Business Model for Developing the Courseware for e-Learning and Self Paced Learning of Programming Languages

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Abstract

Teaching and learning programming language is a challenging task at the undergraduate level. This paper focuses on the basic elements required in learning the programming languages at undergraduate level. In this paper authors share their experience of the development of course material using the multimedia tools. They found that it is difficult to maintain the system, as it requires constant development. They propose a component model in the continuing development of such multimedia courseware incorporating the industry with a business model to support this development.

1. Introduction

In teaching a course the most important aspect is the courseware of the subject. The structure of the courseware depends upon the kind of the subject also. The quality and depth of teaching can be well defined and managed using the quality of the corresponding courseware. Due to advancement in the technology, the newer techniques and tools can be incorporated in developing better courseware for enhancement of teaching.

This paper explores the structure and elements of a courseware in general and explains how they are different for the programming language subjects. It also focuses on the use of newer multimedia and presentation tools in preparation of the better courseware. The paper discusses these aspects in the context of an effort to develop the courseware for teaching and learning the C Language Programming. It also discusses the difficulties and obstacles in such effort of developing courseware. The paper then introduces a new concept of development of better courseware with the help of software development industry based on a business model. This business model is beneficial to both industry and academic institutes.

2. Structure of Courseware

A course configuration includes many essential elements, which forms a basic comprehensive foundation for the teacher [1]. The essential elements include – syllabus, the topic list prepared from the syllabus, teaching plan for the semester, question bank, frequently asked questions, acronyms, class notes, slides, handouts, reference and text books, resources for reference, research papers for each topic, list of enrolled students, attendance record of the students, students performance record, and test mark record. The figure-1 shows the most common configuration of a courseware.

The syllabus is prescribed by the governing authority like a University. It consists of a broad list of topics and summaries of subject which is expected to be covered in the course.

The topic list is the detail list of topics which are implied by the syllabus. Some topic may not be explicitly specified in the syllabus, but may be needed for deep and detail understanding of the subject.

The teacher then prepares a teaching plan dividing the topic list in the number of weeks and topics to be covered per week. This teaching plan guides the teacher in teaching and managing the teaching during the entire course. It keeps track of the teaching and teaching related activities in the entire duration.

The other essential elements of the courseware include the question bank, frequently asked questions, acronyms, lecture notes, slides and handouts. It also includes the text and reference books, web addresses of the web resources, and research papers.
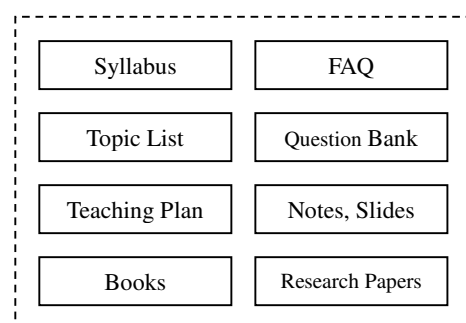

Figure 1– Courseware Configuration

3. Courseware for Programming Courses

The courseware elements discussed in previous section may not be appropriate in the course on programming languages. The programming language learning and

teaching is mostly related to the actual programming. It is mostly non theoretical. Due to this major difference the courseware for the programming language course is mostly different.

The elements of the courseware for the programming language teaching and learning as shown in figure-2, involves the syllabus, topic list, teaching plan, objective questions on programming, questions involving analysis and design of the programs for the given problem, results and variations of the various programs, different version of the program.

The programs involve execution. The courseware should be able to express step-by-step execution with animations and explanations. The traditional approach of courseware development does not have this capability. These obstacles affect the quality of courseware for programming language subjects.

As such the courseware for such subjects should be developed with the help of modern technologies. These modern tools provides facilities to express the dynamic aspects of the courseware. These facilities may be animation, sounds, videos, texts, simulation, etc.
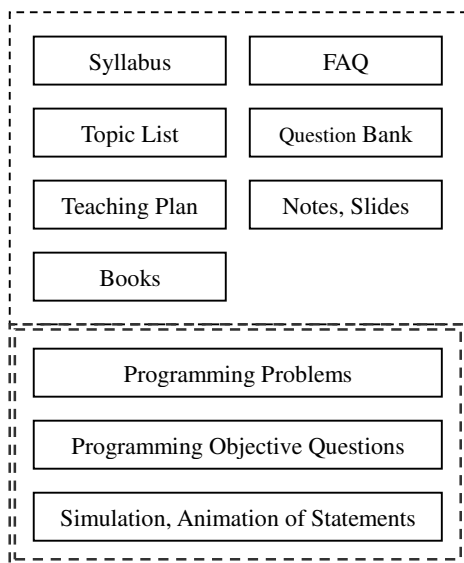

Figure 2 - Courseware Configuration for Programming Language Subject

4. Case Study

This section focuses on a case study of multimedia courseware development for the "C Programming" course [2]. The syllabus specifies, programming in C with basic programming constructs, functions, files, pointers, and advanced programming concepts should be covered.

The syllabus can be divided into the topic list as shown below. It shows about 29 topics. Each topic may be of one or two lectures duration.

The topic list for C Programming is –

1) Introduction to programming
2) Introduction to C
3) C programming basics
4) Writing first C program
5) Basic data types
6) Input and output statements
7) Operators in C
8) The for loop in C
9) The while loop in C
10) The do while loop in C
11) Conditional statement – if else
12) Conditional statement – switch, break
13) The goto statement
14) Nested loops
15) Introduction to functions
16) Functions with parameters
17) Local and global variables
18) Advanced data types
19) Arrays
20) Pointers
21) Strings
22) Structure and union
23) Basic file handling
24) Advanced file handling
25) C preprocessor
26) Command line parameters
27) Unsolved programming problems
28) Mini project
29) Review

Each topic from this topic list is again divided into some subtopics. For example the topic "Basic data types" can be subdivided as –

5.1) Need of data types
5.2) List and example of data types
5.3) Integer data type
5.4) Float data type
5.5) Char data type
5.6) Double data type

Each subtopic here needs basic explanation, syntax, programming examples, and unsolved problems. For each point many slides with animation are required. These slides or presentations should again be under constant development in order to include more and more new examples and novelty.

The number of such subtopics can be then calculated as 29 main topics x 5 subtopics per main topic. It comes out to be 145 subtopics in total. In practice each topic takes about 5 animation slides. In all it comes out to be about 725 slides for a subject.

Every slide needs to be developed with novelty and with the technical contents. As we want to include more and more examples always, most of the slides will be under constant updating and development.

Each slide needs the development time in the range of hours. For this project in all the total development time is much more.

5. Difficulties

As described by the previous sections, the nature courseware for traditional is static; where only text and simple documents are sufficient to express the contents. It does not have any need of animation, simulation facilities to express the topics.

But, the programming language subjects are of dynamic nature. Most of the topic in these subjects need the explanation using some sample execution of the program or programming statements. Due to this difference the programming language subjects courseware should be developed in some different manner. In the teaching and learning of computer programming we may develop the courseware which can itself deliver knowledge to the learner even in the absence of any trainer or teacher.

As our case study describes the courseware can be developed in the form of many animated slides. The slides can be developed with many software tools like Power Point or Flash available in the market. Many new tool always emerge in the industry. It is a challenging task for the teacher to learn to use these tools proficiently and apply them in the development of the courseware.

It will be a difficult task for a teacher to self develop and use these slides constantly. As seen in the case study, it will take much time to develop the courseware as there are large number of dynamic subtopics. We can define the dynamic subtopic as a subtopic which needs constant updating. In the programming languages, we need to update the programming example, style of teaching the topics always.

The most significant reason of these difficulties is in the fact that, the multimedia courseware development and teaching with this multimedia courseware are two different aspects and we are forcing the teacher to become multimedia courseware developer.

In order to develop the multimedia courseware for e-learning as well as self paced learning, we need to develop the courseware professionally with the help of industry and utilize it in the actual teaching and learning process.

6. Developing Courseware with Industry

The problems in the development of multimedia courseware of programming languages can be solved by introducing the industry-academic partnership in the development of theses courseware. This partnership will enable us to get best of both the worlds.

The development of the courseware can be performed by the industry experts while, the contents of the courseware will be described by the expert persons from academic institutions.

The courseware is one type of software. It is not needed as a whole at a time. It can be delivered in parts also. These parts may be developed independently based upon the topic list of the subject. This will also enable the developer to upgrade a part of the courseware system at a time as well as whole team can work in parallel on the whole project.

The developers have expertise in using the latest software development tools. As such less time is needed to develop the courseware as compared to that of the time taken by the teacher to develop the courseware.

The structure of the courseware, contents, illustrations, examples can be depicted by the teacher. Developer can utilize this information and the teacher's experience in the development of the more effective courseware.

The partnership can be based on a business model. The business model may involve the production and marketing of standard quality courseware. The academic institutes will get their share in the financial aspects.

7. Benefits

Student is the focal point of all the teaching learning processes. The multimedia courseware development for e-learning and self paced learning of the programming languages and it's direct use by the teacher while teaching the subject will result in the better understanding and more exposure to the students.

Apart from this direct benefit many other possible benefits are –

- Better and production quality in multimedia courseware as it is developed by industry experts
- Better quality of educational contents as the content is developed by the experts from academic institutes
- It will improve the collaboration between industries and academic institution
- Increased number of programming examples can be possible since a team is working on the development, not only a teacher
- Industry can make collaborations with many academic institutes which will result in more

detail and better quality of technical and educational contents in the courseware.

- The industry can constantly work on the development of the courseware; producing more effective and high quality courseware.
- The development time needed for the courseware development will be much less than that of the time taken by the development within academic institutes.
- A faculty can be involved in the development of more than one courseware; which was difficult with the development within the academic institutes.
- As the courseware is in the form of a multimedia presentation product for e-learning, it can be marketed. This will result in revenue generation for the academic institutes.
- The multimedia courseware will also be available for the other people outside the academics.
- The other people which will use the multimedia courseware for self learning and not involved in academics, can avail the excellent faculty indirectly.
- This system will produce the courseware which will be suitable for the distance as well as continuing education
- This approach is so beneficial that its application in other areas will also result in better quality learning material.

8. Conclusion

Multimedia courseware is the most important aspect of teaching programming subjects. This courseware can be developed by the teacher himself, but this will not produce production quality courseware. The academic collaboration with the industries in the courseware development will result in production quality, better courseware. This courseware will be in the form of self learning package. It will be beneficial for the people who want to avail good faculties and learning facilities.

This collaboration of industry and academic institutes will improve the penetration of distance and continuing education of computer programming languages.

This approach will be beneficial not only in programming subjects but all other courses also.

References

[1]   Atkin J.A. *How Students Learn: A Framework for Effective Teaching: Part 1,* Thinking-Critical for Learning Seminar Series No 22, Melbourne: IARTV, 1993

[2]   Brian W. Kernighan, Dennis M. Ritchie *The C Programming Language (2nd Edition)*, Prentice Hall 1988