A New Cloud Storage Support and Facebook Enabled Moodle Module

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Abstract— **With Moodle a web based interface supporting a wide range of activities including forums, contents, and assignments is provided to assist both the teachers and the students. However, limitations of the file-size acceptable for uploads, weakness in the assessment procedure, complicated task of replacing an existing file, and the lowest visiting rate of the traditional discussion module are some major deficiencies in the traditional Moodle module. Thus, we propose a new Moodle module integrating both the cloud storage services and Facebook with the traditional Moodle module to cover the mentioned shortcomings. The module provides a straightforward uploading-function to allow, with only few seconds, uploading several large-size files simultaneously without any restriction on the files-size. The new module also offers an assessment-function that supports the web browsing of the files being uploaded to assist teachers, without the need to download and save each assignment separately, in checking and grading the submitted assignments directly via any web browser. The proposed module also integrates the Moodle with Facebook to increase the visiting rate of the traditional discussion Moodle module; hence, increasing the students' motivation to ask questions and the interaction among the students. The performance and the usability of the new module was evaluated and promising results were obtained.**

Keywords—Moodle; Facebook; cloud storage; Dropbox; Google Drive; Sky Drive.

I. INTRODUCTION

Nowadays, Moodle is one of the most popular Learning Management Systems that have a significant impact on the learning/teaching process. To reduce the course size and the overall storage requirements for a course site, Moodle released the core 2 repository support to allow bringing content into Moodle from external repositories [1]. Yet, the Moodle server has to keep a copy of the uploaded file which still consumes a lot of storage space. Moodle is an open source software; thus, this fact together with its modularity, web-based and open interfaces allow developers to design new modules, increasing the capabilities of the default Moodle.

The assignment Moodle module is one of the important modules that aims at helping teachers to set the course assignments with a description and a due date. Within the specified date, the students are able to submit their assignments to the server. The teacher is then able to download the submitted assignments and give grades with feedbacks. Students are able to view the grades and feedback at any time and location. In the context of teaching and learning computer science courses, simulation assignments, and programming projects are a great challenge for both teachers and students. Teachers have to assign several appropriate practical exercises and projects to their students for understanding a particular topic better and thus the students' cognitive skill can be increased. However, we still have observed major deficiencies in the traditional Moodle module: (1) limitations of file-size that are acceptable for uploading to the Moodle course page arise a serious challenge for both teachers and students while uploading their large-size files such as uploading a course lecture recorded as high-definition movie or submitting a programming assignment. Consequently, students/teachers first have to compress those large-size files to upload them successfully, means additional task for the teacher/students must be performed before performing the uploading process which consumes much time and efforts. Unfortunately, we also have noticed that most of the time the uploading process failed because of that file-size limitation and these steps must be repeated every time a user has to upload a new file. (2) As known larger files take more time to be completely uploaded to the Moodle server than smaller files; thus, as most of the students, simultaneously, upload their assignment near the assignment deadline, the uploading process becomes a common bottleneck (i.e. some students may claim that they could not upload their assignment because of the system error or the heavily load). (3) We also have observed that a common challenge in the assessment procedure arises when teachers perform the evaluation function to grade the submitted assignments and projects. Since Moodle lacks in supporting the web-browsing for the uploaded files, teachers, who wants to grade the students' assignments, have to download all the assignments separately in order to grade and give feedback. This problem becomes more difficult if the student, who submit a large assignment, has compressed the assignment first before the submission (i.e. the compression task is performed because of the files-size limitation), then another task to decompress large size assignments must also be performed by the teachers. Therefore, for groups with a large number of students, this may result in a very time-space-effort consuming task. (4) To modify and replace an uploaded file, a user, first, has to download that file, modify the file and uploaded again to replace the old one. This problem becomes a great challenge especially for students, when they have to

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modify a submitted assignment that consists of several files since they have to repeat those processes for each file separately. (5) We, finally, have noticed that a new challenge arises when a student ask a question using the discussion Moodle module. Since most of the students usually open the Moodle course page to check the new course material, or the new assignments as well as the course announcement, the discussion Moodle module has the lowest visiting rate module among the other Moodle modules. A student who asks a question using discussion Moodle module has to visit the Moodle course page frequently to check the discussion module and find the answer about his question. This process in turn may result, for questions that were posted long time ago, in losing the interest in finding answers to these questions. Therefore, more students feel more comfortable to ask their questions face-to-face or by sending email, this result in decreasing the interaction and the communication among the students who registered the same course. This paper proposes a new module that integrated Moodle with both the Cloud Storage Services (CSS) and the Social Network Services (SNS) to cover the limitations in the traditional Moodle module. To alleviate the limitation of the size of files being uploaded and thus improving the uploading process, the assessment procedures as well as the task of replacing an uploaded file. We integrate the Moodle with three of the most CSS: Dropbox, Google drive and SkyDrive. This integration, from one hand, provides a straightforward uploading-function to allow, with only few seconds, uploading several large-size files simultaneously without any compression task or any restriction on the files-size, and, from the other hand, offers an assessment-function that supports the web browsing of the files being uploaded to assist teachers, without the need to download and save each assignment separately, in checking and grading the submitted assignments directly via any web browser. Another advantage of this integration is that any modification required to be done on a file that was already uploaded can be directly done on the original file without the need to repeat the download/ modify/ upload procedures to replace the old one. In addition, since Facebook plays a significant role in increasing the communication and the interaction between users [2], integrating the Moodle with Facebook, from one hand, will increase the visiting rate of the Moodle discussion module and thus remedy the problems associated with the lowest vesting rate, and, from the other hand, will motivate more students to ask questions as teachers, classmates as well as the students' Facebook friends can also participate in the discussion. To test the performance and the usability of the proposed new Moodle module, the proposed module was applied to the operating system Moodle course page and a study was conducted using a sample consisted of a set of 165 participants, in the department of computer science of National Chaio Tung University, Taiwan, who registered or assisted in teaching that course over one semester from February 2013 through June 2013. Also, a comparison between the traditional Moodle module and our proposed module was performed, and promising results were obtained.

II. Related Work

CSS have become popular in the world [3]. They not only provide security online file systems but also allow sharing files easy [4]. Users can install a desktop application and access Cloud Storage files by dragging and dropping the files into their Cloud Storage folder. Several studies have proposed new Moodle modules that provide better support for the Moodle assignments module that require teamwork and subsequent processing [5,6]. The authors in [7] proposed an intermediate system called JAssess which is developed to provide a handy way to manage the submission of students' Java programming exercises from Moodle, as well as grading them semi-automatically including compiling and running the programs, as well as giving marks and feedbacks. Gutiérrez et al [8] proposed a Moodle module that gives support to the practical content of a basic computer organization course.

III. Our Proposed Moodle module

To achieve our goals, we developed a new Moodle module that integrates Moodle with three of the most popular CSS, Dropbox, Google drive and SkyDrive, and Facebook. CSS offers a free account with a set storage size and allows users to download a special folder on each of their computers. CSS automatically synchronizes the folder content to their servers; therefore, it appears to the user as the same folder (with the same contents) regardless of which computer he/she is used to view it. Files placed in this folder also are accessible through a website and mobile phone applications. Moreover, CSS are safe and secure; thus, even if the user computer crashes, his stuff is always safe in CSS and can be restored in a snap. Moreover, integrating Moodle with Facebook can increase the students' motivation, satisfaction, and interaction among them. Our proposal provides three main functions (see Fig. 1).

A. The Uploading Function

The uploading function is responsible for covering the file-size limitation in the traditional Moodle module by allowing uploading, in addition to the small-size files, large-size files without any delay or network failure. This function reduces the storage space needs to store large size-files, and thus decreases the time required to upload those files. As a result, the proposed function, from one hand, reduces the students' and the teachers' efforts when uploading large-size files, and, from the other hand, avoids the bottleneck case that arises when many students uploads several large-size files simultaneously. Practically, this function assists teachers in uploading the course material even a recorded lecture saved as a high definition movie, as well as helps students in submitting and uploading their assignments even large-size ones. In addition, students can use this function to upload some suggestion files such as references books to help other students in completing their assignments or some tips saved as a high definition movie which in turn increases the interaction and the communication among the students. Fig.2 illustrates the concept of the uploading function. Our proposal by integrates the Moodle with the CSS manages and easiest the uploading function. The CSS offer a free account for a user (students and teachers) with a set of storage size, allow users to download a special cloud storage folder on his computer, and allow the user to access these services through a desktop folder, a website and mobile phone applications.

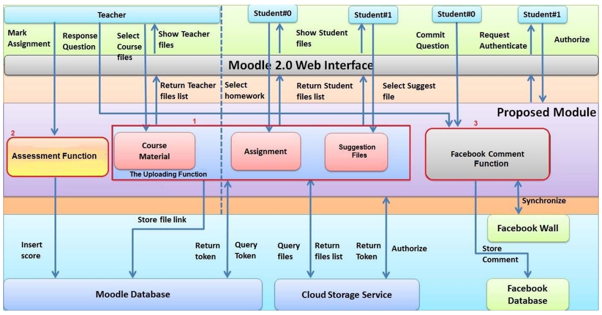


Figure 1. Overview of the proposed Moodle module

Unlike the traditional Moodle module, where uploading files of different sizes and formats requires performing the compressing task for large-size files and then performing the uploading procedure when the user is online through the Moodle course page for each file separately, that means to upload 10 large-size files, a user has to perform, first, the compressing task 10 times and then the uploading procedure 10 time as well (totally, 20 steps are required). In contrast, to upload several files at a time using the proposed Moodle module, for example 10 large-files, a user has to perform only two steps; first, creating a folder in the cloud storage folder to drop the 10 files into it, and then a user has to go to the Moodle course page to link the created folder with the Moodle course page (totally, only 2 steps are required). Note that, by using our new Moodle module, no more compression tasks are needed even for large-size files. Moreover, the second step to upload files using our module is required only once during the course, at the first time of using our proposed module, that is, to upload additional files, for example 100 files, the user only has to perform one step to drop that 100 files into the created folder without the need to visit the Moodle course page again and the CSS automatically synchronizes the folder contents. Our proposed Moodle module allows the user to upload the files in the go. Since the CSS are accessible through a desktop folder, a website and mobile phone applications, a user can drop the file using his phone or iPad, even the device is offline, and the changes of the folder content will synchronized automatically when the device comes back online without the need to any additional efforts by the user. Moreover, unlike the traditional Moodle module, where modifying a submitted file requires, first, downloading the old file to modify it and then upload it again to replace the existing one. For example, if a student, who have already submitted his programming assignment that consists of 10 files, has to modify the submitted assignment, then the student has by using the traditional Moodle module to download each file separately to modify and then submit each modified file again to replace the existing old one. In contrast, by using our proposed Moodle module, a user (student) can directly open the old file from his cloud storage folder to modify that file and then the existing old file will be updated automatically without the need to visit the Moodle course page to download and replace. Fig.3 shows the steps of uploading files using our proposed Moodle module.

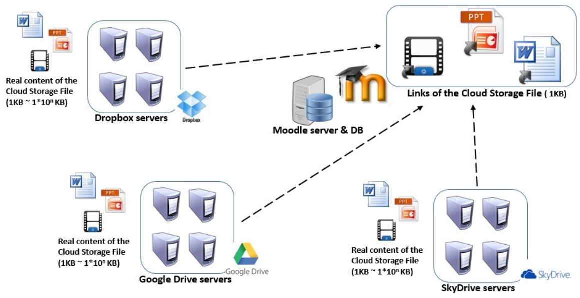
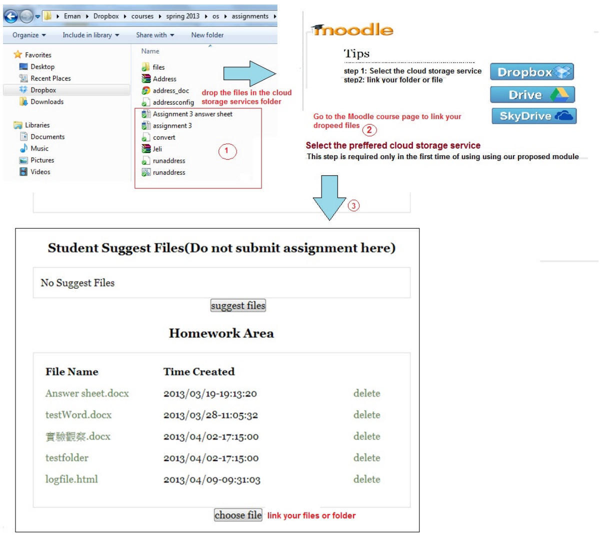

Real content of the Cloud Storage File (1KB ~ 1*10ⁿ KB)
PPT
Dropbox servers
Dropbox
Moodle server & DB
Links of the Cloud Storage File (1KB)
Real content of the Cloud Storage File (1KB ~ 1*10ⁿ KB)
Google Drive servers
Google Drive
Real content of the Cloud Storage File (1KB ~ 1*10ⁿ KB)
SkyDrive servers
SkyDrive

Figure 2. The concept of the uploading function

B. *The Assessment Function*

The assessment function aims at helping teachers to evaluate the students' assignments by giving grades and writing feedbacks without the need to download each assignment individually (see Fig.4).



1 drop the files in the cloud storage services folder

Tips

step 1: Select the cloud storage service
step2: link your folder or file

Go to the Moodle course page to link your dropeed files 2

Select the preffered cloud storage service

This step is required only in the first time of using using our proposed module

3

Student Suggest Files(Do not submit assignment here)

No Suggest Files

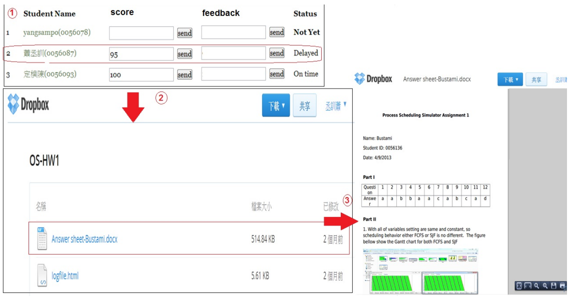
Homework Area

File Name	Time Created	
Answer sheet.docx	2013/03/19-19:13:20	delete
testWord.docx	2013/03/28-11:05:32	delete
實驗觀察.docx	2013/04/02-17:15:00	delete
testfolder	2013/04/02-17:15:00	delete
logfile.html	2013/04/09-09:31:03	delete

link your files or folder

Figure 3. The steps of uploading files using our proposed module

This function keeps updating the last modification time of the uploaded assignments' files, and stores that time in the Moodle database to help teachers in identifying assignments that are submitted in time and the delayed ones. Unlike the traditional Moodle module, where a teacher who needs to evaluate the students' assignments has to download separately each assignment to grade and give feedback (Note that by using the traditional Moodle module and because of the file-size limitations, students have to compress their large-size assignments before submitting; therefore, a teacher, in this case, needs also to decompress the assignments first before grading them). For example, to evaluate 100 assignments, 100 download tasks must be performed. On the other hand, our proposed module allows teachers to grade the assignments without the need to perform the downloading task by only clicking on the submitted assignment link to browse that assignment directly via any web browser to check, grade and give feedback. Since our proposed module only stores the link of the folder contains the submitted assignments and not the real files, our module, from one hand, easily retrieves the assignment from the cloud server and browses the assignment via any web browser without the need to download that file every time the teacher needs to check, and, from the other hand, saves the storage space required to store the downloaded assignments.



①	Student Name	score		feedback		Status
1	yangsampo(0056078)		send		send	Not Yet
2	蕭丞訓(0056087)	95	send		send	Delayed
3	定樸陳(0056093)	100	send		send	On time

OS-HW1

名稱	檔案大小	已修改
Answer sheet-Bustami.docx	514.84 KB	2 個月前
logfile.html	5.61 KB	2 個月前

Answer sheet-Bustami.docx

Process Scheduling Simulator Assignment 1

Name: Bustami

Student ID: 0056136

Date: 4/9/2013

Part I

Question	1	2	3	4	5	6	7	8	9	10	11	12
Answer	a	a	b	b	a	a	c	a	b	c	a	d

Part II

1. With all of variables setting are same and constant, so scheduling behavior either FCFS or SJF is no different. The figure bellow show the Gantt chart for both FCFS and SJF

Figure 4. The steps of the provided assessment function

Moreover, unlike the traditional Moodle module, where a teacher is restricted with the device in which the assignments were downloaded, our proposed Moodle module, because it support web-browsing, allows the teachers to grade the assignments "on the go" using their PC, laptop, mobile, iPad, etc. without any restriction with using the device in which the assignments were downloaded.

C. The Facebook-Comments Function

Since we observed that the traditional Moodle discussion module has the lowest rate among the other Moodle modules, we have developed the Facebook-comments function that integrates Facebook with the traditional Moodle module in order to, from one hand, motivate more students to ask questions and to increase the interaction as well as the communication among the students, and, from the other hand, increase the visiting rate of the Discussion Forum Moodle module. The original Moodle Discussion Forum module is a Moodle module that is separated from the Moodle Assignment module. A student who asks questions about the course, such as questions about the assignments or the exam time, has to leave a message in the Moodle Discussion Forum module. We observed that most of the students pay little attention to the Moodle Discussion Forum and more attention to the course announcements or the assignments announcements as students visit the Moodle Discussion Forum module only if they left questions there; thus, no interaction is happening between students. Consequently, to attract the students viewing other students' questions, our proposed module displays the question about a related topic below the announcement of that topic. For example, if a student asks a question related to the assignment 2, then the question will be appeared below the assignment 2 announcement. Our module also allows the students to publish their questions in their Facebook Activity Feed. Fig.5 shows a screenshot of the Facebook-comments function. As a result, the interaction among the students will be increased as viewing the questions below the announcement motivate others to answer those questions without the need to visit the Discussion Forum module. Moreover, any question/answer being asked/responded to/from teachers/students will be synchronized to the user Facebook account and thus teachers/students will receive a Facebook notification if any user has posted/ "replied or answered" the question. In other words, if a student asks a question about the assignment via the Facebook-comments function and someone answers it, then the student will get a notification via his Facebook account. Additionally, allowing the students who ask questions using the Facebook-comments function to publish their question to their Facebook account Activity Feed creates more and more interaction since the student Facebook friends, including those who do not register the course can see the questions via Facebook, comment and response. Fig.5 shows the scenario of asking questions via the Moodle Facebook comments function. Technically, integrating the Moodle with Facebook has additional advantage of saving more storage space since all of the comments will be stored in the Facebook database.

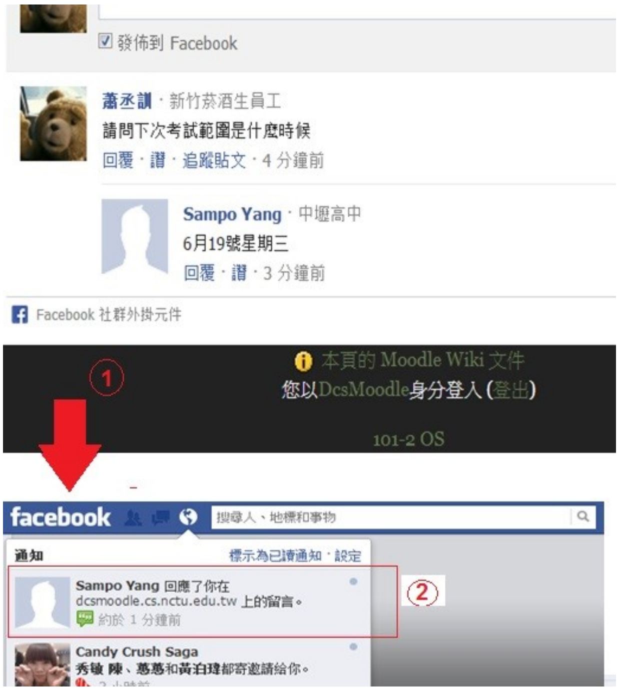
IV. EXPERIMENTS

A. Participants: Sample and data collection

To test the proposed Moodle module, a study was conducted using a sample consisted of a set of 159 students and 6 teaching assistants (n=159+6=165), in the department of computer science of National Chaio Tung University, Taiwan, who registered or assisted in teaching the operating system course over one semester from February 2013 through June 2013. Students had to complete three practical assignments and upload it using our proposed module during this course. Regarding the participants practical experience, the sample consisted of 108 students who have previous experience with CSS, 95 students who have experience with Moodle, 51 students who have not previous experience with CSS, and 64 students who have no experience with Moodle. Moreover, the sample consisted of 5 teaching assistants who have previous experience with CSS, 3 teaching assistants who have experience with Moodle, 1 teaching assistants who have not previous experience with CSS, and 3 teaching assistants who have not experience with Moodle.

B. The experiment Procedure

At the beginning of the course, the students were introduced to both the teaching platform, including our proposed Moodle module and the course practical assignments, including a sample simulation tool. Our proposed Moodle module provided three significant functions, for both teachers and students, to upload the course material by teachers/ teaching assistants, submit the assignments by students, evaluate the assignments along with a way to increase the communication and the interaction among students during the semester when the operating system course was taught. The teaching assistants provide the students with a very precise description of the assignment, documentation about the simulation tool, and user-manual about the functions provided by our Moodle module. Moreover, the students were provided with a precise description of the CSS supported by our module, Dropbox, Google drive, and SkyDrive, that will assist the students in submitting their assignments along with all the assignments related files without consuming their time and efforts. Each student registered the operating system course in the time of the experiment was asked to create a free cloud storage service account.


☑ 發佈到 Facebook

蕭丞訓 · 新竹菸酒生員工
請問下次考試範圍是什麼時候
回覆 · 讚 · 追蹤貼文 · 4 分鐘前

Sampo Yang · 中壢高中
6月19號星期三
回覆 · 讚 · 3 分鐘前

Facebook 社群外掛元件

本頁的 Moodle Wiki 文件
您以DcsMoodle身分登入 (登出)
101-2 OS

通知
標示為已讀通知 · 設定

Sampo Yang 回應了你在 dcsmoodle.cs.nctu.edu.tw 上的留言。
約於 1 分鐘前

Candy Crush Saga
秀敏 陳、蕙蕙和黃泊瑋都寄邀請給你。

Figure 5. Screenshot of the Facebook-comments function

In fact, most of the students had an account before registering the course. In the Moodle course page, they find the full specification and objectives, the deadline, and a description of the documentation to generate. In addition, students who have questions were encouraged to ask their questions using the proposed Facebook-comments function offered by our proposed module. At the end of the semester, a system usability questionnaire was developed and administered to participants in the classroom. All students who registered/assisted in teaching the operating system course completed and returned the questionnaires. Before carrying out the survey, all participants received instructions. The activity was performed by respondents with the support of, at least, one teaching assistant to assist respondents during the process and, in case of need, further explain questions and procedure.

V. Results and Discussions

A. Usability Evaluation

The principal factors proposed by [9,10] were used for designing a questionnaire to evaluate the usability of the proposed Moodle module along with its three main functions. The questionnaire consisted of 15 questions based on factors of appeal, ease of use, content, ease of learning and support and was used to survey the 165 participants who registered or assisted in teaching the operating system course over one semester from February 2013 through June 2013. Fig. 6 shows the overall degree of agreement. Results indicated that the uploading function provided by our proposed Moodle module helps both teachers and students to easily complete the uploading task as well as saves their effort and time. The importance of our proposed module appears when a user has to upload several large-size files to the Moodle course page. Since the student or the teacher, who has to upload several files to the Moodle course page, can create a folder in the cloud storage service folder and link it (i.e. first time to use the function, once during the semester) with the Moodle course page to drop those files into it. Thus, any addition, deletion, or modification on the folder content automatically gets synchronized.

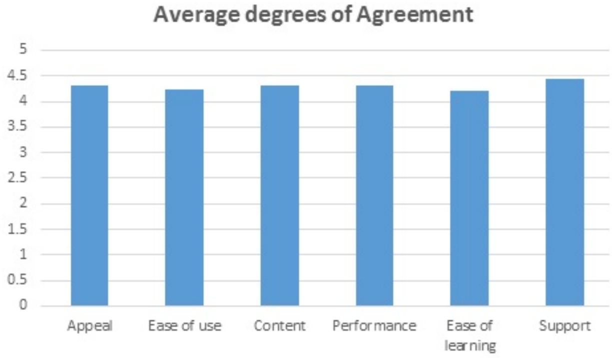


Figure 6. Average degrees of agreement

Moreover, if any work is conducted on the linked folder while the device was offline, then changes will synchronize automatically when the device comes back online. In other words, no need to visit the Moodle course page every time a student/a teacher needs to upload a new file, delete a file or replace an existing one which save the user time and effort. Moreover, results implied that the proposed module was easy to use, and the participants did not require professional help when using the proposed Moodle module since participants, in fact, were highly familiar with the traditional Moodle module and the proposed Moodle module functions were straight forward. Also, the reason behind these results was that the responsible teaching assistant had taught the other teaching assistants how to use the new Moodle module and the students were provided a very precise description about the new module and its functions. Results demonstrated that the Facebook-comments function, which integrates the Facebook social network service with the Moodle and display the questions below the related course announcement, motivate students to ask questions, increase the interaction and the communication between the students. Using the Facebook, from one hand, helps the teachers to easily observe the questions being asked by the students as any posted question on the Moodle course page will appear to the teacher as a Facebook notification and, from the other hand, helps the student who asked that question to notice the response as any posted response about the question will also appear to the student as a Facebook notification. In other words, no need to keep visiting the Moodle course page to check any question/response. Another advantage of our proposed function is allowing the students to publish their questions on their wall or timeline which in turn gives the opportunity for the student's friends to participate with the discussion. Moreover, since the students focus on the course announcements when visiting the Moodle course page, we have observed that providing the questions related one course announcement below that announcement, such as an exam announcement, attracts and motivates more students to participate on the discussion as the question will appear to them directly without the need to visit the traditional discussion Moodle module. The questionnaire contains some questions that only appeared to the teacher and the teaching assistants to evaluate the assessment function. Results showed the teaching assistants were satisfied with the assessment function to grade the students' assignments and give feedback. These results were not surprised as the proposed function provided by our Moodle module covers the lack of the traditional Moodle module in supporting web-browsing. Therefore, this function assists the teachers to grade the assignments directly via any web browser without the need to upload each assignment separately which, from one hand, saves their efforts and time in downloading each assignment separately, and, from the other hand, allows them to grade the assignments "on the go" using their PC, laptop, mobile, iPad, etc. without restrict them on using the device in which the assignments were downloaded.

B. *Storage-Space comparison*

A storage-space comparison between our proposed new Moodle module and the traditional Moodle module is shown in Fig.7 To store only the assignments for students who registered the operating system course excluding lecture slides, recorded lectures, etc., 56.88 MB (Megabyte) are totally needed via the traditional Moodle module while only 1.27 MB are needed by using our proposed new Moodle module. In other words, using our proposed new Moodle module saves at least 55.61 MB storage-space (97.77% storage-space will be saved).

VI. CONCLUSION

We proposed a new Moodle module that integrates the traditional Moodle module with three of the CSS and Facebook to cover its limitations. The new module provides three main functions that are: the uploading function, the evaluation function and the Facebook-comments function. The module provides a straightforward uploading-function to allow uploading several large-size files simultaneously without any restriction on the files-size. The new module also offers an assessment-function that supports the web browsing of the files being uploaded to assist teachers, without the need to download and save each assignment separately, in checking and grading the submitted assignments directly via any web browser. The new proposed module also integrates the Moodle with Facebook to increase the visiting rate of the traditional discussion Moodle module; thus, increasing both the students' motivation to ask questions and the interaction among the students.

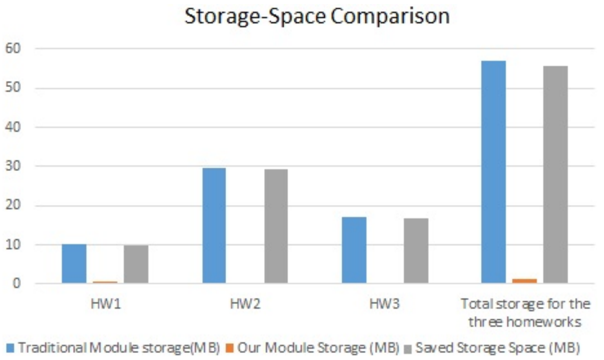


Figure 7. Storage Space Comparison

To evaluate the performance and the usability of the proposed module, the proposed module was tested by a sample consisting of 165 participants, and a comparison between the traditional Moodle module and our proposal was performed. Results indicate that our proposal has the capability to save 97.77% storage-space per a course.

VII. REFERENCES

[1] MoodleRepositoryplugins, "Repository-plugins," 2013. [Online]. Available: http://docs.moodle.org/dev/Repository_plugins.

[2] E. Y. Daraghmi and S.-M. Yuan, "We are so close, less than 4 degrees separating you and me!," *Computers in Human Behavior,* vol. 30, pp. 273–285, 2014.

[3] V. Stantcheva, R. Colomo-Palaciosb, P. Soto-Acostac and S. Misrad, "Learning management systems and cloud file hosting services: A study on students' acceptance," *Computers in Human Behavior,* vol. 31, pp. 612–619, 2014.

[4] M. N. M. Saad and A. W. Selamat, "UPSI Learning Management System (MyGuru2) in the Cloud Computing Environment," *Procedia - Social and Behavioral Sciences,* vol. 67, pp. 322–334, 2012.

[5] E. D. Gutiérrez, M. A. Trenas, F. Corbera, J. Ramos and S. Romero, "An Experience of e-assessment in an Introductory Course on Computer Organization," *Procedia Computer Science,* vol. 18, no. 0, pp. 1436-1445, 2013.

[6] M. A. Trenas, J. Ramos, E. D. Gutiérrez, S. Romero and F. Corbera, "Use of a New Moodle Module for Improving the," *IEEE TRANSACTIONS ON EDUCATION,* vol. 54, no. 2, pp. 222-228, 2011.

[7] N. Yusof, N. A. M. Zin and N. S. Adnan, "Java Programming Assessment Tool for Assignment Module in Moodle E-learning System," *Procedia - Social and Behavioral Sciences,* vol. 56, no. 0, pp. 767-773, 2012.

[8] E. Gutiérrez, M. A. Trenas, J. Ramos, F. Corbera and S. Romero, "A new Moodle module supporting automatic verification of VHDL-based assignments," *Computers & Education,* vol. 54, no. 2, pp. 562-577, 2010.

[9] J. Brooke, "SUS: A quick and dirty usability scale," in *Usability evaluation in industry*, 1996.

[10] G. Kakasevski, M. Mihajlov, S. Arsenovski and S. Chungurski, "Evaluating usability in learning management system moodle," in *30th International Conference on Information Technology Interfaces* , Dubrovnik, 2008.