

# CECIL: A LEARNING ODYSSEY

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**Abstract:** Having designed and maintained a web-based LMS for 15 years we find ourselves with access to more powerful servers, “cloud” based options , greater bandwidth and highly flexible, integrated development environments. It has been a very long time since a university’s administrative computing arm and the teaching and learning computer support groups could share the “biggest Swiss Army knife of information software that anyone has ever developed “ This paper describes the actual and potential use of SharePoint to radically change the services provided by standard LMS using the skills possessed by the average academic user.

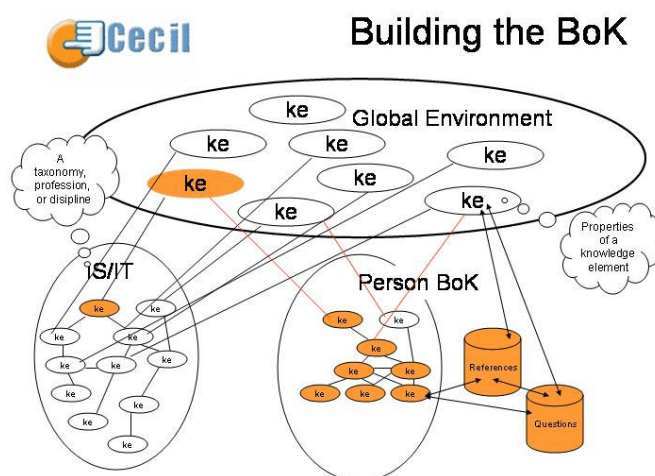
## Introduction

Cecil began in 1995 and has been designed, implemented and maintained over the past ~15 years by a combination of two lead academics and more than 60 students who began as part-time programmer / developers shadowing their full-time peers. As their mentors moved on, trainees from the student population came on-board. Over the period many changes occurred in software and computer architectures. In most cases change was inevitable as hardware and software engineering evolved rapidly thanks to Moore’s Law. Some new features were based upon requests from academics with their respective departments paying to have the option included for the following year. In the beginning there were no appropriate servers on the market for something like Cecil, with the result that a load-balanced, environment of multiple, single threaded web servers running on a single box was created by Richard Vowles, a very talented tutor in the MSIS department. Based on this homespun technology we believe that Cecil became the first web-based LMS in February 1996 - our first semester. (Sheridan , 1995) (Gardner & Sheridan, 2000) (Gardner, Sheridan & White, 2001 & 2002) (Sheridan, et al, 2002)

Cecil’s authoring tools were initially accessed via Citrix terminal services to provide a richer user interface for academics than was possible, at that time, in a web browser. From the students’ perspective Cecil used the popular browsers on a variety of common platforms. Based on Microsoft SQL Server installed on commodity hardware Cecil provided a reliable, responsive, and flexible environment, both for development and production. We began with desktop computers as servers and after a couple of semesters and with rapidly increasing loads migrated to a Sequent™ four processor system thanks to one of our champions, the Director of Information Systems. The use SQL Server was a matter of considerable industry speculation because Cecil was the busiest educational site in the country running on what some believed was a system inferior to Informix, Oracle, Sybase, etc. Keeping up with the browser wars and noting many students seldom updated their browsers was a challenge for the team. Now both academics and students use browsers to access Cecil’s resources.

One of the Cecil “founders”, an educational psychologist, requested that every transaction on the system be tracked and recorded. The other Cecil “founder”, an engineer and a systems and database architect, agreed. (Sheridan, 1998) The design specification also called for a response latency of less than one second. The security subsystems were extensible and therefore able to embrace all industry standards as they evolved. As a result we have the records of tens of thousands of students’ responses to on-line questions, access to Gradebook, contributions to discussions and the date and time they decided to read the documentation for their next assignment.

One of the foundation features arose from the belief that academics and students would seek to organise their resources around a taxonomy or body of knowledge. However much we attempted to convince our colleagues, the idea did not seem to gain acceptance. From observation the behaviours describe a person who rolls over a course from semester to semester and leaves the organisation mainly undisturbed and certainly not integrated across other related courses that are taught. It is only in recent years that taxonomies/ontologies have become part of many academics’ vocabulary yet we designed Cecil from the start to integrate a taxonomy and to relate all assignments and assessments and other learning resources to the taxonomy – in effect to embed the taxonomy and the graduate profile at the same time in the interests of life-long learning. (Figure 1) (Sheridan, 1997) (Sheridan & White, 1997) (Ronchetti & Sant, 2007)



**Figure 1. Bodies of Knowledge**

We implemented rubric marking as an integrated feature of the Gradebook with the result that markers could be assigned groups of students, work from the same criteria submit their grades remotely and ‘on time’. (White, 2002) Further analysis could plot markers performance in comparison with others to compare their interpretation of the rubrics and adjustments could be made before the results were released and feedback sent to students.

Through data mining we discovered it was possible to cheat during a supervised laboratory based quiz even though the questions were shuffled as well as the possible answers. We also proposed how the LMS could be adapted to inform the supervisor when online behaviours were suspicious. (Sheridan & Witherden, 2004)

Instructors experienced a very high work load in monitoring discussion forums in large enrolment classes. As a result we discovered an application that was designed to graph SMS was useful in visualising discussions quickly to determine the quantity and quality of student activity. (Sheridan & Witherden, 2006)

Students were often asked to complete on-line surveys but the response rate was disappointing. We found students would respond to incentives and that students who answered surveys about the quality of teaching were actually the better performers. (Sheridan & Kan, 2007)

Complaints about the quality of students' written assignments and projects led to some speculation about when the given assessment was undertaken. Our results discovered the students did not download the assignment documentation until very close to the date it was due. On the other hand assignments that required students to peer-review each other were completed in half the time allowed. (Sheridan & Jenkins, 2008)

Over this time we learned that the best way for us to implement an LMS was to use an Extroverted Learning Facilitator (ELF). Candidates were selected for their extroverted, self-starter personality, demonstrated academic talent in a given discipline, and computer literacy. ELF's became a remarkable group of people who visited academics and assist them in understanding how Cecil can be used most effectively in their discipline and specifically in their classes. "No one should under estimate the power of an ELF". (Sheridan, 1999)

## **Basic functionality: Gradebook**

Grade book, the cornerstone application within Cecil was designed before Cecil as a stand-alone MS Access application. It records assessments and non assessments (such as milestones, attendance) of a student or group of students within a class. It was possible to set up a template of assessment types such as labs, mid-semester test, project and final exam and to assign weights to each of the events. These could be 'rolled over' from year to year with the result that Departments were found to gradually standardise their class delivery & assessments.

An audit trail of all transactions within Cecil was part of the initial design. When marks are entered each is tagged with the user's ID and time stamp. A change in marks requires the entry of a comment to justify the change. These changes are summarised and sent to the teaching team to ensure any changes are noted by those in ultimate authority.

Other features included 'plussage', 'agrotat', did not sit (DNS) and 'x best out of y'. These later features significantly reduced the workload of the lecturers who had large classes with the result that there were a number of compelling reasons to use Gradebook even if other aspects of Cecil were unattractive. The return on investment (ROI) for some of these features was outstanding. In fact ROI has been one of the central motivations in creating 'round trip' solutions. (Phillips et al, 2004) (Moonen, 2005) (Kirkpatrick & Kirkpatrick, 2006)

An improved Gradebook is now under development which will integrate assessment creation, links to taxonomies, and assessment results whether OCR, peer assessment, team-based or output from rubric / criterion marking applications. Information will be presented using visualisation tools to assist students in understanding their results in comparison with their peers, and academics in understanding the validity and reliability of their instruments.

## **Basic functionality: Assessment**

The most important contribution an LMS can make to teaching and learning is the provision of feedback.<sup>1</sup> Cecil was designed with this service in mind and so from the beginning had a variety of assessment questions each capturing the response as well as the time stamp of the response. Cecil provided multiple-choice, weighted multi-right, and random number / word embedded problems and was adapted to provide criteria-based assessment as well (White, 2002). Feedback may be provided in a number of ways so that formative and summative assessment could contribute to learning events as well following the final exam. To the extent that academics provided on-line assessment and imported off-line assessments, Cecil is a repository for the strengths and weaknesses of tens of thousands of students through out their time at the university. It was this design that contributed to the vision of life-long learning and the institution's potential role for prompting professional 'continuing' education with mass customisation for each student. (Sheridan & White, 1997)

The assessment engine was written in Borland's Delphi and used the Excel engine to compute or parse the questions in real time. Given the millions of questions provided by Cecil the robustness of this design is amazing. With the demise of Delphi programmes a solution was sought and QuestionMark™ was selected two years ago. Unfortunately QM tools appeared underdeveloped for tertiary level academics but version 5 has promise.

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<sup>1</sup> Hattie (2009) provides a meta analysis with specific emphasis on 'what works' Petty (2009) quickly followed with his book using evidence based finding to support teaching & learning decisions. Both Hattie and Petty identify 'feedback' as a major, positive contribution to improvements in learning.

## Core systems then, now, and implications for the future

Over the past 15 years there has been a continuing concern about ‘sizing’ the LMS to meet expected demands – often building in a matter of hours to completely challenge the engineering design. In the beginning we created multiple servers and adjusted the load of each server to provide optimal response times. Continued vigilance was the ‘secret’ to excellent response times as the art of load balancing was learned and applied. The rule of thumb we adopted was to build a system three times the usual daily load. The real impact of students can be observed in Table 4, and some sense of what drives this activity was noted in a paper on procrastination. (Sheridan & Jenkins, 2008)

Historically the up-time of Cecil was nearly 100% and been maintained although we transitioned from desktops to IBM 6600 series, to current virtualised servers. Storage began with low cost RAID followed by Storage Area Networks (SAN) with fibre optic plumbing as Cecil became viewed as ‘mission critical’ for the university. Team Cecil maintained a wariness with regard to plugging into central systems following their discovery that money spend on fitting gigabyte communications within the Cecil domain was frustrated by a 10 mbps connection to the university backbone which itself was running at <5%!

Virtualisation technology is now a seemingly stable solution for optimisation of hardware investments – as multiple operating systems each running many applications can run on one CPU. Thus each operating system has its virtual machine. It is certainly an economical solution that will be pursued given the logins and hits for 2009 (Table 1). Note that the learning materials are still primarily Adobe Acrobat files (PDF) and MS Office files, File Type Analysis (Table 2) and the File Size by Type Analysis (Table 3) indicate the creeping threat of large files, often videos – which academics may upload to Cecil and subsequently compromise Quality of Service. Our current solution is to capture the most significant assets, lecture archives, and place these on specialised media servers. We are also cautiously observing academics as they take advantage of approximately 50 television channels through UniSat and e-cast with the ease of use tools found in Office 2010. (Collie, Shah & Sheridan, 2009)

2009	Number
Max concurrent logins (15 min)	2561
Max concurrent logins (60 minutes)	4516
Max daily logins	39527
Max weekly logins	206807
Page hits per hour	188,874
Page hits per day	1,828,766

**Table 1.** Logins & Hits for 2009

File Type	%
PDF Related	46.49%
MS Office Related	46.27%
Binaries	1.89%
Images	1.37%
Text	0.95%
Video	0.86%
Flash	0.82%
Compressed Files	0.82%
Audio	0.45%
Unknown	0.08%

**Table 2.** File Type Analysis 2008

File Type	GigaB	%
MS Office Related	34.0	38.14%
PDF Related	30.0	33.67%
Video	9.5	10.65%
Flash	8.5	9.53%
Audio	2.5	2.86%
Binaries	1.9	2.15%
Compressed Files	1.6	1.82%
Images	0.9	1.00%
Text	0.1	0.10%
Unknown	0.1	0.09%

**Table 3.** File Size by Type Analysis 2008

## The challenge of social networking

Both academics and students requested chat rooms and discussion boards to fulfil the need to exchange opinions, have debates, leave messages, etc. Through the use of a succession of commercial products we failed to deliver the functionality and educational setting required. For example, we believed if assessment of contributions needed to be credited we needed tools that would aggregate each student's contributions, manage threads so that merging could occur, feature photographs or ensure anonymity if necessary, search through threads for common themes, etc. In the end we built our own discussion system to meet the requirements. Of course with hundreds of classes and many with huge enrolments we needed a means to assign students to smaller groups so that social interaction had some usefulness. Along the way we applied a strange product called PieSpy to provided a way for academics to visualise discussions quickly to see if any significant interactions were being made. (Sheridan & Witherden, 2006). Given more than 2 million 'readings' in 2009, the collaboration feature of Cecil is important. At this point we are now implementing the collaboration features of SharePoint (2007) with anticipation for the known improvements in SharePoint (2010)

In a somewhat oblique entry into social networking Cecil negotiated an arrangement with Vodaphone in 2000 to send short text messages to students who were willing to register their mobile numbers. The announcements in Cecil were abbreviated to fit the viewport of a mobile phone. In the four months the feature was available 400,000 txt messages were sent by Cecil advising students of changes to their assignment dates, lectures, etc.

## Where to from here? - Microsoft Office SharePoint Server as an LMS foundation

For the first time in the authors' experience, spanning more than thirty years, we now have a system that bridges both academic and administrative interests. We believe we can leave the 'back-end' to a vendor and build the features and functions into it that the academy desires. The opportunities as we see it are to have authentication control over every part of the system based upon the roles of the individuals concerned. Document management is assured with versioning and access controlled. Staff and students will have personal websites, wikis, blogs, and portfolios without huge administrative problems. Staff and students may form sub-groups, invite others to participate, integrate their email, project plans, discussions, RSS feeds, etc. without undue difficulty. SharePoint 2010 and Office 2010 will appear the same through common and bridging interfaces. Location independence will be possible for our MBA and part-time students. We can have joint viewing (chat), discussions - asynchronous learning. Team-aware calendaring will assist in coordination. We can organise libraries of resources: documents, media, and links for classes or teams. Academics can 'drop in' to see how things are going anytime, from anywhere. In effect we can create environments that are aligned with the real-world working conditions.

We also plan to introduce workflow solutions to cover assignment submissions, criteria marking, and feedback. Administrative tasks such as pay sheets have already been implemented with no paper passing between teaching assistants, supervisors and the department managers. We look forward to solving other time consuming tasks.

At this point we have two years of experience in delivering several classes via the SharePoint crafted LMS. Features of Cecil are been gradually provided in a SharePoint context through the familiar web-based interface in

parallel with the current Cecil functions. Web 2.0 services are being provided simultaneously to other applications within the university. Software developers are beginning to see the advantages of a layer of high abstraction on which to deliver solutions.

Throughout this process we have been determined that our ability to capture transactions and subsequently analyse our data is not impeded. Fortunately there are hundreds of academic institutions who are building web parts, web objects and general functionality. Based upon what we know about educational institutions in the USA and UK there should be a lively exchange of designs, templates, patterns, workflows and consultants! No institution needs to remain captive to a single LMS vendor.

## **Planning & building for tomorrow**

A recent Educause *Horizon Report* lists the trends likely to make a significant impact on education over the next one to five years. (Johnson, Levine & Smith, 2009) Taken as a whole these will guide our LMS design for the future. The key trends are summarised as follows:

- ✓ Increasing globalisation and its effect on our work, collaboration and communication.
- ✓ The notion of collective intelligence and how we think about ambiguity and imprecision
- ✓ Games as learning tools and how this should influence teaching & learning
- ✓ Visualisation tools to make information more meaningful and insights more intuitive
- ✓ Mobile phones and applications that increase their utility

Issues arising from these key trends and identified as providing critical challenges to education are therefore:

- ✓ Formal instruction in key new skills
- ✓ Students are different and the curriculum is not
- ✓ The conduct of scholarship and research needs to innovation and leadership
- ✓ Measurement and formal assessment
- ✓ Expectation that mobile devices will be used to deliver services.

*Developing new skills* – while it is generally believed that the millennium generation is highly skilled in using contemporary technologies we have been assessing first year students for 15 years and can confidently state our students have the minimum levels of skills based upon their perception of what they need to know. (Sheridan, 2005) The majority of academics as a group have not progressed past their understanding of MS Office 98 and are urgently in need of upgrading to take advantage of the integrated features of MS Office 2010 and SharePoint 2010. Given the same interface and multitude of features available an academic can literally create their own LMS building on Cecil's Web 2.0 services. Our library tracks staff and student utilisation and confirm that the digital collections, that are world class, are not used to the extent possible if the academics possessed advanced skills in information retrieval.

*Modifying the curriculum* – As noted earlier, the learning materials currently lodged in Cecil remain the basic \*.doc and \*.pdf media and the ratios have not changed significantly over the past years. We have used the university's strategic development grants to create an enviable menu of multimedia drawing from 50 television sources and providing scheduled and archived services. The uptake is much lower than one would expect leading us to suspect that the instructional delivery is not changing to meet students' expectations. We are about to launch a new media service that provides discussion and chat features embedded on the time-line of the media object. These features will apply equally to recorded lectures as well as to other sourced media. We are hopeful this enriched environment might stimulate its acceptance.

*Recognition for innovation and leadership* – The benefit of having an LMS that time stamps every 'transaction' is the data mining potential to report on the effects of innovations in on-line delivery. Many of the references provided in this paper are indicative what is possible. Now given the adaptability of SharePoint, our design philosophy is to quickly match the most popular third party software so as to keep the 'customers at home' and in that way better understand how such developments as "social networking" can be embedded in the learning environment. A recent example involves archiving lectures using Camtasia Relay but ensuring the streaming and downloading events are all captured too. Our findings provide an insight into how, when and where students use lecture recordings. We are

also able to provide lecturers with up to the minute reports on the popularity of their lectures, apparent preparation for exams, and recommendations on how to better design and deliver their lectures. (Collie, Shah & Sheridan, 2009). This solution has already generated research output for academics in Marketing and Accounting & Finance.

*Building a portfolio of learning* – A design goal for Cecil was to provide a taxonomy for the academic to organise their life's work and for the student to build as they progress through university. At some point we believe these taxonomies will be shared at some level of formality. In Figure 1. the idea was to have available professional bodies of knowledge (BoK) as well as the curricular BoK and personal BoK. The richness and accuracy of the personal BoK incorporating written work, digital collections, academic and peer reviews, and personal reflections must surely be a more accurate than one hour mid-terms and a three hour final exam. SharePoint provides a feature to build taxonomies; in the meanwhile Sharepoint XXL has been trialled with success.

*Ubiquitous services for life-long learning* – e-learning is now to be delivered via m-learning? The growing popularity of sophisticated mobile phones and netbooks with 12 hours of operational life is simply another phase in the development of anywhere, anytime continuous communication services. (In our own institution 'clickers' will give way to the use of cell phones for capturing student responses. ) The 'cloud' is now providing an amazing range of applications and memory options. Clearly, whatever feature or function may be lacking on one's personal device will be available via client access to the 'cloud'. The overarching principle for educational technologists should be to not only provide the best possible learning environment but to also capture / create the richest possible archive of activities surrounding the use of these systems and applications. It is through our understanding their use that we can accurately plan for the future.

## Final thoughts

Computer supported learning (CSL = Cecil) remains our goal – in other words, the emphasis will always be on 'learning' over 'management' e.g. LMS. In the past 15 years the focus has been on 'listening' and then attempting to deliver on the requests. The continuous, evolving change in platform technologies often delayed the range and improvements in features and functions. We now see many opportunities through the adoption of SharePoint or any other equivalent platform that will allow us to address enterprise level improvements in teaching & learning and specifically to empower staff and students to adapt it to their needs.

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