are the other user group in Elorp. In a faculty scenario, other than the core review component, there are two other parts in the faculty scenario: course management and the grading system. Figure 3.2 shows a structural diagram of faculty scenario.

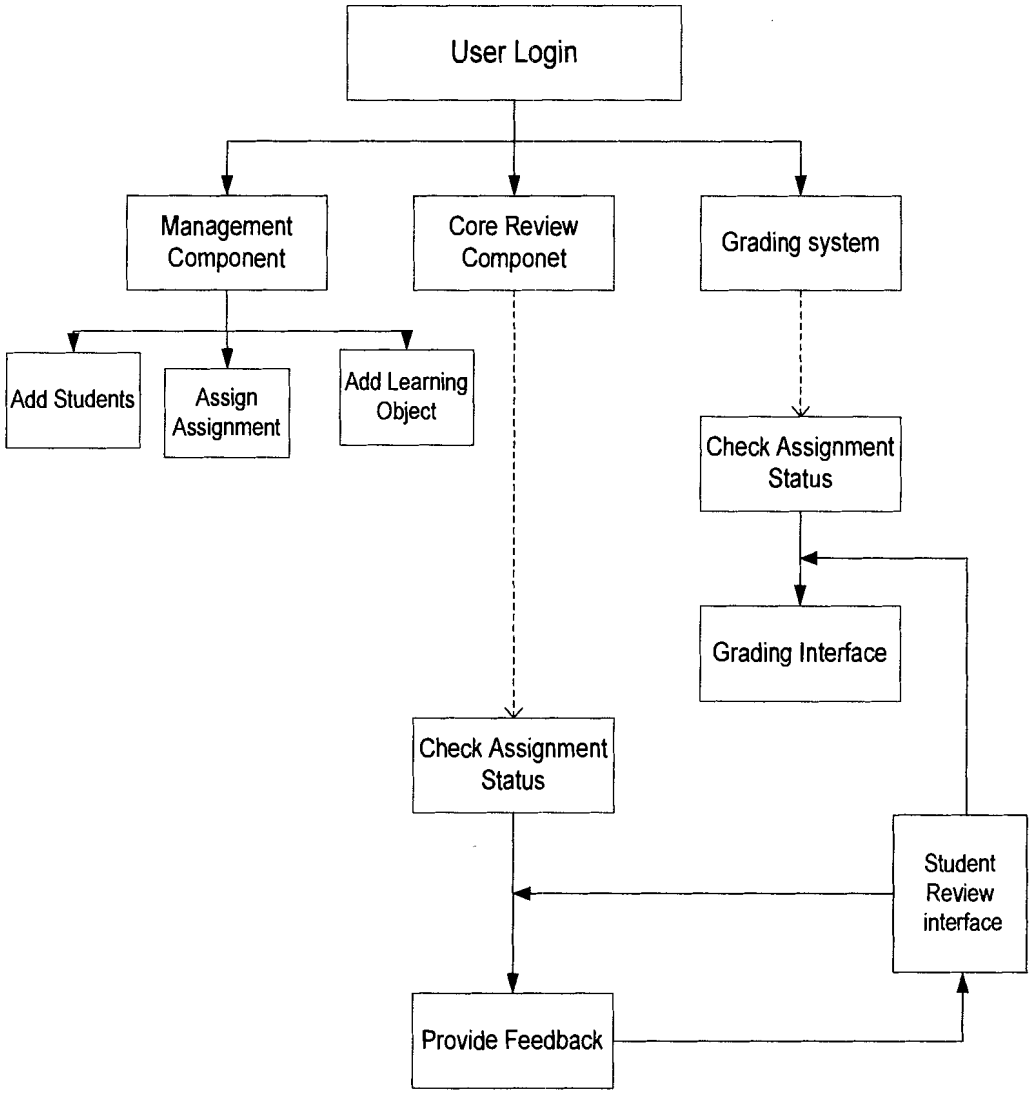

Figure 3.2 Structural Diagram of Assignment in Elorp (Faculty)

In the management component, faculty is responsible for several activities to support the complete cycle of the review assignment. At first, the students are required to be added to Elorp. Typically, faculty create user accounts for every student who may be a participant in a specific review assignment. Second, faculty also need to choose appropriate learning objects and then add them to Elorp. These learning objects are usually research papers, educational software, simulator tools and so on. The last part of course management is the component "Assign Assignment", which consists of two kinds

of assigning: "designated learning object review" and "learning object review by choosing from delimitation". Unlike designated learning object review, "learning object review by choosing from delimitation" provides a group of similar learning objects from which the students can pick one up.

Compared to the same part in the student scenario, the core review component involved in the faculty scenario only contains a feedback phase, where the faculty provides feedback on the submitted review assignments. This part is very productive in help students who may be new to learning object review. With the feedback/comments from faculty, the student can complete the review both in content and structure.

The grading system is another part of Elorp which evaluates a students' review work. Combined with the student's review itself, a grading result can be a necessary supplement to compose a whole new learning object, the review of the original learning object. Technically, both the grading system and core review component in the faculty scenario communicate with the student scenario through the student review interface through which the faculty and students share the review state. The activities involved in the faculty scenario are based on the activities in the core review component in the student scenario. For instance, faculty provide feedback after the student has submitted the review. The activity of grading happens after the student has finally submitted the review assignment.

3.2 Transactional States

Elorp is an iterative web application with effective states control. Currently, there are six states involved in Elorp. Figure 3.3 shows the transitions between states in a state diagram [20]. The first state used for the student scenario is "New" once any new review assignment is created. While the working on the review assignment, the state is changed

from "New" to "In Progress", to "Submitted" then to "Feedback", and to "Final Submit Ready" and finally "Complete".

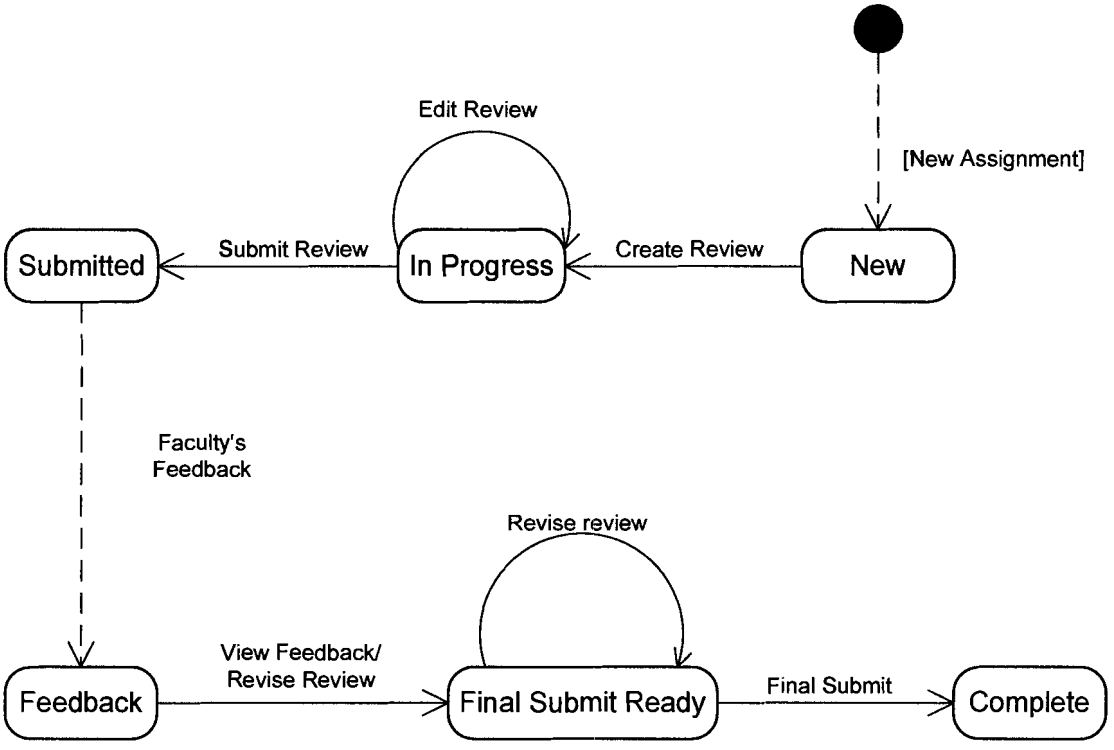

Figure 3.3 Transaction states for student scenario

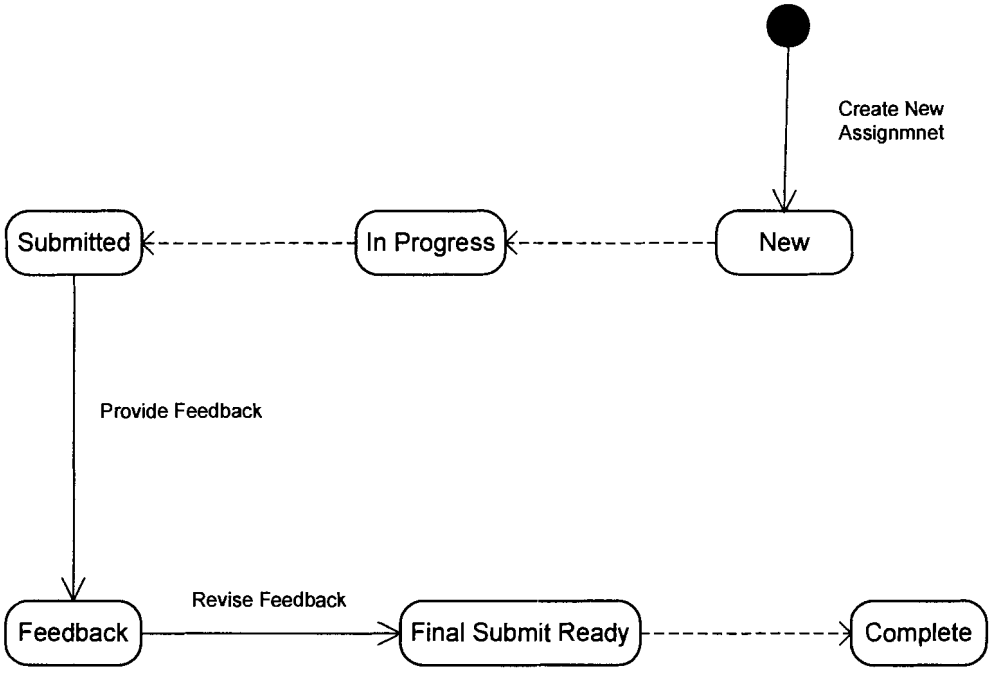

Figure 3.4 Transaction states for faculty scenario

It's important to be emphasized that the interactions between faculty and students happens on the state change from "Submitted" to "Feedback". After students submit the review for feedback, faculty get a feedback request. Similarly, students get the state "Feedback", changed from "Submitted", after faculty have provided feedback.

Compared with the student scenario, the transaction state for the faculty scenario can take the same six states, but has different actions. In the faculty scenario, the faculty mainly act on the states "Submitted" and "Complete". The state "Submitted" requires faculty to provide feedback on the review submitted by students. Faculty can also revise their feedback while the state is still set to "Feedback".

Figure 3.4 is the portion of page where the faculty write the feedback. Similar to students, faculty can also revise the feedback time and again as long as student has not submitted the final summary.

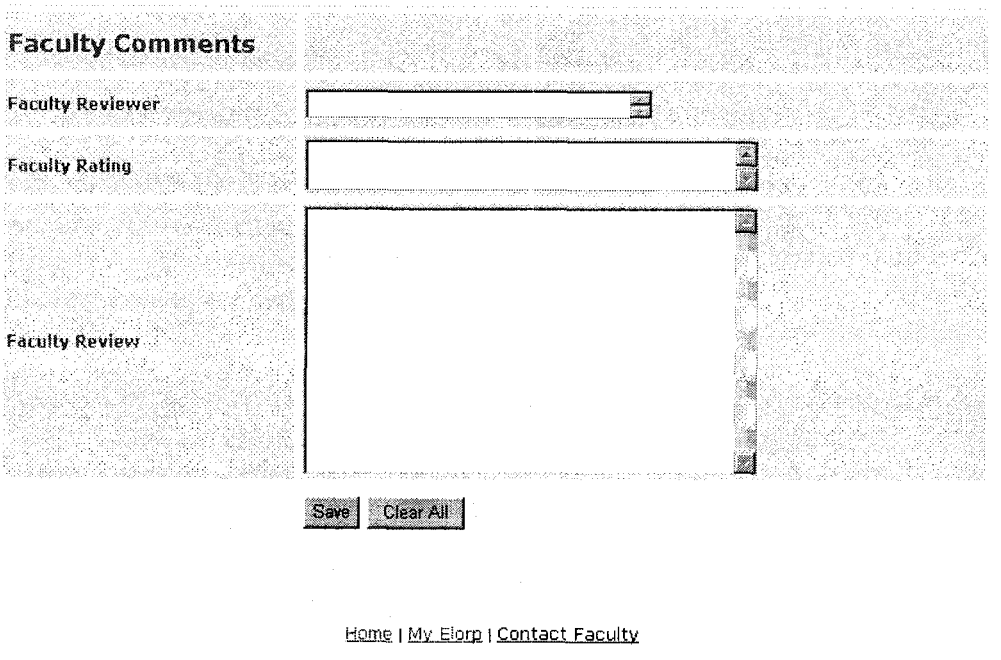

Figure 3.5 Provide feedback in faculty scenario

It's easily understood that the actions corresponding to different states are particular and dissimilar. These differences are depicted in table 3.1 as following. With the exception of the states "Submitted" and "Complete", the other states all request student actions.

Table 3.1 Transaction States Actions

Transaction States	Student's Actions	Faculty's Actions
New	Create Review	
In Progress	Edit Review, Submit	
Submitted		Provide Feedback
Feedback	Revise Review	Revise Feedback
Final Submit Ready	Revise Review, Final Submit	
Complete		For further .....

3.3 Core Review Component (Student Scenario)

As described in chapter two, there are two kinds of assignments in the Elorp system: "designated learning object review" and "learning object review by choosing from delimitation". Just as its name implies, "designated learning object review" is an assignment that is designated to specific learning object. While, "learning object review by choosing from delimitation" offers students a more flexible option to choose one learning object from a learning object set. The process details of these two kinds of assignments will be depicted in next two sections. The description mainly elaborates on the activities in the student scenario because students are the primary participants in Elorp. For faculty, only the different activities from the students are mentioned.

3.3.1 Designated Learning Object Review

The basic process of "designated learning object review" follows the steps depicted in figure 3.5.

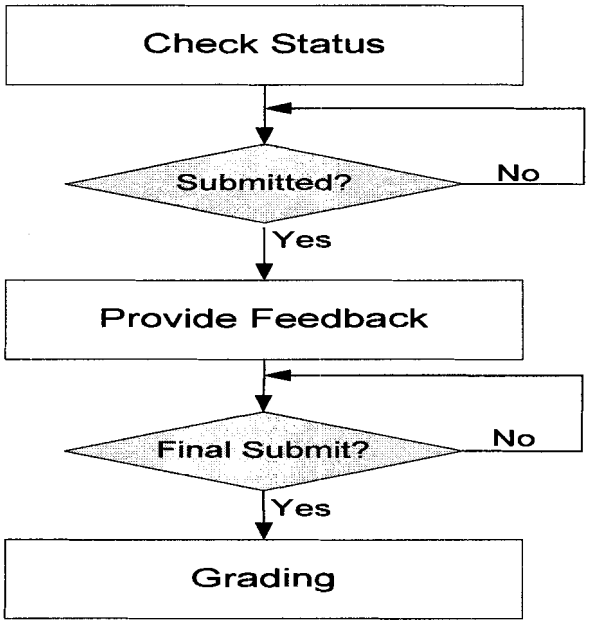

Figure 3.6 Workflow of Designated Learning Object Review

Check Assignment State Notice

The first step to go in Elorp is always checking the assignment state notice. Students get the assignment notice when they login Elorp after the assignment is assigned to them. The typical assignment notice consists of link to an assignment description, assignment state, and proceeding action. For instance, the assignment state notice depicted in figure 3.6 shows that there is new assignment for the student "jonathan". The highlight "Operating System Simulator (Deadlock)" links to a new page with detailed description both of the learning object and the review assignment itself. The state line underneath the hyperlink describes that it's a new assignment and the proceeding action is to "create review".

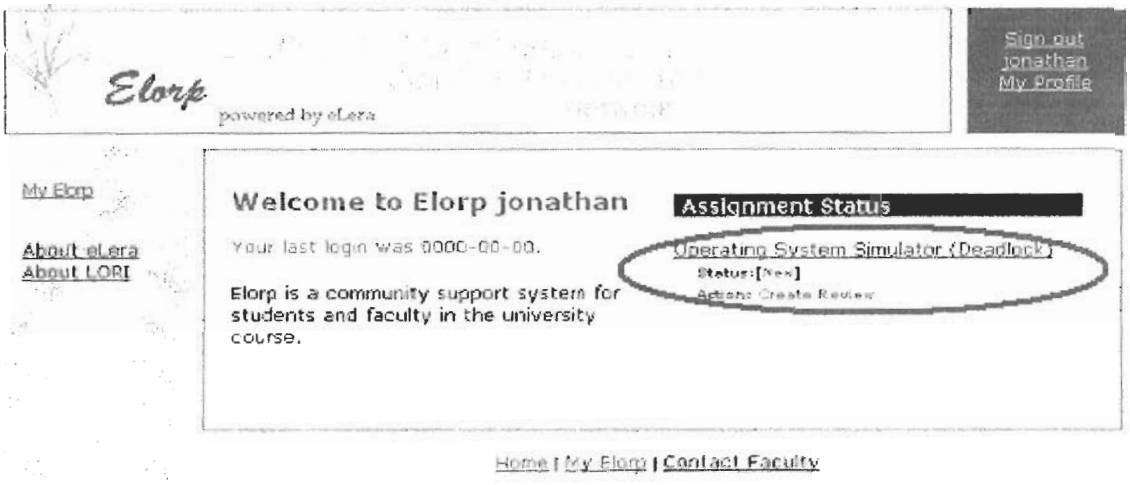

Figure 3.7 Check assignment state notice

Check Assignment Requirement

After entering hyperlink by clicking on the link, "Operating System Simulator (Deadlock)", students see a new page presenting the detail of the learning object and assignment. In the first section of the main body, the detailed attributes of the learning object are listed. These typical attributes relate to location (URL), subject, language, and educational context of learning object. In the case of "Operating System Simulator (Deadlock"", a student can go directly to the link http://www.ontko.com/moss/#deadlock. Before starting to write this review assignment, students will need to read documents, download/install a simulator and test it. Good preparation is very helpful to write a quality review quickly. Besides the attributes listed above, a note, which describes the date when the paper was added to Elorp and who added the learning object to Elorp, is listed at the bottom line in this section. Other than the information of learning object itself, the review assignment requirements are another area to which students should pay attention to. Students must schedule their work to meet the assignment deadline. The hyperlink

"Create Review", which guides students to start their review work, is listed at the bottom line of the page body. By clicking it, the review commences.

Figure 3.7 is the screen shot for "Check Assignment Requirement".

Figure 3.8 Check assignment requirement

Create Review

As described in chapter two, review in Elorp is based on review rubrics which can be customized in order to adapt to different disciplines. In evaluation experiments which will be depicted in chapter 4, 14 rubrics were introduced to students guiding them on starting a simulator review for a course operating system. For this case the rubrics primarily summarize the installation, error handling, usability and functionality of the simulator. These kinds of review rubrics are not generic review rubrics like LORI [6]. That means they don't apply to all general learning objects. The review rubrics consist of 12 customized ones which are listed in chapter two, 1 "credits" rubric [13], a necessary part to complete the learning object review with a credits detail and one more "General" rubric at last to summarize the whole review. Compared to other rubrics, the rubric "credit" is a special one containing 19 sub-rubrics which mainly consist of the information on the learning object source, related journal articles, author(s) and so on. The rubric "credit" also contains the basic information on the creator (author) of learning object. For new comers to learning object review, the optional rubric "Credits" can effectively lead them to know how to summarize a complete learning object review with necessary credits. In figure 3.8, the whole rubrics used in "Create review" are listed.

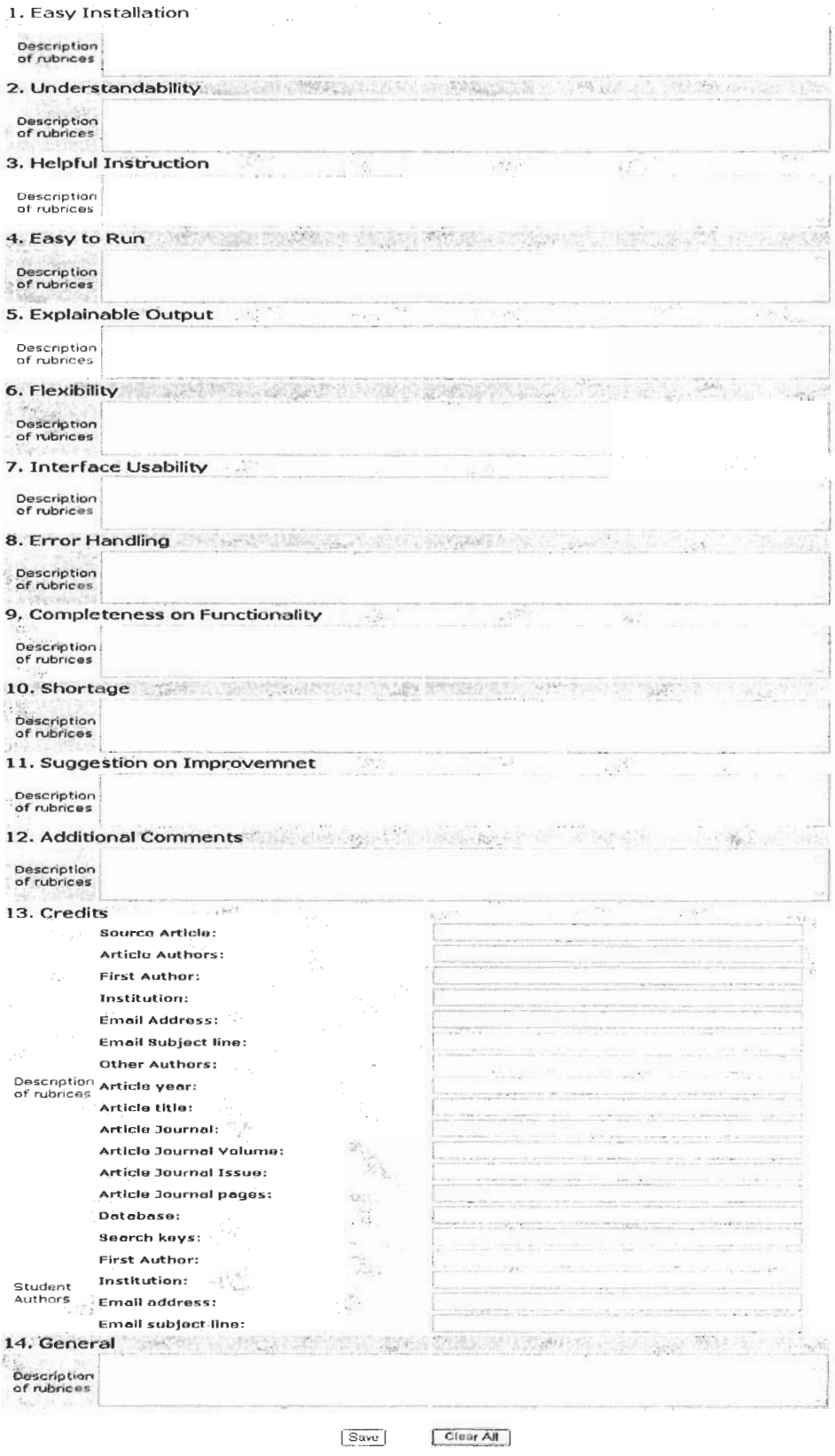

Figure 3.9 Rubrics of creating review

Edit/Revise Review

Elorp allows students to keep revising their review as long as the review has not been submitted. This webpage has the same rubrics as the page "Create Review" and the hyperlink "Edit Review" is available at the bottom of this page. This link guides students to apply the update to a previous review work. The reviewer(s) have a chance to make a review step by step.

Submit Review

The mechanism of review state control, which is introduced in the previous section, will set the state of review to "submit ready" and a new hyperlink control will be added with name "Submit" as shown in figure 3.9. After students have created their review, this event will be triggered. And, during period of "Edit/Revise"", the state of this review will be kept in the state "submit ready". That means, students will be able to submit their review to faculty at any time.

There are two ways to submit the review assignment as shown in figure 3.9. The figure 3.9 (a) demos how to submit a review in the phase of "Edit/Revise". The students can also follow the highlighted hyperlink to submit the review easily as depicted in figure 3.9 (b) after re-log in. If the review is saved to Elorp, the state of review becomes "In Progress" instead of "New". This state can be viewed by both faculty and students.

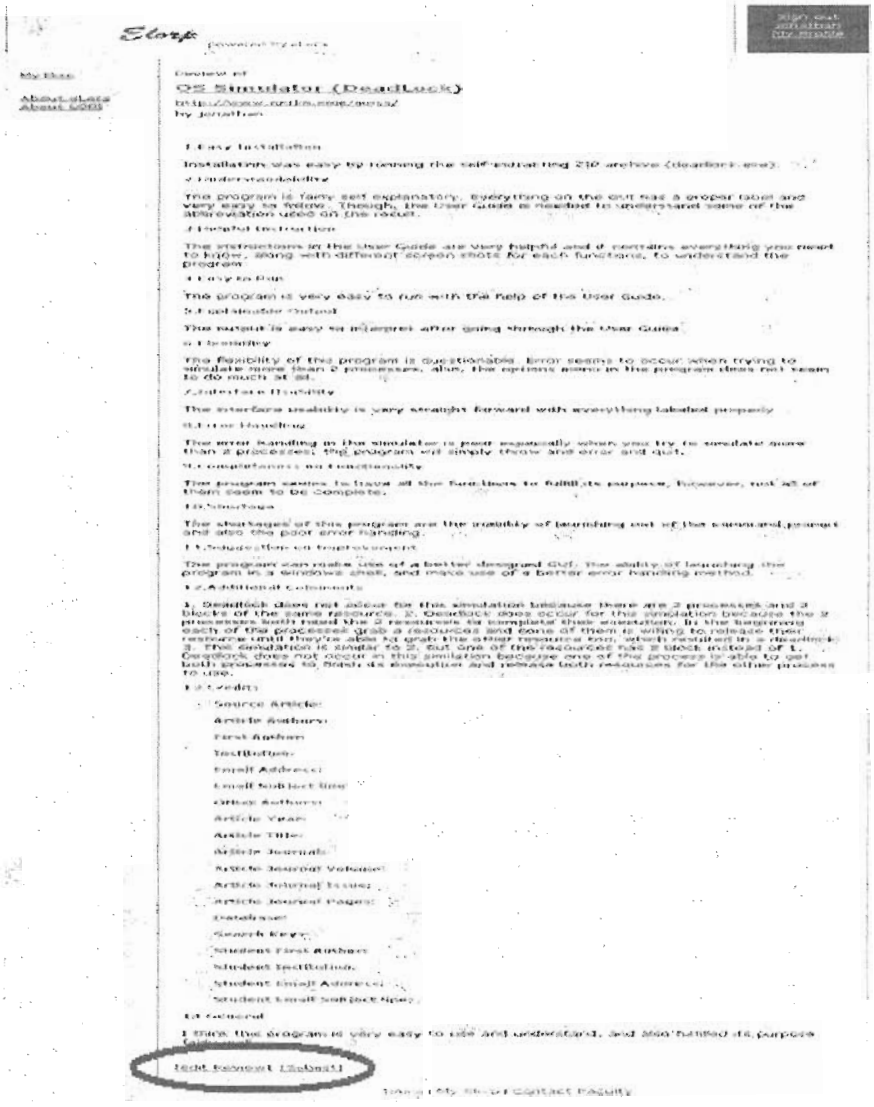

Figure 3.10 Submit review

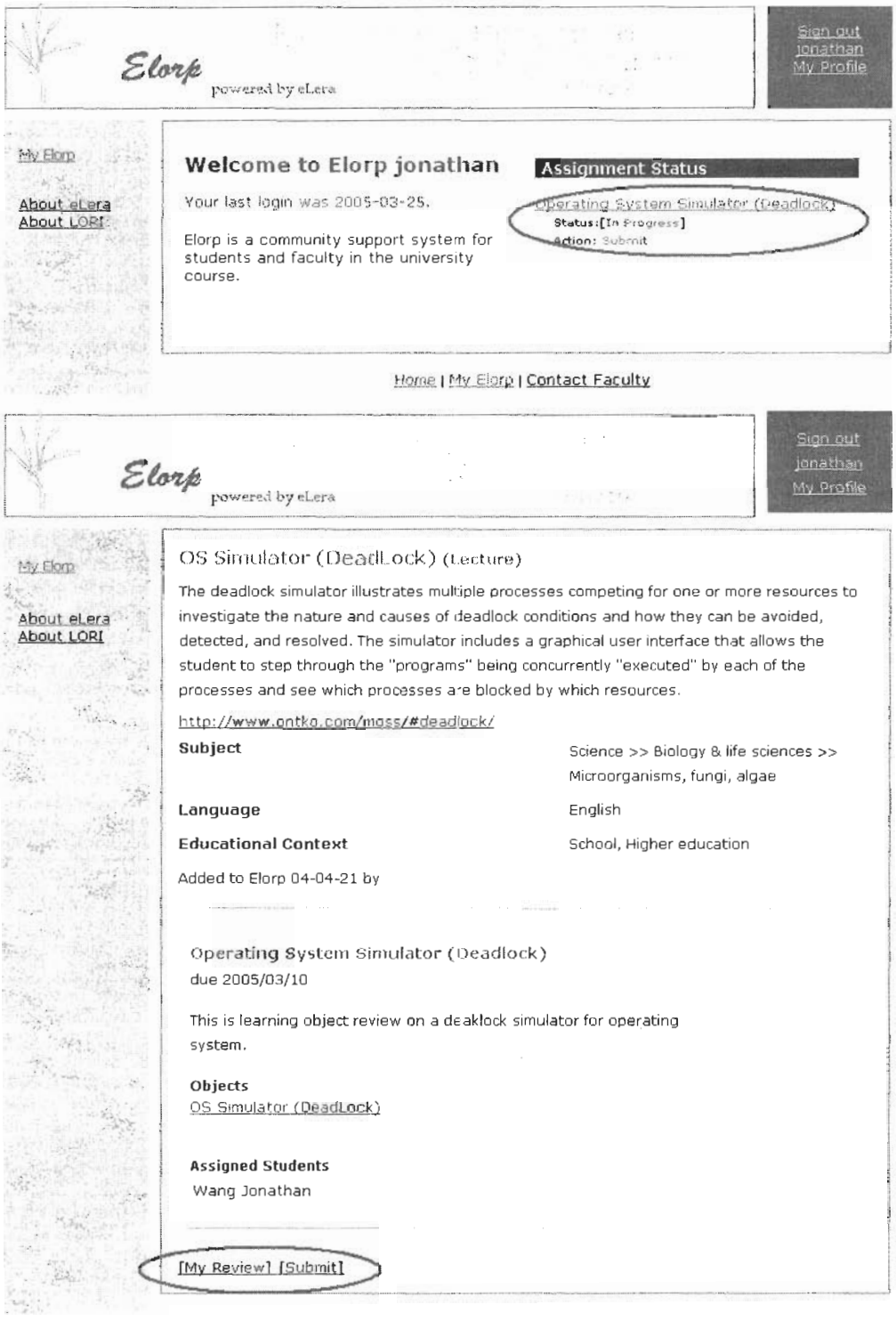

Figure 3.11 Submit review

Check Feedback

After submission of the review assignment, students will know if the feedback is ready by checking their assignment state notice. The state “Feedback” means there is feedback ready for viewing for students. By clicking the assignment link and then “View Feedback”, students will be navigated to the page with feedback.

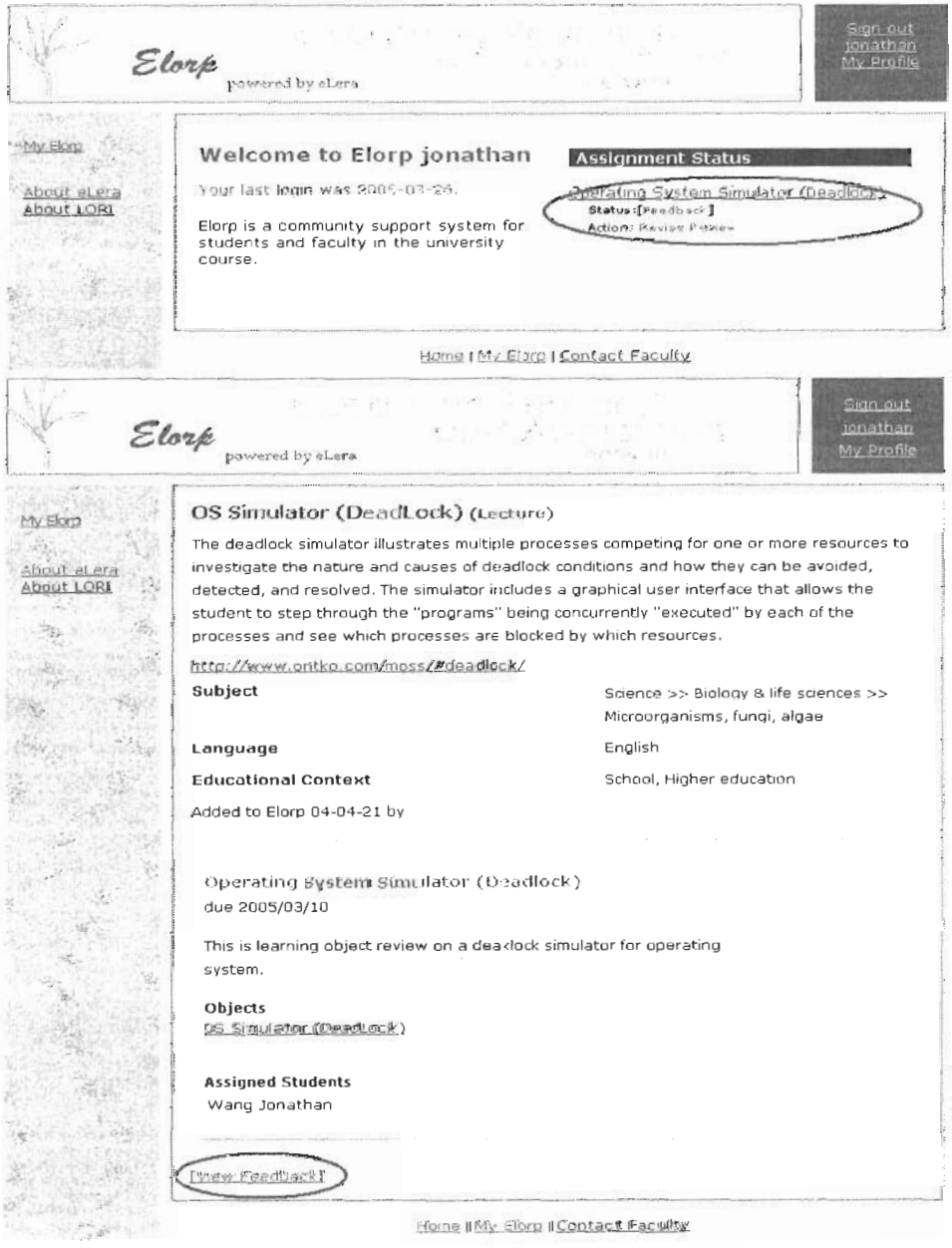

Figure 3.12 Check feedback

Typically, in Elorp, the feedback will be displayed in a detailed review page with a review statement. Figure 3.10 (b) is the screen shot for the viewing of feedback. The feedback part, which consists of "Faculty Reviewer", "Faculty Rating" and "Faculty Review", is listed at the top of the page in figure 3.10 (b). Students can easily compare the feedback with their review and will know which parts need to be revised. The hyperlink "Revise Review", which is at bottom of this webpage, leads students to another webpage allowing them to revise their review assignment.

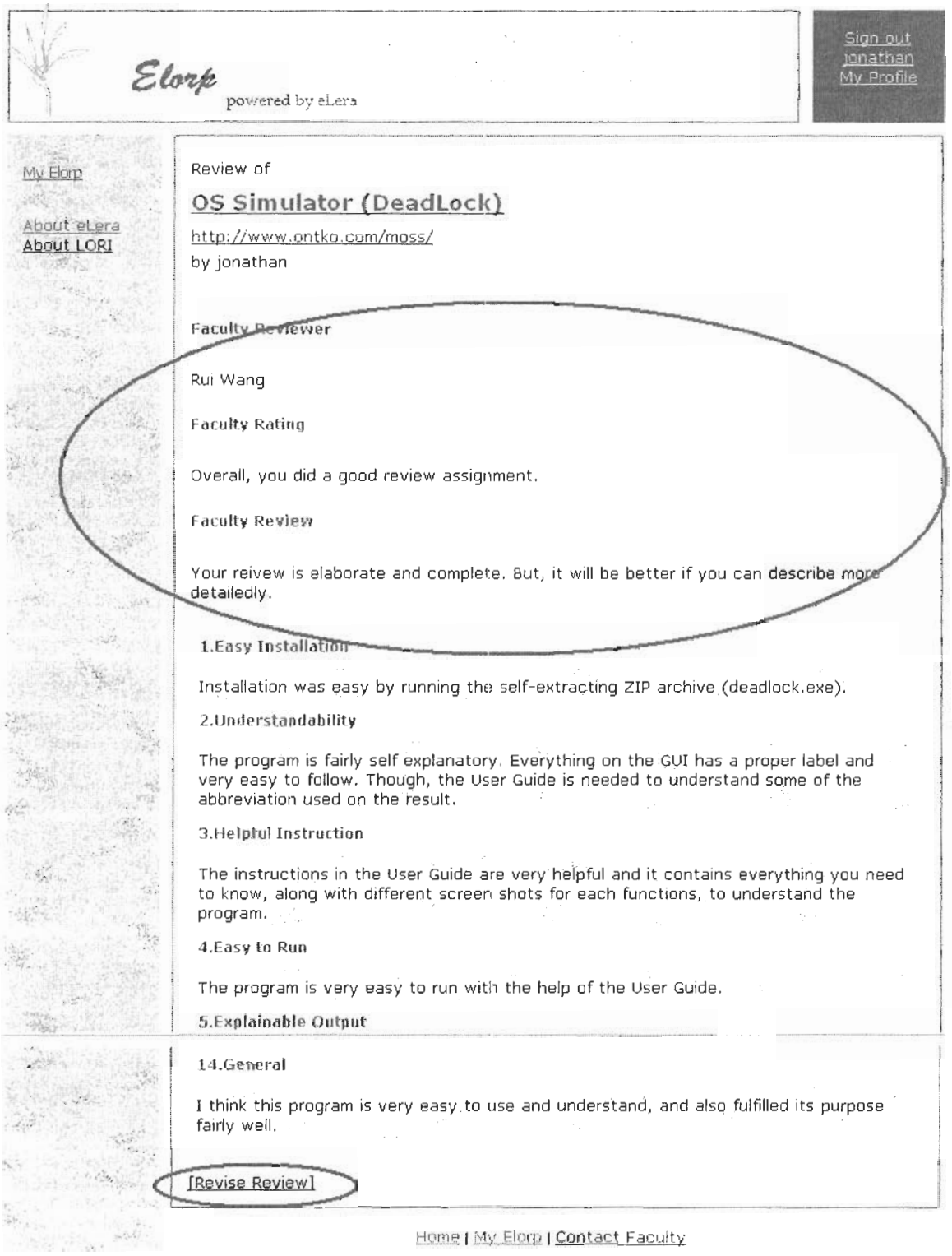

Figure 3.13 Preview of faculty feedback

Revise Review

Same as the "Edit Review" described above, Elorp allows students to revise the review time and again as long as the review has not had final submission. This webpage has the same rubrics as the page "Create Review" and "Edit Review". The whole review rubrics statement is populated to specific text areas and is available for changes. Figure 3.11 shows a portion of the page "revise review".

Figure 3.14 Revise review (portion)

Final Submit

Students will perform familiar actions after they are done the review revising. At the very beginning of review cycle, students can "submit" the review to faculty or to a TA when it is done. Similarly, students can "final submit" their review if they are satisfied with their revisions. There are also two ways to "final submit" the review assignment. Figure 3.12 shows one way to do that by following the "assignment state" and hyperlink "Final Submit". At this moment, the state of review assignment becomes "Final Submit Ready". This state can be viewed by both students and faculty just like other states.

Figure 3.15 Final submit

3.3.2 Choose Learning Object from Delimitation

Other than "designated learning object review", there is one more option available for participants of Elorp. That is "choose learning object from delimitation". The basic process of "choose learning object from delimitation" follows the steps depicted in figure

3.13. Compared to "designated learning object review", this type of assignment allows students to choose one learning object from a list which contains several related learning objects. In figure 3.13, the blue section shows this difference.

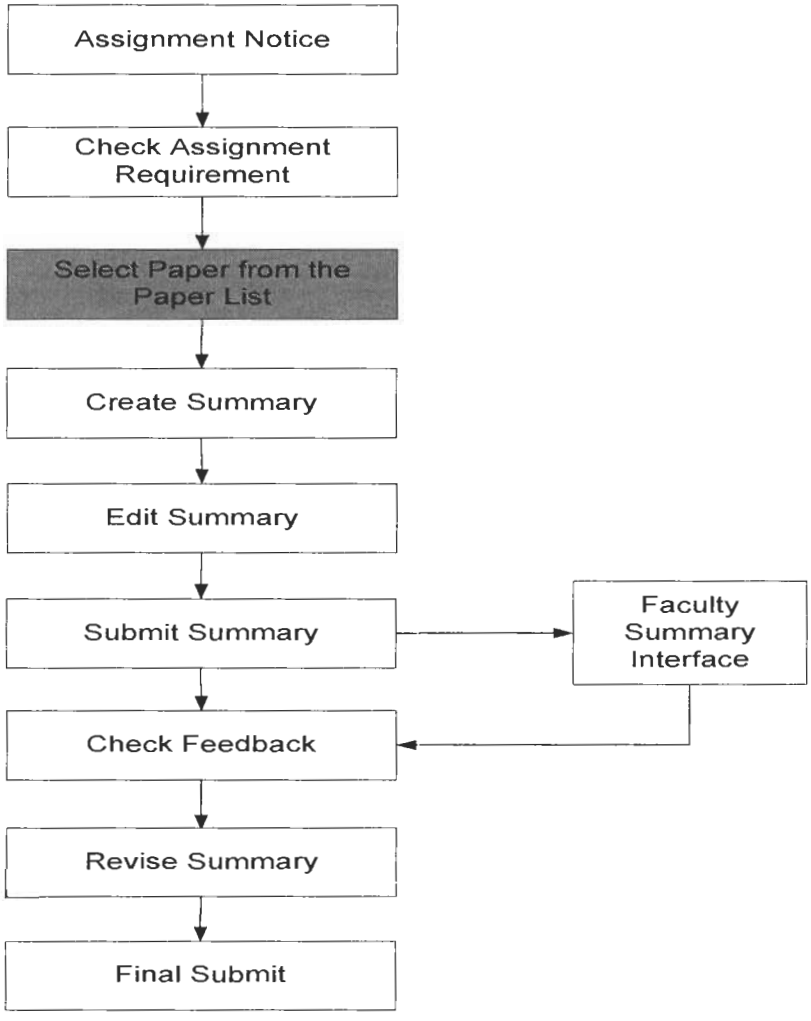

Figure 3.16 Workflow for "Choose Learning Object from Delimitation"

The corresponding review state for this type of assignment is "Select Learning Object". Students can freely pick up one of learning objects which they are interested in and confirm their selection. Aside from the additional step of learning object selection, the rest of steps will be same as these in "Designated Learning Object Review". Figure 3.14 intuitively shows the process of it.

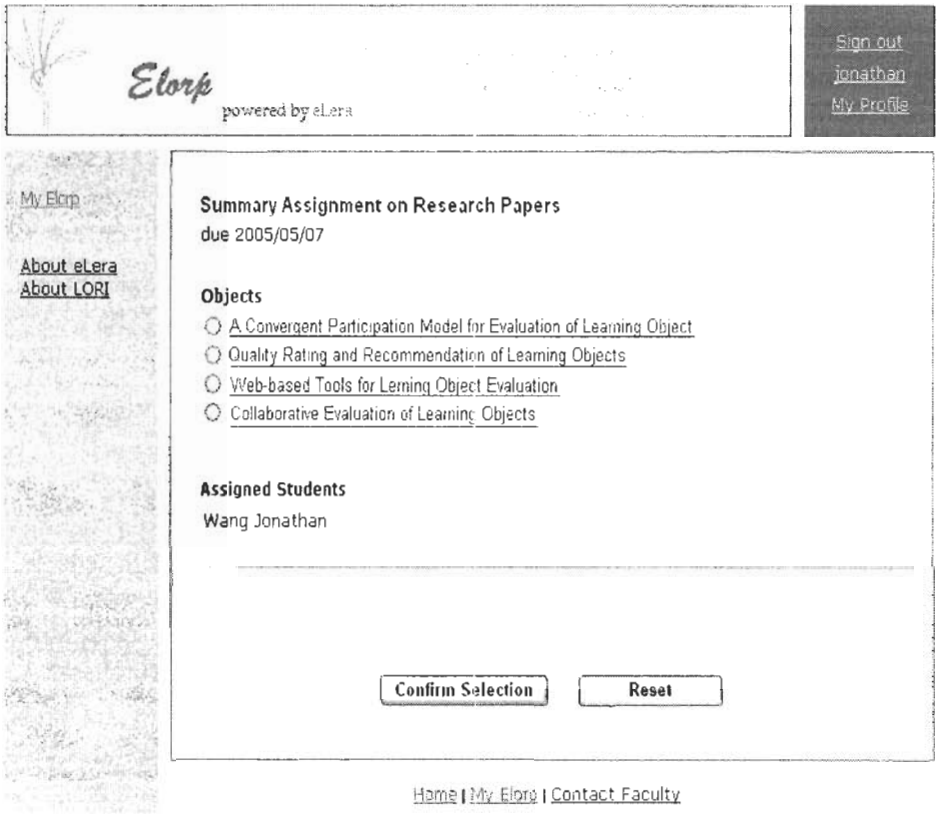

Figure 3.17 Choose Learning Object from Delimitation

3.4 Management Component

Aside from their involvement in the process of review, faculty are also responsible for some other course management issues, such as "Add Learning", "Add students", "Assign assignment" and "Manage assignment". With the exception of "Manage assignment", the other three duties are all necessary for preparation of the review. Before the processing of the review, the faculty must:

1. Add learning objects to Elorp for further paper summary
2. Add students to Elorp and create an account for every student in Elorp
3. Assign the assignment with a type: either "Designated Learning Object Review" or "Choose Learning Object from Delimitation"

"Manage assignment", a supplemental function, is designed to manage the assignment with two action options: "edit" and "delete". The detail of these issues will be depicted as following.

Add Learning Object

The following content is mandatory for "Add Learning Object" as shown in figure 3.15:

1. Title, which indicates the title for the paper
2. Location (URL), which has the online availability of the paper
3. Subject, which allows for more subjects than psychology for further extension

Other than above three items, there are also optional items like "language", "resource type", "contributors" and so on. The more items that have been added, the more complete the learning object. The user name of the faculty who added the learning object is also saved with the learning object in a database for tracking the adding of learning objects.

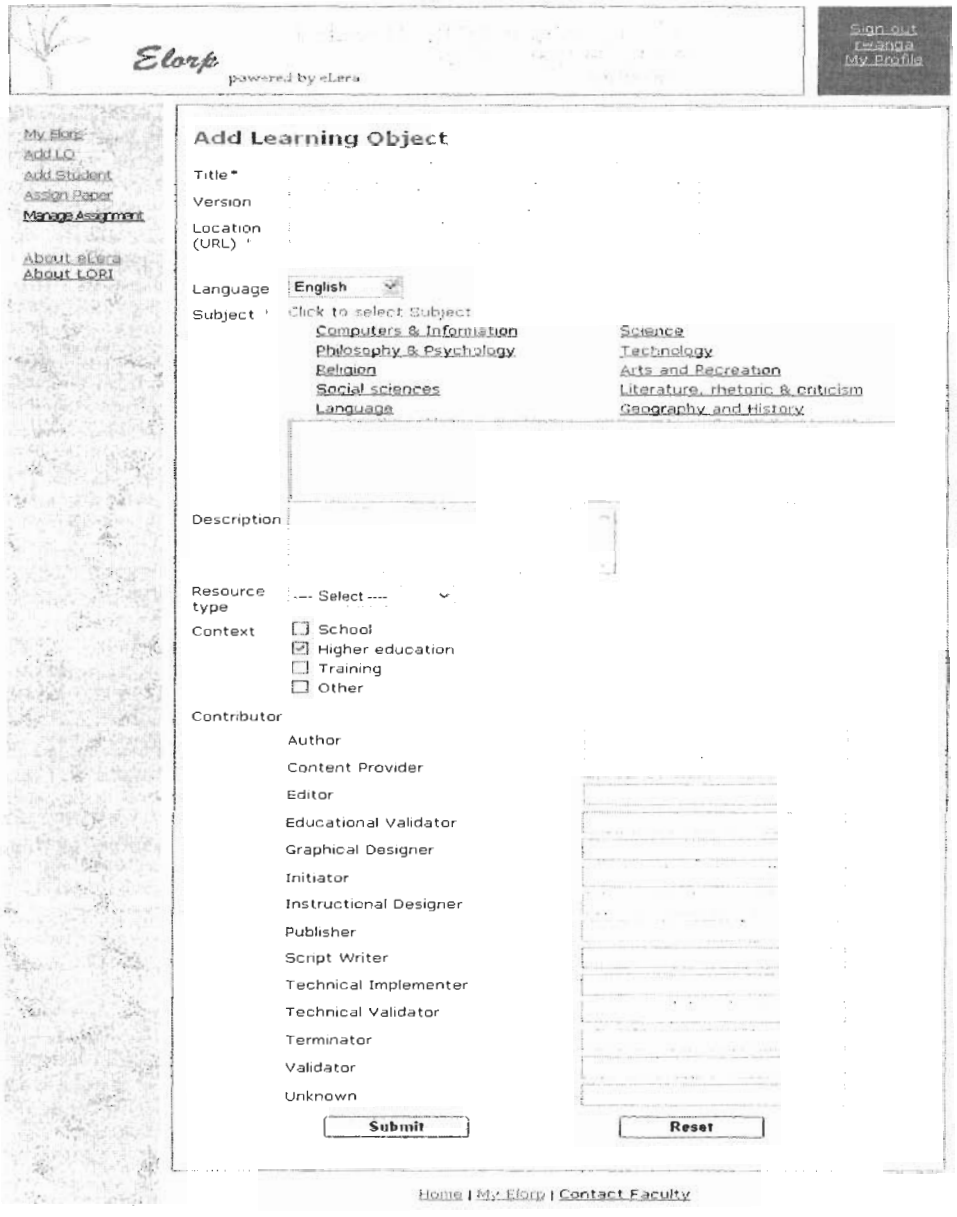

Figure 3.18 Add learning object

Add student

Adding students who will participate in reviewing is also responsibility of faculty. When creating an account basic information is required by Elorp, such as last name, first name, student id, and email address. The user account is created with a default password which can be changed when the user logs in.

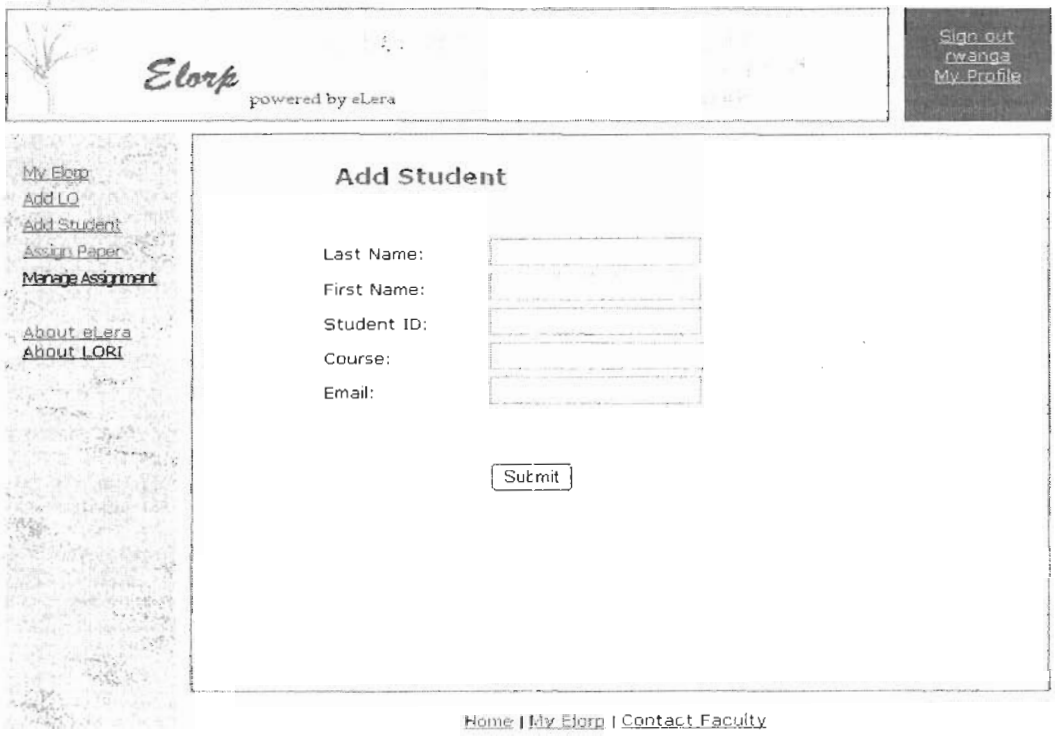

Figure 3.19 Add student

Assign Review

In Elorp, there are two kinds of review assignment: "Designated Learning Object Review" and "Choose Learning Object from Delimitation". These two options are provided as showed in figure 3.17 as following. Faculty can enter and assign different assignments.

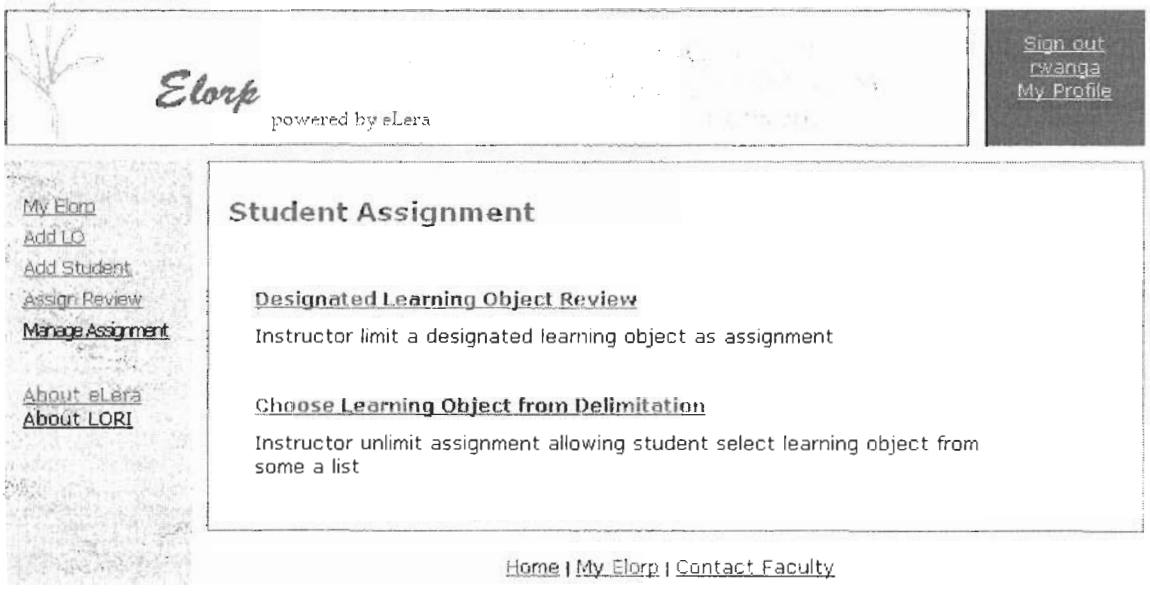

Figure 3.20 Two options for review assignment

The typical assignment "Designated Learning Object Review" is depicted in figure 3.18 as following.

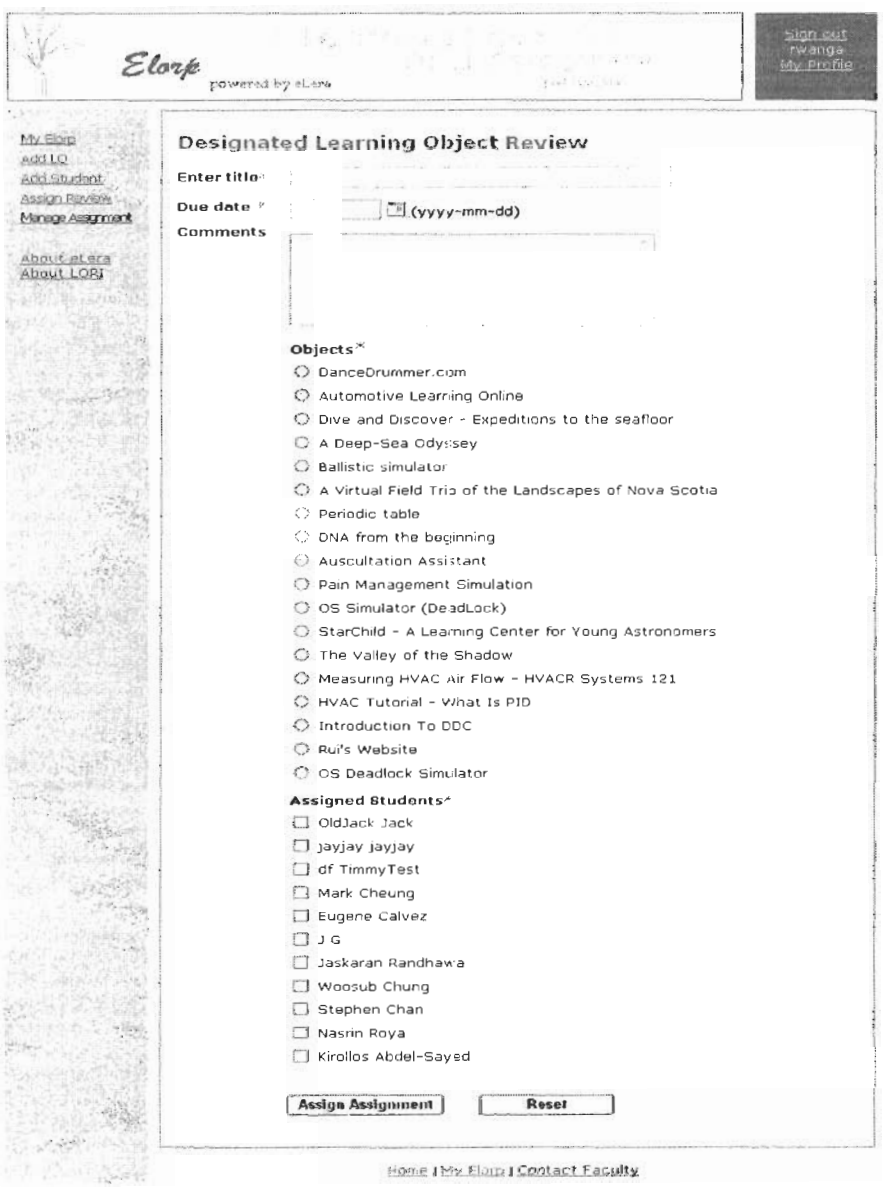

Figure 3.21 Assignment of "Designated Learning Object Review"

As depicted above, the part "Add Learning Object" and "Assign Review" are technically referenced from eLera.

3.5 Characters of Elorp

As a learning tool, Elorp is designed tc help effectively complete review/summary assignments. Aside from the example described in this chapter, Elorp can also

accommodate more topics from multiple disciplines. In order to meet the requirements of multiple disciplines, the rubrics deployed in Elorp can be customized specifically. Faculty can create new rubrics for different assignments.

Another characteristic of Elorp is the state-control mechanism. In Elorp, the actions of both students and faculty are triggered by state. That means a specific action is required during a specific state. Students can easily control their own progress by checking their assignment states and faculty can track a student's work by checking their states.

The review/summary assignment conducted in Elorp is supported by an iterative review model, which consists of two iterations. Once faculty have created a new assignment, the first iteration is triggered. During this iteration, students start to write the assignment and then update it. After the students have submitted the assignment, this iteration ends. The second iteration is triggered by faculty after their feedback is provided. Subsequently, Students will revise and then submit the final review assignment. The iterative review model is designed to help students learn better by involving the guidance of the faculty.

CHAPTER 4
ELORP EVALUATION TEST

The purpose of this evaluation test is to get some quick and early feedback on the system development of Elorp. The general steps for this evaluation test are listed as following:

- Plan the evaluation experiment and develop supporting materials
- Run the test and collect data as specified in the test plan
- Analyze and interpret the data

In this chapter, the technique offered here for the Elorp evaluation test can be divided into two phases: planning and preparing for evaluation and conducting the evaluation test.

4.1 Planning and Preparing

Typically, the followings jobs are required prior to Elorp evaluation test.

- Decide on user and task focus for the test
- Assemble the test environment and develop test materials
- Recruit the test users

These three preparation jobs will be addressed in the next three sections in detail.

4.1.1 Decide on user and task focus for the test

As a learning tool, Elorp is designed to help students to complete review/summary assignments. In order to evaluate Elorp, the best way to evaluate is to broadly sample from all potential categories of intended users. But, due to limitations on resources, we will just focus on one potential user group. This group is considered to be

"high-priority" users, who are a class of students currently taking a course where a review assignment is required. Ideally, this is a group of test participants that is a representative group of specific user characteristics and skill levels.

As for the tasks of evaluation test, 9 criteria are introduced in this evaluation test. These nine criteria are classified to two categories: Iterative review model and System design. The test of the Iterative review model is conducted to collect some feedback about this model. The second category focuses mainly on the usability of Elorp [15].

Iterative review model:

1. **Completeness** – This system has complete review cycle I expect it to have.
2. **Effectiveness** – I can effectively and quickly complete my work using this system.
3. **Functionality** -- This system has all the functions and capabilities I expect it to have.
4. **Innovation** -- I will characterize this system as an innovative one.
5. **Productivity** -- I believe I became productive quickly by using this system

System Design:

6. **Interaction** -- The interaction on this system is easy to understand.
7. **Interface Evaluation** -- The interface of this system is pleasant
8. **Satisfaction** -- Overall, I am satisfied with how easy it is to use this system.
9. **Understandability** -- The information provided in the system is easy to understand.

Among the above nine test criteria, Innovation, Interaction, Productivity and Satisfaction are the core tasks of most importance to Elorp's design. From the design evaluation test, Elorp could be characterized as a "good" system if the nine criteria are evaluated positively.

4.1.2 Assemble the test environment and develop test materials

Technically, the evaluation test of Elorp is a special one, which asks the students go through a review assignment and then take an evaluation test. In order to take this evaluation test, several related materials have been developed and given to the participants. Typically, these materials are an introduction, a consent form and a post-test questionnaire [16]. In addition to the above materials, Elorp has been assembled to involve an evaluation test. The consent form and post-test questionnaire have been integrated into Elorp and the data is collected is recorded in database.

The "introduction" mainly introduces how to use Elorp to review a learning object. The Consent form and post test questionnaire are integrated in Elorp. When the students log on to Elorp for the first time, they are asked to read and sign the consent form. The posttest questionnaire needs to be filled in after the students have finally submitted their review assignment. Through the post-test questionnaire, the evaluation measures are collected along with the normal process of learning object review.

The two documents mentioned in this section are listed as appendix.

4.1.3 Recruit test users

As described above, Elorp is designed to help students to complete review/summary assignments. This means the most representative group of users are students who are involved in course learning. Another consideration for picking a group of test users is discipline. Even though Elorp can technically accommodate multiple disciplines, a test on a specific discipline is more representative because of the simplicity of Elorp. Basically, Elorp offers intuitive review criteria which are simple to understand. For instance, if the review focus is on a software simulator, the review criteria, such as "Easy to run", "Easy to install" and so on, can be understood by newcomers easily. If we

are reviewing a research paper on psychology, more abstract review criteria have to be introduced, such as background, methods, findings and so on.

By considering that, I decided to recruit a class of students who are currently taking a course on "Operating System" in which a review assignment is required. In this evaluation test, the students are required to write a review assignment on a "deadlock simulator". This simulator illustrates multiple processes competing for one or more resources to investigate the nature and causes of deadlock conditions and how they can be avoided, detected, and resolved. Totally, there are 44 undergraduate students participated this Elorp evaluation test under the Ethics approval on ref. #36567. The evaluation test happened in the period from Feb 25th to Mar 6th. The evaluation results, consent form and post-test questionnaire are all stored in a database for record.

4.2 Conducting the evaluation test

After the stage of planning and preparing, the evaluation test is conducted with following 3 steps:

- Collect and summarize data
- Analyze/interpret data
- Conclusion

The following three sections will mainly depict the above three steps.

4.2.1 Collect and summarize data

Based on the data collected from evaluation test, the first summary table has been created in Table 4.1 as following. In the summary table, the numeric evaluation points have been listed for all 44 participants.

Table 4.1 Evaluation results on Elorp

StudentID	Satisfactior	Effectivity	Interaction	Productivity	Understandability	Innovation	Interface Evaluation	Functionality	Completeness
[redacted]	4	4	5	4	4	4	3	4	4
	5	4	4	4	5	5	5	5	5
	5	4	4	4	5	5	3	4	4
	4	5	4	5	5	4	5	4	5
	3	3	3	3	3	5	4	3	4
	3	3	3	4	4	2	2	3	3
	5	5	0	5	4	5	5	5	3
	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	4	4	4	4
	5	5	5	5	5	5	5	5	5
	4	4	4	5	4	5	4	4	4
	5	4	5	5	4	5	5	4	5
	1	1	5	1	1	1	1	1	1
	4	5	4	4	5	3	4	4	4
	4	5	5	4	5	4	4	5	5
	5	5	5	4	4	5	4	5	5
	5	5	5	4	5	5	5	5	5
	5	5	5	5	5	5	5	5	5
	2	1	1	3	3	4	3	1	1
	5	5	5	5	5	5	5	5	5
	5	5	4	5	5	5	5	5	5
	5	5	5	5	1	5	5	5	5
	3	3	3	3	3	4	4	3	4
	4	4	5	5	5	4	4	4	4
	2	3	5	4	2	3	4	5	5
	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5
	2	4	5	3	5	5	3	4	4
	5	5	5	5	5	5	5	5	5
	1	2	3	2	3	3	3	3	2
	3	4	3	4	4	5	4	5	4
	5	5	5	5	5	5	5	5	5
	3	4	4	4	5	3	4	2	3
	5	5	3	5	3	5	3	5	3
	5	5	5	5	5	5	5	5	5
	3	4	3	3	3	3	3	5	3
	4	5	5	5	5	3	3	5	5
	4	4	5	4	5	3	4	4	3
	5	5	5	5	5	5	5	5	5
	4	5	5	5	5	5	3	5	3
	5	5	5	5	5	5	5	5	5
	2	2	4	3	3	4	4	2	3
	5	2	5	2	3	3	5	4	3
	1	1	1	1	2	2	3	1	1

During this evaluation test, the test participants were not lead in any way, and were not given any information about how the interface worked, as this would invalidate the data being collected. Due to the not-sharing policy of Ethics, the students' usernames are shielded by a black column.

4.2.2 Analyze/Interpret Data

This evaluation experiment is conducted by evaluating two categories: the iterative review model and the system design. For the first category, iterative review model, we collected the result data to analyze how this model designed to meet the students' requirement. And, we also interpreted the result data on category "system design" to show how the system is implemented, which included user interface, usability and so on.

4.2.2.1 Score Distribution

Based on the original evaluation data in Table 4.1, a "Score Distribution" table has been created to present the summarized data distribution about this evaluation test. The table "Score Distribution" is not a sophisticated way of summarizing data. It just offers a way to weight the relative data distribution and give us an intuitive idea about the system that we evaluated.

Table 4.2 Score distribution for weight

	Score				
	1	2	3	4	5
Completeness	3 (6.8%)	1 (2.3%)	9 (20.5%)	10 (22.7%)	21 (47.7%)
Effectivity	3 (6.8%)	3 (6.8%)	4 (9.1%)	11 (25.0%)	23 (52.3%)
Functionality	3 (6.8%)	2 (4.5%)	4 (9.1%)	11 (25.0%)	24 (54.5%)
Innovation	1 (2.3%)	2 (4.5%)	8 (18.2%)	8 (18.2%)	25 ($56.8%)
Productiity	2 (4.5%)	2 (4.5%)	6 (16.6%)	12 (27.3%)	22 (50%)
Interaction	2 (4.5%)	0 (0%)	7 (15.9%)	8 (18.2%)	26 (59.1%)
Interface	1 (2.3%)	1 (2.3%)	10 (22.7%)	13 (29.5%)	19 (43.2%)
Satisfaction	3 (6.8%)	4 (9.1%)	6 (13.6%)	9 (20.5%)	22 (50%)
Understandability	2 (4.5%)	2 (4.5%)	8 (18.2%)	7 (15.9%)	25 (56.8%)

As mentioned above, of the nine evaluation test criteria, Innovation, Interaction, Productivity and Satisfaction are the core tasks of most importance to this evaluation test. Summarily, these four criteria both have an average score over 50% on score 5. And, Interaction and Innovation take the highest average scores among the nine criteria, 59.1% and 56.8%, respectively. Even the lowest score, which applied to criteria Interface, 43.2% also means that over 40% participants characterized Elorp as an application with positive interface design. Except for the highest score 5, score 4 is also acceptable for this evaluation test. Score 4 means the application is evaluated without obvious negative evaluation. In the next section, where the confidence limit is plotted, the evaluation score on 4 and 5 are all regarded as the positive evaluation for Elorp.

Table 4.2, another "score distribution" table, depicts the mean score and standard deviation on the evaluation results.

Table 4.3 Score distribution for Mean and SD

	Score		
	N	Mean	SD
Completeness	44	4.0	1.2
Effectivity	44	4.1	1.2
Functionality	44	4.2	1.2
Innovation	44	4.2	1.1
Interaction	43	4.3	1.1
Interface	44	4.1	1.0
Productivity	44	4.1	1.1
Satisfaction	44	4.0	1.3
Understandability	44	4.2	1.2

Examining the score distribution depicted in table 4.2 on, we found the score of Mean averagely located around score 4.1 with the standard deviation around 1.1. Differing to the previous score distribution, the score "Mean" indicates the average score

by sampling whole participants. And, the score "SD" tells us how tightly all the various examples are clustered around the mean in a set of data. Due to the 6 evaluation score (0,1,2,3,4,5) are spread apart and the bell curve is relatively flat, we have a large standard deviation.

Ignoring the impact of the small samples and apart evaluation scores, we could conclude that almost over 50% participants positively evaluated Elorp. And, the average evaluation score fall into the good range which take the smallest score 4.

4.2.2.2 Binomial Proportion for "Good"

Unlike score distribution discussed above, binomial proportion is computed as the proportion of observations for the first level of the variable that we are studying. The following statements compute the proportion of evaluation criteria with "Good" (evaluation score is 4 or 5) and test this value against the hypothesis that the proportion is around 70%. The default confidence limit 95% apply to the evaluation and therefore the lower and upper conf limit can be computed to describe the binomial proportion satisfaction.

```
proc freq data=satisfaction order=freq;
   weight Count;
   tables completeness / binomial(p=.70) alpha=.1;
   title "Binomial Proportion for "Good"";
run;
```

By using SAS procedure shown above, we got the following nine tables on binomial proportion for "good". These nine tables apply to the nine evaluation criteria, respectively.

Table 4.4 Binomial Proportion for Completeness

Binomial Proportion for Completeness = Good	
Proportion	0.7045
95% Lower Conf Limit	0.5697
95% Upper Conf Limit	0.8394
Exact Conf Limits	
95% Lower Conf Limit	0.5480
95% Upper Conf Limit	0.8324

Table 4.5 Binomial Proportion for Effectiveness

Binomial Proportion for Effectiveness = Good	
Proportion	0.7727
95% Lower Conf Limit	0.6489
95% Upper Conf Limit	0.8966
Exact Conf Limits	
95% Lower Conf Limit	0.6216
95% Upper Conf Limit	0.8853

Table 4.6 Binomial Proportion for Functionality

Binomial Proportion for Functionality = Good	
Proportion	0.7955
95% Lower Conf Limit	0.6763
95% Upper Conf Limit	0.9146
Exact Conf Limits	
95% Lower Conf Limit	0.6470
95% Upper Conf Limit	0.9020

Table 4.7 Binomial Proportion for Innovation

Binomial Proportion for Innovation = Good	
Proportion	0.7500
95% Lower Conf Limit	0.6221
95% Upper Conf Limit	0.8779
Exact Conf Limits	
95% Lower Conf Limit	0.5966
95% Upper Conf Limit	0.8681

Table 4.8 Binomial Proportion for Productivity

Binomial Proportion for Productivity = Good	
Proportion	0.7727
95% Lower Conf Limit	0.6489
95% Upper Conf Limit	0.8966
Exact Conf Limits	
95% Lower Conf Limit	0.6216
95% Upper Conf Limit	0.8853

Table 4.9 Binomial Proportion for Interaction

Binomial Proportion for Interaction = Good	
Proportion	0.7907
95% Lower Conf Limit	0.6691
95% Upper Conf Limit	0.9123
Exact Conf Limits	
95% Lower Conf Limit	0.6396
95% Upper Conf Limit	0.8996

Table 4.10 Binomial Proportion for Interface

Binomial Proportion for Interface = Good	
Proportion	0.7273
95% Lower Conf Limit	0.5957
95% Upper Conf Limit	0.8589
Exact Conf Limits	
95% Lower Conf Limit	0.5721
95% Upper Conf Limit	0.8504

Table 4.11 Bnomial Proportion for Satisfaction

Binomial Proportion for Satisfaction = Good	
Proportion	0.7045
95% Lower Conf Limit	0.5697
95% Upper Conf Limit	0.8394
Exact Conf Limits	
95% Lower Conf Limit	0.5480
95% Upper Conf Limit	0.8324

Table 4.12 Binomial Proportion for Understandability

Binomial Proportion for Understandability = Good	
Proportion	0.7273
95% Lower Conf Limit	0.5957
95% Upper Conf Limit	0.8589
Exact Conf Limits	
95% Lower Conf Limit	0.5721
95% Upper Conf Limit	0.8504

The above nine tables, from table 4.3 to table 4.11, list the binomial proportion for the nine evaluation criteria. In this computation, the hypothesis is that a proportion of around 70% is taken. There are two kinds of confident limits listed in above tables: lower confidence limit and upper confidence limit. The range between lower confidence limit and upper confidence limit shows the percentage on satisfaction with specific criteria. For instance, in table 4.11, the proportion confidence limit of understandability falls into the

range (0.5957, 0.8589). That means at least 59 percent students positively evaluated the attribute "understandability" of Elorp. At most, around 85 percent students were satisfied with it. Technically, from a statistics point of view, the exact confidence limit has a broader range than the proportion confidence limit. Due to limited sampling in this evaluation test, the difference to these two confidence limits is not significant. But, it gives us a statistical idea on the evaluation result. Taking a quick look at the binomial proportion listed in above nine tables, we found we get around 60% averagely on lower confidence limit and around 86% on upper confidence limit. Most importantly, we got high values on the following four evaluation criteria that we are most concerned with: satisfaction, productivity, innovation and interaction.

4.2.2.3 Summary of individual total score

Compared to the confidence limit of binomial proportion, the summary/average is another intuitive way to show the evaluation results. The statistical data on summary/average is listed in table 4.12 and table 4.13. From the tables, for individual participant, mean summary score is 37.06818 and the mean average score is 4.13037. That means the average score on the nine evaluation criteria is over 4 which is levelled as "good". The confidence limit also falls into this range (3.84386, 4.41687) which shows the trend for substantial sampling.

Table 4.13 Summary of individual participant

Basic Confidence Limits Assuming Normality			
Parameter	**Estimate**	**95% Confidence Limits**	
Mean	37.06818	34.49811	39.63826
Std Deviation	8.45342	6.98441	10.71070
Variance	71.46036	48.78200	114.71915

Table 4.14 Average of individual participant

Basic Confidence Limits Assuming Normality			
Parameter	**Estimate**	**95% Confidence Limits**	
Mean	4.13037	3.84386	4.41687
Std Deviation	0.94236	0.77860	1.19400
Variance	0.88805	0.60622	1.42563

4.2.3 Conclusion on data analysis

By calculating the result data, I present three values to describe the evaluation on system Elorp: mean, GOOD(4 or 5), and confidence limit. Table 4.14 depicts the summary on data analysis with respect to 2 categories.

Table 4.15 Summary of two categories of evaluation

	Mean (out of 5.0)	GOOD (4 or 5)	Confidence limit for GOOD
Iterative Review Model	4.14	75.9%	61%-87%
System Implementation	4.15	73.4%	58%-86%

Ignoring the limitation due to insufficient sampling, we can draw the conclusion that Elorp is technically a highly acceptable web-based system with a positive evaluation. Overall, over 70% participants rate on score 4 or 5 and the value mean stand around 4.14. Even though the confidence limit, multiplied by proportion 70%, still falls into a range no less than 58%. Generally, we got very positive response by conducting this evaluation test. The evaluation result shows that the design for Elorp has been successfully implemented and the iterative review model is helpful for students to complete review/summary assignments.

CHAPTER 5
SUMMARY AND FUTURE WORKS

Elorp, a learning tool with the support of an iterative review model, is mainly based on the eLera technical platform. Elorp is designed to help students to complete review/summary assignments. As described in chapter 1, eLera (LORI) is a learning object review community which offers expertise on learning objects. Creating reviews in eLera will help faculty, students, instructional designers and others to select pedagogical models that meet their requirements. Usually, eLera reviewers may involve two kinds of reviews: individual and panel. Unlike individual review which is just conducted by individual reviewer, panel review is managed by a moderator who invites reviewers to write reviews on specific learning objects. The idea of panel review can be applied to Elorp in which faculty can control the process by creating new assignments and providing feedback. Elorp is a web-based learning tool which is engaged to help students to learn course content by conducting iterative reviews. Elorp mainly focuses attention on workflow to help students go through a complete review cycle. For example, if a review on an operating system simulator is taken, the faculty can write feedback or comments to students. Students will learn how their review (actually, their understanding on the simulator) is written and what's lacking in it. The part of Elorp, "Faculty or TA write feedback and comments", is the most productive part in where guidance is effectively deployed by faculty. The process of revising reviews upon feedback is an effective way for students to learn the weak points of their assignments and how to improve them. By customizing the rubrics in Elorp, more disciplines can be accommodated. By using a management component, Faculty and instructors can add students, create new assignments and customize rubrics.

In order to testify the feasibility of Elorp, 44 undergraduate students were recruited in a participative evaluation experiment using Elorp. The evaluation results on the iterative model and the usability of the system are all results were definitely positive. Averagely, over 50% of the participants evaluated the nine evaluation test criteria on score 5. And, for the criteria "Interaction", the percentage the participant evaluate on score 5 reached 59.1%. On the other hand, the mean score on individual criteria which is sampled on 44 participants averagely located around score 4.1 with lowest 4.0 and highest 4.2, respectively. The mean score falls into the range (4.0 to 5.0) which is good as we have defined. From the statistical point of view, the results on confidence limits also exactly indicate the range of individual criteria. Examining the value of confidence limit on each test criteria, we found that the results generally fall into the range (0.55 to 0.90) and no lower confidence limit less than 0.50. That means that over 50% participants were satisfied with using of Elorp and evaluated it very positively.

With Elorp, students can complete review/summary assignments guided by faculty. The two iterations triggered by faculty help students to improve their works on assignments. However, Elorp can not evaluate properly what students learned by going through the assignment. A realistic way to track students' works is to keep every version of the assignment in Elorp. This repository can offer further research to evaluate what students really learned. As a learning tool, Elorp should be enhanced to integrate closely with CMS [17] and other learning object repositories, such as POOL [18] and EduSource [19]. Hence, interfaces are required. For instance, there is a demand for an interface which can load the information of enrolled students. Another typical interface to learning object repositories is one which deals with transforming metadata.

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