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An Effective E-Learning Services using Different Web Service Component Interfaces

Dr.M.Balakrishnan[1], Dr.A.B.Arockia Christopher[2]

Assistant Professor (SG)[1], Assistant Professor(SG)[2], Department of Information Technology, Dr.Mahalingam College of Engineering and Technology, Pollachi, Tamilnadu (India)

ABSTRACT

A web service is defined as a software system which communicates with the applications over the network in an independent manner. At the present time, every type of communication has been taking place online. To efficiently use E-learning many online tutorial services have been developed. With this new online tutorial service in hand the students can therefore learn all of them through Internet. An earlier technique has been developed for intervention infrastructure which provides an E-learning system using Smart Space Learning System (SSLS). The main concern over SSLS is that it cannot be applied to an information technology mediated learning which has closed information environments. Another technique for E-learning service is that Open Smart Classroom (OSC), on open smart platform to facilitate intercontinental and intercultural class with superior features. The main flaw in OSC is that it provides E-learning services to only intercultural students which are highly unreliable to use. To overcome the above issues, a new framework is presented in the research paper, in order to provide efficient interface between web services and components, Online Tutoring Framework for E-learning system using Web Service technology (OTFWS) is introduced to present an E-learning system in a well-organized way.

Keywords: E-Learning, Open Smart Classroom, Web Services, SSLS, OTFWS.

I. INTRODUCTION

With the rapid increase in network applications, the main focus concerns with the vision by providing computer-based media support, where no extravagant training is required. Among these applications, E-learning systems are rapidly gaining the significant popularity. Some of the features that made E-learning technology worthwhile are the easier-to-use development tools, cost optimization, extensive broadband channels and extraordinary higher returns. The above said factors are obtained in the form of increased learner productivity, have made the E-learning technology more attractive to a wider variety of institution and individual users.

Various studies conducted on learning confirm the fact that the type of computer-based media combined with E-learning materials has a higher range of significant impact on the volume of information retained, received and recalled by the learners. Several web-based techniques are used to develop online learning systems.

From an E-learning 2.0 perspective, traditional E-learning systems were usually designed on the basis of instructional packets, which were provided to the students in addition to the assignments that were evaluated by the teacher. When compared to the conventional method, the E-learning 2.0 maximized the emphasis on social learning and increased the use of social software such as blogs, wikis, podcasts and virtual worlds. The most

suitable user environment has not yet been found, but the individual interface are sufficiently enough to a certain specific point when it becomes feasible to design systems capable of making a positive impact on the E-learning experience. Center to such systems is a conversational interaction using speech recognition and text-to-speech synthesis.

In conventional method, learning takes place between the students and teachers using face to face method which was assumed as a better learning system. With the development of technology, new ways of communication has expanded many new things i.e., now everything is based on the Internet. As a result, even the tutoring system is also being performed online which is referred to as online tutoring. Many web services have been developed for online tutoring system which requires certain electronic tools to deliver the information online.

In the past, online tutoring was performed using Email where a student sends a question to the tutor, with the anticipation that the Email returned will consists of the answer. As an alternative, what happened was a disconnection. Even though the student can expect and provide answers using face-to-face tutoring conference, the Email format recommended the student to answer the question with a straight answer.

Though the web enables a student to select from different form of educational resources, but it is difficult for the learners to find appropriate learning services such as courses, seminars, and web-based training applications. Corporate learners and independent learners obtain the services of learning using the heterogeneous properties and the sources are also obtained from heterogeneous in nature. But at the same time, the rationality with which the process of selection is performed by a student is limited for the following reasons (i) the limited overview availability of the learning services, (ii) limited capabilities of processing all the information describing learning services.

II. BACKGROUND WORK

The online environment whenever applied in the field of education uses the learning environment in virtual manner. Some of them includes are Modular Object Oriented Dynamic Learning Environment (Moodle), Sakai, dedicated community who work together to develop a common collaboration and learning environment and applying the conventional blackboard practices. The process of online tutoring can be either provided directly or through a link. With the help of virtual learning environment, online tutoring is offered directly and with the help of the learning management system, it is provided with the help of a link. In the specific case, the student using the online tutoring process has to pay for the used tutoring time before actual delivery of service takes place. But many educational institutions and popular publishers of major textbook sponsor on behalf of the student, by sponsoring certain amount of tutoring without making a direct charge to the learner.

Yue et al (2009) developed a human-computing interaction named Component-based Open Smart Classroom Model (COSCM). In this COSCM more and more natural human-computing interfaces were incorporated for enhancing work efficiency. In the learning environment, human-computing interface assists the teacher to teach in the class. It helps the students to learn and discuss with others. The progression of human-computing interface was then integrated to improve the work efficiency in E-learning system. The major problem related to COSCM was the model could not be reused. The defect of the model reusability, was enhanced later by (Gang 2009).

RealXtend as fully executed using the new Tundra Software Development Kit (SDK) and also included an add-on for the open simulator server. The designed framework treated the primary elements of virtual worlds by (Alatalo 2011) as add-in functionality, with the overall architecture providing a wider range of virtual worlds. The attribute values were automatically synchronized between the participants in a networked environment.

Mansour & Dillon (2011) proposed a service-oriented reliability model that dynamically calculates the reliability of compound web services with rollback recovery based on the real-time reliabilities of the atomic web services of the composition. In this case, the broker reception testing mechanism examined the results returned from a particular web service. If it is acceptable, then the calculation continues to the next web service.

The interaction between the human and computer plays the key role for E-learning concepts. Munoz et al (2011) proposed an interactivity model which is holds the main characteristic of tradition face-to-face teaching. It was considered as the vital method in the design of such arbitrated instructional settings as Computer-Assisted Instruction (CAI), computer-assisted learning. E-learning with the multimedia and graphical boundary is now stylish in most of the effectual knowledge environments.

A large number of software component models were developed with different aims using different principles. Crnkovic et al (2011) provided a comprehensible concept and differentiate component models more effortlessly by classifying the large number of component model framework. The advantage of the system being the usage of components and the limitation was the application of components-based model in only specific research areas. The two most important subject of analysis in software engineering and parallel distributed systems are the component-based system and program construction.

Brut et al (2011) provided a solution to enhance learning object model with ontology-based semantic annotations for efficient use of learning objects. The data model was first presented. Followed by this, the technique called as indexing was designed in order to acquire better measure of learning resources by integrating both the methods for indexing based on structure and the WordNet-based text processing based on the linguistic-oriented method. Two important activities were highly required during the transfer protocol which included the web application and significant payload encoding for the successful accomplishment of embedded web services. (Shelby 2010) analyzed the most promising payload encoding techniques and also introduced the new Internet Engineering Task Force (IETF) Constrained REstful Environments (CoRE) standardization activity which varied in large way according to the attitude and characteristic features of the student.

To overcome the scalability issue, Si et al (2010) designed an approach for disseminated Semantic Web Services (SWS) discovery based on peer-to-peer and semantic web service technology. Adopting Ontology Web Language System - Test Collection3 (OWLS-TC3) as untried data and testing continuously proved to be a scalable, flexible and effective method to publish and discover SWS in distributed environment. The suitability of the model designed by Si et al (2010) was designed to be scalable but only served for distributed environment and not for heterogeneous type of network and finally quality of service was not provided.

Learning objects were classified in an automatic manner using dimensionality reduction and feature subset selections in an E-learning system by Chellatamilan & Suresh (2012). The author collected the user query and integrated it into different Learning Object Repository, (LOR). The LOR was then evaluated and interacted with the E-learning system which then retrieved the Learning Objects (LO) in addition to the Learning Object

Metadata (LOM). Semantic Oriented Web Services (SOWS) considered the semantics of the web service as developed by Khdour & Fasli (2010) for automating the process. The major hurdles in SOWS were that the recent web service matchmaking checked the capabilities of the requested web service against the capabilities of all advertised web service advertisements in the registry. Once the number of advertised web services in the registry gets increased, the process of checking all advertised web services against a single client query becomes consuming process.

Yiqun et al (2012) presented an application on smart phones for the sake of mobile learning in an interactive manner. Image recognition technology is used to link physical objects seen through the camera, to pertinent information through the built-in camera on the smart phone, visual interactive learning are realized. With the Global Positioning System (GPS) sensor, the activation of learning based on the location was only possible with the combination of both the camera and the GPS sensor on the phone.

III. DIFFERENT WEB SERVICE TECHNOLOGIES

3.1 Online Tutoring

Online tutoring is the process of tutoring in an online mode. It is a virtual environment or network environment in which teachers or professors and learners or the students in an engineering institution are separated by time and space. Online tutoring, as a reflection of the diversity of the wider Internet, is practiced using different approaches and addressed to distinct sets of users. The distinctions are in online content and interface, as well as in tutoring and tutor-training methodologies. While information system plays key role in several organizations, their utilization is not limited to business domains. Nowadays, 'information systems' is a common term used to depict any means of processing, storing and accessing information for all types of disciplines. The concern is to provide online learning and in particular providing access to course information and learning material.

3.2 The Evolution of Online Resources

Though the initiation of online tutoring models started with Email, there has been increasing number of new models both in the form of synchronous and asynchronous format. The following models are presented in the context of the specific tool used, for example, web board or Net Tutor. For example, one of the most significant models of tutoring online is the accounting faculty at Paradise Valley Community College (PVCC). The design of this tutoring online includes web pages and the application of an asynchronous discussion forum, called web board. Here the tutor began the web page by including the list of all the chapters present in the accounts textbook and also included the FAQ related to each chapter. As a result, the students could refer to the answers of the FAQs before making contact with a tutor. Tutors could follow up on questions on the web board for all the students or chat individually with a student. This resource became so popular that students outside the college soon started to use it.

3.3 Online Tutoring for Online Classes

Online tutoring is all about using web services or the Internet for tutorials or tutoring activities. Students would be learning from their tutors through the use Internet. Online tutoring for online classes require certain types of applications including instant messaging in order to make the discussions effective. Apart from the questionnaires and lectures performed through Internet and through the mode of web conferencing, certain

amount of quiz, publication of exam results and recommendations for other programs are also performed through the Internet. The attitude of parents with respect to tutors changes according to the knowledge of children. Some parents prefer regular and ethical tutors who follow the traditional model of teaching their children often face to face. Some other parents on the other hand prefer online tutoring services because their children may possess higher level of knowledge and productive.

3.4 Web Services for Online Tutoring Service

Web services for online tutoring service involves a method that efficiently communicates between two electronic devices over the Internet. The concrete agent consists of the concrete piece of a specific service that sends and receives messages, whereas the service comprises of resource that are in a way significantly characterized and provided by specific set of functionality. In order to illustrate this, a specific web service is deployed using one concrete agent one day written specifically in one programming language while another concrete agent writes in a different language the following day. Although the agent may have changed, the web service remains the same.

3.5 Server Layer –Web Services

The web services are hosed in the web services that mainly consist of different mainframe computer servers that are located either in earth control centers or in a space station in the low earth orbit. These servers define the execution of the web services, process tutor/student' requests, execute business logic, and perform intensive calculations on behalf of the tutor/student. The web services are of any type, protocol, or version and interact with the middle component framework via web service interface. Each time a new web service is integrated into the system, the middleware interactive components save itself inside an internal registry, along with other important details. The middle component framework then exposes to the tutor/student allowing it to call remotely all available functions.

3.6 Middleware Component Frameworks for Building Online Tutoring Framework

This section discusses in detail about the middleware component framework for building Online Tutoring Framework for E-learning systems using Web Service technology (OTFWS) software components. The OTFWS is a distributed model made out of loosely-coupled interoperable web services. The communication between the client (tutor/student) and the web services is bi-directional and it is performed in a remote manner with the help of the middleware.

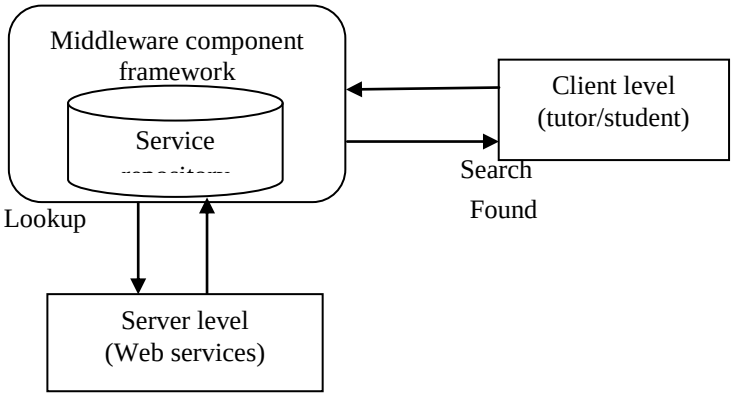

Figure 3.1 Framework for middleware component

Figure 3.1 illustrates the middleware component framework using web service software components with its different levels. Essentially, the middleware component framework is composed of three basic levels: The first level is the client (tutor / student) level which invokes methods of web services to perform operations such as examining materials, analyzing learning environment, studying and assessing the queries, and capturing and processing images for different types of applications.

The second level is the server represented by the web services. The web services provide the actual learning services. The third and final level is the middleware represented by the standard interface and a unified data-path for both the client and the server levels to interoperate efficiently and exchange the data regardless of their incompatible platforms and implementation technologies. In fact, the service requester (Tutor/student from client level) is a client application requesting a particular functionality from the service provider, and the service provider is usually a server that hosts and runs the actual web service.

The middle component framework (interface) delivers a transparent communication between the different components of the OTFWS allowing them to interoperate, despite their underlying incompatible technologies and platforms. The algorithm for communication process is described as shown in Figure 3.2:

Algorithm:

Input: Tutor and Student
Process: Different Middleware Components
Output: Transfer the message from Tutor to Learner

Steps:

Step 1: The tutor/student invokes web service.

Step 2: The request encapsulates metadata describing the request message, including the source client, the destination service, and a set of parameters.

Step 3: Middleware interactive components receives request message
3.a: It first validates the correctness and then converted into the destination web service
3. b:Middleware interactive components uses an internal registry to lookup the technical details about the destination web service components.

Step 4: Middleware interactive components routes the converted request to the web service interface that is compatible with the addressed web service

Step 5: The web service interface then locates the corresponding web service and gets bound temporary to it and starts executing the requested function

Step 6: Once processing is done, a response is sent back from the destination web service to tutor/learner.
6.a:It is first sent to the web service interface, then to the middleware interactive components, then translated to client requested format, and eventually routed to the tutor/learner.

Figure 3.2 Algorithm for middleware component communication process

The process of the algorithm is first tutor or student invoking the web services and the requested metadata to the server. The middleware interactive components receive the request message and process it if the message is validate then converted into destination web service. Once the process is complete the web services are translated to the client requested format to the tutor/learner.

IV. EXPERIMENTAL RESULTS

4.1 Speed of Message Transfer

Message transfer refers to the rate at which the message is transferred and delivered to the students. The outcome of the online tutoring framework for E-learning system using web service technology is compared with an existing semantic oriented web services. The table 4.1 describes the speed of message transfer after which

have been applied through an web interactive component interface model. The outcome of the online tutoring framework for E-learning system using web service technology is compared with an existing semantic oriented web services.

Table 4.1 Number of users vs Speed of message transfer

Number of users	Speed of message transfer(Mbps)	
	SOWS	OTFWS
5	2	5
10	5	11
15	8	17
20	13	22
25	15	24
30	18	28
35	25	33
40	30	38

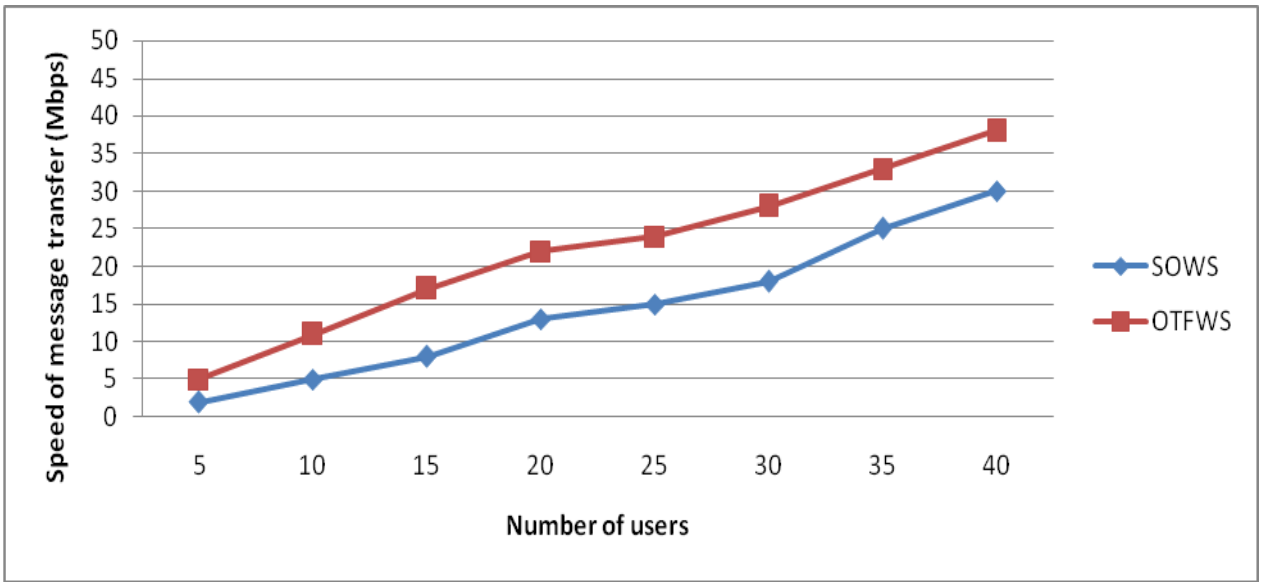

Figure 4.1 Number of users vs Speed of message transfer

Figure 4.1 describes the message transferring speed when more number of users involved in the E-learning system. Since the proposed work used web service component interface for middleware common component framework, the E-learning concepts outperforms well for both the students' and the tutors. Compared to the Semantic Oriented Web Services (SOWS), the Online Tutoring Framework for E-learning system using Web Service technology (OTFWS) provides high speed of message transfer because of the fact that services (contribution of faster E-learning services) are deployed in the design phase and there is not separate deployment phase which result in the increased speed of message transfer than the existing SOWS model.

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4.2 Maintenance of Tutoring Sessions

Maintenance of tutoring session describes how the tutoring sessions are maintained based on services, tutoring process, and the time taken to analyze the skills of the students' and to learn it. Table 4.3 describes the maintenance of tutoring sessions and the function of number of users.

Table 4.2 Maintenance of tutoring sessions

Number of Users	Time taken to maintenance of tutoring sessions (milliseconds)	
	SOWS	OTFWS
5	21	15
10	25	16
15	28	18
20	30	13
25	28	12
30	32	15
35	38	18
40	45	21

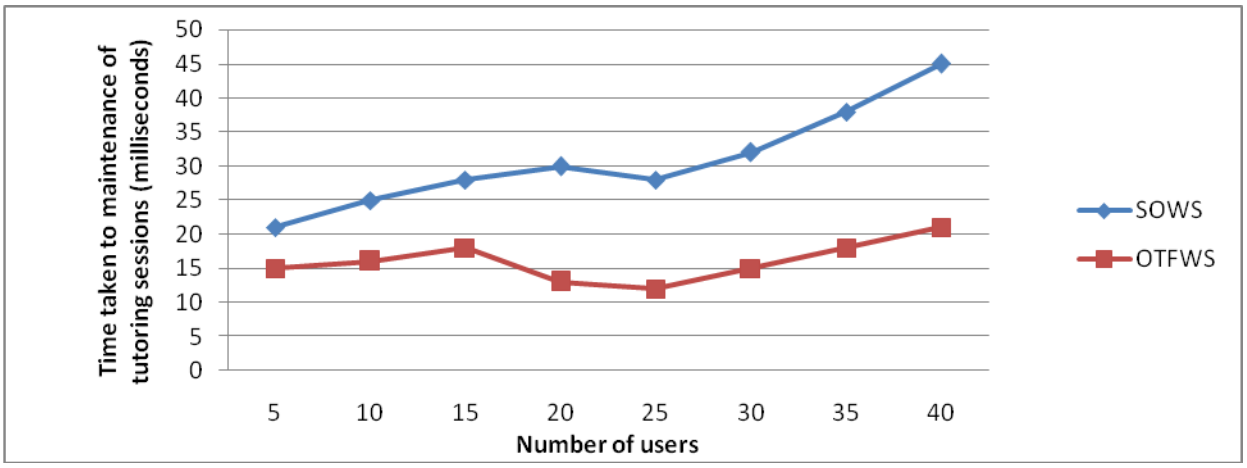

Figure 4.2 Maintenance of tutoring sessions

Figure 4.2 illustrate the amount of time taken to maintain the tutoring sessions in proposed OTFWS and existing SOWS tutoring scheme. Since the services are built as components framework, the maintenance of tutoring sessions are easy. When number of users (both learners and tutors) increases, the maintenance efficiency of tutoring sessions is also being high and maintenance time is less in the OTFWS scheme. The maintenance time is lesser due to the fact that an interface is built based on back end web service and middleware interactive components embodied by unique code when compared to semantic oriented model.

4.3 Communication Efficiency

Communication efficiency refers to the effectiveness of the communication i.e., the communication between the students and trainers while tutoring in the class using effective communication and resource tools. The outcome of the online tutoring framework for E-learning system using web service technology is compared with

existing semantic oriented web services. The table 4.3 describes the efficiency of communication services after which have been applied through an interface model. The outcome of the online tutoring framework for E-learning system using web service technology is compared with existing semantic oriented web services.

Table 4.3 Number of users vs Communication efficiency

Number of users	Communication efficiency (%)	
	SOWS	OTFWS
5	10	15
10	17	24
15	23	38
20	26	49
25	34	60
30	45	69
35	52	75
40	58	82

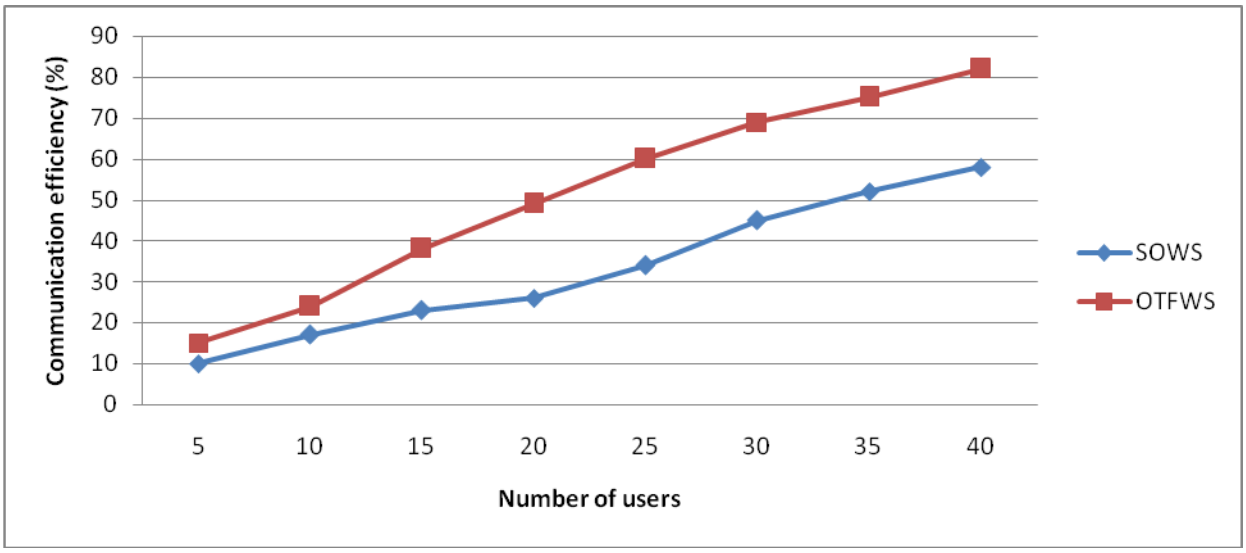

Figure 4.3 Number of users vs Communication efficiency

Figure 4.3 describes the effectiveness of the communication between the tutor and student. In the proposed OTFWS, the communication is performed through an interface and the students also get their response as soon as possible from the tutor regarding the course, discussion forums, logistics, syllabus, videos, messaging services with communication and resource tools in middleware component.

Communication efficiency is measured in terms of response obtained between the tutor and student. Compared to existing semantic oriented web services, the online tutoring framework for E-learning system using web service technology is efficient (contribution of communication ability of the research). As the communication between the client (tutor/student) and the web services is bi-directional model and performed in remote manner

with the help of the middleware, results in the increased communication level and provides efficient web service component framework for communication services.

V. CONCLUSION

New challenges and requirements increased by E-learning systems have been pointed out, in this study of work and to meet them, an online tutoring framework is developed using web service technology. The evolution of online tutoring has shown that success may not depend so much upon the tool selected, but on the development of an appropriate culture for online tutoring, an understanding of the process and parameters involved. Learning services which make use of physical or human resources are offered according to the specific schedule since the use of those resources need to be managed. The experimental results show that the proposed OTFWS outperforms well in online tutoring scheme by providing better learning services. The performance is evaluated and the experimental results show an improved performance of communication rate, speed of message transfer and maintaining tutoring session which proved the efficiency of interactive web service tutoring scheme for E-learning.

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