ISSUES FOR COLLABORATIVE DEVELOPMENT OF LEARNING OBJECTS TO SUPPORT E-LEARNING

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ABSTRACT

Learning objects are interactive visualizations of program code which focus on a specific learning goal and have the competence to improve the current E-learning environment radically. By reducing the complexity in learning computer programming these e-modules help the learners to better understand and master, and the teachers to better explain and illustrate the problems connected to the use of basic and advanced structures in computer programming. On the other hand, collaboration is the keyword that summarizes recent trends in information technology, especially in the world of academe. When content is developed in a collaborative environment, its scope and sustainability are simply increased. In addition with the presentation of specialized learning objects, the issues and challenges associated with their development in a collaborative environment have been addressed in this paper.

1. INTRODUCTION

E-Learning has significant impact and invaluable contribution in the area of education and as a whole in human development (Garrison and Anderson. 2003). A learner can avail the opportunities to get enormous help regarding a subject matter with the support of e-learning modules. One of the most important aspects of e-Learning is the content. Content's selection, analysis, designs and presentation creates a comprehensive learning experience. As the e-learning contents can be accessed by a range of learners from various places, different cultural backgrounds, located in different countries, so the content should be selected and developed such that the content possesses appeal to the global community. If a suitable content can be identified, learning objects can be developed more effectively in a collaborative environment (AFLFa, 2004). Quality assurance can be accomplished with relative ease and efficiency. The University, where the authors are affiliated with, has become an active partner in a global e-learning program through the Codewitz Asia-Link Program (Codewitz, 2004). The goal is to plan, produce and evaluate unique illustration, animation and visualization aids for students and teachers of computer programming. Even if the use of visualizations has increased in introductory programming courses, the visualizations are still often not integrated in the teaching, the course content and the learning situations.

With the partnership of Tampere Polytechnic of Finland, a four-party collaborative team developed a handsome number of learning objects which have already been integrated to the courseware. Experiments show that performance of the students learned using learning objects are quite better then the students who didn't use them. We organized the paper as follows. First we present the issues of collaborative content development that are identified during the project time which follows an illustration of the learning objects developed under the project. Finally, results of a survey conducted on the usefulness of the learning visuals are explained.

2. ISSUES ON COLLABORATIVE CONTENT DEVELOPMENT

The key issues and challenges associated with content development (Blinco 2004) are – content selection, language selection, technology selection, instigating and managing quality controls, systemizing activities and so forth. There are however particular issues associated with external arrangements and partnerships. Here we are presenting the major issues and challenges experienced in collaborative content development under the Codewitz Asia-link project.

2.1 Choosing the Appropriate Partners

Interactive visualization tool is both expensive and labor-intensive to create, so it makes sense

to share the burden and the cost. The same topics are being taught across wide geographical area, which means that duplication of effort is taking place. If generic and reusable learning theme could be identified and produced, much time and effort could be spared. Thus the central issue in the collaborative content development is choosing the right partners. The partners should have the balanced skills and potentials to work in the collaborative environment. The range of skills which might be required includes technical expertise and project management ability. A general guideline (AFLFb 2004), which will describe the project requirement, expectations, deliverables and critical timelines in details can be prepared for all the partners. Project manager should play proper strategic role to achieve the best possible outcome. Project manager should have appropriate leadership ability to establish greater control over the project.

2.2 Content Selection

Relevance of the content is another vital issue. The subject-matter of the content should be timely and relevant so that it makes sense within the context of its environment. In general the content should have certain positive impact to the global community. For example, the problems in teaching and learning programming techniques are prevailing all over the globe. Learning programming logic is really tough without utilizing any visualization material. To improve the learning environment effective e-modules are therefore highly relevant in this age of ever growing development in IT sector. Under Codewitz Asia-link project, teachers of the partners' countries have exchanged visits to partners' countries and exchanged their views on teaching environment which eventually results in the development of learning objects. Learning objects have been incorporated in programming courses which enhanced the overall teaching and learning environment.

2.3 Content Language Selection

Learning in native language is the best way for learning. If the content is mostly technical or the targeted group of learners has prior knowledge on the content then the language issue may not be so crucial. Sometimes the topic is new and the learners are unable to understand the content developed in foreign languages. A more practical approach would then be to design the content with multilingual usability. This can be achieved through proper interface design, effective presentation mechanism based on different lingual perspective. The content must be designed in such a way that it is easy to translate to other languages.

2.4 Technology used to develop the Content

The content should be developed with appropriate tools so that it is effective for online learning. The development tools used to create the contents must be Unicode compliant and must support reading of external structured Unicode files. The content (text), for example, can be represented with XML and presentation can be created with Macromedia Flash, Shockwave or Applet environment. Flash has built in Unicode sup¬port and has rich XML support as well. This independence ensures the real reusability of the learning objects.

2.5 Developing the Contents

Effective content development requires close collaboration of the Instructor and the user Interface designer. If the content has to be interactive, the instructor is the best developer because of his/her familiarity with the content theme. Sufficient space must be kept during presentation design so that it can accommodate the content. Text output is desirable with scrollbars which enables expansion in screen area based on content without overflowing the screen. In case of multilingual interface provision should be kept for changing the font size so that appropriate outlook of the content can be made possible according to language selection. The key contents that should be presented on screen should be decided such that clarity and completeness of the learning objects are achieved. Presentation considerations should support the learners move to independent thinking as they become more familiar with the topic which is very important to do when learners are not in a face-to-face situation. Context sensitive

learning support should be provided for students either in the content itself or in documentation.

2.6 Assuring quality in Content Development

It is quality which ultimately ensures the success of an e-learning program. A good e-Learning content should have following key desirable features:

- ✓ Extremely interactive and user-friendly
- ✓ Appropriate to learner type, needs & context
- ✓ Self-containing and self-explanatory visuals
- ✓ Step-wise instructions with animations
- ✓ Supporting audio-video files
- ✓ Troubleshooting made easy
- ✓ Continual Improvement in the above

For collaborative developing environment, quality assurance is somewhat straightforward. Learning objects developed by the individual partners can be uploaded to a common web site. Technical persons from the partners' side can make comments on the learning objects. Based on the comments the developers have the opportunity to improve the quality of the learning objects.

2.7 Evaluating the Performance of the Learning Objects

Instead of using the learning objects as a separate learning environment on a web page, these should be integrated to the actual course materials. This allows the learners to gain the maximum benefit out of learning objects. Teaching using learning objects facilitates the evaluations of the contents where the students are asked to make comments on the appropriateness of the content and presentations. Teachers can the update the contents accordingly. Teachers can also arrange assessments on different group of students with/ without learning objects so that a picture of the content appropriateness can be obtained.

3. A PARADIGM OF COLLABORATIVE CONTENT DEVELOPEMENT

While there are numerous e-Learning solutions available today, the differentiating factors, i.e., the factors which help achieve a superior

learning experience and motivation to learners, are the innovative instructional design and content development process. Effective content design should consider the accessibility, clarity, consistency, efficiency, focus, and flexibility of the content (Kheterpal S.). The concept of learning objects introduced in this paper shows clear potential as an e-Learning tool for learning various programming structures. Within the Codewitz network, the learning objects are defined as visual tools for learning that are browser capable, stand-alone, reusable, not linked to any other learning objects or resource and are focused on one specific learning goal (Codewitz, 2004). The developed learning objects are based on visualizing programming logics and suitable for exercising. The learning objects developed so far covered topics including looping, conditional branching, array, string, function, various topics related with data structures, algorithms, operating systems etc. The idea of the visual learning objects resembles with a debugger which shows step-by-step program execution in both forward and backward directions. The program-code is highlighted in each meaningful step of the program execution and the execution of statements is also visualized by arrows when necessary. Windows for console and memory area for illustrating the operations are shown for every step of program execution. An information window is also included for explaining the current step. The memory area is the only part where the layout can be changed according to the subject-matter of the underlying structure. These changes appear, for exam¬ple, in case of array when the structure of the array is visualized. A typical learning object on the use of if-else structure is shown in Figure 1. As can be seen in the figure, in addition to the output window, the learning visuals provide statement
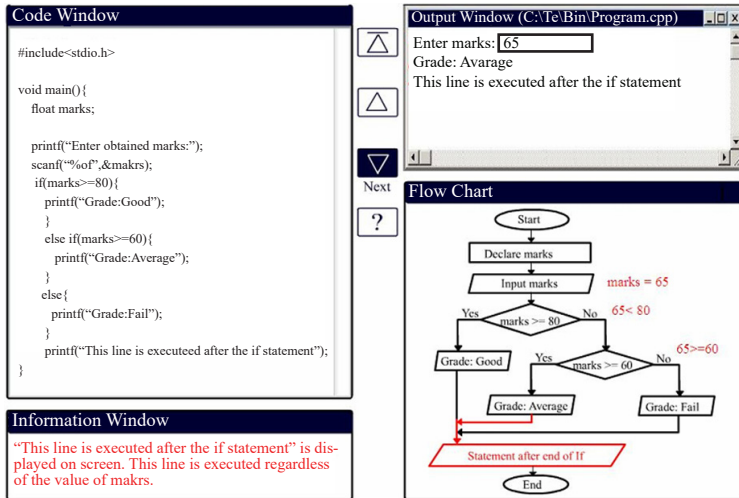
Code Window

```
#include<stdio.h>

void main(){
  float marks;

  printf("Enter obtained marks:");
  scanf("%of",&makrs);
  if(marks>=80){
    printf("Grade:Good");
  }
  else if(marks>=60){
    printf("Grade:Average");
  }
  else{
    printf("Grade:Fail");
  }
  printf("This line is executeed after the if statement");
}
```

Output Window (C:\Te\Bin\Program.cpp)

Enter marks: 65
Grade: Avarage
This line is executed after the if statement

Next

?

Flow Chart

Start

Declare marks

Input marks   marks = 65

marks >= 80   Yes   No   65< 80

Grade: Good

marks >= 60   Yes   No   65>=60

Grade: Average   Grade: Fail

Statement after end of If

End

Information Window

"This line is executed after the if statement" is displayed on screen. This line is executed regardless of the value of makrs.

Figure. 1: A typical learning object on selection logic

4. SURVEY ON THE USE OF LEARNING OBJECTS

The study was conducted in Shah Jalal University of Science and Technology for Computer Engineering students who have two programming courses as major. The course "Structured programming language" is conducted in first semester using C language which typically covers the uses of selection logic, loops, arrays, functions, and structures. The course consists of lectures (2 hours/ week) and lab exercises (6 hours/week). Since the course is a first semester course students do not have prior programming experience. To evaluate the performance of learning objects, 105 sensitive information and execution-flow in separate windows. Different set of input can also be exercised by moving the flow of execution back and forth which gives an interactive learning environment to the students.

students are grouped into two sections (Section A: 53 students and B: 52 students). The same instructor taught in both the sections. The students of Section A are taught using the aids of visual learning objects while the students of section B are delivered verbal lectures using traditional white board. The program visualization learning objects were also available for the students of Section A when studying at home. The students found the aids interesting as learning tools. The final grades obtained by the students of Sections A and B are shown in Figure 2. From the figure, it is quite clear that students using visual aids performed better than those without using the learning objects. An important insight in the figure is that a big number (30) of Section B students (without using visual aids) got grades between 60-69 and 70-79, whereas 27 of the Section A students got grades between 70-79 and 80-89. This shifting

Performance Analysis by Using Learning Objects
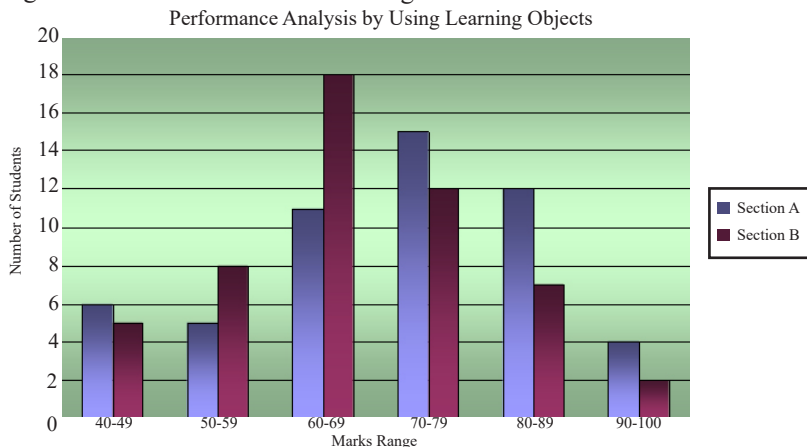
5. CONCLUSION

This paper has focused on the potential of using visual learning objects for teachers and students of computer programming and on the issues and challenges experienced in a collaborative developing environment. Experiments have shown that of students using program visualization learning objects seem to get better grades than those without using such material. Since the amount of the students is not very large in this survey the next step would be to repeat the study with new groups of students. Finally, this is to say that the project has given an effective outline about handling any logical problems those are usually encountered in teaching and learning. Development of further learning objects can be aimed to other sustainable areas like science education in schools and colleges.

REFERENCES

AFLFa, 2004. Success Factors for Collaborative, Development of Content to Support Online Learning, Australian Flexible Learning Quick Guide Series.

AFLFb 2004. Developing e-learning Content, Australian Flexible Learning Framework Quick Guide Series.

Blinco K, Mason J., McLean N., and Wilson S.,2004. Trends and Issues in E-learning Infrastructure Development.Codewitz 2004, Codewitz project: http://codewitz.net/asialink/

Garrison, D R and Anderson. T, 2003. E-learning in the 21st century: a framework for research and practice. London: RoutledgeFalmer.

Kheterpal S., 2005. Quality Measures in Design & Development of e-Learning Content, ELELTECH India