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An Innovative Web Based Learning Framework to Assist a Non-Formal Education System

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ABSTRACT

Nowadays, it is quite be difficult to offer the quality of education for learner in non-formal ways in India. Due to limited resource, budget problem and family burden, there are many people are not capable to adopt formal education systems. In literature, there is no proper work for non-formal based education system. However, current systems have low content classification accuracy as well poor performance in terms of content extraction from database. To overcome these issues, this paper presents an innovative web based learning framework to assist a non-formal education system. This system reduces the gap between education system and learner. It brings opportunities for learner to adapt standard education system with no age bar and time constraints. It will be easily accessible by utilization of centralized database. To evaluate the learner performance, this system also creates the user interface for teachers and board. To enhance the classification accuracy, information extraction and course content management, Effective Learning Content Monitoring Algorithm is presented. This approach also assists to user to re-ranked content indexed based on learner query. Based on experimental results, proposed approach perform good results in the terms of accuracy, information extraction and content management compare than existing approaches.

Keywords: *E-learning, Content Extraction, Non-formal education systems, Content Classification & Content Management.*

1. INTRODUCTION

Currently, E-learning is broadly offering learning opportunities anywhere and anytime effectively. E-learning environment, many people showed their interest in rich learning material initially that is not possible through distance base course or by book and paper learning. This cannot be covered through broadcasting of distance based education systems. As e-learning system is flexible in many environment and it can be contributed among large volume of people easily. An e-learning system becomes a most popular interesting application for public to gain the knowledge from home or office without investment of additional time. Nowadays, e-learning application is started by many school, universities, research center and industries. "Electronically-based assisted learning" takes benefits of multimedia technologies with help of internet. This technique provides freedom about time and places by using various latest techniques. Here, this work noticed that only a few works are available in the terms of course content classification, content retrieval time and interaction between learner and teacher.

In literature, there are no online Education facilities in many educational institutions. Still, they prefer formal education systems. However, this approach is not flexible for rural area and economically back warded people. In spite of that, this system consumes more time to conduct exam and produce the results to learner. In paper [17], author implemented LAMS (Learning Activity management systems) to provide teachers with a "highly intuitive, visual authoring environment" to maintain learning activities in sequential

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manner. Activities can be considered as a group work and as well individual tasks behalf of content collaborations. However, this approach is not feasible for classifying the learning content with high accuracy. Due to content classification issues, the given system is not flexible for low level of literate learner. However learners do not have the opportunity to share in an open-ended fashion. In paper [18], author introduced Moodle tools to describe itself as a course management system which assist to educators to create "effective online learning communities". Moodle can be utilized as a general Web content system and it cannot be specialized for e-learning. However, this approach is not flexible with content management and content translation. Still, the accuracy is very low for content monitoring. Here, OLAT tool introduced to utilize as a content learning management system. It has typical e-learning functionality, like wiki, calendar, Ajax, and full text search, among others [19].

However, it noticed that it too differs in terms of modularity and flexibility, scalability like clustering support, usability and options for personalization. OLAT can be only used in university environment, where adaptation and personalization are the main factors. In paper [20], authors introduced as a Sakai's tools, it like a forums, chat rooms, and message centre can be augmented with tools designing for a particular application like assignments, and syllabus. However, Sakai is mainly dominant in the United Stated and United Kingdom region because it does not offers translation in other languages. The existing system suffers from following issues: content designing, reusability, content publishing, and content maintenance which are creating worst impact behalf e-learning. There are a variety of domain (cognitive science, management science, information science, knowledge engineering, and economics) contents are available for learner. E-learning requires interactivity among learners and teachers. However, the existing mechanism does not provide a proper interaction system between learner and teacher. Content design approach has more knowledge about theoretical problem which reduce the interest to learner to prefer e-learning. Existing learning content monitoring system explains the subject neither diagrammatically nor practically. However, this mechanism is not flexible for non-formal education systems.

To alleviate the current problems, this paper proposed an effective learning content monitoring algorithm to content design, enhance the content classification accuracy and minimize content retrieval and which encourage the learner to prefer the e-learning systems. With the help of system, people can learn from their own cities and villages easily. By using this system they can conduct exams and give results online within short period of time. This work examines the semantic aspects of e-learning from both pedagogical and technological points of view. It brings effective platform for learner to adapt standard e-learning system where age and time is not a constraint. It provides effortless database monitoring and operation with the help of centralized database. To enhance the classification accuracy, information extraction and course content management, effective learning content monitoring algorithm is presented this approach also assists to user to re-ranked content indexed based on learner's query. The rest of paper contributions are followed as:

- This paper proposes effective learning content monitoring algorithm to interactive content design, and enhance the accuracy of content retrieval and content classification.
- This system designs a user friendly and innovative application (more practical and diagrammatic representation included content) for learners to adopt the e-learning system without any hesitations.
- This system also creates interaction between teacher and academic council or board to evaluate the subject-wise performance of learner for award the degree them.
- Proposed systems performs well in the terms of content retrieval time, content classification accuracy and success rate compare than existing approaches.

The rest of paper is follows as: In section 2, we mentioned related work which is close to proposed mechanism. In section 3 introduces the system design with proposed techniques elaboration. Section 4 explains about result and discussion. Section 5 summarizes the overall work with future work.

2. RELATED WORK

In this paper [1], authors explored opportunities for integrating formal and non-formal education in Uganda ways that help learners to acquire, build and maintain productive skills for sustainable livelihoods. Using an interpretive paradigm, authors drawn on the capability approach and social practices theory of literacy to guide their qualitative analysis. The authors described good practices in non-formal education in Uganda and Africa which diversify learning options for learners. Integration of formal and non-formal education is shown as capable of promoting practice-oriented skills learning which can significantly improve Uganda's education system that is currently too theoretical for addressing people's real needs. In paper[2], author expressed course participants, attitudes and levels of acceptance of non-formal learning recognition compared to traditional university credit in both developed and developing countries. The actual study uses both certificates of completion and digital badges to recognize and validate learning in an introductory, university level course in web programming using HTML5/CSS.

In this paper [3], author designed Educative system classification model to compare a formal, non-formal and informal education, their features and relations at the level of concepts and practical utilization. Considering the problems arising from formal education, alternatives that displace the "center of gravity" from formal, to non-formal education processes are advanced. Paper [4] focused on online based education system where it examines possible difficulties to adopt and implement online tools outside school and university environments. Second, it will highlight the advantages of incorporating e-learning tools specifically in the teaching of Portuguese. The third focus lays on the introduction and use of e-learning tools in classes of Portuguese as a foreign language. During a month, synchronous and asynchronous online activities were offered to two groups of 7 students each as a substitution and complement of the regular classes.

In paper [5], authors implemented method to find out available information and it should be presented among many people as possible in a way that will allow them to assimilate the knowledge. The most appropriate forms of education for the concrete target group are included in informal education. Informal education is divided into informal general education and informal education for the profession or for the professional work. The fact, regarding the method of giving information has to be considered that people differ from each other, and in accordance with this. It makes a difference as to how they perceive certain information. The methods of education should be adapted among different types of people. Elements such as people's levels of concentration, motivation, non-linear receipt of information, stability of information and obtaining of knowledge are looked at more closely. Paper [6] motivated the educational institutions to co-operate in the system for validation of non-formal and informal learning in EU countries and Slovenian position.

In paper [7], authors developed a framework to promote engagement through a community of practice, learners are encouraged to share the knowledge and co-construct explicit knowledge through social media and a dedicated collaborative tool. These are integrated into a framework which supports non-formal learning facilitates, knowledge creation, sharing through socialization, externalization and combination. Paper [8] advised to process the evaluation of non-formal educational activities which are similar to the basic design principles and used in formal education. It works for identifying the goals, objectives and competency-based outcomes; developing instructional design parameters; analyzing the context and culture of instruction; evaluating and measuring non-formal teaching. This growth, in concern with the expanded use of Open Educational Resources (OERs) that is creating a potential synergy between non-formal education and OERs to strengthen the continuum of education.

In paper [9], authors implemented Augmenting Reality to enhance the non-formal blended learning. Augmented Reality (AR) technologies and smart phones can transform such informal and non-formal settings into digitally augmented learning settings by superimposing "digital" layers of information over physical objects or spaces. At the same time, the formality of these settings increases when connected to

formal settings through these digital layers. The right combination of AR and mobile technologies with computer-based educational tools such as Learning Management Systems (LMSs) drives this digital connection, leading to articulated blended learning activities across formal and non-formal settings. Paper [10] improved the non-formal learning through vocational education, and the role of ICT for providing appropriate accreditation model. Paper highlights on the development of a model and a prototype of an adaptive eLearning system that ensures the pre-defined learner outcomes. In paper [11], authors integrated formal learning and non formal learning to minimize the illiteracy levels among the masses. It also assists to combine regional and gender-based educational imbalances to encourage the primary vocational education and training for the poor and low-income masses people.

In paper [12], authors described a current progress of quality e-learning for expanding distance education. It identified the major problems of e-learning in distance education at tertiary level in Bangladesh, with special reference to Bangladesh Open University. Author produced some recommendation based method to solve the e-learning in distance education at tertiary level issue. Paper [14] implemented framework to deploy an online course based primarily on IMS specifications. These tools include a learning object sequencing environment, a content delivery engine, and an assessment application. Paper [15] presented an adaptive e-learning course model including introduction, contents, assignments, Exercises. This system is based on open source learning management system LAMS (Learning Activity Management System) to present course materials in different ways according to learner's learning styles. In paper [16], authors offered a hybrid-style programming courses supplementing e-Learning with small-group of instruction. As a result, the weak students received better grades, and the number of students who failed has been decreased.

3. SYSTEM DESIGN

This section introduced the system design with proposed techniques and algorithm details. This system elaborates implementation procedure step by step with design architecture in figure 1. The objective of proposed system is to create an interactive e-learning application which provides interesting content material with good content classification accuracy. These systems also provide the interaction between board member and teacher to evaluate the performance of learner. In detail, this system provides interaction board member, teacher and learner with their accessibility and operation. Proposed effective learning content monitoring algorithm works to enhance content design, content classification and content retrieval based tutor's search query.

3.1. Board Member

This module presents accessibility and operational page for board members. Also, this module creates interaction among board member, teacher and learner to enhance the non-formal based education systems.

3.2. Teacher

In this module, teacher can access his/her homepage after login authentication. Here, teacher can view the learner details, course details and upload course materials details. Proposed algorithm assists teacher to design the interactive content (with proper diagram along with practical application) which encourages learner to prefer e-learning systems. This modularizes the content in effective manner which helps learner to retrieve the content in easiest way.

3.3. Learner

This module provides most interactive and user friendly application systems to learner after sign-in validation. Here, tutor can learn about any domain or any subject with their convenient time and place. In this module, tutor can search the terms or query from this application where proposed mechanism

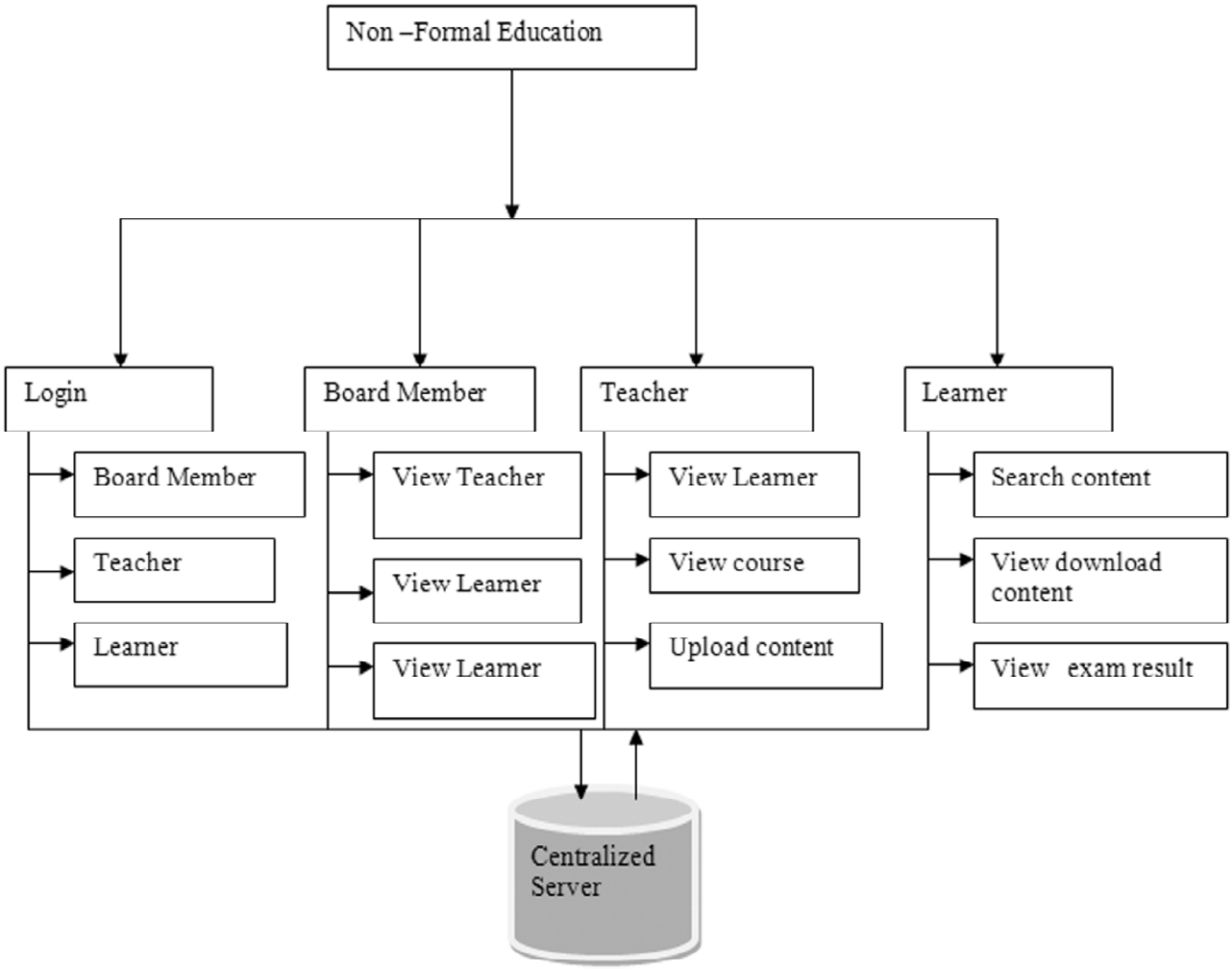

Figure 1: System Design architecture for non-formal education system

retrieve the relevant content information based on learner's query. Finally, he/she can download and access the application from anywhere.

3.4. Effective Learning Content Monitoring Algorithm

This section explains the proposed algorithm in detail along with features. The working principle of proposed mechanisms is elaborated with mathematical representation and features of technique. The main motto of this algorithm is to design and build the course content in effective manner. This technique designs the content in various categories. It assists to teacher to upload the course content in interactive way. Simultaneously, it provides interface to the learner to retrieve the relevant course content within minimal time. This system helps the application to rank the course content based on the query. Finally, it enhances the classification accuracy in the terms of content classification category.

Here, Effective Learning Content Monitoring Algorithm works with course content C to design the course in effective manner. Teacher (T) uploads the course content(C) in centralized database (DB). This process continues until data teacher is not filling up data with proper category with classification. Once, data is uploaded in successfully then it will be stored DB. Hence, Learner can search query (Q) based on his/her course content. Then, proposed approach retrieves the relevant information and ranks the content index based on his/her query. Now, learner can view the course content and he can attend the exam also. Teacher evaluates the exam question and report to board member as well learner. Finally, board member awards degree to learner.

```
Start
Input:  course content (C) and learner query Q,
Output:  Learner content retrieval RC,
Teacher (T) uploads the content;
Repeat the procedure until complete;
If course content text filed complete then
{
Store in centralized the database;
}
Else
{
Go for course content page;
}
Learner search query;
Extract from DB; // DB: collect the all the information from centralized database
Check the relevant information behalf of course content;
If query match to content then
{
Display first relevant page;
}
Else
{
Go to DB; \\ Go to: Repeat the extraction process to collect relevant information
}
Classify the content;
Display the query content (q);
View the task;
Raise the query;
Go through the query;
Teacher provides the results on the step;
Learner the view exam results;
}
End
```

Figure 2: Pseudo code Effective Learning Content Monitoring Algorithm

4. RESULTS AND DISCUSSION

4.1. Experiments

In order to compares our proposed mechanism with existing algorithm. This work is deployed with Intel Dual Core Processor with 1GB RAM running with windows 7 ultimate. Here, we implemented proposed techniques in Netbeans 8.0 with Apache Tomcat 8.0.3 and MYSQL 5.5 database. To evaluate proposed mechanism with existing approach, Weka 3.7.3 open source tool is utilized.

4.1.1. Data

For experimental work evaluations, proposed approach used three different types of learner like Learner with Primary School pass (5^{th}), Learner with Middle School pass (8^{th}) and Learner with High School pass (10th) whose details are mentioned in table 1.

4.2. Result

In this phase, proposed systems will represent mathematical model to enhance the content retrieval time, content classification accuracy to encourage e-learning among older ages and as well rural people. Here, learner can search the query related to his/her course content (Java/ OOPs Concepts) and he can view the query result with proper diagrammatic representation and practical application. It performs following model separately such as content retrieval time, content classification accuracy and success rate performance result.

4.2.1. Content Retrieval Time (CRT)

In this section, proposed approach elaborate mathematical model for code execution time in equation (1).In this step, method calculates content retrieval time in given applications. Content Retrieval Time (CRT) is calculated as,

$$CET = \frac{\overrightarrow{d_j} \bullet \overrightarrow{q_l}}{\left|\overrightarrow{d_j}\right| \times \left|\overrightarrow{q_l}\right|} \tag{1}$$

Where, q_l is the learner query. In details ql = (w1, ql, w2, q_l, w3, q_l ……..wt, q_l) are coordinates in t-dimensional space. There is t an index term in query vector which have weight w for every one of them. D_j is total content documents. In details dj = (w 1, j, w 2, j, ... w t, j), N is total index in document vectors. Each one has a weight for each keyword in the indexing system.

4.2.2. Content Classification Accuracy (CCA)

This section represents the mathematical model of content classification accuracy in percentage (%) which is expressed in equation (2). Here, content classification accuracy is calculated based average value of precision, recall and f1 score of given content by teachers where teacher provides content name, category, description and file.

$$CCA = \frac{2 \times Precision \times Recall}{Precision + Recall} \times 100 \tag{2}$$

Where CCA = content classification accuracy, Precision represents level of measurement that yields consistent results when repeated. Recall is *defined* as the number of relevant documents retrieved by a query search in percentage.

4.2.3. Success Rate (SR)

Here, success rate (SR) represents the success possibility for learner query content retrieval. For success query, there is at least one query hit. Let assume that query resource are available in application as well on their given hosting website. Assume that the queried resources are uniformly distributed in the network with duplication ratio D, and then SR can be calculated as,

$$SR = (1 - D)\, O \tag{3}$$

Where R is the duplication ratio and O is the occupancy. This formula shows that the SR is mainly depending on the occupancy of the content retrieval process and monitoring approach. Table 1 shows content retrieval time (CRT) in seconds, content classification accuracy in percentage (%) and success rate (SR) in percentage %) for primary school pass, middle school pass and high school pass learners. This table shows its average values for respective parameter with respective datasets. Here, proposed approach is evaluated with several existing mechanism on given parameters like a CRT, CCA and SR.

Based on table 1, figure 3, figure 4, and figure 5 result performances for primary school pass learner, middle school pass learner and high school pass learner; it shows that proposed effective learning content monitoring algorithm is best approach. In the terms of content retrieval time which represents the learner's

Table 1
Content Retrieval Time, Content Classification Accuracy and Success Rate of Primary Pass, Middle Pass and High School Pass Learner

Learning Approach	*Primary School Pass Learner*			*Middle School Pass Learner*			*High School Pass Learner*		
	CRT	*CCA*	*SR*	*CRT*	*CCA*	*SR*	*CRT*	*CCA*	*SR*
LAMS	15	95	87	12	96	89	11	97	93
Moddle	12	89	84	9	92	87	7	93	91
OLAT	7	80	91	5	85	93	4	87	95
Sakai	8	93	95	6	95	97	5	96	98
ELCM	4	97	98	3	98	99	2	99	99

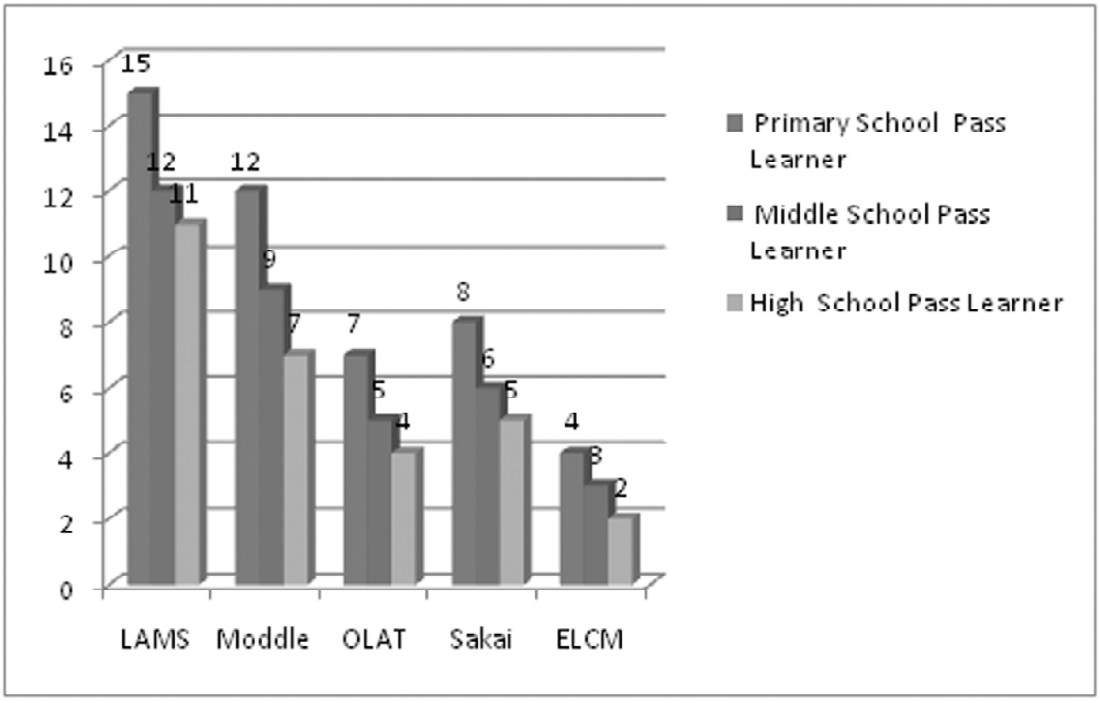

Figure 3: Content Retrieval Time for Primary School Pass, Middle School Pass and High School Pas Learner.

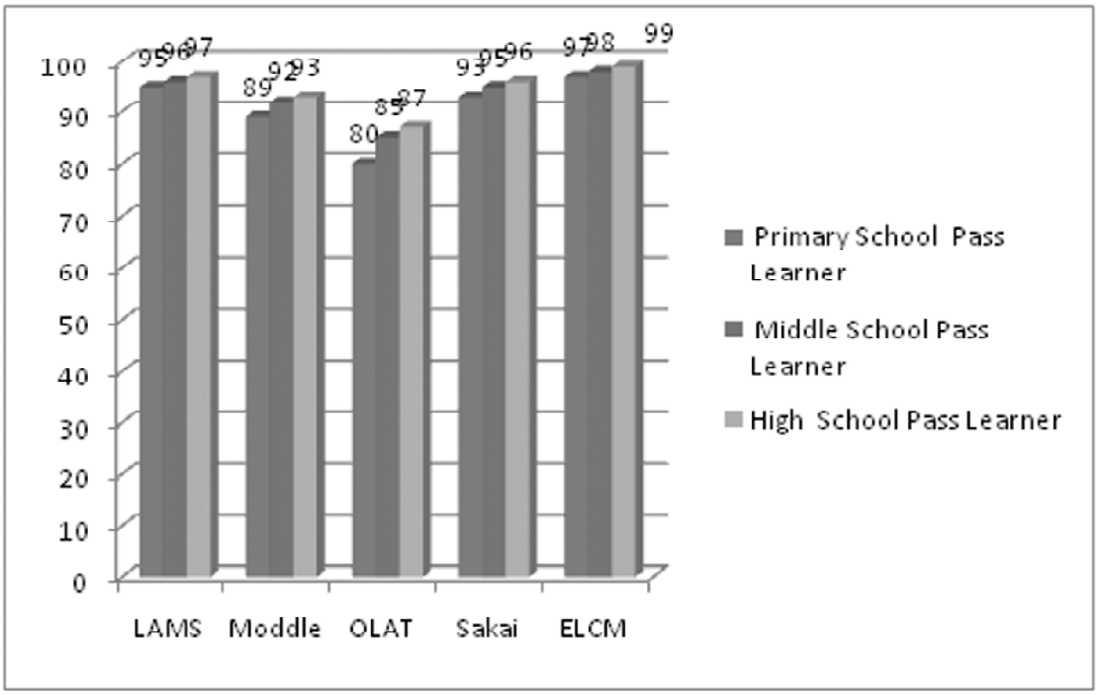

Figure 4: Content Classification Accuracy for Primary School Pass, Middle School Pass and High School Pass Learner.

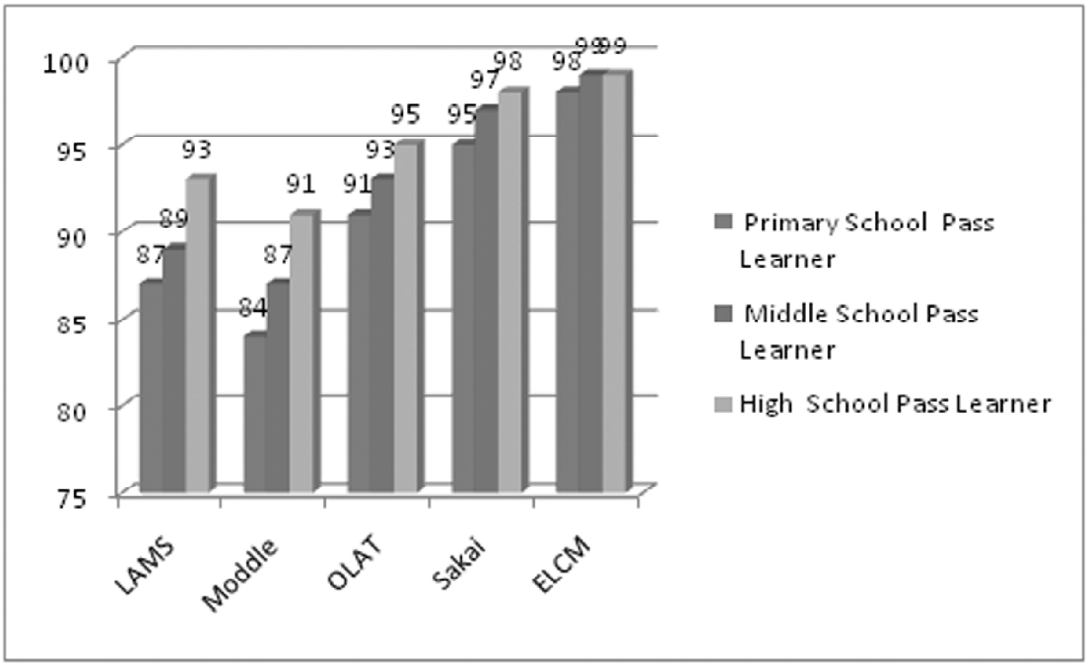

Figure 5: Success Rate for Primary School Pass, Middle School Pass and High School Pas Learner

query retrieval time with nearest competitor was OLAT [19]. Behalf of content classification accuracy, it displays the content management accuracy of application with closest existing approach LAMS [17]. In the terms of success rate, it performs and highlights simplicity and ease to use of application. Here, nearest competitor was sakai [20]. Proposed ELCM approach increase the content classification accuracy 2%, success rate 2% and reduce content retrieval time 2.33 seconds. Finally, this paper claims that proposed effective learning content monitoring approach is best approach because it performs well on every respective parameter along with respective datasets.

5. CONCLUSION

In this paper, this research work presents an innovative web based learning framework to assist a non-formal education system. This system reduces the gap between education system and learner. It brings opportunities for learner to adapt standard education system with no age bar and time constraints. It will be easily accessible by utilization of centralized database. To evaluate the learner performance, this system also creates the user interface between teachers and board. To enhance the classification accuracy, information extraction and course content management, Innovative Learning Framework Algorithm is presented this approach also assists to use to re-ranked content indexed based on learner query. Based on experimental results, proposed approach provides good results in the terms of accuracy, information extraction and content management compare than existing approaches. Proposed system improved content classification accuracy 2%, success rate 2% and reduces content retrieval time by 2.33 seconds. In future, this work can be extended with content privacy with keyword based ranking in cloud environment where teacher can store large volume of contents.

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