Numeracy Skills, Employability and the Role of the Education Sector
Developing Relevant Numeracy Skills at Work

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The Leitch Review of Skills, a major economic review of UK workforce skills, was published at the end of 2006. The review specifically identified the skills required to maintain the UK as a global economic force for the next 10 to 15 years. This has resulted in a big shift in policy, people and resources to focus on the delivery of skills training for adults in the workplace. There is a particular emphasis to up skill those people with skills lower than level 2, but now moving onto level 3. While many would agree the intention to up skill the workforce may be laudable, there is a great concern in the education sector that the outcomes are too narrowly focused on skills for work.

The focus on workplace learning and training has raised the question ‘what are relevant skills?’ and more specifically ‘what are the relevant numeracy skills for now and for the future?’ This article considers some of the challenges for the education and employment sectors when considering this question.

• Are the numeracy skills we wish to develop relevant for work now or to become equipped with skills to adapt to the future?
• Can the educations sector deliver the relevant skills, indeed do current teaching methods lend themselves to adapt to the changes needed? Do we need to consider new approaches to developing skills?
• Likewise do employers fully appreciate what the education sector is capable of offering? Indeed do we even have a shared understanding of the vocabulary needed to make the produce training that makes most of both sectors skills and talents?

Introduction

Defining numeracy as an essential skill to succeed at work is not contentious, what is more debatable is exactly what numeracy skills are relevant to work and what aspects of numeracy are essential to the concept of employability now and for the future. Concepts of employability continue to change in response to technological advances and economic development as a consequence the debate on relevant skills continues apace at an international and national level.

Central to this debate is the role of the education sector, as a whole, in workplace skills development. Is it to provide the economy with a skilled workforce or is it also to develop citizens to be able to fully engage in our cultural and social heritage? Is to support the current job market or is it to prepare the future workers for jobs that have not yet even been invented. Is skills development only relevant at FE level, at 14, or earlier? The ethical and moral debate on the reasons for skills development will, and should, take place within the education sector but not at
the cost of enabling people to develop skills to enhance their own and their families’ lives and livelihoods. The Education sector is, after all, the product of citizens and workers of the past and the preparation for the future.

If we agree that that the education sector has a role in life skills development, the challenge for that sector is to identify at what point skills support is needed for the workplace and how to deliver it. With changes in Government policy on Apprenticeships and Diplomas (World Class Skills: Implementing the Leitch Review of Skills in England, 2007) the education sector post 14 is now challenged to move from a more generic approach to learning and knowledge acquisition to consider contexts for learning. The interaction between aspects of Employment and Education sectors is being encouraged. Schools are confronting the 14–19 agenda with Apprenticeships and Diplomas; Further Education is practically being redefined by these new challenges and Higher Education continues to develop relationships with specific industrial sectors.

**Delivering Training**

Tensions between aspects of the industrial and education sectors often arise when employers want to concentrate on their core business and see the development of numeracy skills in their employees as something that school education should have already dealt with. If the education sector failed once to teach the relevant skills in school, how can employers be confident that they can teach the right skills for their business, a second time around in FE or HE? For the education sector the discussion is also around not just when but how best to deliver the skills relevant to the workplace. There is much research to identify the difficulties of transferring skills learned in classroom to the workplace setting (Coben et al., 2003).

The current debate on what are relevant numeracy skills for employment, often focus on the functional skills that are regularly used in the workplace. The lists, such as those identified in the CBI document Taking Stock: Education and Skills survey (2008), often include: percentages, ratios, odds and probabilities. While these skills are undoubtedly an essential part of the workplace skills base they do not necessarily give the complete picture. Most of these skills need to be adapted to particular contexts in order to support workplace practices.

Also in an increasingly technologically driven world are ‘doing percentages accurately’ enough? Or do we need to know when it is appropriate to use percentages, which percentages are relevant to the problem and how do we communicate the key messages about these percentage calculations in the most effective manner? In fact are the skills taught in maths classes sufficient to support employment now and in the future? Are there other skills such as communication and information processing as identified by Hoyles et al, called Mathematical Literacy (Hoyles, 2007), that are essential to make sense of the mathematical calculations in the technological workplace context. Dossey identifies the skills needed for citizenship as including:

> the ability to apply aspects of mathematics (including measurement, data representation, number sense, variables geometric shapes, spatial visualization, and chance) to understand, predict, and control routine events in people's lives (Dossey, 2007).

An SSDA report identifies that:

> Once learning is viewed as a complex, contextualised process, we open the door to a much more meaningful exploration of how knowledge and skills are developed, adapted, transformed and shared within the dynamic setting of the workplace (Unwin et al, 2006).
This more complex model of an interdependent set of ‘supporting’ skills in various contexts can include “on the job training “as an essential part of efficient skills development. Workers need to engage in learning taking place outside, as well as within, the classroom, as an essential part of skills improvement for their job roles (Braddell, 2007).

Research, backed by experience, also identifies the issue of language and the lack of shared understanding as a barrier to skills development when managers do not understand the dialogue surrounding skills development. When discussing underpinning language and numeracy skills Newton et al. found that

*Largely they (employers) articulated these as ‘communication skills’ or ‘customer care’ skill; less often they referred to ‘language skills ’ and ‘IT skills’. This does not mean that the language, literacy, numeracy and information Technology skills cluster is not required at work; rather, that supervisors and managers remain unfamiliar with this vocabulary* (Newton et al., 2007).

Now the skills debate is also impacted upon by the newly defined functional skills. The mathematical and the process skills identified include the ability to:

*Understand a situation, choose an approach to tackle the problem, formulate a model using maths, use maths to provide answers, interpret and check results, evaluate the model and approach, explain and analyse, apply and adapt to the situations as they arise* (www.excellence.gia.org.uk/functionalskills visited 21/06/08).

Questions remain for education and workplace sectors. Will the skills as defined above develop the workplace numeracy skills that organisations like the CBI are seeking? And will the education sector be willing and able to enable classroom learning to be adapted to workplace projects and problems to develop these skills?

In order to consider some of the complexity of the challenges for the education sector and workplace learning I have tried to develop a model that enables education and other industrial sectors to consider how they might consider the skills required and adapt their training to support numeracy skills development with the workplace.

The model, discussed later, tries to consider some of these challenges and identify where changes in approaches to training, understanding definitions of shared language or preconceptions may be essential to successful skills development. In fact is the education sector workforce aware of the challenges, are they ready to rise to the challenges and adapt to a more complex approach to work place numeracy skills development? Indeed is the qualification and assessment system also able to address this greater complexity.

At the same time are employers ready to consider these new problem solving skills as essential to workforce development. When most employers went to school it was a case of learning percentages and fractions- these were the Maths skills. Many may not see the purpose or relevance of the development of numeracy skills in context with other “support skills” as essential to their workforce to meet the changing demands of their businesses. Hence a list of numeracy skills may dominate, but not necessarily satisfy, the employers needs.
Workplace Numeracy Teaching Model

A model is used for identifying the skills needed to teach and learn numeracy relevant to the workplace. The axes represent a continuum of concepts, for example, the generic approach to skills development is at the opposite end of the axes to context driven skills and a particular mathematical product e.g. fraction calculation will be at the opposite end of the axes to a mathematical process of understanding, for example ratios and proportions, and its application to a variety of contexts.

The model was originally developed when reflecting on the methods used in a drug calculation used by nurses in a clinical setting. The example used is developed from the content for a training session for supporting Nurse Lecturers and Mentors to support trainees to develop their numeracy skills in a clinical setting. The participants were given the following problem and asked to write down how they would solve the problem.

**The problem:** You need to prepare an injection of 0.75mg of digoxin. The stock solution has 500mcg in 2ml. How many millilitres do you draw up? Show how you would carry out the calculation.

More than one method for calculation was identified in this exercise. The model below was used in the analysis of the methods written and discussed.

Diagram 1

Possible Model of Analysis for Workplace Numeracy

![Diagram of Workplace Numeracy Teaching Model](image)

**Method 1**

The standard formula used in nurse training when reading a prescription and then deciding the amount of drug in solution (the number of phials of medicine) to be administered to the patient is shown below.

\[
\text{What you want} \times \text{volume} = \frac{\text{What you have got}}{}
\]

This formula is learned by rote and specific to the clinical context, not transferable outside a clinical context and often not fully understood by those within it. This method is placed in the bottom left quadrant; context driven with a specific answer or product as the outcome.
Method 2
The mathematics for this calculation is based on ratio and proportion.
750 mg is prescribed but the medicine phials are produced in amounts of 500 mg. Hence the calculation below was carried out.

\[
\begin{align*}
0.5\text{mg} &= 2\text{ml} \quad \text{(concentration in one phial)} \\
0.25\text{mg} &= 1\text{ml} \\
0.75\text{mg} &= 3\text{mls}
\end{align*}
\]

To deliver 750 mg of the medicine the nurse will need to deliver 3mls of the solution, or 1.5 phials.

This is a proportion calculation that can be used and applied to many different contexts. (A common use of this approach is in the calculation of VAT). This calculation is transferable to many contexts and generic in its use so the calculation will appear in the top left hand corner of the model.

Method 3
Using the approach in Method 1 but not using any units. In this case the calculation could be reduced to a simple fraction, with no units and a simple number answer.

\[
\frac{3 \times 2}{2} =
\]

In this case the calculation would be placed in the top right hand of the model; generic (no units) and no context.

Method 4
This method resulted from the discussion that took place with the group of nurse tutors and mentors. The calculation could be described in words, in this case linked to delivering medicines and procedures used specifically in that hospital or organization. This would be placed in the bottom left hand quadrant. It was a process for calculating the medicines, but totally context driven.
### Diagram 2

<table>
<thead>
<tr>
<th>Numeracy Process</th>
<th>Numeracy Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion</td>
<td>What you want x volume =</td>
</tr>
<tr>
<td>linked to medicine</td>
<td>-----------------</td>
</tr>
<tr>
<td>dispensing amounts and hospital procedures</td>
<td></td>
</tr>
</tbody>
</table>

\[
\frac{3}{2} \times 2 = \frac{3}{2}
\]

#### Context driven

**Adapting the Model to Education and Workplace Contexts**

The model can be adapted so that the vertical axis represents the contexts of education and workplace, while the horizontal axis represents the function of learning from rote to problem solving. The model now offers a scenario to explore skills and knowledge, context and function.

The model in this way may also be used to identify teaching and learning approaches in different contexts and which may be considered most appropriate for a particular numeracy skill. For example, it may be appropriate to learn the generic skills for fractions at school but learners may be more open to ideas developed in a workplace/problem solving context to reinforce learning.

Thus teachers/lecturers may move around the axes to adapt approaches to learning. Considering the research and employers' contributions to the workplace skills debate it may also be appropriate for employers to consider whether they may wish to progress from the concept of ‘accuracy’ to ‘accuracy and application’. Enabling employees and employers to develop the language to discuss the skills needed for their employment and education.
The model can also be used to consider a change of approach may be appropriate for workplace learning too. The teaching and learning can move across the quadrants as appropriate. The use of the model does not seek to pigeon hole a particular type of approach, but rather to suggest the approach could be categorised, or thought of, in a certain way but also adapted to engage and motivate learners.

Work place training, position 4 on the model, may start with ideas from a particular work problem but can easily move across the axis to position 1 perhaps broadening the numeracy approach to other problems in the factory. Understanding the change in approaches a lecturer or teacher is using helps develop a more personalized methodology for the learner and the employer.

Traditional maths teachers may start at position 3 but can move to and from any of the quadrants. Moving from position 3 to 2 recognises the movement towards a more problem solving approach. Moving from position 3 to 4 recognises maths used within a particular context. Employers often start with skills for a specific product at position 4, like percentages, can quite quickly move to a more generic problem solving model to adapt the skill to other contexts of work, or changing quantities within work.

The model only seeks to recognise approaches and numeracy skills, it does not seek to make value judgements about approaches or create a hierarchy of value. It merely seeks to help reflect the skills, approaches and challenges that exist in teaching numeracy. The choices of where we start and finish on the axes are down to the professional judgement of the teacher/lecturer/trainer/employer.

References


