

Using Google Docs To Support Project-Based Learning*

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Abstract

Project-Based Learning is a wide-ranging approach that uses authentic problems to engage students. One of its main benefits is that it enables ideas in the classroom to be linked with real-life. Among its limitations: it is difficult for students to collaborate on artefacts outside of class time and it is problematic for the teacher both to monitor the progress of the project and to assess the individual contribution of each student. These limitations are partly overcome by Google Docs, a suite of free online applications that facilitate collaboration. Firstly, Google Docs enables students in different locations to work simultaneously but independently on the same artefact. Secondly, we, as teachers, can be included as observers on each project group and thus track the development of the work. This year, various groups of students across the Science and Business departments used the Google Docs word-processor to work both collaboratively and individually on a diverse range of projects. We present a case study of one of these class groups, the results of which were largely positive. However, some problems arose that will inform our approach with future student groups.

Keywords: (Project-based learning, collaboration, Google Docs.)

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1. Introduction

Project-Based Learning is an approach that aims to engage students by organising learning about projects (Thomas 2000). Projects have two essential features: a question that organises and motivates activities, and a series of artefacts culminating in a final product, which addresses the question (Blumenfeld et al. 1991). Other typical features of projects include that they:

- are largely student driven (Thomas 2000) and give students the opportunity to work autonomously for extended periods of time (Blumenfeld et al. 1991); if the teacher participates, it is with an “advisory rather than authoritarian” role (Adderley et al. 1975) — the teacher facilitates but does not direct (Moursund 2002).
- have characteristics that give students a feeling of authenticity (Thomas 2000).
- compel students to come into contact with the main concepts and principles of a discipline (Thomas 2000), usually by means of a “driving question” (Blumenfeld et al. 1991) or an ill-defined problem (Stepien & Gallagher 1993).

The benefits of Project-Based Learning include: it can lead to increased student interest, it has the potential to promote deep understanding, and it enables ideas in the classroom to be linked with the real world (Blumenfeld et al. 1991). In addition, Project-Based Learning can encourage active inquiry and higher-level thinking (Thomas 1998), can result in increased self-reliance and improved attitudes toward learning (Thomas 2000), and can contribute to students’ intrinsic motivation (Helle et al. 2006). It can also develop problem-solving and communication skills that are invaluable to students both in academia and in the workplace (Thompson & Beak 2007).

Moreover, when Project-Based Learning is undertaken by students working in groups, other benefits can result. For example, more comprehensive projects are possible (than would be possible for individuals), and it can facilitate the development of students’ interpersonal skills, preparing students for the real world (Gibbs 1995). Project-Based Learning has the potential to develop the ability to “participate constructively in a complex team environment” (HETAC 2005a) a core competence in the HETAC awards standards for both science (HETAC 2005b) and business programmes (HETAC 2005a).

Although Project-Based Learning promises many benefits, its implementation gives rise to a number of difficulties (see Thomas 2000 for an extensive catalogue). Three difficulties are of particular interest to this paper as these are difficulties Google Docs¹ has the potential to address. First, as projects require extended periods of time, much of this time must be found outside class, and it is a challenge for third level students who generally have busy lives to find times that suit all members of the group to collaborate on artefacts. Second, it can be problematic for the teacher to monitor the progress of the project, especially given the limited class time typically available. Third, while Project-Based Learning has been assessed in

1 <http://docs.google.com/>

many different ways (Van den Bergh, V. et al. 2006), assessment of Project-Based Learning should, in general, have an individual and a group component (Helle et al. 2006), and evaluating an individual's contribution to a group's output can be extremely tricky (Thorley & Gregory 1994).

This year, various groups of students across the science and business departments used the Google Docs word-processor to work both collaboratively and individually on a diverse range of projects, where the final output of each project was a written report. In this paper, we begin by giving a brief overview of Google Docs. We then present a case study of one of the class groups, which describes our experience, and that of our students. In particular, we consider: how easy was it to setup? How did the students find using it? How did we (the teachers) find using it? Finally, we weigh up the advantages and limitations that were identified, and outline future work.

2. Google Docs

Google Docs is part of a wider offering of online applications from Google. It includes an online word-processor, a spreadsheet application, and a presentation application, as well as the very useful ability to easily create simple online forms, the results of which are automatically stored in a Google spreadsheet. The big advantage of Google Docs is that it enables people to collaborate online (see Figure 1).

The traditional way of collaborating to create a document is for one person to create an initial document and then email it out as an attachment to all other team members. Different revisions are sent back and work is required to put it together, since there are many different versions to be kept track of. The online collaboration alternative is to send an email containing a link to the document instead of the document itself. The main benefits are that each team member can modify the current, up-to-the-second version, and all revisions are tracked.

Google Docs (word-processor documents, spreadsheets, presentations, and forms) can all easily be shared with anyone who has a Google Docs account. Other people can be added as collaborators (with editing rights) or as viewers (without editing rights). Documents can also be downloaded in a number of formats including PDF and Microsoft Office (Word, Excel or PowerPoint); they can also be published as a web page for all to view (thus no need for a Google Docs account).

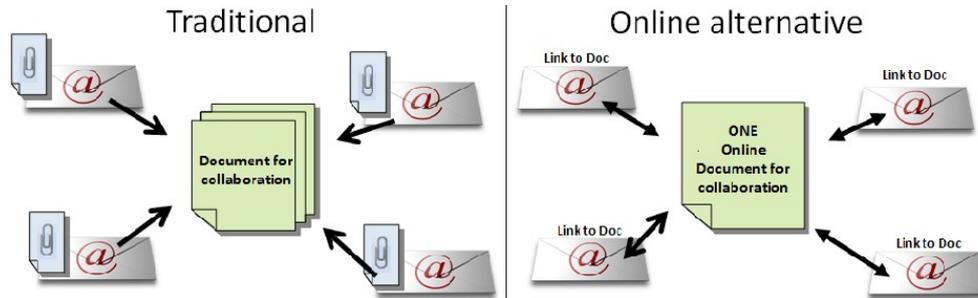


Figure 1: Comparing the traditional way of document collaboration with the online alternative

The Google Doc word-processor has all the main features of a standard word processor, such as: changing text format including colour, font, and size e.g., superscript and subscript; adding bulleted and numbered lists; changing alignments; adding images, hyperlinks, and tables (see Figure 2). However, the features are somewhat limited when compared to MS Word. One particularly useful feature is the ability to add comments – these can be colour coded and automatically include a timestamp and the commenter's name. Notice the box at the bottom right-hand-side of Figure 2 showing that another person is editing the document at the same time (Google Docs enables up to ten multiple users to collaborate simultaneously). The revision history is a very useful feature. It archives each saved version which can be easily reviewed and allows for comparisons between versions. Note that the changes made to the document are highlighted and colour-coded to indicate who made the changes.

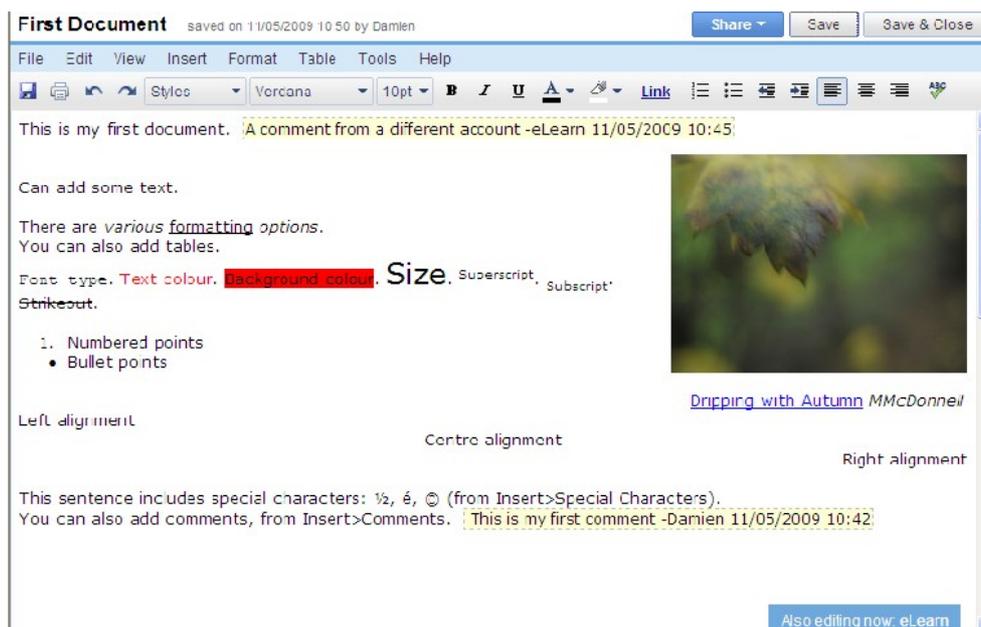


Figure 2: The word-processor of Google Docs in action

In summary, the word-processor application of Google Docs can enable students in different locations to work simultaneously, but independently, on the same report or other document. In some ways Google Docs is like a wiki, but with more word-processing options. This is what online collaborative software such as Google Docs enables.

3. Case Study

We conducted a case study of one of the class groups that used Google Docs this year. We identified the benefits and drawbacks of using Google Docs for Project-Based Learning, first with regard to setting up a project, then from the students' point of view, and finally from the teachers' point of view.

3.1 Set up

Google Docs was introduced to the students by demonstrating it using a digital projector. For classes where the students were not in a lab, the live demonstration was complemented by means of an online screencast. The students were then given two tasks. Firstly, they were asked to create an account, each using his/her student number as the username. Secondly, they were asked to create and share a document. Most students were able to complete the tasks without any trouble.

However, a few students inadvertently managed to set up two accounts with same username and password. This occurred after a student had received an e-mail automatically generated by Google Docs inviting her to share a document. Instead of directing the student to the standard Google Docs login screen, it directed her to a portal for the college. This led to some confusion and annoyance among the students. Once the students had successfully shared a document and played around a little with the features of Google Docs, they then created the first of the series of project artefacts, which would ultimately culminate in a final product.

3.2 Student evaluation

In this paper we focus on one particular group who used Google Docs for a large (three-month long) project, the aim of which was to produce a quality manual. At the end of the project, the students were asked to complete a questionnaire (shown in [Figure 3](#)) designed to identify the benefits and limitations of Google Docs. Out of the 29 students comprising the class group, 26 responded to the questionnaire, which was administered using a Google Doc form.

The students identified a number of benefits of Google Docs. They found, as we had anticipated, its ability to allow numerous people to edit a document remotely to be very useful. They also found useful both the ability to see which team members were currently editing the document (by means of an icon at the bottom of the screen) and the ability to see changes made by team members almost immediately. They noted that it was easy to share documents, and with regard to ease-of-use, the group on average did not find it difficult to use — the scale measured from 1 (v. easy) to 5 (v. hard), and the average result was 2.89; the breakdown is shown in [Figure 4](#).

1. How easy did you find using Google Docs?
2. What features of Google Docs do you think worked well?
3. What problems did you experience?
4. Did you find a difference between collaboration with no-one else online, and collaboration with several of the group online?
5. Would you use Google Docs for a project again? Why/Why not?
6. What changes would you suggest to improve Google Docs?

Figure 3: The questionnaire designed to identify the benefits and limitations of Google Docs.

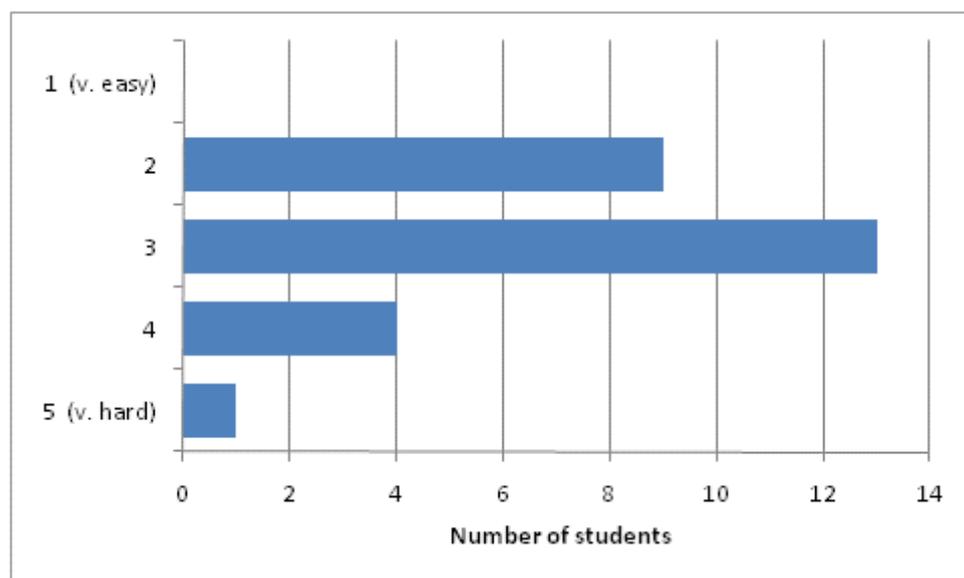


Figure 4: Ease-of-use of Google Docs; the scale measured from 1 (v. easy) to 5 (v. hard)

The students also identified a number of limitations of Google Docs. Firstly, since Google Docs enables simultaneous editing, if two or more students edit text in the same region of a document, one of the students will receive a message (such as that shown in [Figure 5](#)) informing the student that his/her text has been discarded. A number of students reported becoming irritated by this, and also by the spontaneous deletions of text which were reported. The autosave feature also received poor reviews (as one student put it: "it auto saved after a second's pause from typing. It then automatically went back to the top of the document, it is

very annoying”). This was more keenly felt as the project went on, as the documents grew to around 20 or 25 pages, and to return to one’s place required a considerable amount of scrolling.

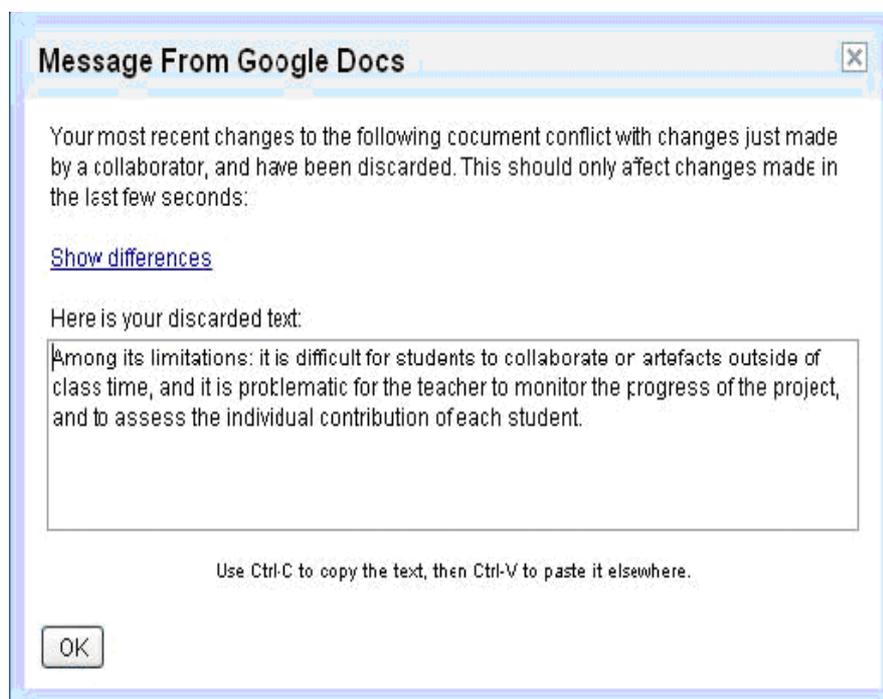


Figure 5: The Google Docs message resulting from two users simultaneously editing text in the same region of a document.

Another limitation identified was that even the most capable students found it difficult to add a chart into Google Docs. Several students also reported that Google Docs can be very slow. Another minor limitation reported was that “font type and size changed by itself”. Finally, an undesirable behaviour that occurred (albeit rarely) was that the servers were unavailable and the document could not be saved for several minutes.

Although the drawbacks identified by the students outweigh the advantages they identified, the acid test is whether they would use Google Docs again. Out of the 26 students, 17, or about two thirds of the group, said that they would use Google Docs again. The main reason given, as one student put it, was: “It is very easy to work with others as a group even when you don't get time to meet up”. This means that, in some cases at least, Google Docs demonstrated its ability to overcome the first limitation we identified at the outset (that it is difficult for students to collaborate on artefacts outside of class time). We noted though that a number of students gave conditional acquiescence. One replied “Yes, for simple documents”, drawing attention to Google Docs’ unwieldy handling of long documents. Another replied, “Yes, if I was working within a group situation”, pointing out that if working on an individual project, Google Docs would have no advantages over Microsoft Word.

The third of the group who responded that they would not use Google Docs again did so for one main reason: that Google Docs compares unfavourably with Microsoft Word. That this should be so comes as no surprise: Microsoft Word has been developed since the early 80s, whereas Google Docs has been developed for just three years. As a result, it is natural that Microsoft Word has a richer set of features and that it is easier to use. Nonetheless, these students would prefer to e-mail Word documents and live with the considerable drawback of having multiple versions in circulation than to use Google Docs. A secondary reason concerned the set up of two accounts with the same usernames and passwords as described above: “There were a lot of problems with members of the group not being able to log in and collaborate and this caused problems within the group. There were more negatives than positives to Google Docs.”

3.3 Teacher Evaluation

We, as teachers, also identified a number of benefits and limitations of Google Docs. Once the students invited us to be collaborators on the documents, Google Docs facilitated the monitoring of artefacts as they were produced. Issues could be flagged, and feedback readily provided to the groups by inserting comments (automatically tagged with username, date, and time). In addition, the revision history feature (see Figure 6) enabled us to readily identify students who were not contributing, or who were contributing very little to the project.

Revision	Last Edited	Changes
<input type="checkbox"/> Revision 127	2 weeks ago by [username]	3 Key Procedures Placing an Order For Raw Materials 1) Phone potential supplier. 2) I
<input type="checkbox"/> Revision 126	2 weeks ago by [username]	Supporting Documentation Requirements Individual Procedure Documents Description:
<input type="checkbox"/> Revision 125	2 weeks ago by [username]	nc text added
<input type="checkbox"/> Revision 124	2 weeks ago by [username]	nc text added
<input type="checkbox"/> Revision 123	2 weeks ago by [username]	3 Key Procedures Placing an Order For Raw Materials 1) Phone potential supplier. 2) I
<input type="checkbox"/> Revision 122	2 weeks ago by [username]	nc text added
<input type="checkbox"/> Revision 121	3 weeks ago by [username]	nc text added Revisions 119-121
<input type="checkbox"/> Revision 119	3 weeks ago by [username]	nc text added Revisions 116-119
<input type="checkbox"/> Revision 116	3 weeks ago by [username]	- Process 2 : Production Cutting: Raw material fed into automated cutting machine set
<input type="checkbox"/> Revision 115	3 weeks ago by [username]	nc text added Revisions 112-115
<input type="checkbox"/> Revision 112	3 weeks ago by [username]	nc text added Revisions 110-112
<input type="checkbox"/> Revision 110	3 weeks ago by [username]	nc text added Revisions 108-110
<input type="checkbox"/> Revision 108	3 weeks ago by [username]	nc text added
<input type="checkbox"/> Revision 107	3 weeks ago by [username]	nc text added Revisions 105-107
<input type="checkbox"/> Revision 105	3 weeks ago by [username]	nc text added
<input type="checkbox"/> Revision 104	3 weeks ago by [username]	nc text added Revisions 102-104
<input type="checkbox"/> Revision 102	3 weeks ago by [username]	nc text added Revisions 100-102

Figure 6: The revision history feature of Google Docs – selecting two checkboxes allows the corresponding revisions to be compared.

Google Docs enables each revision of a document to be examined, and moreover, it enables two revisions to be compared (see Figure 7). Each student’s username is shown in a different colour on the top right of the screen. Each block of text that is in the second selected revision but not in the first revision is highlighted using the colour of the particular student who wrote the text. This meant that, in addition to a group mark, each student could be given an individual mark according to his/her contribution. However, a limitation here is that only two

revisions that appear on the same page of revisions can be compared. For example, in [Figure 6](#), Revision 127 can be compared with Revision 102, but not with Revision 1. This is unfortunate, as were this the case, it would be possible to produce using Google Docs a colour-coded version of the final product, providing an indication of the contribution of each student. A final benefit of the revisions comparison feature was that it enabled the identification of two students who plagiarised text — something that is impossible to do in, for example, a Microsoft Word document, since without the colour coded text, the individual could not be identified.

In addition to evaluating a project by examining the artefacts produced and the final product, it is common to get the students to perform a self review and/or peer review. To this end, Google Docs facilitates the production of simple forms, and with the click of a button publishes them on the web, eschewing the usual hassle of collecting pieces of paper or collating e-mails. A link to the form was embedded in the VLE used in the college, making it convenient for the students to access. Once a Google Docs form is published, it is immediately ready to collect data; this data is added to a Google spreadsheet as each form is submitted. From here, it can be exported to a variety of different formats, making it convenient for the teacher to complete the evaluation calculations.



Figure 7: Comparing two revisions of a document in Google Docs.

4. Conclusion and Future Work

We set out to investigate if Google Docs could overcome three difficulties with Project-Based Learning: that it is difficult for students to collaborate on artefacts outside of class time, that it is problematic for the teacher to monitor the progress of the project, and that it is difficult to assess the individual contribution of each student. The second and third of these difficulties are from the point of view of the teacher, and in these respects Google Docs made a definite contribution. Only one limitation was identified: that it isn't possible to compare any two revisions of a document. If this was the case, it would be possible to produce a version of the final product, colour-coded, giving an indication of the contribution of each student.

With the first difficulty also, Google Docs was successful: several students mentioned that it alleviated the difficulty of finding a time that suited all the group members to meet up outside class to collaborate on the project. However, a third of the students would prefer not to use Google Docs again, and some other disadvantages of using Google Docs were identified by the students. One part of a solution to this is that students should undertake a more detailed initial training targeting specific features found to be difficult, such as adding charts to Google Docs. The second part of the solution requires the input of the developers of Google Docs. We note that most of these disadvantages could be readily remedied, and we hope that they will be in a future version of Google Docs.

With regard to future work, we plan to do a comparative study using Office Live Workspace² instead of Google Docs to support Project-Based Learning. Office Live Workspace is a free service from Microsoft enabling storage and collaboration of Microsoft Office documents. Documents can be viewed and shared online, and by downloading a plug-in, it is possible to edit shared documents directly from Microsoft Office applications. Consequently, it appears that Office Live Workspace does not have the chief limitations the students identified with Google Docs. However, it may well prove to have other limitations in the context of Project-Based Learning that are not present in Google Docs. For example, in the current version of Office Live Workspace, only one user can edit a document at a time. For another user to edit a document, the first user must "check in" the document.

2 <http://workspace.officelive.com/>

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