ABSTRACT
This paper is a primer for the instructor who wishes to employ TEL in the classroom in an institutional environment which has not adopted TEL on a global scale. The judicious use of TEL can lead to something we call the virtual classroom, superior to the traditional classroom and not restricted by physical or geographic boundaries. The paper also provides a checklist of do’s and don’ts for TEL development that the authors have found useful.

KEYWORDS
TEL, Online learning

1. INTRODUCTION
This paper has three themes: [1] An instructor can adopt TEL to improve teaching/learning effectiveness without waiting for wholesale institutional conversion [2] the pedagogical value of every university lecture course can be enhanced by the appropriate use of technology. [8] Identification of development guidelines useful to help avoid pitfalls.

The model of knowledge transfer used for centuries as the cornerstone of university education has been the on-campus lecture. However, the pure lecture has been discredited by almost all the pedagogical literature as the least effective model of learning. Twenty limitations are identified [2].

The question is relevant of why we still use lectures at all in post-secondary institutions. Lectures still dominate the university scene. There are two principal reasons. The first is economics. The lecture remains one of the most economical modes of instructional delivery.

Interestingly, today using TEL to do lecture capture and webcasting is seen as the new great cost saving tool [22]. This strategy is often shortsighted. Successful internet delivery systems do require large infrastructure costs to properly develop. E-learning on a shoe string budget often results in a degradation of the learning environment [19]. Courses which are just converted to Internet delivery without modification of pedagogy get low student ratings. Courses which properly utilize the features of TEL are well received. There is another economics argument to deal with. Most costs associated with lectures and lecture halls are what accountants would call fixed and sunk.

The second and perhaps more formidable reason why universities might resist abandoning the traditional lecture is that there is staunch resistance to any organizational change [10]. Teachers themselves are more resistant to teaching innovations than are students.

It is very clear that student performance can be enhanced when the Lecture is supplemented with TEL [8]. One of the reasons for this that TEL is a good tool for facilitating interactivity [26]. Few courses in university environments exist today without some form of TEL supporting the course. This can run the gamut from the use of overhead and slide projectors to courses delivered completely online to geographically remote students.

The gold standard today for an institution to push the TEL envelope is to adopt a commercially hosted learning management system such as Desire to Learn [7] or Blackboard [11]. Some universities are attempting to use do it yourself open architecture platforms such as Moodle [3].

When there is an institutional TEL framework, most of the choices are pre-specified for instructors. This paper addresses the issues that face an instructor who wishes to employ TEL without the support of an institutional TEL framework….in other words….a do it yourself TEL primer.

2. THE COURSE WEBSITE
A component of courses today, most university servers provide server capacity to mount a course website. At a minimum, these act as repositories for announcements, course outlines, email contact addresses and course notes. Gone are the days when knowledge of html coding, FTP file uploads are required. Today drag and drop is the order of the day. Most universities provide some type of shell to promote uniformity and drag & drop capability. At York we moved from HTML websites to IBM Learning space [18] to IBM QUIKR [35], and are now experimenting with LMS systems.

It is still possible to create a course website without institutional support. FLASH is the ultimate product for website design and has a lengthy learning curve. There numerous FLASH emulators for the neophyte. For
instance, one such program is Coffee Cup [6], which produces Flash type output using plain text. It is theoretically possible to use the social networking media as a host. Although unorthodox, there is no reason why a website cannot be a Facebook page.

The most cost effective method to gain access to a full featured website to use the resources provided by the textbook publishing industry. Most of the big publishers today provide a website to accompany their texts.

3. THE TEXTBOOK

There is less and less justification for using hard copy paper textbooks in 2013. To start with, paper texts are not ecologically friendly. Second, students should not have to carry 20 pounds of textbooks back and forth to campus everyday when all of their learning resources can reside, or be accessed through their laptops. Third, the cost of paper based texts have become prohibitive. It is not out of the questions for low volume paper textbooks to cost more than $200 US. The average cost for an e-book is about $60 US. Fourth, the e-book is more pedagogically friendly. It supports multi-color graphics too expensive for paper books. It can be linked to the course website and can be made interactive. Revisions can be made by authors/instructors on the fly and students can use the annotated book as their notes. E-books can contain hotlinks to port students to other web resources. E-books can be accessed by mobile devices such as book readers/Iphones and Ipods so students can learn anywhere at any time. An e-book can be published as a password protected website within your institution, from the publisher’s website or downloadable from Amazon or I-Tunes. If you produce an e-book it is very likely you will synch this material to other TEL resources as well.

One of the biggest and most exciting advantages of the e-book is the opportunity to include multi-media content that supplements the traditional lecture content. It is very time consuming to work problems in class but students benefit from seeing the instructor’s verbal flow of logic as these problems are solved. This speaking our loud working of problems can now be captured by desk top publishing and added to the e-text or course website as a valuable ancillary resource.

4. THE LECTURE

The ideal lecture is composed and delivered from the film studio. You only have to watch one educational show on PBS television or the National Geographic channel and the inferiority of the classroom lecture is apparent. While the cost and effort to create a studio lecture is high, one they exist they can be reused over and over. Most importantly, students can view the lecture when they want, as often as they want and fast forward to the juicy parts. The canned lecture is a central feature in the virtual classroom.

However, this can create a real issue with university administrations who impose teaching load requirements that must be met solely by appearance in a lecture hall. We eventually dealt with this issue by turning the 3 hour lecture into a voluntary tutorial. Instead of 36 hours of lectures, and tutorials run by T/A’s, you have lectures available on demand on the website and 36 of hours of tutorial by the professor. A Socratic Q and A dialogue typically ensues. There is also more time for relating real world examples to enrich student understanding. Traditional lecturing is not performed. It takes some courage to switch to this mode of teaching but once tried it is addictive.

Most instructors who convert to TEL tend to begin with straight lecture capture from the classroom, but later gravitate to more sophisticated lecture content [9]. Classroom capture is a good start. It does allow repeat viewing by students and random access to content. At York we use Mediasitelive [30], Camtasia [12] and Tegrity [27]. We are planning to try D2L also. Others exist. We do not recommend audio capture as it is not amenable to random access, although some audio podcasts for smartphone use are often appreciated by students in commute to campus mode. To create a film studio lecture requires intense planning and upfront investment of time by the instructor. Cost is not the biggest issue since most universities have underutilized facilities and staff who will gladly support such initiatives. There is a second issue with the film studio lecture. What if there are multiple instructors or what if there is course rotation by instructors. Sharing and course migration issues have to be addressed and dealt with collegially. A third issue is copyright. If university resources are used to produce lectures then they might want to claim copyright belongs to the university. Some instructors would view this as untenable. A less ambitious but still worthy approach is to film a traditional lecture in the traditional lecture hall and save it for re-use or alternatively to create a desk-top lecture.

There are two key guidelines for “canned” lectures. The lecture should be repeatable by the student (allow repeat viewing) and the lecture should permit random access for efficiency.

The latest trend in learning is modularized content [25], [15] where content is broken into bite sized chunks much smaller than the traditional chapter. The key features of this approach are its compatibility with objectives based learning [3], and its support for self-paced learning [5], [16]. Modularized content also facilitates tailor made course syllabi and desk top lecture production.

If a three hour lecture is divided into 18 ten minute vignettes, these are easily produced using desktop software. Both Camtasia [12] and Tegrity [27] support this. These can be superior to content captured in the lecture hall because of the ability to post-production editing and add transition, music and other enhancements.

5. LECTURE MATERIALS

In theory, a lecture hall student should never have to take pen to paper because listening and writing are not
congruent activities and there is often data loss in the attempt. Microsoft ameliorated this issue many years ago when they introduced Power point. Lecture slides can now be put on the course website. Students have the choice of viewing on their laptop or downloading to a printer. Either way the slides form the backbone of the student note taking exercise and all they have to do is make annotations as the lecturer speaks. Today the majority of students no longer even print these slides as they bring laptops to class.

Many publishers provide slides with their textbooks but these are tedious and a recipe for failure. We have never seen a successful lecture when someone uses borrowed slides. The power of slides, tuned to the instructors own psyche, is always evident. The personal touch can bring sterile material to life. We make these available to students as a additional learning resource, but they are never used as the basis of a lecture.

6. TESTING

TEL provides both the biggest advantage and biggest shortcoming to the virtual classroom. There are two purposes of testing in academic courses [32]. One is to provide student with performance feedback and the other is to provide the instructor with performance feedback. The former is well suited to the e-environment, but the latter is not. The problem with e-testing for exams hinges around control [24]. The academic integrity of a postsecondary credit course requires assurance that the student writes exams in supervised environment without unauthorized aids. For this reason exams still need to be held in supervised environments.

However, term work is often relegated to e-testing even with the control issues simply because it is normally a small percentage of the total grade and there is pedagogical value to the students doing these assignments. All submitted work is of course run through a plagiarism scanning protocol. We employ Turnitin and it has reduced cheating [36]. It is also good practice to use search engines to attempt to buy assigned papers online. It is amazing how often and how quickly they show up, especially on sites not well policed such as Craigslist [37]. We have used a commercial website called Lyryx [17], where we load the quizzes and a randomization algorithm ensures that each time a student signs on, the numbers in the question are changed. This deters copying and collaboration. Many textbook publishers provide a similar service. Often if you adopt the publisher’s text the service is free or the testing center can be used standalone for a fee.

One of the advantages of producing an e-book is that these quizzes can be built right into the text book. We now have done this for one course and others may follow suit. In order to give incentive to students to complete these weekly assignments but not have to worry about the control issues we have said that ten percent of each exam will be drawn from this question data base. These quiz engines typically provide instantaneous grading and feedback can be programmed into the answers.

The gold standard in e-testing involves branching. The student response determines where he/she is ported next and the pace of learning is tailor made to each student’s abilities. There are numerous commercial websites that can provide e-testing with these features. Capitivate [4] is one such example.

There was research some years ago to deal with the control issue in delivering exams by Internet. For instance, key stroke monitoring can give a signature for the keyboardist that is identifiable. Web cam monitoring has been tried. These methods have not turned out to be cost effective or foolproof but experimentation continues [29]. In our courses we have both on campus and distance education students. Distance education students are required to have a local notary public or justice of the peace supervise the exam taking. If there are sufficient numbers in one geographical site we arrange for a local educational institution to host an exam. We generally limit the unsupervised component of course testing to 10% of the course grade to guarantee academic integrity is not unduly compromised. Testing is clearly the weakest link in e-learning.

7. TUTORIALS/LABS

Every large lecture should be supported by tutorials and web-based tutorials are easy to mount. We use bulletin boards type chat rooms with threaded discussion. We offer these in addition to campus drop in sessions and students are welcome to migrate back and forth. The bottleneck and limitation of chat rooms is typing speed. At one time we tried a more sophisticated tool called IBM Sametime [23] that allowed the tutorial leader to take control of student computer screens and also allowed video chat using web cams and mikes. It was a magnificent teaching tool but we discontinued it because of bandwidth issues. We expect to have another look at this software soon. Using webcams and this type of software to allow real time voice chat is orders of magnitude better then text based chat rooms and comes close to the ideal of the virtual classroom.

8. EMAIL

It goes without saying that email has had a profound influence on student/faculty communication. E-mail has largely supplanted office hours and also facilitated both larger classes and distance learning. The problem with email is that it seems to actually empower students. They are willing to communicate more often and at greater length than when office hours was the contact mode. Email traffic can overpower an instructor. On of the authors teaches a course with 2,000 students annually and a filtering system was employed to keep traffic to a reasonable level. Course related questions go first to T/A’s. Those that cannot be answered at that level are pushed on to the instructor. Questions involving
computing issues are first filtered through techie help at computing services.

One control issue with email is viruses, especially when attachments are involved. We require all students to use a university supplied email account which does auto scanning.

Now email seems to be declining in favor of the social media (facebook and twitter). The social media has become so important to learning that we are planning to offer a course in it as an essential management skill.

9. INTERACTIVITY IN THE CLASSROOM

This is where the instructor can be cutting edge and push the envelope. Research shows that the average attention span of a university student is between 15 an 20 minutes, which does not interface well with a 3 hour lecture. Interactivity is the technique by which students are engaged in the dialogue so they ‘refresh’ their attention span and stay engaged. Interactivity has a second benefit. It gives the instructor timely feedback on whether students are getting the material and gives cues to modify the lecture plan if needed. The lecture becomes a dynamic instead of static exercise.

Typical modes are breakout groups, hand held response systems (clickers) [20] and WIFI laptops. Microsoft is now offering software called the Interactive Classroom [21] which helps interaction and collaboration between educators and students by enabling the creation of classroom polls using PowerPoint, and sharing content with students using OneNote [21].

Synchronous white boarding is being increasingly used and one such example is a program called MBone [31]. Yet another form of TEL interactivity is the clicker [20]. These devices allow polling during the lecture and do provide a degree of interactivity. If nothing else they are useful to keep the attention span problem manageable. The cost of these devices has come down to about $35 US and we will be requiring students to purchase these next year.

10. CONCLUSION

The TEL environment is so rich today that the virtual classroom is a real possibility. Tel enhancements to the course website, textbook, lectures, testing, tutorials, and most importantly the classroom are all available today from desktop publishing type software at a reasonable cost. This trend will continue. The traditional lecture and traditional physical campus will continue to decline as a teaching paradigm.

While experimentation by individual instructors is encouraged and is even fun, an institutional approach to TEL is still preferred. Learning management systems hosted by external companies are gaining remarkable acceptance. These LMS obviously have significant licensing fees and are beyond the resources of the individual instructor.

In the virtual classroom, the course escapes all the traditional physical and geographical boundaries. More importantly, learning occurs using paradigms that todays students are very comfortable and adept at.

APPENDIX: GUIDELINES TO GOOD TEL DEVELOPMENT

Instructor or institutional?

Ideally TEL adoption is done at the institutional level. This creates synergy of talent resources and produces a single institutional web look that is reputation enhancing.

Pitfalls and Misconceptions and Things to Look Out For

• TEL does not guarantee budgetary savings. Planning should start with an assessment of what level of infrastructure can be supported. There are authoring costs, development costs, licensing costs, bandwidth costs and help desk costs to consider. How much money is in the kitty? Do you want a barebones or gold plated model? As a adage, TEL should be adopted for its pedagogical rather than economic benefits.

• Web authoring issues need to be decided. This includes compensation for authoring web materials and release time. The issue of copyright has to be decided. Challenges to academic freedom especially in multi section courses have to be dealt with. Successful TEL at the institutional level typically reduces the degrees of freedom of individual instructors. It is posited that TEL adoption will face more hurdles and challenges in a strong union environment which traditionally is preoccupied with minimizing changes to work conditions.

• Is the pipe big enough? The information conduit has to be expanded. Sufficient bandwidth needs to be purchased such that information flow is kept at reasonable speeds. Most institutions we know of are facing a severe bandwidth crunch and that is why the move to externally hosted learning platforms is accelerating.

• Its 24/7 or bust. A distance education program based on TEL has to have a 24/7 helpdesk. Students in different time zones all need attention. Servers cannot be allowed to crash for more than a couple of hours. No such thing as being down for the weekend.

• Faculty buy in and Administration buy in. The relationship with the faculty association or union has to be thought out. This may have a profound influence on TEL development, especially if change in working condition clauses are present. The collective agreement will have to be rewritten to interface with TEL practices. Equitable teaching load provisions have to be developed. An internet course with 1,000 students should be equivalent to teaching how many on campus courses? Some campuses have come up with the concept of equivalent
unit of work that can be employed to measure teaching service or research productivity. Equally important, tenure and promotion guidelines have to be revised to reflect the different work challenges and achievements of a TEL environment.

• Not all courses are equally amenable to internet mode. Content based TEL courses are easier and cheaper to design than analytical problems courses where process must be demonstrated.

• Standardized interface or no? Should this be subcontracted out to commercial purveyors such as D2L or Blackboard, or is the host shell going to be developed internally?

• Is the University wired? If TEL is going to be used in campus lecture halls are they wired for such. Does the campus use WIFI?

• Be prepared for student empowerment. Students will treat courses like Twitter accounts and email traffic will increase exponentially. The ideal is still a response to students within 24 hours so some type of filtering mechanism will have to be designed.

• TEL implies multimedia. No point in developing a TEL interface to scan the dog-eared yellowed instructor lecture notes. Students are sophisticated and demand a FLASH type environment.

• Tel needs a sympathetic Dean. There will be glitches during development and students run to the

Development Guidelines

The following guidelines appear to have universal applicability:

• Be clear on objectives

• Centralized development less problematic and tends to result in a more professional product. A uniform interface to the outside world is better for image.

• Development standards should be codified, voted on and enforced.

• Create tech support as a separate entity. Students need this and it should not be linked to courses or instructors.

• Off the shelf software is normally less expensive and more reliable than custom software.

• Course management software is the heart of TEL. Do not choose solely on price. Some vendors have a reputation for bait and switch. Low entry fee when the platform is introduced and then in subsequent years fees escalate.

• Increase faculty buy in with a two pronged model. Some instructors will adopt TEL with gusto, others have to be dragged kicking and screaming. Some salesmanship may be necessary and there should be support staff to coach the faculty who are computer illiterates.

• You get better buy in and a better product in institutions where TEL is recognized as a legitimate branch of faculty research. Historically pedagogical research has been treated as second class and this mind set needs to be changed.

• Consumerism also applies to students. Solicit their feedback and keep the in the loop as to development milestones and development glitches.

• An institutional culture with a commitment to change is helpful. Software usually has a product life cycle of about six months before a better version or product appears. Regular technology updates are needed.

• A different level of TEL is needed for supplementing on campus lectures and to create a true distance education program.

• Hard to ignore student proclivities to use social media. They expect things such as Facebook, Youtube, Twitter and Linkedin to be part of their daily life so if your course incorporates social media it produces a greater comfort level with students.

A good summary of development guidelines along with toolkits to assist self-managed development can be found on the JISC Infonet, 2012 [13].

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