DEVELOPMENT AND INTEGRATION OF VARYING EDUCATIONAL RESOURCES AND STUDENT ENGAGEMENT:- DIVERSE. A TOOL FOR AIDING STUDENT LEARNING AND INTERACTION

Dr. John C. Murray, Ben Trott, Max Woollard

University of Lincoln, School of Computer Science, Brayford Pool, Lincoln, LN6 7TS (UK)
john@jcmurray.com, btrott@lincoln.ac.uk, mwoollard@lincoln.ac.uk

Abstract

Students are expected and encouraged where possible to explore as much of the literature pertaining to their field of study as possible. Using this literature to enrich their knowledge and improve their assessment submissions. This acquisition and discovery of literature is usually gathered during a student's self directed study period. It is therefore the case that multiple students could be searching for the same materials and resources. Whilst in itself this is not a concern, by effectively crowd-sourcing the research more in-depth and diverse sources could be discovered. In addition, this information, source location and relevance to a topic is lost after the students submission of their assessment. This paper presents an on-line peer collaboration tool called DIVERSE (Development and Integration of Varying Educational Resources and Student Engagement) whose aim is to develop active participation, research and sharing of knowledge between students themselves. It is hoped that the use of such a collaborative tool can improve student research, engagement and attainment with their studies. Within this paper DIVERSE is discussed with regard to its application to student collaboration of research and literature materials and its use throughout the pedagogical experience. Results from the use of DIVERSE with trial modules topics are also presented.

Keywords: Technology, pedagogy, Virtual Learning Environment, Online Educational Resources.

1 INTRODUCTION

The current lecture format usually follows a delivery model of one or two hours per lecture. This time is predominately used for the direct delivery of lecture materials (or transfer of knowledge), usually via a power-point slide and oral presentation, this is known as the Instruction Paradigm [1]. The advantages of this 'banking' method of teaching are well understood. For the institution, staff and students, it is a predictable, efficient and structured method of course delivery and consumption. However, a number of problems exist, too. For example, there is minimal opportunity for individual student participation and engagement with either the lecturer or their peers; student inquiry is largely separated from the lecture experience; there is a dislocation between the learning taking place outside the lecture and the lecture itself.

Although it is understood that following a model such as this is effective for surface learning [2], that is, to memorise information, facts and concepts without reflection. Therefore, it would rely on students' engaging in self-directed study outside of the delivery lecture. Researchers have realised that whilst effective in the transfer of knowledge, changes to this more traditional lecture format can bring improved learning and knowledge retention [3,4]. It is still important that students' do engage with this self-directed study.

It is reasonable to suggest that the main use of this self-directed study time is used by students to achieve a deep learning [2] and try to put context to what was delivered in lectures. As such, this involves 'individual' self-directed study and to some extent study in small 'cliques' of peers. As a result of the separation between learning taking place outside the lecture and the lecture itself; the lecture is largely uninformed by the resources students themselves may be discovering and using during their self-directed study and conversely the self-directed study is uninformed or supported by the lecturer. As it is, the traditional lecture format creates a disjuncture between the lecturer and the student.

In the authors experience, this raises several important questions for lecturers, learning development and library staff:
• Have the students understood the lecture correctly? How can this be confirmed without conventional assessment methods?

• In preparation for summative assessment (e.g. exam revision, writing essays), are students discovering and using appropriate resources?

• How can the resources that students discover benefit the wider student base, even year-after-year and across cohorts?

• How can the institution itself learn over time, so that teachers, learning development and library staff can respond effectively to student needs?

• How does detailed monitoring of student contributions to a course affect their engagement?

With the availability of online educational resources such as e-journals, Wikipedia and OERs, students are increasingly turning to these resources rather than the traditional library setting. Study materials and online resources used by students are becoming more diverse and dispersed and as developments in disciplines change, so do the resources associated with them; as new theories and ideas are published, older articles drop out of favour. It is important that these resources are not forgotten in addition to ensuring that new articles are interpreted correctly in the context of the student’s studies. Due to the sheer amount of resources available it can be difficult for students to know the relevance of these to the topic in question. It is therefore important for students to develop critical, digital literacy during the course of their studies. This might be supplementary to their courses via the library or embedded in the curriculum, but when pursued face-to-face, this level of support can significantly increase the workload of tutors and support staff.

A large part of student work is still conducted in solitude. For individual assessment this is not surprising or indeed considered negative, but this time and effort by an individual student will be replicated many times. The sharing and critiquing of student researched resources is one method of reducing the burden of assessment while sharing the knowledge that each student has produced. This method of peer-review is usually limited as the work of assessment is rarely distributed (i.e. ‘crowd sourced’) across the whole cohort of students.

1.1 OERs and VLEs

There are many online educational resources (OERs) that students have access to for supporting their learning whilst at university. The majority of these OERs surround the access to journals that the university may subscribe to. Access to these online resources come via many different interfaces, but predominately via access portals such as Science Direct (www.sciencedirect.com) or more specifically tailored sites such as the Association for Computing Machinery (ACM) digital library. However, access to the journals and resources hosted on these sites, in addition to other such journal access portals are restricted based on the institution's subscription models. This can therefore limit the scope of materials available to students via the suggested routes, i.e. these identified portals.

The use of materials such as journals and conference papers that are hosed on such sites are an invaluable resource to undergraduate and research students as they allow them to uncover a lot more information regarding a subject topic, and follow up-to-date research in the field. However, it can sometimes be particularly difficult in getting students to utilise these resources, due to the effort required in finding and identifying appropriate articles. As a consequence of this, and due to the difficulty in tracking the use of such resources it is difficult for academics to put forward a strong case in justifying the cost associated with the subscription of these services [5].

In addition to the use of OERs to improve the development of student knowledge and learning, Virtual Learning Environments (VLEs) are used by universities as a central point for students to access information pertaining to their particular studies. At the University of Lincoln, Blackboard is the currently employed VLE. Blackboard is mainly used by staff on each course as a repository for lecture materials and other module resources, such as library reading lists and e-Books access. Students are able to access the resources provided by the module lecturer via these course sites on Blackboard for the purpose of further study and to support assessment [6].

As previously discussed, with the majority of students engaged in self-directed study and research to support assessments, predominately in solitude, there will no doubt be a vast amount of resources being discovered and accessed by the students. Ultimately, these resources will only be used to the benefit of the one particular student, and quickly lost after the submission of any assessment. In addition to this, as a result of this lone working environment, lecturer and student are naturally
separated and thus it is difficult for the lecturer to feed back on the resources individual students are accessing. Those students that are more proactive in their studies may approach the lecturer or tutor to seek further support or clarify sources, however, conducted on a one-to-one basis can indeed be costly in terms of time. As such this naturally reduces the level of support that can be provided in this context.

2 DIVERSE

DIVERSE is a tool developed by researchers and students at the University of Lincoln, UK, with the aim to develop and encourage active participation, research and sharing of knowledge in [initially] Computer Science topics by students themselves. Computer Science by its very nature is a subject that changes rapidly and incorporates new technologies yearly. One of the objectives of DIVERSE is to enable the students to research and share the plethora of changing information available via OERs and Internet resources, relating to module topics, bring this information together in one easily accessible place, and share and review with their fellow students.

2.1 Student as Producer

DIVERSE is a project that has been specifically tailored and oriented towards the ground-breaking HEA-funded Student as Producer project (http://studentasproducer.lincoln.ac.uk) which, underpinned by progressive pedagogical theory, asserts that students can and should be producers of their social world by collaborating in the processes of research, teaching and learning [7]. Student as Producer has a radically democratic agenda, valuing critique, speculative thinking, openness and a form of social learning that aims to transform the social context so that students become the subjects rather than objects of history - individuals who make history and personify knowledge.

Student as Producer is not simply a project to transform and improve the ‘student experience’ but aspires to a paradigm shift in how knowledge is produced, where the traditional student and teacher roles are ‘interrupted’ through close collaboration and a recognition that both teachers and students have much to learn from each other. Student as Producer is not dependent on technology but rather on the quality of the relationship between teacher and student. The extent to which technology can support, advance and even progressively disrupt this relationship is key to Student as Producer.

DIVERSE builds on the recommendation and principles of Student as Producer by encouraging the students to discover, share, collaborate and peer-review each other's research efforts in terms of discovery of materials to support their own learning. Thereby, rather than being simply the consumers of knowledge and information, they are becoming more of discoverers and explorers and indeed producers of knowledge and information.

2.2 Using DIVERSE?

DIVERSE is an online tool that makes use of ‘Resource Clouds'. This is where students can upload specific links to materials that they have discovered whilst revising for exams, revisiting lecture notes, engaging in self-directed study, or completing assessments. Any OERs, library sources, RSS feeds, twitter, Facebook, Blogger and other pieces of related information discovered on internet sites can be uploaded as ‘resources' to DIVERSE. Fellow students studying the same topic can then gain access to these resources and themselves upload links to the resources they are discovering. This allows for a totally peer-generated 'cloud' to be built over a period of time by the students themselves whom are assessing and discovering this information. Fig. 1 shows an example of what a resource cloud may look like.

Using Blackboard, DIVERSE is integrated as a hyperlink to weekly lecture topics. Students then use Blackboard as a collective location for all their clouds and can easily find a specific cloud for lecture materials relating to a specific week's lecture topic. Looking at Fig. 2, A7 - Software Engineering is a link to the resource cloud shown in Fig. 1. As students research materials on 'Software Testing' they can add these to the associated research cloud, as discussed in section 2.2.1.
Fig. 1 - An example resource cloud containing varying resources linking to topics on 'Software Testing', with different icons representing different types of resource.

Fig. 2 - Blackboard lecture topic page, hyperlinks, i.e. Software Engineering, link to Resource Clouds.

2.2.1 Adding Resources

The DIVERSE project addresses the problems outlined in Section 1 above within the pedagogical framework of Student as Producer by providing a 'Resource Cloud' for each Blackboard course site. DIVERSE encourages students to collaboratively aggregate any resources they have found pertaining to the course topic in question, see Figs. 1 and 2. In this sense, DIVERSE is a type of interactive, course specific social bookmarking tool that allows students to build their own collaborative Resource Clouds. Students populate the Resource Clouds for a specific subject topic by adding links to useful sources and materials for which they have discovered online, such as library book references, journal articles, webpage entries, blogs, images, etc.

Once a resource has been found there are several ways a student can add this to the cloud, either directly using the 'Add link' button on the cloud, see Fig. 3, or directly from the source site using the DIVERSE toolbar, see Fig. 5. Once a resource is added to the cloud it is immediately available to other students. In order to prevent the system from being spammed by unwanted links or users students and staff need to authenticate via the OAuth single sign-on system. This is discussed in section 2.3.
When adding a resource, it was found to be of vital importance to ensure that it was easy to make resources as distinguishable, identifiable and informative as possible without making the clouds too crowded or ‘noisy’. This was achieved by using graphical icons as opposed to words. It has been shown by Stelmack et al [8] that the correct recognition of pictures is much higher than that of words, in addition to Maruyama [9] who discusses information theory with the contrast of words and images, stating that one page of images can code more information to the observer than one page of text. This leads us to conjecture that by using representative images for resources, users can identify a type of resource much quicker.

Therefore, as shown in Fig. 1 each resource is identified by an associated Web 2.0 style icon dictating the type of resource the object represents. I.e. a book for a library resource, or the Wikipedia logo for a Wikipedia link or reference.

2.2.2 Peer Review of Resources

One of the main aims of the DIVERSE tool is to build collaborative peer-developed resource collections where the students themselves contribute. Allowing the students to have full control of the resources added to a cloud ensures that students feel included and non-discriminated against. However, this results in a particular problem whereby very quickly the resource cloud can become over populated with too many resources that a) make it impossible to display them all on the screen and b) mean that good resources are lost in the sea of other, maybe less relevant, resources.

In order to prevent these conditions from occurring, a peer-review system was incorporated into the tool. This allows the students to vote on the relevance, important or usefulness the resource has to the resource cloud subject topic. As with adding a link there are two methods by which a student can vote on a resource, firstly they can hover over the icon on the resource cloud and select to either vote up or down the resource, see Fig. 4 or secondly, the students can use the DIVERSE toolbar to vote on the resource. the process of voting on a resource has the effect of changing the physical size of the image representing the resource, the more positive votes, the larger the image appears on the Resource Cloud, the more negative votes received for a resource the smaller the image becomes.

Adapting the size of the image on the resource cloud provides two pedagogical benefits. Firstly, it enables the users of the cloud to get an instant representation of the importance of the resources on the cloud, thereby being able to directly access the resource most voted by their peers. Secondly, and from a pedagogical point of view, more importantly the voting system allows the lecturer to periodically access the resource cloud and gain an impression or feel for the resources students think are the most relevant to the particular subject topic.
Having this insight into the resources students are accessing and voting on can provide many benefits to teaching and learning. If the lecturer feels that students are going 'off topic' with their resources or are voting up resources that are irrelevant or incorrect, then during the next lecture, this information can be fed back to the students. This provides a fantastic benefit by closing the learning loop between Lecturer → Student → Lecturer. The lecturer imparts information and knowledge to the students via an instruction paradigm lecture; the students in their self-directed study time expand on this information by further research and discovery; this information is uploaded to DIVERSE and students vote on the relevance, importance and usefulness of a resource; finally the lecturer views the cloud and provides feedback on the accuracy and relevance of the most popular resources on the cloud. The result of this, is that students can gain up-to-date and almost real-time feedback on their progressive self-directed study and assessment research.

2.2.3 DIVERSE Toolbar

To make the DIVERSE tool more assessable and user-friendly a toolbar has been developed that allows access to the DIVERSE tool from within a browser on any website. This allows students to add resources to their available Resource Clouds without the need to navigate away from their current site. The toolbar allows for adding resources to clouds, voting up or down an existing resource, or sharing the resource via social media. Fig. 5 shows the toolbar, which is accessed via an added bookmarklet.

Fig. 5 - DIVERSE toolbar with left to right functions including, Home (visit http://diverse.lincoln.ac.uk), share on Facebook, share on Twitter, vote resource up, vote resource down, add resource to cloud, report resource.

2.3 Anonymity and OAuth

Such a system is not without its problems of course, and indeed during initial trails of this system one of the main concerns expressed by both students and staff was around anonymity. Initial uptake of the system was slow, as students expressed concern that they would not wish to add a resource if people could determine who posted the resources, as this could lead to embarrassment if the resource was deemed poor or inappropriate.

Ainsworth et al [10] discuss how research they have conducted surrounding anonymity can provide positive benefits for online voting and debating systems, however they do mention how, due to anonymity, initial off-task behaviour can occur. Ainsworth et al show that during initial topics 56% of participants were ‘off-topic’, that is posting irrelevant comments or non-conducive posts. However, they are quick to point out that by the later topics, the off-topic condition falls significantly to just 19%.

This effect is further demonstrated by Lapidot-Lefler et al [11] who explains how anonymity, invisibility and lack of eye-contact can lead to a phenomenon termed toxic online disinhibition. Whilst Lapidot-Lefler et al state that anonymity is an important contributory factor to online disinhibition, it can be shown to induce more flaming behaviours [12].

In a system whose main focus is to increase engagement and improve the quality of resources being used by students, reducing misuse of DIVERSE is a major priority. Flaming of students by their peers and toxic disinhibition would only serve to deter from the use of DIVERSE, detracting from the objective of increasing student engagement. With this in mind it was important to allow for the anonymous posting of resources but to reduce where possible the negative effects that result from anonymity.

DIVERSE uses two methods to take advantage of anonymity and reduce its negative impact. Firstly, the effect described by Spears et al, results as a communication between all participating students within the class, each student having access to see posts and comments by other students. However, with DIVERSE, other students are unaware as to whom posted resources on the Resource Cloud. Thus this helps to prevent any negative flaming.

However, this does not address the concerns expressed regarding anonymity. DIVERSE does not log or record which students have posted which resources and this is made clear to the students from the onset. This in itself brings back the concerns raised by Spears et al of flaming, however, not flaming the other students but the system and possibly the lecturer. As such, DIVERSE sits behind a
university secure sign-in system which is implemented using the OAuth API (http://oauth.net). Fig. 6 shows the university’s OAuth sign-in system.

![University of Lincoln OAuth secure sign-in.](image1)

Fig. 6 - University of Lincoln OAuth secure sign-in.

The student is able to use their standard university ID and password to login to DIVERSE. From here a list of the available Resource Clouds are listed for which they can post resources, as shown in Fig. 7. The added benefit of using OAuth ensures that only registered users can access the system, whilst allowing the students to remain anonymous to the lecturer. When a resource is added the system checks the domain against a list of blocked and blacklisted sites, if the site is blocked or blacklisted the resource is not added.

![List of available clouds for which resources can be added to.](image2)

Fig. 7 - List of available clouds for which resources can be added to.
3 TESTING AND EVALUATION

The DIVERSE tool has been in development from the academic year 2011/2012 and had been trialled in three separate schools within the University of Lincoln, UK. These schools were Lincoln School of Computer Science, Business and Law - Languages Department and Forensic Science. The initial prototype of the system was presented to students within these schools in order to gain feedback on the function of the system and the usability of certain aspects of DIVERSE.

Feedback was collected using quantitative and qualitative methods via a questionnaire after several weeks of beta the first questionnaires were sent out, and collated on the 31st October 2011. Based on this feedback changes were made to the tool and the second trials were carried out, with questionnaires collated on the 2nd December 2012. Figs. 8 and 9 show the results of these two trials. As can be seen from these graphs, it was consistent across all questions that students perception and satisfaction with regards to all elements of the system had improved.

![DIVERSE feedback comparison](image1)

Fig. 8 - Feedback from questionnaires for determining user responses to using the DIVERSE tool.

![DIVERSE toolbar feedback comparison](image2)

Fig. 9 - Feedback from questionnaires for determining user responses to using the DIVERSE toolbar.

Although the submission of resources are anonymous certain statistics are recorded by the system. For each of the resource clouds on DIVERSE, the following elements are logged: Number of individual resources, number of votes (positive and negative) per resource, number of cloud accesses per day. From this information a number of interesting statistics can be determined which give information about the use of the clouds. For example, monitoring the cloud shown in Fig. 1, the access history of the cloud can be viewed, Fig. 10 shows the access of the cloud in total number of votes per week.
Fig. 10 - History of 'Software Testing' cloud viewed by number of votes (on all resources) per week.

The votes in Fig. 10 show when the resources are being voted up or down the most. It can be seen that the cloud was most popular for voting during weeks 2, 11 and 15. As the topic relating to this particular resource cloud was part of both the assessment and exam for the module, it demonstrates that near assessment submission in week 12 and exam revision for the exam in week 18, students were most active on the cloud, this is evident by the tree peaks seen in Fig. 10.

4 CONCLUSIONS

This paper presents an online virtual learning environment that utilises Resource Clouds. These clouds are populated and modified by students themselves based on resources they have discovered for a specific topic. These clouds have been shown to have many advantages to students by allowing them to collaboratively share resources they have discovered on a topic, and peer-review the relevance and usefulness of these resources. It allows the lecturer to monitor the types of resource materials students are using, and thereby feedback to the entire cohort on the relevance and applicability of the resources they are voting up or down. Therefore, if students are using irrelevant resources, or indeed using excellent quality resources, the lecture can feed this information back, ensuring students get the most out of the available literature.

By logging the lists of resources per resource cloud, number of votes on individual resources and dates of access of the clouds, then this information can be stored and compared to successive cohorts to compare the different types of resources students utilise, this can have the added benefit of informing library reading lists, as for example the top 5 book sources used by a previous year could be suggested as the reading list for the current cohort. More importantly, it can be used to inform or build a case for buying journal and e-book subscriptions, as the clouds can be utilised to demonstrate the sources students use most. By plotting this information over a number of years trends it is hoped that trends can be discovered in the data demonstrating access information for particular sources, or indeed changes in the types of sources being used.

There are still several problems that need to be overcome for total penetration of this tool within the university, and indeed for complete uptake by the students. Approximately 150 students were selected for the initial trials of the DIVERSE tool, from this test sample the uptake by the students was less than 50%. During free-form interviews with participants of the study, the main concern for students, and overriding reason for not engaging with DIVERSE was down to students not wishing to share the information they find with other students. It is therefore important to demonstrate that sharing resources and materials with other students will in turn have its own rewards as by engaging in the collaborative sharing process not only will the students have access to their own materials, but those of the rest of the class. In addition they will gain the benefits of peer-assessment of those resources and further clarifications by the lecturer on the usefulness and relevance of such resources.
REFERENCES


