Tackling emergent needs
The Applied Technology Framework project

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This chapter describes the development and implementation of the Applied Technology Framework. This is a curriculum initiative designed to meet the needs of post-trade (or equivalent) workers in those industry areas where there is no existing culture of lifelong learning and where technological change is occurring at a faster-than-average pace.

In order to recognise the realities of learning through work and from others within a community of practice, the concept is based on an accredited training framework rather than on accredited qualifications. Underpinning this is the assumption that learning is not uniform or developmental; rather, that learning is shaped by the context and the learner’s interaction with this context. In addition, the outcomes of the learning are not necessarily known at the outset of the learning experience, as learning in such circumstances is expansive and unbounded.

The framework is still at an experimental stage and is being piloted within the precision manufacturing, plumbing and waste management industries. One pilot program has been completed and others have begun. The response of industry has been very positive, with enterprises volunteering to be part of the project and to pay for the experience—to the extent that there is an urgent need for professional development of teaching staff to enable the current demand to be met.

Introduction

The introduction of training packages in Australia, as the specification of training outcomes, has provided registered training organisations with a greater degree of flexibility in meeting industry enterprise training needs than was available under the previous system/s. Nationally endorsed training packages provide a specification framework which covers: the endorsed competency standards for that industry sector; the rules for the award of recognised credentials; and the standards governing the assessment processes.
leading to the gaining of qualifications. However, in a world characterised by rapid and continual technological change and the consequential merging of traditional industry and/or discipline streams, the flexibility currently enabled by training packages is sometimes not sufficient to meet enterprise needs.

By the time a training package has been endorsed, it has undergone an extensive period of consultation and development. While this might be said to have assured its validity, this process has not necessarily ensured its timeliness or its comprehensiveness. It is, like all such moderated documentation, a prescription based on past and present needs and does not cater for emerging or future needs. Within industry areas where the rate of change is comparatively slow, this is not problematic, given the facility for customisation. It is only in those areas where changes in work practice are rapid and ongoing or in newly emerging industry areas that this causes significant problems.

Planning and training for emerging and future needs is a difficult and risky task. Not only is it difficult to imagine the specific skills which might be needed, but it is almost impossible to train people for tasks which do not yet exist—using technology which has not yet been designed. Learning for the future must be grounded in preparation for future work and future developments.

The first stage of the Applied Technology Framework project has been undertaken this year by a team of RMIT University staff with the assistance of funding from the Victorian Office of Training and Tertiary Education. It is designed to promote new product development and aims to prepare post-trade and equivalent workers, who are already working in industry, for their future learning as well as to provide them with the additional skills and knowledge required now.

Aims of the project

The major objective of this initiative is to develop a recognition and curriculum framework which will facilitate the development and delivery of applied technology programs which:

❖ relate to one another and thus provide development frameworks which link to job and career structures within a number of industry sectors
❖ enable the lifelong development of design, process, project management and business competence as well as acquisition of current and emerging technical competencies
❖ allow for cross-sectoral skill development
❖ can be easily broken up into relatively short intensive programs to meet the needs of individuals and specific industry enterprises
❖ use mentoring, active learning approaches and reflective practice to integrate formal and experiential learning within the context of the workplace
provide multiple entry and exit points which enable them to be accessed in a variety of ways.

Workplace learning

Learning while working is increasingly essential if we are to keep pace with technological and organisational change and to contribute to the intellectual and social capital of our workplaces. While it might be argued that not all work results in learning—routine repetitive tasks once mastered are unlikely to result in new learning—much of it does (Barnett 1999, 2002). A lot of this new learning takes place in response to new or contingent situations where the learner must adapt what he or she knows to resolve an issue, solve a problem or learn to adapt in response to new organisational structures, functions, work systems or technology.

Workplace learning is a purposeful, dynamic activity in which workers interact with the work context—its people, culture, organisational history, work systems, processes, procedures, physical nature and emotional ambience—in order to better understand and work within it. As workers achieve this, they construct and reconstruct working identities and understandings. Workplace learning requires effort, and workplaces are by no means benign environments.

Much workplace learning is situated learning—taking place in specific contexts—and it is the ‘situatedness’ (Lave & Wenger 1991) of this learning and the learner which determines what is learnt and how it is learnt. New skills and knowledge are not learnt through memorising or internalising; instead, they are enacted by the learner as part of work practice.

Essential to workplace performance and learning through work are the affordances (or opportunities) to learn, which the workplace offers and the extent to which learners are able to influence this. As Billet notes:

... how affordances are constituted in workplaces, are shaped by workplace hierarchies, group affiliations, personal relations, workplace cliques and cultural practices, as well as the kinds of activities in which individuals are able or requested to engage. (Billet 2000, p.31)

Kim Kirsner (2002, p.18) notes that studies of surgeons in Canada found that surgical skill was positively correlated with practice in carrying out a particular operation; that is, that the more experience a surgeon had, the better s/he became at that operation. The surprising finding was that, as their performance improved, their ability to pass the examinations which gave them entry into their profession actually declined until, decades later, they were struggling to answer many basic questions.

A number of studies with fire-fighters, nurses and others have confirmed such findings. Because we learn from our work experience by enacting our learning within our practice, it is implicit (or tacit) knowledge and becomes,
over time, unconsciously embedded in our practice. We mimic the practice of our mentors and models without necessarily giving conscious thought as to why we are doing it.

While such tacit knowledge enhances our performance, it remains unspoken and, therefore, cannot be shared with others. It is only by reflecting on our work practice that we can examine the component parts and transform such implicit knowledge into explicit knowledge. This is important if we are to work collaboratively or to teach or train others. This was acknowledged by respondents of a situated learning research project (Down forthcoming) when one of them wrote:

*It is only through reflection of what we do, that we can identify how our practice is changing, what is new and what we no longer do. By rationalising these changes, we add to our theoretical understandings of learning and our work.*

(Research participant, cited in Down [forthcoming])

Thus, effective learning occurs through work and through the systematic reflection on that experience. Learning can also occur from others—either by listening to what they have to say, watching how they work or reading what they have written. However, learning is more likely to take place when active questioning and reflection occurs. It is the seeking-out of information and reflection on this which enables the learner to gain knowledge and make it their own by using it in their practice.

Bounded learning

Most of the learning we do is bounded learning; that is, the knowledge we are seeking is already known, there is an expert to guide us, and we know the outcome we are seeking.

Unbounded learning

When we are doing something new, such as exploring, implementing and using technology which is new to our workplace, then the outcome of the learning process will not be known at the outset; there is no expert to tell us what to do and we are creating new knowledge. This is unbounded learning.

The creation of new knowledge is usually a group process and covers all the ramifications of the situation. For example, when commissioning new machinery, the knowledge created is not just about how to operate the machine; it is about operating the machine within the context of the workplace and therefore includes the effect of the new machinery on production schedules, work flow, maintenance procedures and schedules, downstream workers, upstream workers, suppliers, customers, and, perhaps, industrial issues like a drop in overtime etc.

The Applied Technology Framework will entail both bounded and unbounded learning. However, it is the unbounded learning that will enhance
the enterprise’s competitiveness and the individual’s ability to work at the leading edge of technological development. It therefore enhances the individual’s value to the organisation.

The framework

When educators talk of their work, they often use the term ‘framework’. We talk of curriculum frameworks, theoretical frameworks, structural frameworks and recognition frameworks. Yet that does not mean we have a clear or shared understanding of what we mean by a framework.

The main objective of this project is to establish a way of accrediting a framework whereby learners have the capacity to access only those parts of the framework they need to have their current competencies recognised. Nationally endorsed training packages form a specification framework which covers the endorsed competency standards for that industry sector (the units of competency), the rules for the award of recognised credentials and the standards governing the assessment processes leading to the gaining of qualifications. These frameworks have now been augmented and given enhanced credibility by the creation of the Australian Quality Training Framework (AQTF). Training package frameworks provide the reference points for our current recognised vocational education and practice within Australia.

Qualifications framework

The frameworks which specify the required outcomes of training under the National Training Framework; that is, the set of all applicable training packages and the Australian Quality Training Framework, are an integral part of the Applied Technology Framework (ATF). However, the evolving Applied Technology Framework is more than just these two frameworks. It will also consist of:

❖ a nested set of qualifications covering levels IV–VI of the Australian Qualifications Framework. The qualifications, the Certificate IV in Applied Technology, the Diploma in Applied Technology, and the Advanced Diploma of Applied Technology will (it is hoped) be accredited by the Victorian Qualifications Authority by the end of 2004.

❖ a customised version of the Bachelor of Applied Technology which has been developed and accredited by Unitech in New Zealand with some assistance from RMIT University. The agreement with Unitech enables RMIT University to customise this program and accredit it within the provisions of the Australian higher education sector.

❖ a graduate certificate and a Certificate III in Applied Technology which is still to be developed. The aim of the graduate certificate credential is to provide a bridge into postgraduate studies and also to enable workers
with other qualifications to access the Applied Technology Framework. It is anticipated that the certificate III will provide an alternative pathway to a traditional apprenticeship in industries with no apprenticeship provision, or act as a bridging program with advanced standing into other apprenticeship programs.

These qualifications and the pathways between them provide an articulation framework which has been designed to meet the possibilities of career pathways for those workers committed to lifelong learning and whose initial training was a trade certificate or equivalent qualification. The research carried out so far for the plumbing, waste management and precision engineering industry sectors show these pathways to be diverse, and characterised by considerable movement between occupational roles. For example, an owner-manager of a small business may be contracted as a part-time paid employee of another business or act in a managerial role for a short time, as the need arises. The career progression of these workers does not follow a hierarchical pathway and is usually opportunistic rather than planned. It does, however, involve the development of considerable competence which crosses industry sector boundaries.

The qualifications and articulation pathways which are currently envisaged for the Applied Technology Framework are shown in figure 1.

Up to this point, the Applied Technology Framework looks like a fairly standard curriculum/recognition framework. After this point, the framework will begin to deviate away from the norm. This is also the point at which a considerable amount of discussion and political activity will be needed if the framework is to serve its intended purpose.

So what other purposes must the framework serve and what additional structures does it need to enable this?

Specification of learning approaches

The Applied Technology Framework has been designed for experienced workers with some pre-entry or co-entry credentials and experience of the nature of work and workplaces, and of different roles within them. Therefore, the framework must be able to recognise the current competencies these workers possess. So the framework must also be a recognition framework.

While there must be processes which enable the recognition of current competency built into training packages and the Australian Quality Training Framework, there is no methodology to enable this to be accomplished. One of the problems consistently noted in evaluations of the recognition of prior learning related to the difficulty and time involved in the process, as applicants for recognition did not necessarily know what skills they had or how to articulate these in the language of curriculum specifications (Wheelahan, Miller & Newton 2002; Bateman 2003; Clayton & McRae 2003).
Thus the core of the applied technology qualifications must enable people to recognise their current skills and knowledge. This requires the development of:

- the skills and habits of reflection on work
- the ability to assess skills against a set of criteria
- the ability to self-assess progress and outcomes
- the ability to make explicit one’s tacit knowledge through group and individual processes.
In addition, the key objective of the Applied Technology Framework is to enable its participants to learn how to approach unbounded learning situations, especially those concerned with being able to learn what is not yet known about technology—and which is probably not yet developed. Most of our current learning theory is specific to bounded learning (Engstrøm 1999). Theories of learning relating to unbounded learning are, as yet, only beginning to be developed. What is clear is that such theories will involve participation in the context where the learning is taking place, such as workplaces, and the ways in which learners utilise the knowledge they gain.

Not all learning methodologies will enable such development. Thus, it is seen as essential that the Applied Technology Framework specifies not only what is to be learned, but also the learning approaches and key strategies to be used.

Such approaches will be concerned with learning through work and learning through, and with, others. Such approaches will thus involve:

❖ situated learning
❖ guided workplace learning using both internal and external mentors and facilitators
❖ investigative and problem-solving learning in the workplace
❖ group learning and reflection
❖ individual reflection.

Access to resources

When teachers talk about the need for resources to aid their practice, they are commonly thinking in terms of specifically written learning resource materials or the specialised equipment needed for students to practise emerging skills.

Within the Applied Technology Framework, resources need to be understood in much wider terms. Given both the scope and the work-based nature of the Applied Technology Framework, the development of specifically written resources is both non-cost-effective and not appropriate.

Most workplaces contain, or have access to, a richness of resources for learning where the learning and the work are relevant. Such resources include:

❖ Workplace mentors: such mentors include both formal and informal mentoring. In some instances, some training may be needed to ensure that the workplace mentors understand their roles. Working collaboratively with institution-based learning mentors can achieve this.

❖ Standard operating procedures, equipment manuals, and documentation on work processes and procedures: in workplaces where these do not exist, they can be written by the participants of the programs as part of their learning, and are thus available for future participants.
Access to suppliers and other workplace support services and the resources they bring: working collaboratively with suppliers and other workplace support services not only adds to the richness of accessible resources and the knowledge suppliers bring with them, but it also gives participants one of the strategies they will need to use if they are to continue to keep their workplace competence current.

Workplace knowledge and culture: in any workplace there is a wealth of knowledge about ‘how we do things around here’. Much of this is tacit, but good workplace learning can be facilitated in order to bring such knowledge into the explicit domain.

Tools and equipment: having the right equipment is essential for a company’s productivity and competitive edge and so workers will learn how to use them through workplace learning if they are to retain their jobs. Thus, facilitated learning with respect to the use of equipment and tools within the workplace should be applied to problem-solving situations so that equipment and tools are used more effectively to minimise waste (of both time and material).

The only resources needed to be supplied by the teachers/trainers are a good understanding of collaborative learning, the ability to adapt to the learners’ needs and plenty of imagination and initiative.

Recognition of existing professional courses
A number of industry sectors have access to a wide range of non-accredited professional courses run by professional organisations, trade unions and by vendors and other suppliers to industry. Such courses range from attendance at field days or trade displays to formal programs run over a number of weeks.

Part of the Applied Technology Framework program’s charter is to recognise the outcomes of these programs. This is possible by mapping the outcomes of these courses against units of competency within endorsed training packages and, therefore, being able to assess such outcomes directly as recognition of current competency.

Where a course is run regularly, working with the providers of the course will ensure that it meets both the outcomes specified in the training package and the quality provisions of the Australian Quality Training Framework. A registered training organisation may delegate its assessment authority to the providers, and successful participants of the course be given credit transfer.

Recognition of non-training package outcomes
The problematic aspect of recognition under the Applied Technology Framework is the recognition of learning outcomes which are not covered by current training packages or accredited courses. Such outcomes will typically be the results of unbounded learning or bounded learning related to technology.
too new or relatively uncommon to have been included in the current versions of training packages.

It is envisaged that this might be achieved by keeping a register of those learning outcomes which are either deemed to be the subject of training package specifications in the future, or those which the enterprises or participants want to have recognised. The register would include:

❖ specifications of the learning outcomes in unit of competency format
❖ details of the attainment of these outcomes, including by whom, when, assessors’ details, assessment method (which would be available to participants as evidence for credit transfer or recognition of current competency appraisals).

Some of this information could be provided to the appropriate industry advisory body whenever the relevant training package is under review to enable the inclusion of the identified outcomes.

Reality of workplace learning outcomes
Currently, under the Australian Qualifications Framework, the outcomes of learning are presumed to be both hierarchical and uniform within a qualification; that is, all the outcomes of a certificate IV qualification are considered to be more complex than those of a certificate III qualification. When we look at the nature of work and the learning we do through work, this is an unrealistic perspective.

Our everyday learning covers a wide range of complexities, from remembering some fact or a person’s name (knowledge), through learning how to use our computers more effectively (application), or identifying potential or emerging problems (analysis), through to designing new processes or resolving system-wide issues (evaluation). We constantly move from simple to more complex tasks and back again.

Thus, when people learn through work (or life), their learning is not neatly packaged into hierarchical or developmental packages. They learn what they need and/or want to learn. Thus, one of the essential components of the Applied Technology Framework is the simultaneous recognition of skills from a range of training packages and a range of Australian Qualifications Framework levels. Workplace learning is multi-disciplinary and of varying complexity.

This means that the Applied Technology Framework must be able to recognise these differentiated learnings without participants having to enrol in a number of different qualifications simultaneously, and thus, possibly, incurring multiple fees and charges. This aspect of the framework, like many other aspects, will need to be negotiated with, initially, the Victorian Office of Training and Tertiary Education, and subsequently, with other state and territory training authorities and the Australian National Training Authority. Such negotiations have begun but are still in an early formative stage.
Summary of the framework

Thus, a key objective of the Applied Technology Framework is the development and establishment of the necessary mechanisms which accredit, or in some way recognise, a learning framework based on current training package outcomes and the Australian Quality Training Framework. It includes:

❖ specific qualifications
❖ specified articulation pathways among these qualifications
❖ specified learning approaches
❖ suggested learning resources
❖ provisions for the recognition of professional and other courses/training within the industry area against training package outcomes
❖ a mechanism for the recognition of non-training package or accredited course outcomes
❖ an ability to ‘enrol’ in the Applied Technology Framework rather than in individual qualifications.

Learning approach

One way of visualising the Applied Technology Framework is as a kind of ‘Rubik’s cube’. While each workplace will have a different configuration of needs and skills, there will be a core mechanism which enables these needs and skills to be configured and applied to form the unique pattern which is necessary for effective workplace practice for that enterprise.

In the Applied Technology Framework, the central mechanism can be understood in terms of organisational, learning and research, and social/work skills such as:

❖ interpersonal/communication skills
❖ environmental sustainability
❖ expansive learning
❖ imagination/creativity
❖ design and planning skills
❖ project management
❖ finance/business skills
❖ innovation.

Clearly, these skills and the knowledge which underpins them, cannot be taught in isolation from the day-to-day skills and knowledge which enable us to perform our role in the workplace. However, the emphasis within this learning approach on critical and systematic reflection on work and learning will enable
learners to recognise the embeddedness of these generic skills and to explore how they interrelate with technical and other specific work skills to form a holistic work performance.

The small cubes which form the visible sides of a Rubik’s cube can be visualised as different combinations of:

❖ trade skills
❖ workplace understandings
❖ technical skills
❖ product/process knowledge.

The learning involves the workplace group being supported by learning and technical experts. It is the workplace group who define and understand the problem and systematically seek a solution. The learning and technical expertise or the supporting registered training organisation personnel provide facilitation for this process, and support systematic reflection and the input of supportive but critical outsiders.

The approach is flexible, and current pilot programs being implemented involve a number of different modes, including the involvement of participants within and/or outside work activities and programs in which one enterprise or workplace is involved and those where the learning group is comprised of employees from different workplaces.

Conclusion

The Applied Technology Framework is a mechanism for finding solutions to the current limitations of a training system which is focused on the achievement of predetermined outcomes. Limitations which need to be addressed include:

❖ qualification rules which:
  – assume that workers require a group of skills, all of a relative level of complexity
  – do not cater for the summative effect of groups of competencies
  – limit the ability of individuals to design skill acquisition programs which meet their work needs and lead to a recognised qualification

❖ industry standards which:
  – are often focused on past, rather than future, needs
  – appear to be built around concepts of vocations rather than a mix of competencies. An example of this is seen in standards relating to design, project management, finance and management, where the existing standards relate to a role as a ‘designer’, ‘project manager’, ‘finance worker’ or ‘business manager’ and, therefore, fail to provide for the majority of workers who need these skills as part of a skill package which is focused on a diversity of vocational roles
failure to recognise that the relative complexity of skills lies as much in
the complexity of the context and nature of their application, as in the
difficulty of their acquisition. For example, maintaining a cash flow
during a game of Monopoly and maintaining a cash flow to keep a small
business from becoming bankrupt both rely on the same understandings
and a similar level of instability due to uncontrollable contingencies.
However, the relative degree of competence required for the two tasks is
very different

a focus on learning what is already known and which can be readily
measured or identified. This means that tacit knowledge, the ability to
innovate and manage contingency, and the ability to construct
knowledge, which are keys to flexibility and ‘leading edge’ practice, are
neither recognised or supported

lack of recognition of the diversity of outcomes of group learning
teaching and learning practices which only recognise predetermined
learning outcomes.

The current Applied Technology Framework pilot projects being conducted
suggest that these issues can be addressed within the framework to enable the
specific needs of industry enterprises and workers to be met.

It is not suggested that the Applied Technology Framework will be able to
find a universal remedy for all these issues. However, it does promise specific
solutions while also providing a mechanism for exploring how workplace
learning can be measured in terms of improved practice and against relevant
units of competencies, while focusing on resolving workplace needs and issues,
and allowing for the uniqueness of each workplace.

The response of government and industry to the framework has been very
positive: peak industry bodies have shown interest in, and sponsored the
programs, and individual enterprises have indicated their willingness to
participate in the project and to fund such participation. One key spokesperson
for the precision engineering industry stated:

We had resigned ourselves to not being able to access this kind of approach in
Australia. The Applied Technology project appears to meet our need for flexible,
rapid and proactive solutions for our industry.

(Spokesperson for precision engineering industry)

One of the key implications of the adoption of this approach is the need to
ensure that enterprise projects can be facilitated by training personnel with the
necessary knowledge, skills and attitudes. Given the current culture of
vocational education and training (VET) across Australia, this is problematic.
While there are VET practitioners who have both the competence and attitude
to facilitate the project, these practitioners are often not freely available, since
their progressive and adaptable approaches make them valuable in a wide
range of applications.
One of the solutions to this dilemma currently being trialled within the pilot projects is to staff the projects with a mixture of experienced and not-so-experienced facilitators working in a team. This enables the not-so-experienced practitioners to develop and enhance their skills through participation. This learning through work is backed up at the institutional level by formal and informal discussion and reflection. By using this ‘learning through doing’ approach to professional development, it is hoped to increase the pool of practitioners who can be drawn on to facilitate future Applied Technology Framework projects.

The Applied Technology Framework project is still in its infancy. There is still much work to be done, especially with government training authorities, to ensure that the framework becomes part of national VET provision and that the achievements of its participants can be recognised within the National Training Framework.

References


Down, C forthcoming, ‘Situated learning, polycontextual boundary crossing and transfer: Practitioners’ perceptions of the transfer of competence across different work contexts’, PhD thesis in progress, RMIT University, Melbourne.


