Supporting the attainment of professional attributes in a work-based learning programme

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Abstract: With the impending change in the higher education landscape within the UK there is a greater need for flexibility and innovation in the delivery of degree programmes. One flexible and innovative form of programme delivery is the work-based learning platform. Additional academic guidance is imperative for students undertaking a work-based learning programme due to the flexible nature of the programme. However in providing this academic guidance and support it places additional demands upon both tutor and student. Hence creative approaches which alleviate these demands are required to facilitate conversations between tutor and student as well as that from student to tutor. This paper will describe the current approaches used and how these demands are particularly important within the context of the personalised nature of work-based learning. The contrasting characteristics with classroom based teaching will be highlighted. In particular this will include the authenticity and those factors which relate to the strong ownership of the context by the student within this mode of learning.

Introduction

This paper is written from the context of those delivering the work-based learning (WBL) MSc Professional Engineering programme at Northumbria University that was borne out of the Engineering Council’s Engineering Gateways Project in 2007. This project was created under the previous government’s long-term strategy of enabling the higher education (HE) sector to develop employer led provision that would deliver the skills that are required by the labour market (Kelly, 2006). This aim resulted in the creation of the Engineering Council DIUS (Department of Innovation, Universities and Skills) funded “Gateways to the Profession” initiative which was delivered as the Engineering Gateways Project. The purpose of this initiative was to provide a flexible pathway to students interested in becoming a Professional Engineer. Another objective of this initiative was to facilitate effective engagement between employers and higher education institutions (HEIs) to plan and deliver a WBL learning programme that addressed the needs of both local and national economies.

The MSc Professional Engineering programme offered at Northumbria University is delivered entirely in WBL mode. It is a three year 180 credit programme which has a total of 12 compulsory and optional modules consisting of 10, 20 and 60 credit sized blocks. In their first year of the programme each student will engage, in their 1st and 2nd semesters, with 4 compulsory 10 credit modules and then select either one 20 credit or two 10 credit optional modules for their 3rd semester. In their second year of the program the student has the choice of selecting a total of 60 credits of optional modules to engage with over the three semesters. In the 3rd year the student will have to undertake one 60 credit compulsory project module.

The teaching and learning strategy takes an approach to student workload which in general results in a 10 credit module having a summative assessment of a 2000 word technical report, a 20 credit module subsequently has a summative assessment of a 4000 word technical report and the 60 credit module a 10-15000 word written dissertation. The programme and module learning outcomes of the
MSc Professional Engineering programme are mapped to the UK-SPEC competence and commitment standard for Chartered Engineers (CEng) (Engineering Council. 2011). This strategy was developed to achieve a timely balance of formative and summative assessment to fulfil the purpose of creating an engineering postgraduate programme that assesses both the learning outcomes and work competencies in one evidence based piece of assessment. The intention is that an engineer who enrols onto the MSc Professional Engineering programme will upon graduating have fulfilled the further learning requirement and all the UK-SPEC CEng competencies.

Work-based learning (WBL)

Marsick and Watkins (1990) have shown that the workplace environment provides good learning opportunities that may be described as informal in nature. The informal learning that occurs in the work place is due to the experiential, authentic and incidental learning which takes place through engagement with work activities. It has been reported that incidental learning produces tacit knowledge and practical intelligence that leads to professional success (Sternberg & Grigorenko, 2000; Sternberg, 2000). WBL is a culmination of both theory and practice that includes the acquisition of explicit and tacit knowledge in individual and collective situations. According to Raelin (1997) theory and practice modes of learning and explicit and tacit forms of knowledge are fundamental to the process of work-based learning. WBL recognises that learning occurs during practice and can happen when engaging with an appropriate activity. Theory when coupled with action produces a good approach to learning, further Schön (1983) describes practice as the method by which individuals attain and practice artistry. Work-based learning is greatly dependant on the practice that relies on explicit information/guidelines within the workplace and also the tacit methods employed daily in a particular situation. Explicit knowledge is articulated knowledge, expressed and recorded in formal language, therefore is deeply embedded in every-day engineering practice. Tacit knowledge however is not typically recorded since it is more action based within a specific context (Polanyi, 1966). Pleasants (1996) explains that this could mean that although individuals are knowledgeable in the practice they might not have the appropriate opportunity to elaborate on their practice.

Tynjälä (2008) explains that there are at least three modes of WBL which are:

(a) incidental and informal learning which occurs as a result of work,
(b) intentional learning but not formal learning such as intentional practicing of a certain task and
(c) formal on the job and off the job training.

Slotte et.al (2004) explain that formal education and planned learning situations can turn tacit knowledge into explicit knowledge by combining conceptual knowledge and the practical experiences which form the fundamental building blocks of expertise. Hence for work-based learning to be successful it should also incorporate formal learning (Hatano & Oura, 2003). This should include structured learning support and guidance, giving explication of knowledge and requiring conceptualisation that may be embedded within an academic programme through the use of project based approaches (Jäntti, 2003; Poelle et al., 1998). Therefore it is clear that for WBL to be successful it should have connectivity between informal and formal learning. Tynjälä (2005, 2007) suggest that this connectivity is achievable through the principle called integrative pedagogics. This principle states that theory, practice and self regulation should be incorporated in any learning situation. A pedagogic model of this principle is shown in Figure 1.

Theoretical knowledge is universal and is elucidated in formal written materials and lectures whilst practical knowledge is instinctive and tacit in nature. The diagram below shows the importance of the reciprocal relationship between theoretical and practical knowledge. Researchers have highlighted that professional education should include the conversion of theoretical knowledge in the context of a practical situation and the conceptualisation of tacit knowledge from practical experience (Leinhardt et al, 1995). Mediating tools (activities) such as those shown in the above diagram enable the learner to combine theoretical and practical knowledge together allowing the learner to extend their self-regulatory knowledge.
Self-regulatory knowledge including metacognitive and reflective skills is integral to this pedagogic model because it reaffirms the integration of theoretical and practical knowledge contributing to the development of professional expertise (Bereiter & Scardamalia, 1993; Bereiter, 2002; von Wright, 1992). Furthermore, Bereiter & Scardamalia (1993) confirm that formal knowledge is converted into practical skills when used to resolve practical problems and into informal knowledge when it is used to solve problems of understanding. An important aspect of WBL is that the learner should be supported through the provision of guidance and their learning should be facilitated. The ideal situation should be that each learner will have an academic mentor, workplace mentor and the three parties would meet and speak at agreed intervals. It is also advisable that the aim of the learning is related to the curriculum and to theoretical knowledge but undertaken as planned activities in collaboration with the needs of the workplace. This enables all three parties to create shared aims and objectives.

Stenström & Laine (2006) explained that the tripartite principle is important from a learner’s perspective in negotiating the learning aims and assessment of the entailed learning.

For WBL to work successfully it’s imperative that the learner receives feedback on their performance from mentors, academic and workplace. The workplace mentor will provide the learner with feedback on their performance in the workplace with regards to their informal learning experience. The academic mentor will however provide the learner with feedback on their conceptual knowledge and its interaction with their practical knowledge. It is recognised that the mentors especially the workplace mentors have the important role of supporting the learner’s learning within their individual workplace. However it should be noted that workplace mentors require pedagogical training to support these learners. Research (Stenström & Laine, 2006) has shown that workplace mentors with training experience have often expressed their feelings of inadequacies in providing appropriate guidance in learning and student assessment skills.
Work-based learning within the MSc Professional Engineering context

In 1997 the requirement of the educational component of CEng registration was raised to masters level to ensure the continued international recognition of UK engineering qualifications. Yet it was found that the majority of graduates were leaving full time education with a BEng degree (Seddon and Lock 2010) which has created a body of students who fall between the educational requirements of IEng and those of CEng. This situation does not serve these students well as they are actively engaged within gainful engineering employment and would therefore have to give-up their income to return to full-time study to acquire a masters award. This situation, combination with the support of the Engineering Council and the Professional Engineering Institutions, established the context for the MSc Professional Engineering programmes initially piloted at 4 HEIs under the Engineering Gateways project. The engagement of employers, PEIs and HEIs provides the necessary components of a suitable learning situation for the student with support from both an academic and professional mentor completing the context.

Hope and Barrington (2012) have reported the experiences of another HEI in relation to the progression of students. The experiences of the authors of this paper differ in relation to the management of the demands of the programme as the number of students accepted during the early stages of the programme was deliberately restricted. This has led to an interest in the effective use of feedback during the programme’s reflective review process rather than the issues identified by Hope and Barrington (2012).

Feedback to support the WBL learner

Feedback has always been considered as an important influence on the learning experience. However the effects of feedback are quite complex and are depended on:

(a) the feedback quality;
(b) learners’ goals and motives (Nolen, 1996)
and
(c) learning environment. It’s also reported that feedback might have an impact on cognitive (attention, strategies), motivational and affective processes and long-term effect on the recipient’s self concept (self esteem, control) (Vollmeyer & Rheinberg, 2005).

Research has shown that giving specific feedback has a direct positive effect on immediate and short-term performance (Ilgen et al., 1979; Luger & DeNisi, 1996). There is evidence that shows that specific feedback given to individuals when measured against their performance criterion produces higher achievements than just superficial feedback on their performance (Kopelman, 1986).

As a review and an auto-ethnographic study the authors of this paper have decided to focus predominantly on their personal experience of providing feedback as academic mentors to support the WBL learner.

As part of the teaching and learning strategy at the beginning of each module of the MSc Professional Engineering programme each learner is given access to the Virtual Learning Environment (VLE) to retrieve information regarding the module. Among the information provided to the learner is the assignment cover sheet which serves is a document outlining the learning outcomes, assignment instructions, assessment guidelines and submission dateline. Being a WBL programme the assignment will involve the work carried out on a selected work place project of the learners’ choice yet aligned to the aims of their individual learning contract. Typically a learner will contact the academic mentor who in this case will be the particular module tutor to discuss the suitability of the selected work place project for the assignment. After agreeing on the suitability of the work place project, the first item of formative feedback, the learner then begins to work on the assignment. Depending on the complexity of the work place project and the deliverables required from the assignment a learner on average can have approximately 6 formative conversations with the module tutor via telephone and/or email correspondence during the 12 week module duration. These conversations would typically be a progress update allowing for clarification of both student and tutor expectations. It is also used to provide formative feedback with a focus on feed forward into the final assignment submission. Typically the learner will contact the module tutor within the first 4 weeks of the semester to seek clarification on the deliverables of the module, hold discussions on the suitability
of specific aspects of proposed work place project for the assignment and discuss about the module tutor’s and student’s expectations from the module. In the subsequent 4 weeks the learner will possibly contact the module tutor to discuss their progress, request feedback on a submitted draft and seeking advice if they have any issues with their work place project. In the final 4 weeks of the semester, the learner will possibly seek feed forward advice on their partially or fully completed assignment or advice if the assignment cannot be completed on time.

From experience most of these module tutor and learner conversations take place with regards to clarifying the module tutor’s expectations, agreeing on the learning opportunities presented by suitable work place project, feedback on the partially completed assignment and practical assignment completion issues. Depending on each learner’s situation and the individual’s conscientiousness the majority of the conversations would normally take place in the first 4 weeks and final 4 weeks of a 12 week semester. Irrespective of the learners’ situation tutor and learner conversations nearly always take place in the final 4 weeks of the given assignment duration. This could be attributed to the nature of WBL which acknowledges the tacit knowledge of the learner by giving them the responsibility of critically reflecting on their practice and turning it into explicit knowledge. The tutor and learner conversations in the final 4 weeks are usually based around guidance of focusing the learner’s attention to creating a cohesive technical report which contextualises the learner’s tacit knowledge into explicit knowledge which addresses the learning outcomes of the module and its respective UK-SPEC CEng competencies.

These formative feedback conversations are where a WBL programme is very different from the traditional classroom based programme. This is because the learner assumes full responsibility for the contextualisation of their acquired knowledge and the customisation of their learning pathway. A WBL programme provides a culturally and historically different learning environment to the traditional HE learning delivered in a classroom. Classroom based delivery is seen to emphasise planned activities where abstract, general and formal knowledge in systematically delivered and individually reflected, whereas WBL, in contrast, is more social in nature, personalised, reflective, tangible and action oriented (Tynjälä et al., 2003; Eraut, 2004). WBL may also be seen as being based on the concept of communities of practice as espouse by Wenger (1998). Wenger explains that communities of practice are informal communities formed by people to work on joint enterprises at work and during their leisure time. This is crucial to the learning process in the work place because it allows the learner to interact and benefit from working under the guidance of a more experienced worker and to participate in the community of practice. By participating in these communities of practice learners share their knowledge, convey their meanings, develop their identities and advance their work practices. Hence one of the responsibilities of a module tutor is to provide guidance to the WBL learner to harness and package the learning experience gained at the work place into a technical report that individually meets each module learning outcome and respective UK-SPEC CEng competencies.

Due to the flexible structure of a WBL module the tutor and learner conversations are crucial to ensure that the learner may fully benefit from the opportunities of the personalised learning. These include comprehension of the tutor’s expectations and their use of reflection to meet the expected deliverables of the module in terms of evidencing both the academic and professional experiences. These feedback and feed forward conversations are greatly appreciated by the learners as they provide the link between their workplace attainment and academic attainment which are not easy to distinguish early in their programme. Some quotes from the students showing the importance of the tutor-learner conversations are “thanks for the information as this now makes more sense and I’m more confident on successfully completing the assignment”, “your feedback has greatly helped in pointing me in the right direction” and “your explanation has assisted me in selecting the appropriate work-based project for this module”. The tutor-learner conversations are specific to the learner and their particular work-based project. Depending on the situation and ability of the learner these conversations may be quite short in duration and frequent, or longer in duration and less frequent but they often develop from the tutor stimulating reflection. It is suggested that there is a particular opportunity for stimulating reflection obtained from the tutor not having the same experiences as the learner, for example as the technical content for a module is derived from work place experience then many conventions of professional practice will apply, for example where design codes will be applied. This enables the learner to be prompted to reflect on and question the suitability of, assumptions made by, derivation of or historical limitations of such design codes in a learning rich and fully authentic manner.
From a module tutor’s perspective the personalised nature of these conversations are manageable only when dealing with a small number of learners per module during the early life of the programme. However as the programme matures then the number of tutor and learner conversations can be reduced by using the VLE, for example by posting a list of frequently asked questions (FAQs), video clips of the tutor providing an in-depth insight of previous students’ experience of the module, making available a sample of “good” and “poor” examples of anonymously completed assignments and a road map showing a successful route to completing the module. It is also possible to utilise a discussion forum within the VLE for the learners to interact with one another although the students must be fully aware that the technical content of their work is often commercially sensitive in nature and that such sharing must be restricted to reflection on learning. This enables the learners to engage and exchange ideas among themselves with a focus on the learning rather than technical context which further enriches their learning experience. The nature of material made available to the learner must also accommodate the level of digital literacy and accessibility available to the student (Strachan et. al. 2011), for example workplace network infrastructure may hinder access to some content and in these cases alternative delivery mechanisms are employed which attempt to replicate the delivery component of the VLE. Another method that can be used to further clarify the module tutor’s expectations is by posting on the VLE a table showing the Level 7 descriptors for a WBL learner. An example of such a table is as shown below.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving</td>
<td><strong>Level 7:</strong> To independently solve complex problems which have incomplete or ambiguous information by applying advanced methods and tools</td>
</tr>
<tr>
<td></td>
<td><strong>Level 6:</strong> Complex problems are solved through the critical application of appropriate methods in stages to reach original solutions</td>
</tr>
<tr>
<td>Self evaluation</td>
<td><strong>Level 7:</strong> To apply critical self reflection to plan own learning needs for personal and professional accountability</td>
</tr>
<tr>
<td></td>
<td><strong>Level 6:</strong> To apply self reflection in identifying actions required to overcome weaknesses and compliment strengths</td>
</tr>
<tr>
<td>Use of information and resources</td>
<td><strong>Level 7:</strong> To undertake broad research activities in a timely manner with minimal guidance for both directed and independent study</td>
</tr>
<tr>
<td></td>
<td><strong>Level 6:</strong> To select and source own learning and research materials with limited guidance</td>
</tr>
<tr>
<td>Learner skills</td>
<td><strong>Level 7:</strong> To independently undertake complex tasks as a self learner and to demonstrate an understanding and aptitude for working with others including constructive negotiation and conflict resolution.</td>
</tr>
<tr>
<td></td>
<td><strong>Level 6:</strong> To work effectively in a range of situations through self-review and able to undertake a range of roles within a group under a range of constraints</td>
</tr>
</tbody>
</table>

Table 1: Level 6 and 7 descriptors for a WBL learner

The information contained within Table 1 clearly outlines the minimum threshold ability that should be demonstrated by a WBL learner engaging with a Level 7 programme. This information can be used as a guide by the learner to enhance their attainment of the required ability to show achievement of the highlighted professional attributes through contrast with the level 6 outcomes with which the learner has previously been engaged.

Having started this conversation with the WBL mechanical engineering students it is then necessary to develop the conversation from a focus on the technical substance of their submissions for assessment onto a reflective self-evaluation of their learning. In general this is not an ability which receives significant development on undergraduate programmes. It has been observed that the student will not immediately relate their learning on a particular module to the reasons for their studying that module identified within their initial learning contract. Reflection is, and self-evaluation
are, key components of identifying goals, organising ideas and planning future learning (Lester and Costley 2010).

**Conclusion**

Learning at work takes place when the learner participates in various working practices, collaborates with work colleagues and clients, whilst engaging new personal engineering challenges. This learning is cultivated by engaging with problem solving with the intention of utilising a theoretical understanding in a practical problem solving situation. WBL encourages learners to adapt to change and uncertainty and to be courageous in the workplace by taking on challenges to explore their creativeness. These are traits that are highly valued by current employers who are seeking employees that are good communicators with the ability to work independently and are highly motivated, determined and adaptable.

Formal learning in the classroom and WBL are opposites in nature but both are imperative for the advancement of practical and professional expertise. Researches (Eraut, 2004a; Guile & Griffiths, 2001) have stressed the importance of integration and interaction between formal and informal learning for the explicit and implicit knowledge that are pertinent to advancing WBL and the development of professional expertise. This is where the tutor and learner conversations and feedback and/or feed forward are important in bridging the gap between explicit and implicit knowledge. In general the learners’ valued tutor and learner conversations and used the feedback and/or feed forward to improve their learning experience. This confirms the findings summarised by Rowe & Wood (2007) where it has been identified that feedback is valued and that students want helpful comments from their tutors. It should however be noted that due to the possible exhaustive demands these conversations can place on the tutor the learner numbers should be kept small to allow it to be manageable and workable. In light of this new innovative ways should be investigated to allow the tutors to effect the learning experience of a greater number of learners with minimal demands placed on both the tutor and learner.

**References**


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