# An Integrated Model to Enhance Virtual Learning Environments with Current Social Networking Perspective

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**Abstract—**A Virtual Learning Environment (VLE) is an accumulation of incorporated software components, empowering the administration of e-learning. The quality of VLE is indispensable for the accomplishment of e-learning goals and responsible to engage students during learning. But the VLEs are not revamped according to the modern technologies, thus the attributes of existing VLEs do not completely meet the requirements of today's e-learning. The students' interest, participation and engagement with web-based e-learning platforms are diminishing. In contrast, the learners' engagement and participation are high-spirited in many modern technologies, including social networking sites (SNS) and web 2.0 technologies. Many studies highlighted various inadequacies in existing VLEs and also emphasis to use the feature of modern learning technologies in an existing e-learning environment. Design and development of new VLEs with all features of modern learning technologies could be one of the options. Another smart solution could be the incorporation of SNS, online tools and modern learning technologies with existing VLEs. The open APIs for various technologies are not available so that the smooth integration of external technologies with VLE is one of the challenging issues. The goal of this research paper is to investigate existing e-learning environment, find their inadequacies and try to resolve them by incorporating available external technologies. The paper proposed an integrated model to enhance existing e-learning environment by incorporating potential modern learning support technologies with VLEs. This paper will provide a good direction and new thoughts for the researchers of technology-supported learning-domain.

**Keywords**—virtual learning environments, integrated e-learning model, issues in LMS, SNS supported e-learning, technology-supported learning.

## 1 Introduction

E-learning is a smart way to provide learning through electronic media with contemporary and timely learning resources. The cutting-edge education or training can be achieved through this technology supported learning. As stated in [1], the e-learning provides great services of a modern learning, especially for those who have a

bustling timetable, and don't have enough time to sit in a classroom. To manage the e-learning processes, VLEs (LMS, e-learning platform, and e-learning software) are being utilized. The open source and commercial, both types of VLEs are available and growing as an integral part of the world higher educational system [2]. The VLEs are software product application, capable to comprise and convey e-learning elements, including contents, pictures, animations, audios and videos. Typically, a VLE is responsible to provide communication, assessment, collaboration, students' tracking, administration, and conferencing features in e-learning. Figure 1, shows some main activities supported by the VLE.

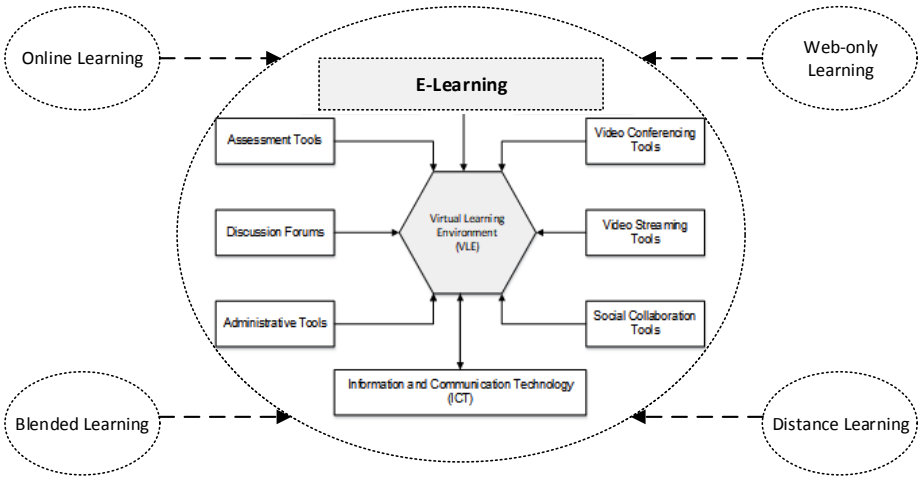


**Fig. 1.** Major activities of a Virtual Learning Environment

As stated in [3], if the contents of e-learning are not properly handled by VLE then the e-learning will drop its usability or effectivity. The e-learning accompanies distinctive flavours like distance learning, web-only learning, online learning, blended learning and so forth, yet the noticeable point is the dependencies of e-learning on VLE [4]. Among different classifications, the blended-learning is getting exceptional consideration from research groups in light of its effectivity, particularly in higher education [5]. The blended learning or mixed learning is a constructive combination of a classroom (face-to-face) learning and online (e-learning) learning system. The learners can watch collaborative lectures, take a test or download learning resources through the VLE and also prepare themselves for a face to face classroom lectures. The VLE is one of the main parts of a blended learning [6]. The figure 2 demonstrates that all categories of e-learning using a VLE, except the classroom learning (without VLE) that runs without any learning platform. It can likewise be observed that only blended learning shaded with the classroom as well as a VLE (LMS). In other words, the blended learning is a trade-off between face-to-face classroom learning and e-learning via VLE. The blended learning is one of the key models of learning for this research paper.

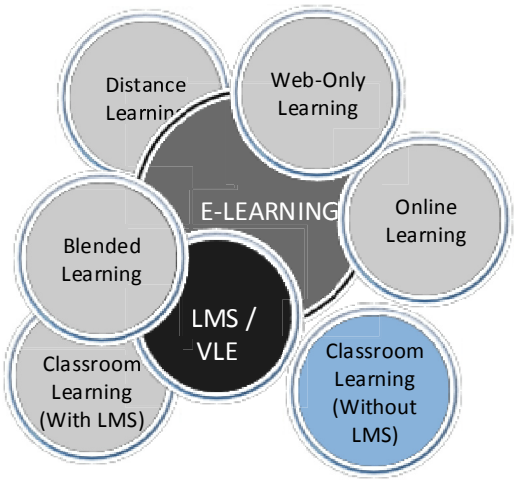


**Fig. 2.** Interdependencies of e-learning and VLE

Although, many researchers are believed the vitality of VLEs in e-learning but in literature various inadequacies of existing VLEs are also highlighted [7], [8]. Due to these lacking, the existing VLEs are not as effective as it should be in student and teachers' communities. As stated in [8] that many faculty members and students criticize in existing VLEs due to the limitation of information sharing, quality in use, contents availability, over-burden of data in web pages, and Web-navigational issues. Some of these major issues are discussed in section-2 of this paper. Some researchers [9], [10] are believed that learning outcomes depend on the degree of learner engagement with e-learning platform, rather than other components. It can be derived from literature [11], [12], [13] that students' participation, motivation and engagement with existing social networking sites (SNSs) are vibrant. As stated in [14] that the students' of these days feel more comfortable with existing SNSs, they login these sites many times in a day. Another study [15] observed that the students' engagement and collaboration with social media or SNSs are vigorous as compared to the VLEs (e-learning). Due to the acceptance of SNSs and online tools in the students' community, many teachers have also been utilized them in learning or as a learning support tools [16]. One of the studies [17] conducted a research with real participants, the findings are summarized as the inclusion of social networking features in existing VLEs can enhance students' participation and engagement in e-learning activities. The study [18] has also endorsed that the integration of SNS in VLEs brings benefits to learners and instructor in many areas of e-learning. Inspired by the acceptance of modern learning and social technologies in students' and the instructors' community, this paper emphasizes either to design and develop new VLE with various social and learning features or incorporate external social and learning technologies with existing e-learning environment. It is obvious to design and develop a new VLE with all vital features of social and learning technologies is time-consuming and tedious work. This paper goes for the smart solution and an integrated model for existing e-learning platform is being proposed. The proposed model provides various external learning-

support technologies, SNSs and online tools to support e-learning activities. The Representational State Transfer (ReST) architecture [19] is followed to integrate external technologies with e-learning platform. The model also enlightens the ways to utilize available open Application Programming Interfaces (APIs) and middleware to incorporate external resources. In ReST supported format, the handling of resource navigation is a challenging issue that handled in the proposed model by introducing outer-wrapper based on annotation scheme. The middleware layer is also developed in the proposed model and discoursed how to utilize the available plugins, APIs and adapters for smooth communication between VLE and external resources. As ReSTful APIs are not working with all conditions, so that to solve this issue, this paper proposed a solution for the condition where ReSTful APIs are not working.

The paper is composed as follows. Section II provides a short review of the inadequacies of VLEs, section III describes the effective utilization of SNS in VLEs, section IV discusses the proposed integrated e-learning model, and conclusion and future work present in the last section.

## 2 Inadequacies of Current E-Learning Platforms

This section will investigate the current e-learning platforms (VLEs) and try to find the lacking areas that hinder the usability and effectivity of e-learning. With many inadequacies, the VLEs have never been as effective as it should be. The issues must be spotted and resolved to strengthen the existing e-learning platforms. The literature introduces various inadequacies in VLEs, some of them are highlighted in this section. A study concluded their findings in [20] as the traditional VLEs are still lacking in various designs, interaction, collaboration and quality-in-use issues. From the feedback of students, most of the e-learning platform designs are chaotic, with unnecessary and redundant symbols and icons. As in [21] the author described that approximately half of the respondents in the current survey have shown that they want to change their present LMS mainly because of user-experience issues. An experiment conducted in [22] with the involvement of real end-users to find the usability of Blackboard (VLEs) user-interface, usability evaluation test concluded that around 37% users are not satisfied with viewing learning contents. Another study in [8] evaluated user-interface, usability and navigational features of Blackboard, the result concluded, the existing LMS are not modified according to the current learners and learning requirements. The study in [23] performed qualitative user experience research, the findings are exhibited as many staff were not fully satisfied with Moodle existing interaction features. The author suggested improving user-interface and interaction module of Moodle LMS. The author in [24] conducted a quantitative study, the findings are concluded as the success of e-learning depends on the quality-in-use factors of the VLE. One of the potential studies conducted in [25] that find the effectivity of existing VLEs. Two main points are discovered by this study, one is difficult to work with basic features and the other is social interaction features are poor in current e-learning. Another study in [26] evaluated course management system (CMS) by using ISO/IEC 9126 standard. The assessment result highlighted that effec-

tiveness, productivity and satisfaction of existing CMS are lowered. The study in [27] evaluated e-learning system according to ISO 9126 based quality assessment model. The result suggested improving in both, programming and product of e-learning platform. The study in [28] performed an assessment of an academic information system by utilizing ISO/IEC 9126 quality model. The result highlighted that the learnability features are ambiguous. The research in [7] described that the VLEs satisfaction assessments are fine for fundamental features like creating and retrieving content, but unsatisfactory for collaboration and engagement perspective. The literature [2] noticed that the software quality assurance is missing from today's e-learning platforms. The research in [15] stated that VLE doesn't provide an effective communication medium for students' and teachers to perform collaboration and social activities. Another research in [29] highlighted the need for an improve VLE that can be included the features of social interaction to provide real-time communication and increase student participation or collaboration in learning activities. Table 1 shows some challenging issues in four major VLEs, which are collected from literature, related forums and research groups.

**Table 1.** Summary of grey areas of major virtual learning environments

| MOODLE | ILIAS | ATUTOR | SAKAI |
|---|---|---|---|
| Video Services Issue | Video Service | Interoperability Issue | Difficult Installation |
| File Exchange | Real-time Support | Documentation Issue | Bad User Interface |
| Whiteboard Feature | Whiteboard Feature | No Modularity | Learners' Profile |
| Bookmark Feature | Learners' Profile | No API | Interoperability Issue |
| Work offline | Hosted Services | Architecture Issue | Complex Navigation |
| Collaborative Work | Registration | Data Localization | Communication Issue |
| Students' Community | Online Grading | Collaboration Issue | User Management |
| Content Sharing | Students' Tracking | Conference Feature | Content Assessment |
| Content Reusability | Content Sharing | Low Security | Assistance Issue |
| Curriculum Managing | Content Reusability | User Management | Students' Tracking |

## 3 Effective Utilization of SNSs in VLEs

The Internet-based technology to provide a worldwide platform to connect people is known as social networking sites (SNSs) and online tools [30]. Many types of contents can be shared and communicate through these existing social media and online tools. As stated in [15] that the age group of 15 to 35 years population are highly involved in social media activities. They feel comfortable to share or communicate through these media in an engaging manner. If these social media compare with traditional e-learning platforms (for learning or social activities), a big difference can be observed. The common interest of people makes relatively more engaged and motivated in these social sites. The acceptance of existing social sites and online tools in educational-communities (teachers and students) and social activities (discussion and collaboration) are increasing drastically. Among various existing social sites the most

vibrant is the Facebook. As stated in [31] Facebook has the largest number of users, till the beginning of 2015, the aggregate number of Facebook users were considered 936 million. The newsroom of Facebook (https://newsroom.fb.com/) has mentioned that "1.4 billion daily active users as average for December 2017 and 2.13 billion monthly active users as of December 31, 2017." The users that have logged in to any particular site during last 30 days, are considered as active users. Figure 3 is taken from source [32] which is highlighted the monthly active users of major social sites and online tools.

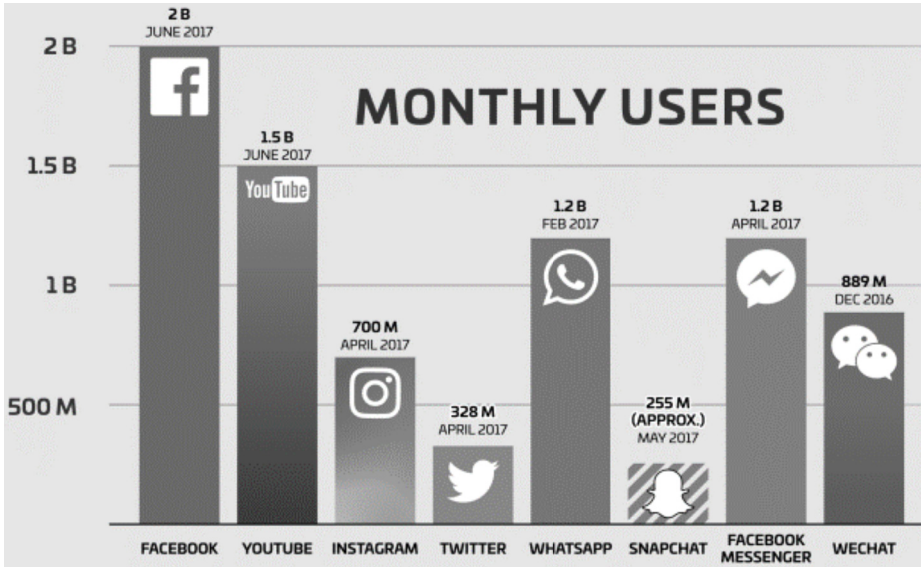


**Fig. 3.** Monthly active users of popular SNSs and tools

The study in [33] investigated the role of SNSs in e-learning. The findings are concluded as the SNSs should be utilized with e-learning for improving their information and collaboration activities. A similar study conducted in [34] reported that the social media are the best gadgets to engage and collaborate learners and instructors in an e-learning environment. There are varieties of online-tools that can work individually or associated with the SNS, to improve the online learning environment. For example, Twitter, Delicious and WordPress are the good online tools for resource sharing. For collaborative workspaces, the Wikis can be a good choice. Some rich media sharing tools are available such as Flicker that can also enable social tagging. Table-2 shows some major social networking sites and online tools and their possible use in e-learning environments.

**Table 2.** Major SNSs and online tools for e-learning

| SNSs | Possible use in e-learning | Online Tools | Possible use in e-learning |
|---|---|---|---|
| Facebook | Chat forum for collaboration | WeVideo | Videos in collaborative learning |
| YouTube | Upload video lectures | Scribble | Sharing learning materials |
| Twitter | For instant messaging | A.nnotate | Sharing research materials |
| Eduspace | Students social networking | Ghost Professor | Writing, plagiarism checking |
| Reddit | Discussion on learning-stuff | Prezi | For presentations |
| Flickr | Archiving learning materials | Dropbox | For cloud data storage |
| Classmates | Networking with peers | Speek | Video lecture/ conference call |
| Meetup | Location-based networking | DoSomthing | Ideas sharing with classmates |
| | | Dipity | Manage online timetable |
| | | Skype | For real-time video lecture |
| | | Google Doc | Online documents store |
| | | Google Calendar | Keep track of learning activities |

Nowadays, many studies are involved in getting advantages by integrating SNSs and online tools with existing e-learning environment. The study in [35] concluded their findings as the SNSs and online tools can be a value-added increment in traditional e-learning environment that will increase learners' engagement and collaboration with e-learning activities. One of the findings of a research in [36] determined that the use of modern learning-support technologies (web 2.0, SNSs) with traditional e-learning can improve the students' learning outcomes. The literature shows some basic discussion on how to integrate (incorporate) SNSs with VLEs for better learning outcomes. The study in [37] proposed a model to reduce learners' dropout-rates during online learning by improving social contacts between learners. They have designed a middleware application and BigBlueButton for external sharing. The Moodle plugin allowing access to SNSs to share information in a controlled environment. No experiment or test results are presented in this paper. The study [38] proposed an idea to integrate the VLE (Moodle) into SNS (Facebook). The concept behind this integration was to allow students and teachers to use Facebook for communication or as a chat forum. For this purpose, this study developed a website in Moodle that can be accessed through Facebook. Another good study presented in [39] that designed the Group Learning Uniform Environment (GLUE) to enable a lightweight interaction of many external applications like Google Drive, Doodle in different learning environments. The learners logged in the LMS would find many applications they need to use. The study in [40] designed a framework for integration of SNS into an e-learning environment. As an application, the author selected Coome LMS and integrated into the Facebook SNS. The users' progress tracking tool has also been integrated with this model. The proposed model is a practical implementation; the author didn't provide any experiment in this paper. Another study in [41] proposed Glesone, which is a new training idea that incorporates SNS with Moodle setting and provided Facebook-style comments within Moodle environment. They used Facebook chatting in the Moodle discussion forum. Another important study conducted in [42] that explored two major issues in existing Moodle environment. One is a limitation in uploading

file size and other is the lowest visitng rate of its discussion forum. The author resolved these issues by incorporating SNS and online tool with Moodle. The cloud storage is integrated with Moodle for uploading files and Facebook integrated for better communications among students and teachers. The authors in [29] explained that the integration of SNSs with VLE can overcome the current issues of e-learning platforms including lacking in interaction, communication and collaboration. This study incorporated SNSs (Facebook, YouTube and Google Calendar) into MyVLEs to address the boundaries of existing VLEs. Another research in [43] concluded its finding as the incorporation of e-learning platforms with Facebook SNS can enhance online aggregate learning and make learners more interactive. This study also investigated students' engagement during e-learning activities. The findings are concluded as the web 2.0 technologies are lacking in current e-learning environment that should be an integral part of today's learning model. A similar conclusion can also be observed in [45] that stated as the inclusion of the features similar to web 2.0 or SNSs, can improve learners' positive engagements in e-learning activities. The term, positive engagement, used in this study means the better learning outcomes.

## 4 Proposed Integrated Model for E-learning

The SNS-based integrated e-learning model is presented in this section. By realizing the fact that many existing learning technologies have great potential to work with e-learning environments. In the proposed model various external technologies are used to enhance e-learning operations. Figure 4 shows some external technologies that have potential to work and strengthen existing e-learning platforms.

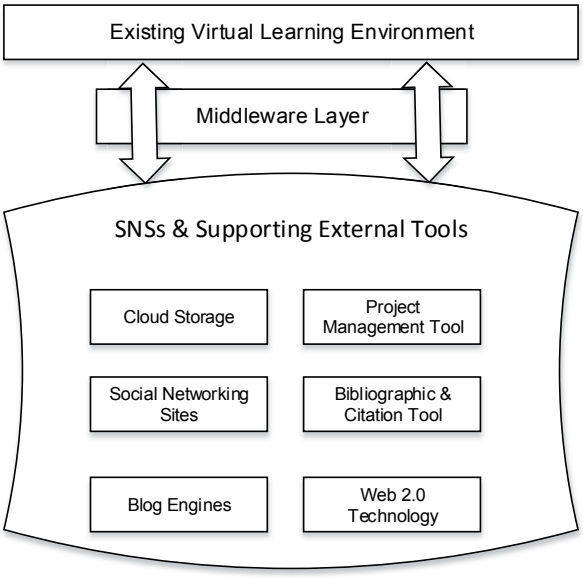


**Fig. 4.** Integrated Technologies with Existing VLE

The social networks as a learning support tools have some limitations, as stated in [46] that due to its enigmatic-open nature the SNSs are not an appropriate platform for formal learning-activities (between teacher-student). Most of the SNSs support group activities, this strong feature is used in our proposed model. Since, in a closed learning group, the activities and knowledge do not leak and remain within the group members. Facebook is one of the best social sites that strongly supports the group feature. In the proposed model, a teacher can initialize a Facebook group and enrol all students as group members. In this learning scenario a teacher can upload, share or guide their students' directly and the students' can see, download or ask queries to their teachers. More can be done by utilizing more features of social networking groups. The YouTube is another SNS that can also support learning activities for synchronous and asynchronous e-learning. This social site is highly recommended, especially for long, high quality and gentle streaming videos [47]. In the proposed model teachers can upload their video lectures and share the link with concern students (student group). The teacher can develop his own channel on YouTube and maintain the record and other activities of his video lectures. Students can subscribe to the teacher - channel so that they can get updates about the new lectures or any information related to lectures that establish asynchronous e-learning environment. The teacher can also establish a synchronous e-learning environment by utilizing some other tools with the collaboration of YouTube. For example, teachers can upload their long video lectures or presentation on YouTube and for live discussion or queries they may use Skype. This online tool supports various features of the synchronous learning environment. Another important SNS for e-learning is Eduspace that is specially designed for educational social networking. In the proposed model, teachers can develop a complete learning environment with this social site and engage their students in various learning activities. The Eduspace SNS has many features that support e-learning and use as an external learning support resource. Twitter is also one of the popular social media that is not directly supported in learning, but due to instant messaging feature, it can be a value-added addition in an e-learning environment. In the proposed model, it is used to support teacher-student short messaging or immediate updates about the course, lecture, quizzes or assignment. The teacher can tweet the main information, lecture or video link, or answer the query to his followers (students). For local group formation, our model utilizes a Meetup social network. Through this social media, a teacher can develop a local group of same-minded, same objective or same course students. This social network specially designs for local groups or group within a city. This social network encourages group members to meet physically, due to the same region or area their physical meeting can be possible. As stated in [48], by utilizing the features of the Meetup social site, a limited but very effective e-learning group can be established. The support level of existing VLEs is deprived of uploading or downloading animated, rich media and heavy files [49]. To resolve this issue, the cloud data storage is used in the proposed model. Many cloud data storages are available, including the Dropbox, SkyDrive, Google Drive and Mozy. As stated in [50] that the chat-forums of various existing VLEs are ineffective. To overcome this problem the Facebook chat-forum is recommended to use as a communication forum in the proposed model. The login

module of the proposed model provided two ways of access to the e-learning environment. The users can either login with their institutional provided credentials or from their SNS login credentials. In this way, the accessibility to e-learning environment can be increased. Figure 5 shows the main components of the proposed integrated e-learning model.

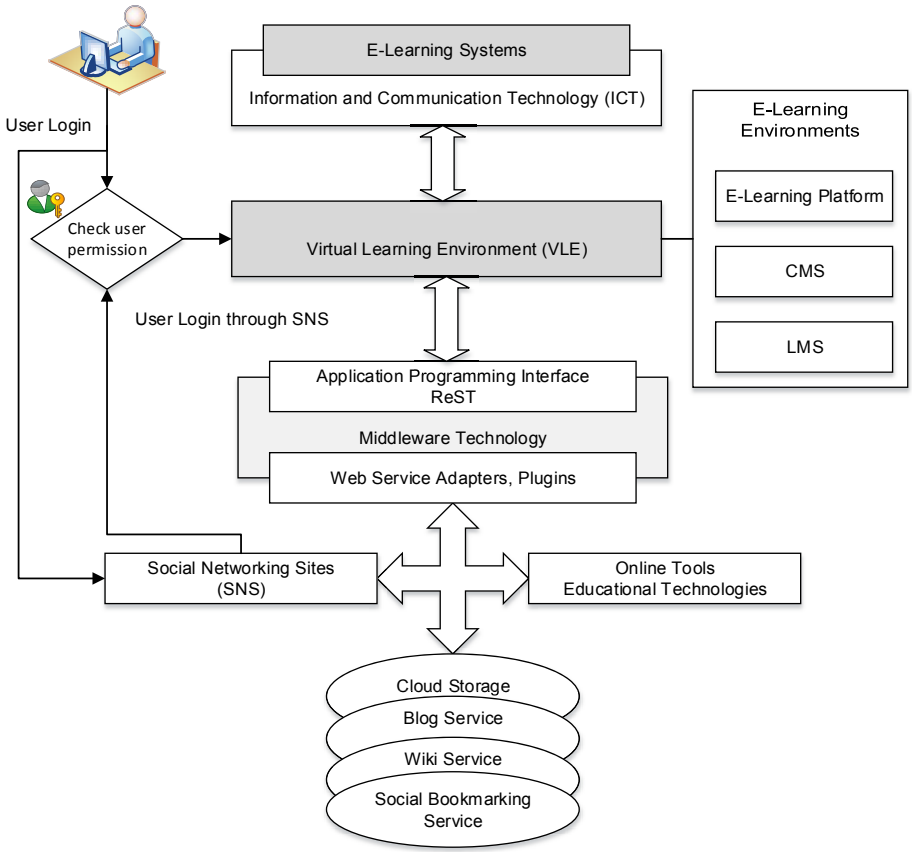


**Fig. 5.** An integrated e-learning model

### 4.1 Integration of external resources with e-learning

In the proposed model, the integration of SNSs and external tools with VLE has followed ReST architecture, the detail of this architecture is available in [19]. This architecture allows VLE to work without any intermediaries, with the application programming interface (API) of various services. The model allows using some adapters where ReSTful APIs were not applicable and also design new adapters with middleware layer. The adapters are software programmed that specially designed to incorporate various external learning support technologies that enhance VLE opera-

tions and provide support where ReSTful APIs are not applicable. The resource-navigation handling is one of the challenging issues in ReST supported format. Many available APIs do not permit resource-navigation in ReST supported system, only offer resource representations [51]. This paper has resolved this issue by introducing outer-wrapper based on annotation and add with each resource that allows learners to ask queries or navigate without knowing uniform Resource Identifier (URIs). Other external applications that follow Content Management Interoperability Services (CMIS) standard as presented in [52] are integrated with the VLE. The proposed model integrated some external applications including bibliographic and citation tools (Mendeley), blog engines (WordPress), project management tool (Redmine) for better e-learning environment. Various open source VLEs have their own APIs and plugin that might be utilized to integrate other external tools. Many extensions, APIs and middleware software are freely available in the literature that can support in incorporating external resources in an e-learning environment. For example, the studies in [39],[53] discussed how to design and develop middleware technologies for an integrated model, these steps are followed by designing the middleware layer in the proposed model. Some new adopters and plugins are designed that work with available APIs as a middleware layer to communicate e-learning environment with external resources. The following codes are used to integrate Facebook group feature with VLE (Moodle).

```
<html>
<head>
    <div id="fb-root"></div>
    <script>
        (function(d, s, id) {
            var js, fjs = d.getElementsByTagName(s)[0];
            if (d.getElementById(id)) return;
            js = d.createElement(s);
            js.id = id;
            js.src = 'https://connect.facebook.net/en_US/sdk.js#xfbml=1&version=v2.11&appId=
101501257*******&autoLogAppEvents=1';
            fjs.parentNode.insertBefore(js, fjs);
        }(document, 'script', 'facebook-jssdk'));
    </script>
</head>
<body>
    <div class="fb-group"
         data-href="<group_URL>"
         data-width="280"
         data-show-social-context="true"
         data-show-metadata="false">
    </div>
</body>
</html>
```

The Moodle extensions are also available to connect it to the CMI - content repository. To incorporate the cloud-data storage with e-learning, the proposed model utilized, Microsoft Azure AD to bring user access, enable Single Sign-On (SSO) and provision user account with Dropbox. The cloud computing platform, Microsoft Azure, is one of the best choices to use in a proposed model with Dropbox due to its flexible infrastructure. The Azure active directory provisions rich SSO with Dropbox. The Mi-

crosoft Azure also provides the data stored in Dropbox can also be viewed and edit with other Microsoft tools including office online, Word and Excel. The main idea of cloud computing integration with e-learning environment is followed by the scheme discussed in [54]. The Mashups of web 2.0 is adapted to integrate web-feeds and web APIs to establish e-learning on a local computer system. For handling Twitter with VLEs, EDU-Twitter available in the literature [55] that is a Moodle extension to integrate Twitter with LMS (CMS). The existing e-learning environments are lacking to provide bibliographic and citation support. For this purpose, the proposed model incorporated Mendeley as an external resource to provide bibliographic and citation support. The proposed model utilized Moodley [56], an extension of Moodle to incorporate Mendeley into an e-learning environment.

### 4.2 Potential benefits of using proposed model

There are many learning technologies that can support and enhance traditional e-learning activities. It is not looking a smart solution to re-design and develop a new e-learning platform (VLE) with the features of noticeable learning support technologies. New learning support technologies are being developed with vibrant features. So that the incorporation of external technologies with existing e-learning environment can be a more effective solution. It is already mentioned that many researchers are highlighted a number of benefits to utilize existing SNSs, online tools and web 2.0 technology in traditional e-learning model. As stated in [57], the idea to incorporate social media, online tools and modern learning technologies with existing e-learning environment can be a game changer that could revitalize the existing e-learning model. Based on the features, the proposed model can:

1. Enhance learners' achievements in the collaborative learning environment.
2. Community-oriented web-based learning can improve by the proposed model.
3. Improve all-in-one learning platform concept.
4. Students feel more comfortable, learn as a fun.
5. Increase learners' motivation, involvement and engagement with e-learning platform.
6. A better learning environment with improvement in learning outcomes.
7. The personal learning environment (PLE) can be established.
8. Increase participation and problem-solving in collaborative learning
9. Existing SNSs have the capability to improve e-learning execution.
10. Archiving tools can help to organize learning resources.
11. The operational cost of e-learning setup can be reduced by using the proposed model.
12. Reduces the limitations of existing e-learning model.
13. Single Sign-On (SSO) feature can be established.
14. Easy upgrades to new learning support technologies.

## 5 Conclusion and Future Work

The paper unfolded existing e-learning platforms and investigated their strength in current social and learning technologies perspective. The paper has explored various inadequacies and challenging issues in traditional VLEs. The existing VLEs are not strengthened with modern social and learning support technologies. This paper has stated that a standalone e-learning platform is less-effective as compared to an integrated virtual learning environment. It is also investigated in this paper that social networking sites and online tools have great potential to reinforce current e-learning model. The major contribution of this paper is the design and development of technology integrated e-learning model. The proposed model strengthens current e-learning by incorporating social and other educational-supporting technologies. Another contribution of this paper is the design and development of middleware layer for the smooth integration of external resources with an e-learning environment. Some challenging research issues for the integrated e-learning environment have also been resolved in this paper. In future, we will integrate some Artificial Intelligence (AI) based software agents with the proposed integrated e-learning model. Work is in progress about how to integrate AI-based multi-agents to enhance existing e-learning operations. To design an architecture for the integration of cutting-edge external technologies with the collaboration of AI-based multi-agents in e-learning environment is the next research goal.

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