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Development of a Moodle Course Content Filter using Meta Data

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Abstract

Moodle is an E-Learning platform that is in use by many educational institutions across the world. This paper outlines the development of a Course page Content Filter created in PHP which can be applied to a Moodle course page to filter the course's learning objects, displaying only those documents matching the filter selections.

The Course Content Filter has been developed as a code patch to be installed to the Moodle installation and activated by the Moodle administrator. It comprises of additional settings to both the Moodle course page and the learning object upload pages. Filter controls appear at the top of the student's course page allowing a student to actively filter the course page content.

The Course Content Filter assists students in navigating to the learning objects relevant to their needs. An example, as described in this paper, is the filtering of course content by Learning Channel. Learning channels are the modes in which a student can take in information. Providing a student with course material in a form relevant to their learning style makes course content more accessible, optimising the learning experience. For example, a student with a preference for their visual learning channel will benefit from course material presented in a visual form. The content filter described here will allow them to quickly access content which is optimised for their learning preference.

This paper also outlines advantages of such a content filter in a Virtual Learning Environment (VLE), reviews current availability of such filters, and describes our approach to developing such a filter.

Keywords: E-Learning, Moodle, Virtual Learning Environments, VLE

1 Introduction

E-Learning tools offer a wide range of diverse content to a student facilitating a more flexible and inclusive access to education. In recent years, virtual learning has had a profound growth with most educational institutes having active installations of VLE's[1].

Moodle offers students the ability to access course content from a remote location by using a web based application to deliver content online. Once the user is created, they can enrol in e-courses which serve as a placement for course content such as lecture presentations and additional notes. Each of the various pieces of course material on a course page is called a Learning Object.

One of the problems that students encounter while using these learning environments is the amount of learning objects per course page, which in a highly active course can include over fifty objects. This volume of course content can inhibit the students' ability to efficiently navigate through the content to find what they are looking for. This paper reports on a solution to this problem. A content filtering plug-in was created that will run at the top of a Moodle course page. This plug-in gives the user the ability to filter through the different learning objects on the course page and leave only content which is relevant to them. Blackboard, a system which is similar to Moodle, does offer its users a limited set of tools for searching through the course content [2], but not without being redirected from the course page or filtering in such detail as described here. Currently Moodle does not offer its users any tool in which to filter the content of a course page.

Once the Course Content Filter is fully implemented on an active installation of Moodle, the filtering process allows the user to filter by different parameters and also implements features for showing outstanding assignments and to hide any content which the user has previously viewed.

In this paper a review of VLE technology is first presented with its variants and is followed by an outline on how the filter will be implemented, followed by a detailed explanation of the development of the filter. Below is a description of each of the following sections in the paper. Section 2, Background explains what VLE's consist of and also outlines the current use of VLE's in educational institutes and what other systems are currently being used for E-Learning. Section 3, Methodology outlines exactly what the content filter objectives are and how the filter will be designed to reach these specified filtering objectives. This section will also include an outline of the roles that each of the users who interact with the system will play, such as the student accessing the filter and the administrator tagging learning objects.

Section 4, Tool Overview, describes what each of the different filters achieve and also how the filter is implemented in to an active installation of Moodle, giving backgrounds and presenting each of the elements which make up the filter. Section 5, Distribution, outlines how the filter is distributed and how it can be applied to a Moodle Installation. Section 6, Future Work describes what changes will be made in future releases of the course page content filter.

2 Background

VLE's are mostly web based systems that offer users a range of learning tools such as course notes, academic testing facilities and grading tools while retaining a course structure. VLE's have transformed offsite learning, allowing users to access course notes and work from a remote environment, replacing much of the traditional tools of remote learning such as custom created course websites and course note file servers. Three of the most successful VLE platforms are WebCT (now acquired by Blackboard Inc), Blackboard and the open source alternative and focus of this paper, Moodle. As of July 2009, Moodle.org has 36,353 registered installations of Moodle in over 202 different countries with almost 25 million users [3].

Course Management Systems (CMS) and Learning Management Systems (LMS) are closely related to VLE's, but differ because the VLE aims to offer a solution for virtual learning rather than just providing educational content. Over the last few years, VLE's have become commonplace in educational institutions and also in the commercial sector as a means of educating staff on and off site.

While originally created for distance education, VLE's are now most often used to supplement traditional face to face classroom activities, commonly known as Blended Learning. Blended learning is the mixing of various different forms of learning such as face to face and E-learning. Blended Learning has been described as “a learning program where more than one delivery mode is being used with the objective of optimizing the learning outcome and cost of the program delivery” [4] and also as “The effective combination of different modes of delivery, models of teaching and styles of learning” [4]. VLE's can be used to support blended learning because they offer the student a wide range of aids which can be used during the learning process. These include,

- interactive course material;
- lecture and course content;
- quizzes and self evaluation tools;
- mentor communication tools.

In addition to supporting blended learning, VLE's can also facilitate the provision of course content in a variety of formats, catering for the diverse range of learning styles and learning preferences present in any class group. Cognitive psychologists distinguish three categories of typical ways learners acquire information: visual, auditory and kinaesthetic [5]. Ongoing research at ITB has shown that raising awareness of channel or mode of learning, amongst both academic staff and learners, while adapting content to cater for the visual, auditory and kinaesthetic modes of learning, improves the learning experience for both the learner and the lecturer, and results in improved attendance and performance [6].

Tying all of these different elements together gives students a rich base of information which can help them during the learning process. VLE's also offer a means of testing, which can allow students to take course tests from a remote location which have been popularised by

institutions such as the Open University (OU) which currently has over 150,000 undergraduate and more than 30,000 postgraduate students [7].

The Moodle platform currently offers no pre existing solution for allowing it's users to filter or manage the content of a course page. Most of the VLE's that are currently available offer additional plug-in support to allow rapid customisation of the system. An example of this is the Shareable Content Object Reference Model (SCORM) which is a collection of standards and specifications for e-learning environments such as the type described here to set a standard for how the client software and the host system interact.

3 Methodology

The methodology used followed the standard systems development life cycle. User requirements were identified based on consultation with both academics staff and students in the Department of Informatics and the Department of Engineering at ITB, and the learning styles research team, a collaborative research team from both ITB and the National Learning Network, based on campus at ITB. The information collected became the basis of the filter design, including:

- A filter that will select content which is relevant for the final course examination. This filter would remove any non relevant or supplement course content;
- A filter which will select any content which is adapted to the students learning style;
- A filter which can remove assignment upload objects from the course page which the student has already uploaded;
- A filter which will allow the user to filter by file type, e.g. Presentation File, Audio File, etc;
- Filter by the type of object, e.g Lab objects or Lecture Objects;
- A filter which selects objects based on keywords or learning object name.

Once the filtering types was decided the roles of each person who would interact with the filter was identified, and are defined as follows.

Moodle Administrator

The Moodle administrator has the ability to add or remove the plug-in from the Moodle installation. They will be in charge of delegating the course administration power to different users. All of the powers which are associated with the Course Administrator (below) will be available to the Moodle administrator.

Course Administrator

The Course Administrator has the ability to enable or disable the filter for a particular course. They do not have the ability to add or remove the plug-in from the Moodle installation, this is reserved for the Moodle administrator.

The Course Administrator can create new course content objects. In the process of creating these objects the course administrator will be shown a selection of radio buttons, where they can categorise the object that has been created. The course administrator will then be given the chance to manually add keywords as meta data to the object. All of this information is used during the filtering process.

Student

Once the administrator have enabled the filter, it will be visible on the student view of the course page. The student does not have the ability to add or remove the filter from the course page, but can maximise or minimise the filter pane, and select filter options to filter though the content.

The user requirements above required a filtering tool that can both filter objects based on categories set for those objects and also allow meta data tags to be associated with each learning object describing the semantics and parameters related to this object. By default very little meta data is stored about the objects which are uploaded by the administrator, apart from time stamping information and course identification links. For the filtering process to work successfully, meta data needs to be stored to describe and tag of each of the learning objects.

Applying the Content Filter

For the filter to be applied to an active installation of Moodle, the code was released in code patch form. Although Moodle does offer some plug-in and extension capabilities, a patch tool was chosen because as at the current time Moodle does not offer any facilities to allow code changes or rollbacks to be made to any of core pages such as the course page or database tables, which the content filter needs to modify during installation.

4 Tool Overview

In the following sections brief overviews will be given describing the tool as viewed by the different roles of interaction.

4.1 Student View

Filter selection criteria will be displayed on top of the student view of the course page. The selections made by the user will be passed to the learning object content filter and each of the learning objects will individually be tested to see if they meet the filter criteria and either added or rejected from the final learning object list that will be displayed. The user has the option to further filter if required.

Figure 1 shows the prototype filter which is added to the top of the students course page. By default the content filter is in maximized state, but the user has the ability to change it to a minimized form if it is not being used.

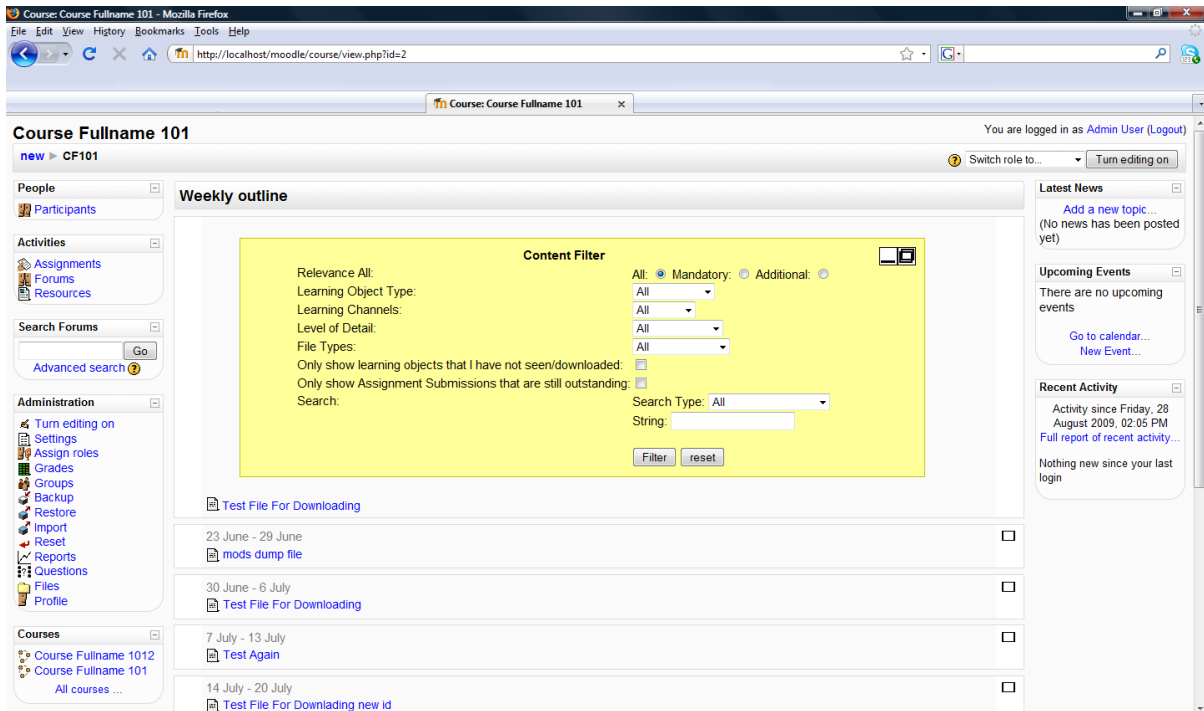


Figure 1. Content Filter in Browser

For the students to use the filter, various combinations of the controls can be set and then the filter button is pressed. At any time the user can press the reset button, and all of the controls will return to their original state and a full list of learning objects can be once again printed to the course page.

Filter 1: Meta Data Filter

The first section of the filter is dedicated to searching through the course content by the use of meta data. This meta data allows the learning objects to be searched based on keywords set by the course administrator when uploading the learning object.

Below are the various headings which a student can search under breaking down the various different cases.

- **Mandatory or Additional course material.** This simple division will allow students to only focus on the material which is needed for their course and not on additional material which will not be tested but supports the students learning. Although a point of contention that all material should be covered, it can be argued that when assessment time arrives, the students' focus should only be on mandatory material.
- **Learning Object Type:** This option will only show content which is specific to the content type under the headings of All, Lecture, Lab/Tutorial or Assignment.
- **Learning Channel:** This divides the course material into the three main categories, Audio, Visual and Kinaesthetic. This option will allow the user to break down the course material by only showing the material which is relevant to their learning style.

For example a student with an auditory learning style can filter for podcasts and other recordings.

- **Level of Detail:** This option will distinguish between object giving a summary of content and objects explaining topics in more detail. The options available are Summary, Medium or Very Detailed.
- **File Type:** This option allows the user to specify what file type they want to filter. This can be helpful if the student knows that the file they are looking for is a Microsoft Word document or a presentation which is usually in PowerPoint form. The options available are, All Files, Text Document, Spread Sheet, Presentation, PDF file, Movie file, Sound file and Web Link.

Filter 2: Outstanding Assignment Filter

Moodle offers course administrators the option to allow students to upload assignments on the course page. If the course consists of a several continuous assessments then over time the course page becomes over crowded. The outstanding assignment filter checks to see if the assignment has been uploaded by the student and if so it will not show the upload object for that that assignment on the course page. Only the assignments upload objects which have not have any content uploaded to them will be shown on the course page. This filter helps reduce the amount of useless content shown on the course page.

Filter 3: Learning Objects not seen or downloaded

Some Moodle course pages can have a considerable amount of learning objects. When searching for a specific file which the user has not seen on a course page this amount of learning objects can make the task take a lot longer and navigation though the object becomes a problem.

As a solution to this a filter was created that allows users to filter out any learning objects that have been opened and only show the objects which they have not opened. This filter works by checking the user's activity logs. If the log shows that the user has opened the file, then it will not be shown on the course page. If a file is modified and the user has not seen the file since the modification has been made, a check is done to see if the modification date is newer then the last seen date. If they have not seen the object since the changes have been made then it will be shown on the course page.

Filter 4: Keyword Search

Some of the users may want to search though the course content by keyword. This filter allows the titles of the learning objects to be searched either or both by the meta data or by keywords which have been supplied by the user. Once this search is complete, only learning objects which match the keyword will be returned.

Figure 2 shows an example of a user setting to search though all of the material which is a lecture and of Learning Channel type Visual. Figure 3 shows the results of this search, various lecture videos.

Content Filter

Relevance All: All: Mandatory: Additional:

Learning Object Type: Lecture

Learning Channels: Visual

Level of Detail: Medium

File Types: Movie File

Only show learning objects that I have not seen/downloaded:

Only show Assignment Submissions that are still outstanding:

Search: Search Type: All

String:

Figure 2. Student selection

Figure 3 below shows the results of the filtering process . Each of the objects are displayed on the course page for the options specified above.

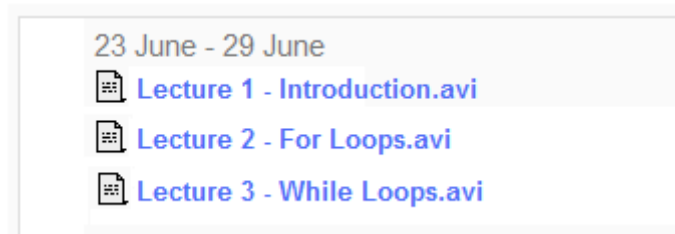


Figure 3. Selected learning objects

4.2 Course administrator view

To enable filtering, each learning object needs to be categorised, and associated with relevant keywords, by the course administrator. This is facilitated by options to add categories and meta data to the learning object during the process of creating a new course content object. These options appear at the end of the object creation page, after the standard Moodle form controls. It appears as a matrix of options which allow the administrator to categorise the learning object under the various headings described in section 4.1 above. An option will also exist to allow the administrator to manually tag the object with meta data. All of the information which is collected will be used during the various filtering processes.

Mandatory Additional

Learning object Type: Lecture

Learning Channels: Visual

Level of Detail: Medium

File Types: Movie file

Meta Tags: programming, java, introduction

Figure 4. Tagging a learning object at upload (Close up)

The screenshot shows a web browser window titled 'CF101: Editing Resource - Mozilla Firefox'. The address bar shows 'http://localhost/moodle/course/modedit.php?update=11&return=0'. The main content area contains a form with several sections: 'Format' with a dropdown set to 'Plain text format'; 'Window' with a dropdown set to 'Same window' and a 'Show Advanced' button; 'Content Filter Meta Data' with radio buttons for 'Mandatory' and 'Additional' (selected), and dropdowns for 'Learning object Type: Lecture', 'Learning Channels: Visual', 'Level of Detail: Medium', and 'File Types: Movie File'; and 'Common module settings' with a 'Visible' dropdown set to 'Show' and an 'ID number' input field. At the bottom, there are three buttons: 'Save and return to course', 'Save and display', and 'Cancel'. A red error message at the bottom right reads 'There are required fields in this form marked*'. The browser's menu bar includes 'File', 'Edit', 'View', 'History', 'Bookmarks', 'Tools', and 'Help'.

Figure 5. Tagging a learning object at upload (In Browser)

Additionally, when the administrator opens the learning object update section a settings matrix will appear which will allow them to make changes to the various attributes which were set for the learning object. They will also have the chance to add or remove the meta data which has been added to the learning object.

4.3 Moodle administrator view

Once the code patches have been installed, a new set of settings will appear for the administrator under the course settings page. These settings will allow the administrator to enable or disable the filter at the top of the Moodle course page.

5 Distribution of the Filter

For this filter to be used in other installations of Moodle a system was needed for packaging and distribution of the source code. Currently Moodle does offer a plug-in service, but it does not stretch to core code changes such as the one described here. Code patching utilities currently offer the only solution for administrators wanting to add the filter capabilities to their installation of Moodle. One downside to using a code patching utility is that it may lead to difficulties if any rollbacks need to be performed on the code in the future and also if any updates occur, difficulties may also arise because core code updates may overwrite the changes which we have made after applying the patches.

6 Future Work

At the present time, the keyword search is only performed on the title of the learning objects and on their meta data that was supplied by the module owner at the time of upload. A useful extension to this search is having the search term used to search through the body of the files also. As quite a large amount of files are text or XML based (Microsoft Word document for example), a tool could be developed for searching through the body of the document.

The content filter is implemented inside of the Moodle course page, so all of the security aspects of Moodle have naturally been inherited. Very few security problems have shown up for the content filter because of this.

7 Conclusion

Over the last few years, educational institutes have begun to install VLE's which allow students to access course material and tools from a remote location. Some of the Moodle course pages can have more than fifty different course content learning objects. Having a large amount of course content learning objects can pose a problem for a student when they are looking for specific material on the course page or to search by specific categories. The VLE Moodle, which was the test bed for this paper does not come with any filtering tools that allow a user to filter through the content of a course page.

This paper reported on, a prototype content filter which when implemented gives the user greater flexibility and control over the content which they view on a course page by applying various different filters that will remove content from the course page that is not relevant to them.

After student and lecturer interviews various different headings under which the learning objects could be classified by were created. These headings were used as the basis for the controls on the content filter. When a new learning object is created on a course page, an additional step is taken to add meta data to the learning object and to categorise it. This meta-data gathered would then be used during the filtering process.

Administrators have the ability to enable and disable a content filter in a student's course page. Currently the Moodle platform does not come with any built in feature to allow code changes to the core pages as described here. This proved to be the main problem when thought came into packaging and distributing the system. This has left code patches as the most feasible way of distributing the changes. The content filter when applied works inside the main course skeleton page and does not make any drastic changes to the Moodle architecture so all of the security aspects of Moodle are then inherited by the content filter.

The content filter proves useful as a tool to help when a student is making a learning object selection and for navigating through the content of a heavily used course page.

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