

Distributed Web Content Management Systems for E-Learning Applications- A Research Study

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Abstract

Nowadays, every organization digitalising their content and making it available over the Internet. Due to the tremendous growth and multi-usefulness of web content, it is difficult to handle and make it formatted. Most of the organizations are not updating their content and the information provided by them is very less accurate or out-of-date. It becomes an overhead to the web users to find accurate and up-to-date information. Even it is difficult for a search engine to find out the latest information ranked by the web server. Distributed Web Content Management System (DWCMS) is specifically designed to overcome the earlier discussed issues. The main objective of Distributed Web CMS is to support business goals and strategies in terms of improvised sales, increased user satisfaction and extended user assistance while communicating with the public. This paper discusses about various approaches and the feasibilities related to web content management and aims to build a Distributed Web Content Management System (DWCMS) to provide the better and strategic solutions on e-learning mechanisms.

Keywords: *Web Content, Digitalization, Content Management System(CMS), Distributed, Business goals, Solutions*

1. Introduction

Earlier, the communication between client and web server is static in nature i.e. each web page was delivered to the client as a static web document. In 1995, a client-side scripting language called JavaScript was introduced by Netscape which allows web developers to add some dynamic elements to the user interface. In 1996, a Flash player is introduced which support web browsers to add a plug-in for embed animations on the web pages and allowed

program interactions on the client side without server communication. In 1999, Java language was popularized by introducing the "web application" concept using servlet specifications. In 2005, applications like Gmail started interactive communication between the clients using AJAX technology. It provides the mechanisms to contact the server for storing/retrieving data without downloading an entire web page. In 2011, HTML5 was introduced in-built graphic, multimedia and semantic capabilities. Document Object Model (DOM) and interactive APIs are the enhanced features of the HTML5. WebGL API has introduced the advanced 3D graphics based on HTML5 canvas and JavaScript language. These are all web related technologies will be used to create platform and browser independent web applications.

Web application is an application that can be defined as a computer software coded in a browser-supported language (HTML, JavaScript, JSP and PHP etc.) and reliant on a common web browser to render the application executable. Several organizations like commercial, educational, government and non-profit entities create their own web application and maintain a lot of content in a day-to-day manner. It is difficult to maintain and retain the information for reusability. Most of the content in the web is semi structured and/or unstructured. It can be anything from complex structured documents to simpler messages, business documents, transactions, emails etc. Every organization will be benefited if and only if it could able to manage their information assets in a meaningful way, such content provides financial benefits and therefore, its value increases automatically.

Content Management Systems (CMS) are used to organize the web content of a particular organization based upon their requirements.

CMS handles all the fundamental details like customer authorization and access control, information updation and reusability and content management and organization. The main purpose of CMS's Data Administration (CDA) is to guide the reader through the creation, utilization, and maintenance of CMS's data resources. CDA provides various data standards, stepwise procedures and guidelines to data analysts for performing data modeling tasks.

Vast growth in the unstructured data leads to a huge demand for content management in a better way and collaboration within and between the enterprises motivates the need for distributed content management solutions. Distributed Web Content Management Systems (DWCMS) extracts the residual content from the applications and maintain greater control over it and efficiently collaborate by sharing data in real-time within a distributed network of stakeholders.

Distributed Web Content Management System (DWCMS) is a virtual repository and it runs independently without disturbing the organizations individual process oriented CMS. So, organizations can deploy the distributed content management solutions to share their real-time information across geographically isolated knowledge workers. These solutions will become as the backbone for any platform that requires real-time, efficient information sharing across the global enterprises.

Latest developments in e-learning strategies have simplified our jobs of manual content preparation and storage. These digital technologies have created the leading impact within the decade. So, our proposed work will collaborate the functionalities of DWCMS with E-learning techniques to improvise the utilization in learning process through assured high quality of outcomes.

2. Literature Review

In today's marketing trends, content management systems are quite new and many of the organizations are still not accustomed with them. CMS have the potential to simplify the maintenance cost of both intranet and internet.

There are mainly two different types of content management systems available on the Internet; they are "Open Source Content Management Systems or Custom Content Management Systems".

Open source CMS are the most commonly used and are generally low cost than custom CMS for a few reasons: the code is normally free and the limited options are available. Because of its free availability over the Internet, open source CMS are been built by many developers with lot of

extra code to make the CMS function well. But, due to its additional code open source CMSs will not be loaded easily.

Custom CMS are likely to cost more than open source CMS, but provided with add-on benefits like scalability, unlimited options and function with little code as possible. Less code on each web page allows for a better chance of ranked high in the search engines.

Alexander W. Wiseman (2017) How does instructors' sexual orientation impact their e-learning innovation based direction in Saudi Arabian government schools? Utilizing one of a kind information gathered in Riyadh, Saudi Arabia, in 2014, the examinations exhibited here demonstrate that male and female educators in middle of the road school classrooms contrastingly utilize e-learning innovation.

Jeretta Horn Nord (2017) Information and communications technologies (e-learning) provide global connections, communication, and empowerment. Empowerment drives social and economic development. This study, part of an ongoing global study, investigated the use of social technologies including the purposes used and benefits realized in Italy as a means of empowerment for women.

Yen-Chun Jim Wu (2017) E-learning innovation instruments are by and large progressively used to encourage instructing in instructive organizations. This investigation inspected the mentalities of understudies and educators towards utilizing e-learning instruments in administration instruction. Instantly subsequent to leading workshops that presented 11 e-learning devices utilized as a part of classroom settings, surveys were managed to understudies and teachers from three state funded colleges in Taiwan. Reactions of 242 understudies and 46 educators with respect to 5 spaces of e-learning apparatuses - input, classroom versatility, distributing, cooperation, and online networking - were dissected to explore their disposition towards the utilization of e-learning.

Maja Seric (2016) The objective of this examination is to inspect customers' view of the most recent innovation arrangements and promoting interchanges inside the lodging setting in two Mediterranean nations - Croatia and Italy. Specifically, inn visitors of four- and five-star lodgings situated in these nations took an interest in the exploration. Right off the bat, visitor impression of cutting edge E-learning innovation and correspondence consistency are dissected and thought about in Croatian and Italian inns.

Martin Gould (2015) Purpose: This examination presents 2013 information from an overview gave by G3e-learning and Disabled Peoples International (DPI). The Progress Report recognizes the degree that each of the CRPD

attitudes on ATs and e-learning openness are instituted in nearby laws, arrangements and controls and their effects. Strategy: The underlying system used to build up the study included a few stages. Initial, an orderly survey of CRPD AT and e-learning innovation necessities was led. Second, 57 factors were recognized. Third, factors were gathered into three bunches speaking to nations': (a) legitimate, administrative and automatic responsibilities; (b) ability to execute; and (c) genuine usage comes about.

Hong Y. Stop (2015) User information has been a vital wellspring of novel item improvement and advancement, yet assembling exact client learning has been tedious and troublesome in light of the fact that client learning is implicit and internationally scattered. Be that as it may, e-learning innovation can extend the limits by making client information less demanding and more affordable to get to. Structures and associations are developing to play out the undertaking of client data gathering.

NarczyzRoztocki (2015) In this examination we survey the distribution base and the exploration slants in e-learning innovation particularly on the move economies. We restrict our investigation to work distributed in scholarly diaries and managing e-learning in nations that have suddenly nullified a midway arranged economy and one-party controlled political framework for a market-driven economy. We lead a writing survey and dissect the inspected examines taking a gander at investigate center, explore approach, and hypothetical establishments. In light of 173 examinations distributed in the vicinity of 1993 and 2012, we watch a few patterns and predominant subjects and distinguish holes in the writing and open doors for future research.

Jimmy K.N. Macharia (2014) Previous investigations have demonstrated that in the advanced education area, e-learning innovation gives the driving force to transform from the conventional ideas of instructing and learning, and prime inspiration driving the change in academic and expert exercises. This underscores the significance of e-learning in advanced education in accomplishing the objective of giving adaptable instructing and learning conditions.

Angelina Totolo (2014) School librarianship has progressed in the computerized time to incorporate intelligence, network, and access to a wide assortment of data in various arrangements, through the abilities of e-learning advancements. School libraries exist to help learning in schools and the significance of the advanced age in understudy's learning can't be exaggerated. The present understudies are conceived in the time of innovation; in this way a school library that does

not include the utilization of electronic media won't address the issues of the computerized age. Laura Stafford (2012) Despite the pervasive penetration of data correspondence innovations into our lives, examine on their parts in individual connections is at a beginning stage. In this exposition, we quickly survey the rise of research on e-learning and outline momentum drifts in the investigation of e-learning and individual connections, including subjects, for example, multi-correspondence, media multiplexity, and unending network.

Mary Kalantzis (2012) In this snapshot of gigantic change, putting resources into old methods for doing instruction isn't the most ideal path forward. In offering a Charter for Change we perceive that information and learning will be critical to the social and individual changes important to address the particular difficulties of our circumstances. The changed monetary framework rising up out of the current budgetary emergency will require human limits that no one but instruction can support, in view of profound learning, pragmatic creative energy, imaginative investment, scholarly curiosity and synergistic duty - not simply with respect to an information tip top, yet of the numerous in the work compel and in the more extensive society.

Robin Shields (2011) The utilization of data and correspondences innovation for instruction in creating nations has been a subject of awesome premium and theory, with its advocates contending that e-learning enhances instructive quality, creates basic reasoning abilities, grows get to, increments monetary aggressiveness and encourages incorporation in a quickly extending worldwide data society. In any case, few of these cases have been confirmed from an exact point of view, prompting significant feedback of the push to extend e-learning.

Stephen J. Fox (2010) Multi-disciplinary multi-national instruction and research in building design, building, development, and activity (AECO) can include members with various first dialects as well as various previously established inclinations. Further, AECO training and research can include unverifiable and developing circumstances and additionally geologically scattered associations.

Jack LinchuanQiu (2010) this examination surveys Asian versatile correspondence look into since the mid-1990s. Initially, it distinguishes key research establishments and financing offices, in Asia as well as overall open (e.g., the Canadian IDRC) and private (e.g., Microsoft) associations. It at that point compresses the regions of research at miniaturized scale, meso, and full scale levels, including their fundamental themes, techniques, and discoveries, and open deliberations that outcome from the association

(and absence of it) among various insightful customs, for example, review, strategy investigation, ethnography, activity research, and relative examinations.

3. Proposed Method And Methodology

Nowadays, technology is growing at a rapid speed. A variety of data needs to be processed and readily available for different applications like social networks; semantic web analysis and bio-informatics are growing unexpectedly.

This research work performs a systematic and experimental analysis to investigate the impact of E-Learning techniques on the education domain. It includes research methods and research tools used for content analysis. In this paper, we discussed different learning mechanisms and e-learning models on the web with reference to content management systems.

A framework is the blue print of methods & procedures for attaining the required information. Initially, a quantitative approach will be used to enable the researchers to collect data. It is a study based on algorithms and tables. Later, data will be collected from various sources like journal, books and various websites in internet.

Three different estimation models are used to quantify the extracted content from the web.

- Formal Estimation Model
- Expert Estimation Model
- Hybrid Estimation Model

Formal Estimation Model:

In this model, the quantification step is based on the use of a formulae derived from collected historical data.

Expert Estimation Model:

In this model, the experts' suggestions will be considered as a measurement for deriving new estimates.

Hybrid Estimation Model:

In this model, the quantification step is based on a judgmental and mathematical combination of estimates from different sources.

Some examples of estimation approaches within each category are shown below in Table-1.

Estimation approach	Category	Examples
Analogy-based estimation	Formal estimation model	ANGEL, Weighted Micro Function Points
WBS-based (bottom up) estimation	Expert estimation model	Project management software, company specific activity templates
Parametric models	Formal estimation model	COCOMO, SLIM, SEER-SEM, True Planning for Software
Size-based estimation models	Formal estimation model	Function Point Analysis, Use Case Analysis, SSU (Software Size Unit), Story points-based estimation in Agile software development, Object Points
Group estimation	Expert estimation model	Planning poker, Wideband Delphi
Mathematical combination	Hybrid estimation model	Average of an analogy-based and a Work breakdown structure-based effort estimate
Judgmental combination	Hybrid estimation model	Expert judgment based on estimates from a parametric model and group estimation

Accuracy of Estimation:

The average estimation accuracy is to find the relative error i.e. MMRE (Mean Magnitude of Relative Error), where the MRE of each estimate is defined as: $MRE = (Actual\ effort - Estimation\ effort) / Actual\ effort$

All estimates are made based upon some form of analogy: Historical Analogy, Expert Judgment, Models, and Thumb rules. The role these methods play in generating an estimate depends upon where one is in the overall life-cycle.

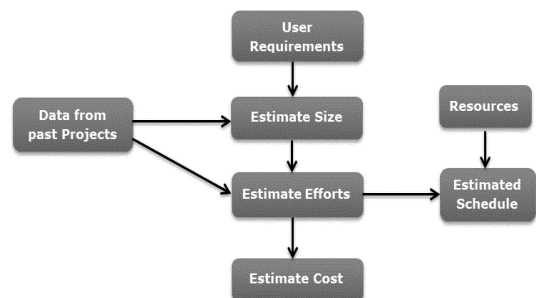


Fig.1. Estimation Model Life Cycle

Below are the major steps which play an important role in the estimation of the software project:

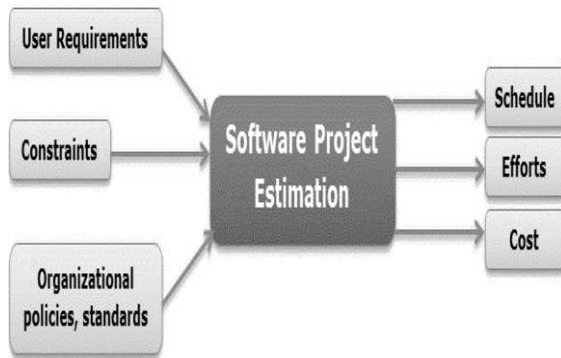


Fig.2. Software Project Estimation

Estimating e-Learning Course:

There exist several factors which are most important and to be considered for estimating an e-learning course development.

- **Organizational Need/Deadline**
To understand the basic need of the process can be decided by its dead line. Based on the deadline one can speed up or slow down the leaning process.
- **Instructional Design**
There is a huge demand of organized framework or instructional design to develop any course using e-learning techniques. Even though the design is common but there might be a different development time required for the different courses.
- **Content Complexity:**
Based on the complexity of the proposed content to be incorporated in any model, required more no of instructional materials and takes more time to gather the content. Also need lot of discussions with subject-matter experts to maintain the accuracy and usability of the content.
- **Media Type:**
It is one of the important factors to be considered while developing the course content. We can use Power Point Presentations (PPT), Audio and Video files to be developed for better understanding of the content.
- **Learning Technologies:**
The design of any eLearning course depends on the technologies we use to develop. We need to measure their speed and accuracy.

4.0 DESIGN AND DEVELOPMENT

The different stages in eLearning design and development process as shown in Figure.3.

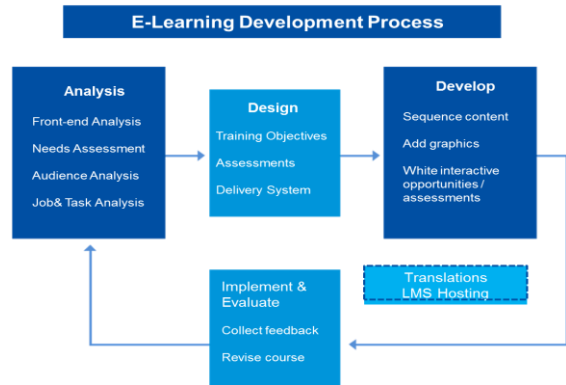


Fig.3.E-Learning development Process

- **Analysis:**
This is the first step of the eLearning development process. At this stage, we need to analyze the learning content, learning objectives and the profile of the target audience.
- **Design:**
Next, learning experts need to create a design document that incorporates the recommendations of the learning management team. It also specifies the instructional, visual and audio elements to be included in the course curriculum.
- **Development:**
The specifications in the design document are executed by incorporating the content, visuals and assessments into a storyboard. The page layout, graphic user interface and multimedia elements are all finalized at this stage and incorporated into the course.

This is research work proposed a learning module which uses the combinations of various data mining tasks such as classification, clustering or associations

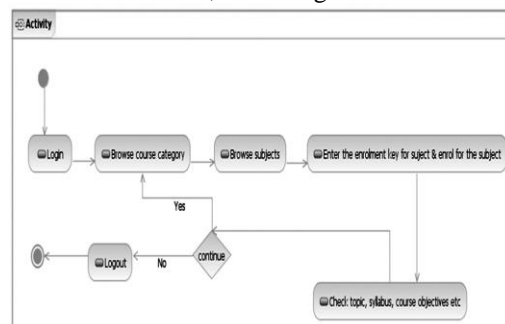


Fig.4.Learning Module for Product Development

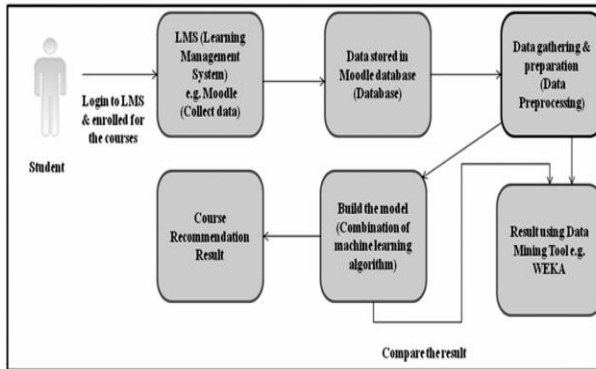


Fig.5. Workflow of Learning Management System
The proposed learning module in pseudo code representation is given below

- Step 1:** Create Student Login.
 - Step 2:** Add the course category & courses under each category.
 - Step 3:** Allow the student to logs in the system.
 - Step 4:** While user logs in the system
Allow user to view course category
 - Allow user to view courses under each category
 - Enroll for those subjects in which he/she is interested
 - Step 5:** Select the data from database & analyze it.
 - Step 6:** Preprocess the data obtained using database
 - Step 7:** Check the best combination of subjects' result using the open source data mining tool WEKA
 - Step 8:** Develop the proposed algorithm
 - Step 9:** Compare the result of this algorithm with those obtained using the WEKA
 - Step 10:** Display the best combination of subject results
- Similarly, a map-reduce algorithm can be deployed on the Cloud computing platform to identify the relevant courses.

Map-Reducer Algorithm:

Class Mapper

```

Method Map (Docid, File Of Objective)
For each line ε File Of Objective
Write(Docid,line)
End for
  
```

Class Reducer

```

Method Reduce(Docid,List(line))
S ? NULL
For each n ε 2 List(line)
S ? S + n
End for
  
```

4. Results and Discussion

The DWCMS is developed using PHP and can be hosted on any Web Server which supports PHP version 5.3.15 and above. This research used MySQL version 5.5.21 is used as database. The CMS development was done using XAMPP on 64 bit Microsoft Windows platform. In e-learning application, there is no single appropriate method which produces the accurate estimates across the every step in the content development process. Following table shows the three basic activities which are performed during the content development process and categorizes complexity level of the work based on the given parameters. These data has been summarized based on the live educational e-Learning projects developed

5. Conclusion

Distributed Web Content Management System (DWCMS) is specifically designed to overcome the issues in native CMS approaches. The main objective of Distributed Web CMS is to support business goals and strategies in terms of improvised sales, increased user satisfaction and extended user assistance while communicating with the public. This paper discussed about various approaches and the feasibilities related to web content management and build a DWCMS to provide the better and strategic solutions on e-learning mechanisms. As per the obtained outcomes, it is proved that major ratio (i.e. 40%) of work effort is put in code and unit test phase. The rest 60 percent effort is put in different areas of the project development life cycle. Hence this signifies the importance of estimating cost for these phases of software development life cycle. Finally, this paper restrained the collaborative mechanisms worked well to obtain the desired results on e-learning web applications.

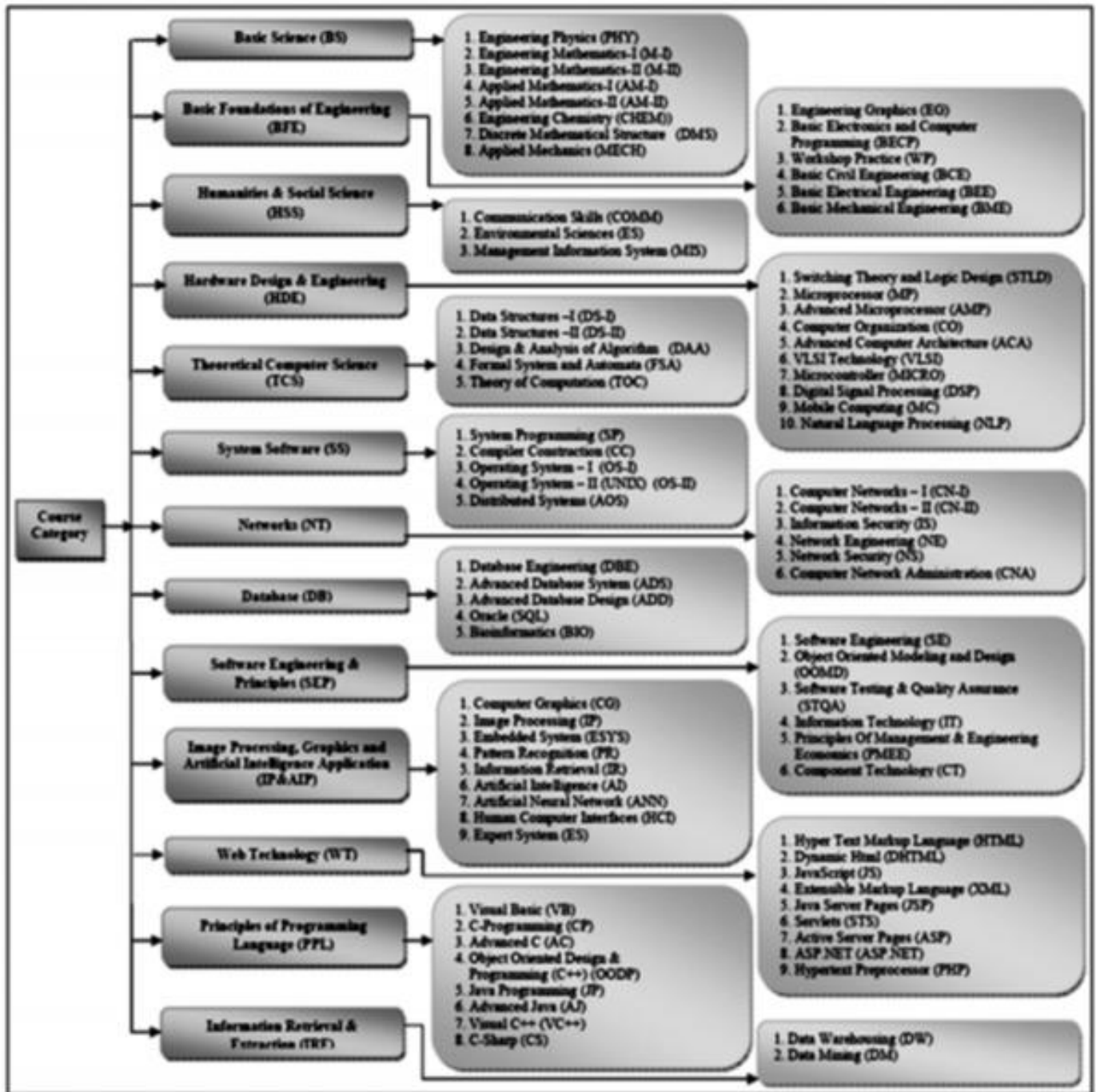


Fig.6.Extracted Course Category

Table-2: Content Development Activities

Content Development Activity	Parameters	Details of Metrics		
		Simple	Average	Complex
Storyboard Creation	No. of Screens	10 - 15	16 - 20	more than 20
	Text	20%	50%	80%
	Pictures	80%	50%	20%
	Characters	2 to 4	4 to 6	more than 6
Media Development	Graphic format	Raster graphics	Rater and Vector graphics	Vectors graphics
	Animations	20% graphically controlled	50% graphically controlled and 50% programmatically controlled	100% graphically controlled
	Illustrations	static characters	characters with animation	animated characters with conversations
Functionality Development	Interactive elements like clickable or moveable objects	Static and similar objects. They are available on screen.	Static and dynamic objects. 50% objects are randomly generated.	All dynamic objects and generated randomly.
	Skinning and Text	Default provided by tool.	Default provided by tool and created by code.	100% created by code.
	Components	All default components are used.	50% default and 50% custom components	100% custom components

Strengths and weaknesses of the different approaches were examined and the observed outcomes are discussed in the following table-3.

Table-3: Strengths and Weaknesses of different approaches

S.No.	Techniques	Strength	Weakness	Applicability in Effort Estimation of the Content Development
1	Top Down Approach It looks the entire content of the courseware as whole and allocates the proportions of the effort estimates to the different activities of the content development process.	System level focus, faster and easier and requires the minimum project details.	Provide the little details for justifying the estimates, less accurate and Underestimate the difficulties at low level.	It can be applied when the major activities of the content development are identified like storyboard creation, media development and functionality development.
2	Bottom-up Approach - Calculate the total effort from the sum of the effort estimation of single task.	Provides the most accurate estimates because it is based on detailed analysis at the low level task.	Requires the detailed knowledge of the project at the early stage of the project.	It can be applied when the total lesson plans and their interactivities along with their individual effort estimates are identified.
3	Analogy Approach	Based on the actual project data and past experience.	Similar projects may not be available and historical data may not be accurate.	It can be applied when the similar type of the content has to be developed like activities based on the similar templates like storyboard creation

				activity.
4	Work Break Structure	Give the structured way of the effort estimation of the each task of the projects.	Require the detailed knowledge of the projects that may not be available at the early stage of the project.	It can be applied when the similar type of the lesson plans or courseware to be developed and their tasks can be divided into the deliverable state like media development activity.
5	Parametric Model like Line of Code (LOC), Function Point (FP) Analysis, Constructive Cost Model (COCOMO)	It is very data oriented approach based on the predefined metrics which considers all the direct or indirect environmental factors.	It requires more subjective inputs. Weights are given based on the previous project experience and that may not reflect the current project environment.	These models can be applied in the functionality development activity where the programming skills are involved.

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