# Online Learning for the Forest and Timber Industries

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**Summary**

Online learning offers advantages for all levels of training and development in the timber industries, from new recruits at technician level to chartered professionals. Learners and employers both value the flexibility it affords, while educators value its pedagogic capabilities. However, the creation of online courses remains an expensive and time-consuming process. Small one-off courses are typically uneconomic, but partnerships and economies of scale can reduce costs and make online short courses viable. Most universities and colleges have technologies and competencies in place to develop and deliver online courses, but industry involvement is essential to ensure the suitability of content and course structure. It can be difficult to achieve an effective partnership but the benefits make it worthwhile. This paper outlines the experience gained from two projects at Napier University.

## 1 Introduction

The forest and timber industries are important to the economy of Scotland and have been identified as a core part of the Scottish Government's strategy to deliver economic, social and environmental aims, particularly in rural areas [1]. However, a combination of recruitment difficulties and varying employer commitment to workforce development has resulted in skills shortages in the sector [e.g. 2,3], which are limiting growth at a time when the timber frame industry is booming [4] and forest outputs increasing [5].

Concerns about assuring the competencies of technician grade staff, the transition from British Standards to Eurocodes, and the general requirement for continual professional development for engineers has lead to industry bodies and policy makers calling for better access to training and development opportunities. However, there are challenges involved in ensuring that these education and training opportunities are viable for the provider, and meet the needs of both learners and employers.

There are several education and training providers currently active in the UK providing a variety of courses across the sector. Many are now recognising the potential of Internet technologies but are adopting different approaches with varying levels of impact.

This paper does not discuss good practice for online teaching, or the application of learning technology per se, as these are well covered by specialist journals and conferences. Rather it is concerned with the actual implementation of online learning courses for the forest and timber industries.

Courses for industry cover a broad spectrum ranging from short seminars of an hour or so to specialist qualifications that involve weeks of work, and that are rigorously assessed. Some courses are practical for manual workers while others, for professional and management staff, are more cerebral. Courses can be explicitly aimed at imparting the necessary knowledge and skills for a role, while others are more about personal development. There is no simple, catch-

all, term that is universally recognised for such courses and so, for simplicity, they will be referred to in this paper as being 'short courses' for 'workforce development'.

Computer aided learning (e-learning) can also take many forms, including the enhancement of face-to-face teaching, but the term 'online learning' is used in this paper to mean, specifically, distance learning over the Internet. The advantages afforded by this method of learning stem from both the distance learning, and computer aided elements.

## 2 The advantages of online learning for workforce development

Online learning particularly benefits those who find it difficult to access traditionally delivered learning opportunities because of constraints on participation such as time, location and the nature of their work. This is a particular issue for Scotland as many of the training opportunities that presently exist are delivered in the South of England. Most of the companies in the forest and timber industries are medium, small or micro sized businesses. For such companies, it is often not economic to send a member of staff away to attend a course. There is not only the expense of the course and the travel, but also the cost of not having that member of staff working. It is perhaps for this reason that many employers regard staff development to be 'too costly' or 'taking too much time' [6].

In addition to this, many of the face-to-face courses that are available are short, and designed as one off stand-alone events with no regard to other courses. This means that someone attending a number of courses on a subject is likely to find they cover more or less the same ground. This is frustrating and inefficient for the learner and a waste of money for the employer. With the application of online learning courses can be made available at any time to a set formula, making it easier to design courses into a modular framework. This allows education and training providers to rationalise their own provision, but to also work with other providers to offer a more useful portfolio overall.

When short courses are delivered away from the place of work employees miss out on the opportunity to apply what they have learnt while they are actually learning. In contrast, online learning can easily facilitate this, allowing learners to implement what they are learning, discover their problems, and ask questions while the instructor is still available. Asynchronous learning is possible allowing learners to progress at their own pace and to commit blocks of time that fit around other duties. Furthermore, online learning can develop transferable skills in the use of computers and the Internet, as well as in self-directed learning and information gathering.

Once set up, online learning can be an efficient and cost effective mode of delivery for course providers. Indeed lower level courses can be designed in such a way that instructor involvement is merely limited to monitoring the course. Instructors can make their contributions from any place at a time that suits them, allowing delivery to be collaborative.

However, compared to traditional face-to-face methods the initial development costs for online learning are huge. While it is often possible to get by with little or no preparation for a face-to-face course, an online course requires considerable time and effort up front. Any shortcomings are readily apparent, and might not be easily corrected once the course is running. Nevertheless, online technologies do allow the creation of learning objects and activities that genuinely enhance the learning experience and, if done well, the expense of development is a good investment.

Few short courses are actually assessed against properly formulated learning objectives, or indeed feature any form of practice. For face-to-face courses the lack of time often simply does not permit this. Here, computer aided learning provides huge advantages as it allows summative and formative assessment to be carried out in a way that puts learners, who may well have been away from a formal learning environment for a considerable time, under less pressure. Importantly it allows an immediacy and detail of personal feedback that is impossible by traditional modes. This is, perhaps, the most readily realised benefit of online learning and online assessment and practice can be added to a face-to-face short course relatively easily.

## 3 Current developments in the UK

Until recently there were no online short courses available within the forest and timber industries, with companies relying instead on colleges and universities, traditionally delivered

face-to-face training, and paper-based workbooks for distance learning and self study. Much of this training is provided by companies for their customers, and therefore is as much about advertising products and services as it is about imparting knowledge and skills.

During 2007 Wood for Good, a generic wood promotional campaign, launched a library of eleven online short courses to promote the use of timber to architects [7]. These courses deal with the basics of materials technology and the principles of use and design and are aimed at encouraging greater use of wood in the building and construction sector. Similarly, many supplier companies who produce printed workbooks are now actively considering converting to electronic distribution and, ultimately, conversion to a fully online format. One (BSW) has already entered the field with an online short course on materials technology for its customers (Constructive Timber Online Learning).

To date, marketing has been the driver for the development of online short courses within the forest and timber industry rather than a strategic approach to workforce development across the sector. The courses do not carry formal qualifications, although some are recognised by institutions for Continual Professional Development (CPD).

There is hardly any coverage of timber in the formal education of engineers in the UK, although this is slowly changing as the profile of timber as a construction material rises. It was in reaction to this situation that, in 2003, the Centre for Timber Engineering was established at Napier University with funding from industry and Scottish Enterprise. One of its core functions from the outset was to provide both degree and short courses for the sector. It was soon realised that, in order to be cost effective for the university, these courses would need to share content and be offered to as wide an audience as possible. E-learning was identified as a method to achieve this.

Napier's Timber Engineering Online (TEO) project was set up in August 2004 with part-funding from the European Social Fund (ESF) in order to build capacity in the university to develop and deliver e-learning for the sector. During the 30 months of operation of the project two MSc courses were set up, piloted, and made available for distance learning through the Internet ('Timber Engineering' and 'Timber Industry Management'). During the project, the possibilities of offering parts of the MSc courses as online short courses was investigated and in December 2006 a further project, called Timber Education to Industry (TEO2I) was set up, also with ESF support, to develop and deliver short courses online within a year. A total of £700k was spent during these two projects and they proved a valuable learning experience involving a variety of subjects, teaching styles and educational levels. It is that experience that informs this paper.

## 4 Challenges and requirements

In essence, the challenge in developing online short courses is reconciling what industry wants, with what education and training providers would like to do, within the economic reality, and whilst aligning with overarching set goals set by policy makers.

In response to Government policy there have been recent moves towards common standards of competence across the sector framed by 'National Occupational Standards'. These combine with the drive for lifelong learning and portable qualifications to demand greater quality assurance, assessment and accreditation within short courses for workforce development.

Employers are, understandably, more focussed on their own needs and they require short courses to be a worthwhile investment in the short term. In essence this means courses providing the knowledge and skills it takes to do the job and not much above that. They seek learning that can be available as and when it is needed and that will fit all types of learners. Employers demand courses that are low cost and low input (both time and effort) and do not require communication between learners. They are generally willing to have in-company mentoring of learners, but are reluctant to standardise this through training of the mentors themselves.

Where professional instructors, colleges and universities are involved, their concerns are that short courses should be effective at fulfilling the learning objectives, and that there is proper quality assurance of the teaching and the assessment. The view is a more long-term one, looking for deep learning and broad-based knowledge together with development of extra transferable skills. Unlike employers, the pedagogy experts tend to prefer collaborative and investigative learning approaches that require synchronous learning and significant cognitive load.

Over and above these factors, the forest and timber industries have certain characteristics that require special consideration. Most of the businesses are of small size, and employers, generally, do not value workforce development, preferring instead to get skills from labour market. The challenge is therefore not simply one of making courses available, it is also one of raising employer commitment. This, itself, could be assisted by online learning by providing employers with the management tools necessary to see how workforce development can help the profitability of their business.

There are indeed skills and training shortages but the demands are diverse and the industry relatively small. This means there are low numbers of potential learners for given courses, especially those higher level courses for professionals and managers. Education and training providers therefore need to recoup the costs of course development and delivery by also making them suitable for a wider market (e.g. general construction) or to keep costs low (e.g. by using content that already exists and that can be adapted for online delivery and reducing the need for online instructor involvement).

There are many trade organisations and representative bodies within the industry and each has its own priorities. Recently, moves have been made to rationalise this and set a common agenda for education and training across the sector, but it still remains a difficult task to work with all the various stakeholders. Many of these organisations are run by committee that meets only a few times of the year, meaning that timescales run at vastly different speeds between stakeholders and education and training providers.

A general idea of the training needs of the UK forest and timber industries was gleaned from an online survey conducted in 2005 [8]. Both employees and employers were surveyed and the results showed that 60% preferred online delivery with just 13% preferring purely paper based distance learning. Training was seen to be needed in a wide range of subjects on a range of educational levels. Employers stressed a need for training at technician and operative level. Predictably, demand for training from employees was higher for professional grades than for technical staff.

# 5 Elements of online learning

There are three key elements to online learning, namely the technical infrastructure, the pedagogy and the content.

## 5.1 Technical infrastructure

Aside from the Internet itself, online courses require technology infrastructure for delivery and management. This is known by a number of different names and acronyms around the world, but in essence consists of two interoperable components:

1) The system that the learner uses to access the course materials through which communication is facilitated (a virtual learning environment, VLE)

2) The wider supporting infrastructure, including the databases of information about the learners and their progress (a Management Information System, MIS)

Unless courses are to be provided freely and without restriction there must be a system of access control.

The standard approach to online learning is to use the Internet as the mechanism for delivering the VLE to the students. This VLE could be proprietary software (e.g. Blackboard), free open source software (e.g. Moodle) or a bespoke system. With this approach the technology can do everything from learner registration and taking of payments to hosting the course, delivering the assessment and tracking the students. This approach works best on a large scale, serving many courses, as it is expensive to set-up and maintain, even with free open-source software.

An alternative approach is to make use of the so-called ‘Web2.0’ technologies that have grown up in recent years. With this, the Internet itself is used as the VLE. Services such as video sharing websites, blogs, forums, chatrooms, social networking sites and wikis, many of which are free, can be used to support teaching and learning activity when used in combination. This bare-bones approach can be inexpensive when used at small scale, but it can be confusing to

those learners who are not familiar with these systems and there are issues around security, service and intellectual property that need very careful consideration.

Another approach, which is gaining popularity as the Internet gets faster, is to use a combination of video conferencing and instant messaging. Some software (e.g. Elluminate LIVE!) is specifically designed for online teaching and adds many useful functions such as remote desktop viewing and an interactive whiteboard. This method allows a course to be taught much as it would be face-to-face, but requires learners to be comfortable using the technology and relies heavily on connection speed and reliability. Some educators are even experimenting with virtual worlds (e.g. Second Life) to create even more immersive virtual classrooms.

A fourth approach is to simply create educational material and make it freely available on the Internet for people to access and share. There are file sharing websites and online repositories that can be used for this, removing even the need for the training provider to have a server. The intention could be to provide materials for learners to find and use directly, or to provide resources to support intermediary trainers in the workplace. If an overall increase in volume of training resources is the objective then this is a good solution, but it might not necessarily mean in increase in the quality of workforce development. It also requires learners to take the initiative with their own learning.

However, it is important that the development of online courses is not driven by the novelty of technology and what can be done with it. Rather it should be used selectively and wisely to achieve the objectives. It is particularly advisable to avoid the 'bleeding edge' and to stick with tried and tested technologies to avoid risk.

### 5.2 Pedagogical approach

There are, essentially, two pedagogical approaches that can be used for online short courses. The first is the teacher-led approach based on a tightly defined curriculum broken down into packages. This is highly suited to short courses for workforce development because it works well for asynchronous leaning undertaken in short bursts. Also, because it is predicable, much of the instructor's role can be automated by the software.

The second is a social constructivist, learner-led, approach. With this, it is the interaction between the learner and the instructor, and between learners, that leads on to the desired learning outcomes. This is a method of teaching that is known to work well at higher levels of learning in engineering (principally as project and problem based learning) and is similar to how people learn informally in the workplace. Online learning is very effective at facilitating research and discussion and recording it for later analysis, but this method places heavy demands on the instructor in the delivery of the course and is not well suited to asynchronous learning.

However, the distinction need not be so clear cut in actual implementation of an online short course and a blend of approaches can be used. Indeed one advantage of online learning is that it can, potentially, offer a learner the choice of approach that suits his or her own learning styles. Much of the best practice literature on e-pedagogy is focused on what is best for the learner, but in the real world the choice of approach must be a compromise that also fits the requirements of the employers, the instructors and the relevant professional organisations and industry bodies.

The chosen approach must also fit within the technical limitations of what is possible within the budget. With industry preferring asynchronous, any time, learning and pedagogy pointing to synchronous collaborative learning, the decision can be a difficult one. As with the technology, it is advisable to avoid novel approaches and to stick with familiar, tried and tested, methods.

### 5.3 Learning objects

The content in an online course can be thought to consist of different parts known as learning objects. These can be any kind of format, from simple text to complex interactive multimedia. Meta data can be attached to these learning objects that gives information about how they are to be used (e.g. level of learning, learning time, topic areas, and rights of use).

Learning objects are typically smaller amounts of content than would be covered by a learner in single sitting, so while it is necessary to think about the structure of content when authoring a course it is not actually necessary to think in terms of learning objects. However, it is useful, in

the longer term, to give some thought to how materials created for one course can be reused and adapted for use in another.

Creating learning objects that can be freely reused is not easy. There are competing standards that are intended to ensure interoperability between learning platforms, and none are yet fully comprehensive. Of these SCORM is perhaps the best known. The key thing is to build in the level of interoperability that is actually required. Slavishly 'future proofing' everything can cripple development, and the anticipated future benefit might never be realised.

Large developments do merit a systematic and structured approach to learning objects, especially where they are to be shared between education and training providers, but even for small developments it is vital to keep track of intellectual property for all the content in a course and to have some method of letting instructors know what learning objects are available to use.

# 6 Implementation

When embarking on the creation of a new online short course there are certain considerations necessary to ensure that the course is marketable and the development is cost effective.

- The needs of learners, instructors, employers, professional bodies, trade organisations and other stakeholders need to be researched and a suitable compromise determined. This should be confirmed by piloting, at least on a small scale.
- The curriculum needs to be agreed, including the explicit statement of the educational goals, the level of learning, the prerequisites, and the method of assessment.
- The current institutional practices and arrangements need to be investigated to check that development, delivery and maintenance of the course is feasible. Without the backing of senior management, this is unlikely to be the case.
- A project plan should be created with both resource and business models to determine if the development, delivery and maintenance of the course are financially viable overall. This should include assessment of current and potential competitors.

The best opportunities to keep the costs of development and delivery down lie in partnerships. Larger projects benefit from economies of scale, and collaborations can remove the need to duplicate materials and infrastructure that already exists. Industry already has training materials and knowledge in one form or another and is in a better position to know what is actually needed. Colleges and universities have the technological infrastructure, pedagogic expertise, and the ability to award formal academic credit as well as CPD hours. This way a system of courses can be created that is accredited by the industry, but that is independently quality assured and can lead into transferable qualifications. However, partnerships can be difficult to secure and the potentially thorny issues of intellectual property need to be addressed at the outset.

General purpose VLEs offer many useful functions and are common in colleges and universities, but their complexity can be a disadvantage. Much of their functionality is not actually needed for online short courses and learners will likely need to be presented with a stripped-down interface to avoid immediate bewilderment. They are also normally configured more for computers on-campus rather than off-campus, and some technical issues can arise due to the different hardware and software used by the online learners. The alternative is to use in-house expertise, or employ contractors, to set up a bespoke system, which can be both expensive and problematic to maintain.

One thing that is easy to overlook is the MIS that supports the VLE. A university or college may have VLE up and running for supporting its normal academic programmes, but that does not necessarily mean that this can be immediately used to support the delivery of short online courses to external learners. If fees are to be charged, there needs to be a system for taking payment and this needs to be linked to a database of learners that keeps track of which courses they have access to and over what period. The registration of learners into the VLE needs be possible at any time, regardless of the academic calendar, and it needs to be possible to un-register learners when their access entitlement has ended. Unlike the courses for normal students that can be renewed for each session, the online short courses need to persist from year to year. For this reason, many some colleges and universities are looking at setting up a separate VLE for commercialised short courses.

Technology is, of course, only part of the challenge, and the short course must also be authored and taught in line with stakeholder requirements. This requires an e-pedagogy specialist, a subject specialist, a learning technology specialist and an industry specialist. However, the development team is unlikely to work well if these are all different individuals. For example, the author needs to have an awareness of learning technology to understand what can be done, and the learning technology developer needs some subject knowledge to be able to create materials to author's specification.

In all of this, it is necessary to take a long view. Technologies develop swiftly, stakeholder requirements change and content needs to be kept current. A maintenance strategy needs to be thought through, and business models made over an appropriate timescale. Many online learning developments are based on lump sums of money from grant income, but fail to be sustainable as all the attention is focussed on the short term resulting in courses that are too costly to maintain.

## 7 Case study

The Trussed Rafter Association (TRA), with support from the insurance industry, surveyed its members in 2006 with a view to devising a standardised and accredited system of courses for the whole trussed rafter industry in the UK [9]. They found an appetite for formal training for new entrants and junior design technicians. Mindful of the expense of time away from the workplace, and seeing the successful implementation of online courses by WTCA in the US, it was recognised that online learning should be investigated.

At the time, the TEO2I project was being set up at Napier University and it was agreed that a pilot course could be set up as a demonstration and as a trial partnership arrangement. While grant funding was advantageous, it was not without its own problems. The conditions of the ESF funding meant that activity had to be focussed on Scotland, while TRA, as a national organisation wanted to work at UK-wide level.

The course was developed jointly with TRA outlining the content as they gained more of awareness of the capabilities and limitations of online learning and Napier experimenting with different approaches to implementation and workflows. Together the course was piloted and reviewed and the feedback incorporated. As a result of this working arrangement the course was ensured to be relevant and high quality, but it also expanded beyond the original concept and the development took significantly longer than originally estimated.

The finished course has been credit rated at 40 hours at the level equivalent to the first year of university bachelor's degree, and is to be accessed through TRA and delivered by Napier University through WebCT Vista. It has been designed for asynchronous individual learning with very little instructor input. Some parts of the content are workplace specific, and so activities to be carried out with an in-company mentor have been included into the course.

The course covers terminology, reading drawings, structural mechanics, estimating and the formation of roofscapes, and in all of these, online technology allows activities that enhance the learning experience for the target audience. For example, terminology is practiced through games, roof forms are shown through 3D objects that can manipulated, and structural theory is explained through interactive simulations rather than complex equations.

Content is linked to selective release criteria based on self assessment activities to ensure that the learning objectives are met, and to help the learners manage their progression through the course. The assessment is fully automated, but also highly randomised so that the learner is presented with different problems every time. This uses variations on multiple choice and calculation questions making full use of ability to link questions to images. This proved highly suited to this type of learning and even the often overlooked jumbled sentence question type can be used to good effect (e.g. In the UK, trussed rafters are most commonly made from European whitewood (marked WPCA or E/W) with some made from European redwood (marked PNSY or E/R). However other types of timber can be used, such as Southern Pine.)

## 8 Concluding remarks

From the point of view of employers online learning offers huge advantages for workforce development. It allows their employees to access courses without the need to set aside fixed blocks of time, or to travel away from the workplace. It can facilitate self-paced asynchronous

learning allowing learners to work through the course whenever it suits them. It can also support a community of learners working through a course together at the same pace, wherever in the world they might each be. At also allows learners' progress to be monitored and for employers to confirm that the learning objectives of a course have actually been met.

For education and training providers, online learning can open up existing learning materials to a new audience. For universities and colleges this can allow income to be generated on top of fees from standard student intake allowing courses with smaller cohorts to be economic. This is particularly relevant for courses related to the forest and timber industries where there is pressure to close programmes because of dwindling intakes.

However, it is not the technology itself that should drive the learning experience. Rather, it is the educational goals and needs, together with economics, that should drive technology use. Technology should be used where it adds value, and simpler, more tried and tested, methods of distance learning should not be over-looked. In general, the application of online technology for teaching and learning should follow its adoption by society at large. It is both cheaper and easier to employ technologies that are riding on the back of large scale developments once they have gained public acceptance. The latest generation of 'Web2.0' services offer particular advantages in this respect. It is also crucial that online course authors and instructors be properly trained. This training should not just be in the use of the technology, but also in the pedagogy of teaching online. It is important that they have a sound underpinning of educational theory, and experience of face-to-face teaching does not necessarily translate to an ability to teach online.

Online learning is expensive to develop, and within all this creativity is paramount. With imagination, basic technologies and techniques can be used in sophisticated ways; saving both time and money. Imagination is also required in setting up of partnerships which can greatly improve the viability and effectiveness of online workforce development in this relatively small sector. Finally, it is extremely advantageous for the course authors and instructors to be actively involved in the conversion of learning materials into online form. This allows them to be able to maintain the course when it is finished, but, crucially, allows them to understand the potential, and limitations, of multimedia technologies for online learning.

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