ASSESSMENT STRATEGIES FOR WORK - INTEGRATED LEARNING AT HIGHER EDUCATION INSTITUTIONS

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Introduction

The policy and legislative commitment of the South African Government as evidenced by the Education White Paper 3 of 1997, the National Plan for Higher Education 2001 and the establishment of the Higher Education Quality Committee (HEQC) of the Council on Higher Education (CHE) have articulated the purpose of higher education to meeting the learning needs and aspirations of individuals. This would include the higher level knowledge and skills needs for growth and prosperity through economic development. Prosperity would also encompass learning interventions to support social and development societal needs, toward improved active citizenship.

There have been repeated calls for higher education to be more responsive, accountable, relevant and accessible. This implies a possible disjuncture between policy objectives and the ability of higher education institutions to deliver on their mandate. Discussion documents and debates on a Human Resource Development Strategy, along with the South African Qualifications Authority (SAQA) Act (1995) and the Skills Development Act (1998), creates opportunities to focus on work-integrated learning as a co-operative education model for applied learning.

Higher education institutions in line with the objectives of the National Qualification Framework (NQF) and the principles embedded in an outcomes-based approach to teaching and learning have an obligation to review curriculum development and implementation strategies. This is to ensure that the integration of academic and work-based learning provides a model, in preparing graduates for the world of work.

Relevance

Technikons have since their inception about 25 years ago been on a development and growth trajectory to be career focussed in their vision and mission. As higher education and particularly Universities of Technology we need to expand on many of the positive distinctive features of Technikons.

These would include:

1. Links with Industry
2. Research (Applied)
3. Entrepreneurship
4. Co-operative Education
5. Innovation and Commercialisation
6. Science and Technology Transfer
7. Quality Service Delivery
8. Community Outreach

The above all speak of a renewed and ongoing understanding of responsiveness to economic and social development needs. This responsiveness means to have an appreciation of the changing requirements of knowledge, skills and competencies in the world of work and the implications and their application in higher education. This would also embrace a more overarching focus on societal goals and a critical citizenry that recognises and engages with a range of key stakeholders from government, labour, the private sector, social and community partnership.

Curriculum Development

Curriculum development that incorporates a work-based or work-integrated prescribed learning outcome should be informed by and curriculated in partnership with commerce and industry. The decision to prescribe a block of experiential learning time in industry should be informed by the assessment criteria of the structured learning outcome components.

Work-integrated learning must be understood to be a learning and development experience that focuses on the student needs. The experiential learning in the workplace must be carefully planned to accommodate the particular workplace environment and its integration with the academic learning at the institution. To effectively manage the learning process, in preparation for and during the experiential learning, needs to enjoy similar priority in terms of infrastructure and resource allocation as is the case for the academic learning environment.

The following diagram serves to highlight some of the aspects that contribute to a supportive learning environment.

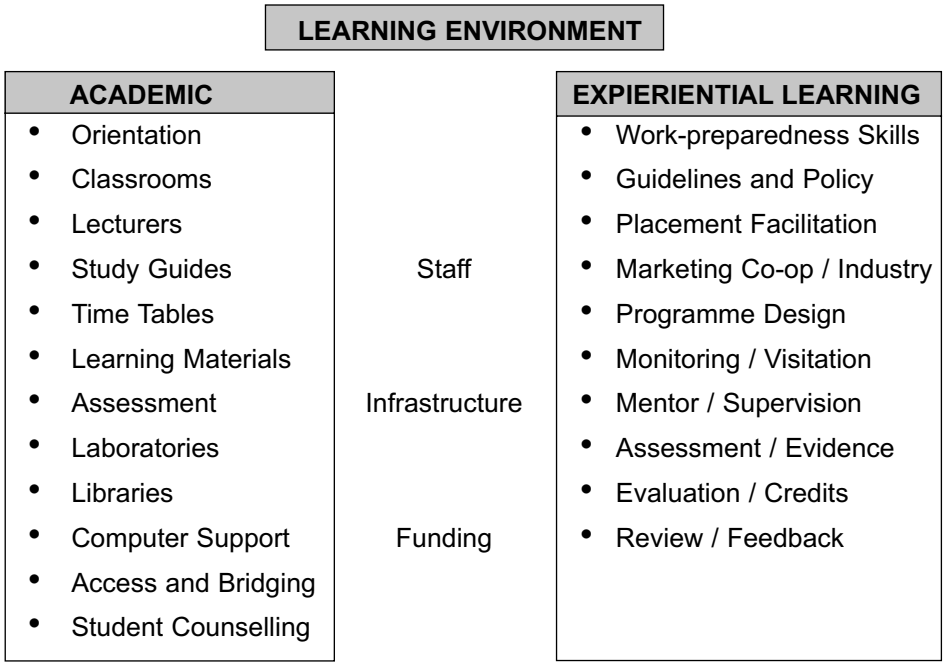

Figure 1: Supportive learning environment

An outcomes-based approach, in line with NQF, is the ideal mechanism to structure learning experiences for students. These learning areas are:

- Orientation (Work-prepared skills programmes)
- The placement learning process
- Structured workplace learning and assessment

Outcomes-based Education and Training in a National Qualifications Framework

The NQF arose out of a need for an integrated approach to education and training. The fundamental need was for articulation between education and training which positioned and recognised all education and training in a national framework. This approach supported career paths that included the recognition of prior learning (RPL), different combinations of education and training, as the basis for progression through recognised levels and across educational bands. The proposed 10 levels of the NQF are structured to reflect increasing

complexity for learning performance and competence, in relation to skills, knowledge, problem solving analysis and accountability, within a wide range of contexts and disciplines.

The outcomes-based approach places the primary focus and emphasis on the outcomes of learning and a move away from traditional content driven objectives. The result is a student centred approach that encourages self-confidence, reflections on learning and the enhancement of critical outcomes (soft skills) as a direct link to the successful integration and application of contextual or discipline specific learning.

The implications of Outcomes-based Education and Training (OBET) for curriculum development create opportunities for re-curriculation that should promote new paradigms and approaches to teaching and learning, assessment and service delivery facilitation. The role of the lecturer changes from provider of knowledge content, to manager of the learning process. This facilitation starts with the whole qualification exit level outcomes and the associated assessment criteria. These outcomes cascade down to smaller enabling or sub-outcomes, each with their own assessment criteria that could be devolved down to a unit standard as the smallest unit of learning. Academic credit allocation now relates to notional hours of learning and such accumulation of credits as can be clustered into flexible modules, for ease of progression and articulation.

The most positive aspect of Outcomes-based Education (OBE) for work-integrated experiential learning is that specific outcomes within the qualification can be identified which could best be achieved in the workplace. The accumulation of these specific outcomes along with the associated credits and notional hours should inform structured learning programmes and timeframes for experiential learning. At the same time, level descriptors as currency for staged levels of complexity can be infused into critical cross-field benchmarks, as the basis for generic assessment criteria in any programme discipline.

The above scenario presents many challenges and opportunities, but can only be realised if supported by adequate funding and dedicated resources for curriculum development, while the core business activities of teaching and learning have to be maintained.

Quality Assurance

The integrity of the NQF is achieved through the auditing and review of quality learning provision. Quality assurance of service and programme delivery represents an ongoing cycle of continual growth and development. Quality should be viewed as a transformative process of implementation, accountability and the

pursuit of excellence. A clear understanding of quality definition should underpin approaches to quality delivery mechanisms. The following distinctions should be noted:

- Quality Management System: A combination of processes to ensure that the degree of excellence specified, is achieved.
- Quality Assurance: The sum of activities / elements that assure the quality of products and services.
- Quality Audit: Activities undertaken to measure the quality of products and services.
- Quality Control: Undertaken by the persons who make the product or deliver the service.

Given that the establishment of the NQF is aimed at transformation at the level of programme delivery, it becomes necessary for higher education institutions to demonstrate programme delivery in line with NQF principles. To this end the following questions specifically relate to work-integrated experiential learning and form part of the Co-operative Education partnership model:

- What are the learning components (modules) that make up the programme?
- How is learner-centeredness ensured in the delivery?
- How are learners given feedback on their performance?
- Do the programme outcomes ensure that the learner is able to integrate the knowledge theory through work-based provider linkages?

Co-operative Education provides an overarching framework for learning integration between higher education institutions and work-based learning as illustrated in Figure 2.

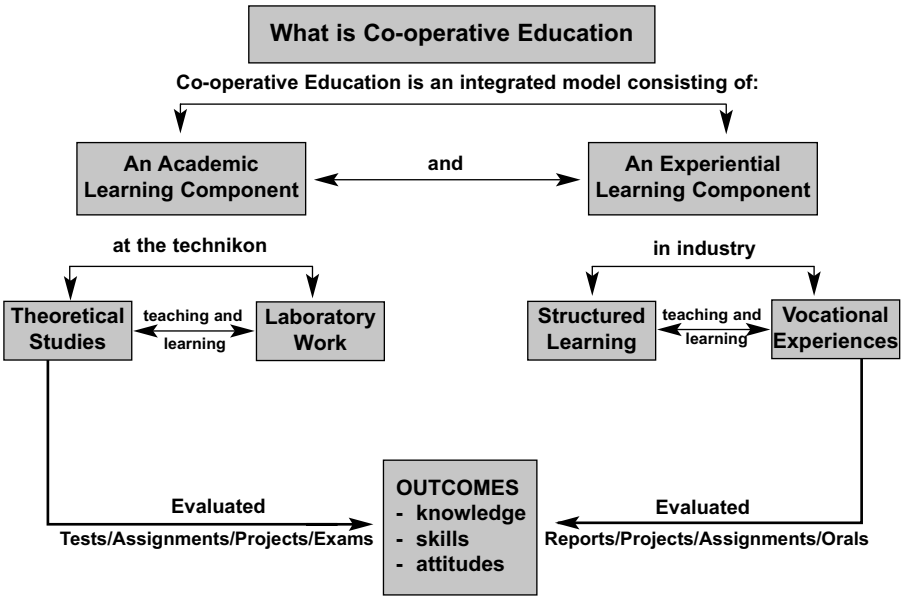

Figure 2: Co-operative Education

It is generally recognised that academic learning at the institution is planned, resourced and structured to ensure an environment that supports the student experience of learning. Examples would include orientation, subject syllabi guidelines, assessment methods, timetables, lecture and teaching methodology, support intervention for access, bridging programmes, libraries, laboratories, tutorship and extended programmes.

As the workplace is not a learning institution, but rather a place for productivity and profit, it stands to reason that for work-based learning to be successful the obligation would rest on the higher education institution to ensure that similar emphasis is placed on ensuring processes that track the student's development, learning and transition from the higher education institution into the workplace, until the return to the institution at the end of the experiential period.

Best Practice

Best practice refers to the operational implementation of core elements that, linked together, will ensure that the experiential learning experience of the student becomes a total experience that enhances development. Best practice therefore recognises the didactic as well as the educational management of the entire experiential learning experience. These operational elements are illustrated as follows:

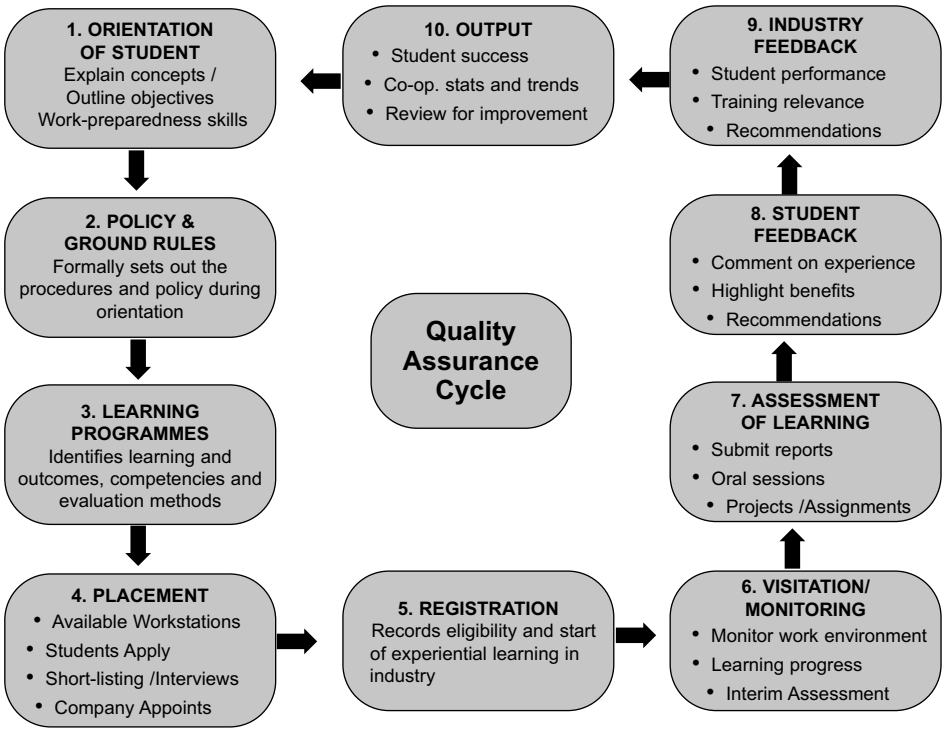

Figure 3: Elements of the experiential learning cycle

Each operational element as a contributor to student learning could then be examined in detail to define best practice parameters as a minimum standard benchmark for regular review and improvement. Each aspect has its own learning outcome and added value to the student learning and experience. The best practice and outcomes are defined in sequence as follows:

(a) ***Orientation: Work-Preparedness and Life Skills Programme***
Students receive instruction to prepare them for the world of work. Policy and ground rules clarify roles and the obligations of the students, higher education institutions and industry in the co-operative education partnership.

Students acquire job-seeking skills such as CV writing, application procedures, interview and presentation skills. Other life skills such as time management, team building and communication are also introduced.

A work-preparedness skills programme **cannot** be achieved by gathering students in a hall for one hour. Students have to be **prepared** for the workplace over a period of time.

OBE gives us the opportunity to identify specific learning outcomes and assessment criteria that will generate activities and tasks which will allow the student to demonstrate knowledge and competence across a range of learning areas that will prepare them to apply the generic critical skills in preparation for the world of work. This learning process should attract notional hour credits when done correctly.

(b) ***The Placement Process***

The higher education institution's markets and promotes co-operative education to commerce, industry and government and secures accredited workstation placement opportunities. Learners are introduced to a range of companies and have to apply and secure their own placements. Higher education institution's facilitate the application and interview process as required and students are selected by the companies after short-listing and interview processes.

Placement is **not** an administrative exercise of allocating students to companies. It must be understood to be a learning experience for the students where they have to acquire knowledge, skills and competencies to prepare for and secure their own placement as an outcome of the placement learning experience. This placement learning process therefore has specific outcomes and assessment criteria along with credits to measure success. Students have to meet minimum criteria and then have to apply and experience the short-listing and interview process, which should lead to the successful outcome of securing a placement. Mock interviews are part of the learning which must be assessed formatively.

The acquisition of industry support to participate in the programme, requires resources which must not be underestimated. The remark of "insufficient availability of workstations" is more often than not the inability of institutions to provide sufficient and competent staff to market and negotiate good quality workstations to meet the learning needs of the programme. Once the company agrees to participate competent staff are needed to facilitate the placement learning experience of the student into industry.

(c) ***Learning Programme***

Learning criteria and specific outcomes are documented to give guidance

to the student and mentors on the work-based training and learning areas for the specific disciplines. Students are guided on how the work learning experiences should be integrated and recorded. Assessment criteria and evaluation timeframes are documented and clarified.

The structured learning begins to unfold once the student has been placed. Although the learning programme and obligation are clarified during orientations, the student has to be supported once in the learning environment. The relationship between workplace supervisor/mentor has to be monitored by technikon staff. Problems associated with interpretations of learning programme, student and industry expectations, actual workstation conditions need to be supported so that valuable time is not lost or morale dampened which could negatively impact on the learning process.

(d) ***Visitation and Monitoring***

Higher education institution staff visits students to ensure that their learning experience meets the expectations of all parties. The students, mentors and academic staff meet to discuss progress. Logbook entries, presentations or any other agreed evidence portfolios or artefacts may be used to assess student progress.

Visits to students at the workplace are planned in time and by appointment. Frequency of visits will depend on geographical location, costs and related factors.

(e) ***Assessment***

Interim and continuous assessment occurs throughout the experiential learning period. Assessment and evaluation is performed by mentors, technikon staff or external examiners. Logbooks, assignment reports, projects, presentations or any other agreed evidence portfolios may be used to assess and evaluate student learning. Marks, credits or records of OBE competence may be used to reflect student success and learning outcomes. Structured and recorded feedback by students and employers in industry can serve as a quality assurance tool for review and improvement.

Best practice in the context of the student learning and development now takes on a process logic with learning outcomes for each of the above categories. Each learning area can now be unpacked and defined using the quality template of input, process and output for each learning element (Figure 4). In an outcomes-based curriculum, learning outcomes and assessment criteria for

each element above will have to relate to the nature of the knowledge, skills and competencies for the progressive development of the student as they move through the work-based experience.

Each element has its own resource demands and accountability for outputs. This approach can now meaningfully address funding provision linked to specific learning outcomes.

Assessment

Assessment is fundamental to the design of any curriculum. Assessment is a process of collecting and interpreting evidence, in order to make judgements on the outcomes of predetermined processes or procedures in a system, towards achieving defined goals or objectives. Evidence can be generated and collected at different times and places with the use of various methods, instruments, modes and even media.

A significant point of departure in presenting notions of assessment in this paper is the inter-relationship between the parallel processes of:

1. Work-integrated assessment of the learner performance.
2. Quality Assurance in the Educational Management of the work-based learning operations and service delivery environment.

The outcome of the above assessment strategies will depend on the many stakeholders who have an interest and involvement in the successful performance of the student. These would include the students themselves, parents, sponsors, employers, mentors, supervisors and lecturers.

The HEQC has statutory responsibility to conduct assessment audits as indicated in the Higher Education Act of 1997.

The nature of such assessment does not seek to measure actual quality of outputs in relation to teaching and learning performance but rather to:

- Establish the nature and extent of the quality management systems in place; what policies, systems, available resources, strategies and targets exist for the development and enhancement of quality.
- Evaluate the effectiveness of such systems on the basis of evidence produced by the institution that will provide indicators of success and effectiveness.

When work-integrated learning forms part of and is integral to the exit level outcomes of the qualification, then it is incumbent on the higher education institution to ensure that the assessment and evaluation of the student's learning experience is managed and measured with the same rigour and credits that apply to the theoretical component of the curriculum.

It is common cause that work-based learning is very often not well structured or meaningfully integrated into the curriculum. The quality and quantity of workplace provision is at times inadequate and the opportunities for maximising student learning and development are compromised. This has serious and negative implications for funding provision.

The Quality Cycle Approach

The HEQC proposes to use the quality cycle approach to quality management as an assessment paradigm for audits and for the formulation of audit criteria.

It could be argued that the elements that make up this model could be used as key performance indicators for a management framework at the level of student performance and institutional management compliance of the work-based learning support environment. Broadly these activities would be the following:

Quality Management Framework	Learner Performance
• Policy Development • Implementation • Evaluation /Review • Improvement • Implementation	• Planning for Learning Outcomes o Preparation o Placement o Curriculum o Monitor /Visitation o Assessment Feedback o Curriculum • Evaluation /Review o Student Success o Satisfaction Surveys

In this context the approach would be to ensure that the documented evidence of the entire operational and learning outcome chain is organised. Operational and networking procedures have to be agreed upon to ensure daily delivery. Communication networks between students, the academic staff and industry mentors have to be structured not only in terms of frequency but more significantly in terms of outputs of evidence, decision making and problem identification, formative assessment interventions and referral strategies for added value improvement.

The following diagram illustrates how the system generates built-in accountability measures.

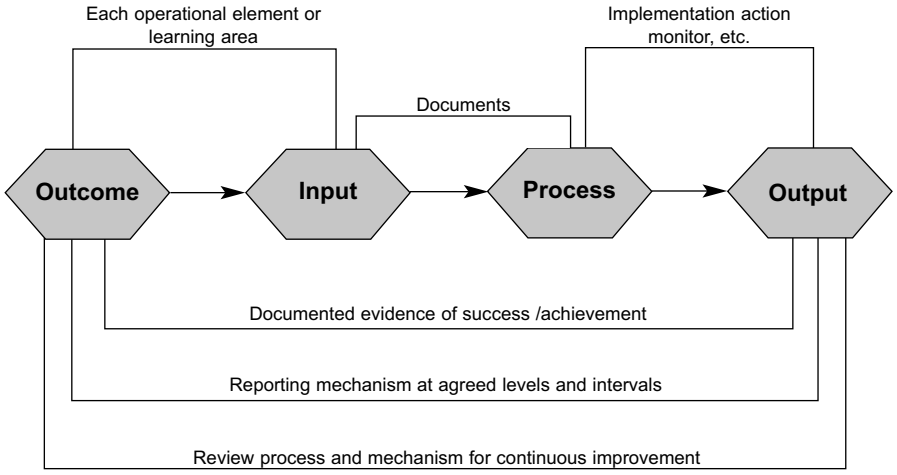

Figure 4: Accountability measures

Work-based Learning Criteria, Student Assessment and Success
In the Audit Framework, the HEQC has identified teaching and learning as the critical focus area for its quality related activities. In this regard two activity areas have been targeted as priorities as follows:

1. Programme development and review
2. Student assessment and success

The HEQC believes that systematic institutional attention to work-integrated learning validated by the audit process would cover a number of critical learning dimensions not adequately addressed in the past.

Within an audit context, the nature and arrangements for institutional planning, design and management of academic programmes are important indicators of the effectiveness of educational provision. Effective procedures in this area could ensure that programmes meet the needs of students and other stakeholders, are intellectually credible, and enable ongoing improvement in design and delivery. The same applies to professional and work-based learning in vocational programmes, where the monitoring of teaching and learning arrangements in the workplace is critical to ensuring the credibility of qualifications. The effectiveness of institutional programme management is also an important consideration, amongst others, in the eventual awarding of self-accreditation status to institutions by the HEQC.

Student assessment and success is a central indicator of teaching and learning effectiveness. The transformation goals of widening access, improving retention and throughput rates and producing graduates with appropriate knowledge and skills, can be supported and directed by an effective assessment system.

Although the curriculum may target skills, knowledge and attitudes appropriate to the goals of social and economic transformation, if assessment procedures fail to prioritise and test these competences, students are unlikely to acquire the intended learning outcomes. Finally, assessment has a critical influence on the quality of teaching and learning and can be used as a powerful point of leverage for change and improvement in education.

The HEQC has formulated a number of criteria for programme development and review in the case of work-integrated and work-based learning. These include criterion statements and are indicated below.

Criterion 1

Sub-Area: Characteristics and needs of professional and vocational education

Criterion: The characteristics and requirements of professional and vocational education are accounted for in the development of the programme

In order to meet the criterion, the following are examples of what would be expected:

i. The programme promotes an understanding on the part of the student of the specific occupation for which he/she is being trained.
ii. The programme has a balance of theoretical and practical or applied knowledge. The student masters the techniques and skills which are required by a specific profession or occupation.
iii. Work-based learning forms an integral part of the curriculum and placement in a work-based environment is regarded as an essential component of the programme.
iv. All relevant stakeholders, including employers and professional bodies (where applicable) are involved in the development of the programme.

Criterion 2

Sub-Area: Management of work-based learning

Criterion: The management of work-based learning is done efficiently in order to promote quality in all the components of the programme

In order to meet the criterion, the following are examples of what would be expected:

i. Effective policies, processes and procedures are in place for the management of work-based learning and are consistently applied across the institution.
ii. Learning contracts are utilised as a means by which the student, the higher education institution and the employer can negotiate, approve and assess the objectives and outcomes of the learning process. The roles of the various parties involved in work-based learning, i.e. the institution, students, mentors and employers, are clearly spelled out in the contract.
iii. Regular and efficient communication takes place between the institution, students, mentors and employers involved in work-based learning.
iv. A system is in place (both institutional and at the place of employment) to record the contents and progress of the student's learning experience in the workplace.
v. Monitoring of work-based learning is done regularly and systematically. Feedback is utilised for improving the practice of work-based learning.

Criterion 3

Sub-Area: Mentoring System

Criterion: An effective mentoring system provides support for the student in the workplace

In order to meet the criterion, the following are examples of what would be expected:

i. The mentoring system is educative, i.e. it enables the student to recognise strengths and weaknesses in his/her work, to develop existing and new abilities, and to gain knowledge of work practices.
ii. The mentoring system is supportive, i.e. it offers opportunities to nurture and develop students.

Incorporation of OBET Paradigm

Burchell Hodges and Rainsbury (1999) suggest that employers value all competencies in students which would include both technical competencies (i.e. hard and cognitive skills) and non-technical competencies (i.e. soft or behavioural skills).

The assessment of work placements therefore should measure contextual learning outcomes and these have to be integrated with the generic (soft skills) critical cross-field outcomes which would include:

- To identify and solve problems
- To collect, analyse and evaluate information
- To organise oneself and others
- To engage in teamwork
- To communicate effectively
- To use technology to enhance learning

Given the understanding that the workplace environment in which students conduct their placements are highly complex environments, the assessment criteria has to factor in the unpredictable variables such as student needs, backgrounds, social skills, physical, mental and emotional attributes. Therefore to record the skills of students in a way which divorces them from the infinitely variable context in which they work, is to miss the essence of what it is to be a learner.

The way forward for the assessment of experiential learning in work placements is to combine summative assessment with formative assessment. In the formative mode of assessment student and faculty focus on learning rather than accountability, and emphasise growth and development over “final judgement”.

The development of an individual capable of reflective practice (Schon, 1983, 1987) and diagnostic evaluation of their own strengths and weaknesses as practitioner in whatever field they are engaged in (Stones, 1994), will likely be of more long-term benefit than assessment based on a rather spurious mark or grade that is based, at best, on a sampling or snapshot of a students’ ability on the day or days in which it was conducted. Instead of leaving their programme of study with a “pass” for their work placement, students can leave with a profile or portfolio of their abilities. This also will enable future employers to ascertain if these individuals possess the skills and attributes desired.

Models for Assessment of Work Placements

The complexity of work-based assessment has to be acknowledged and any attempt to propose that a simple pass/fail system would be in conflict with the spirit and objective of an outcomes-based approach to assessment. A multi-model arrangement has to be negotiated between stakeholders which could include:

- Employer's views on the quality and competence of student performance.
- The student records on reflective understanding and the integration of work-experience with academic learning.
- The preparation of assignments and portfolios profiles.

Accumulation of learning outcomes credits

The outcomes-based approach to curriculum design creates an opportunity to allocate credits for work-based learning derived from the curriculum design process of the whole qualification.

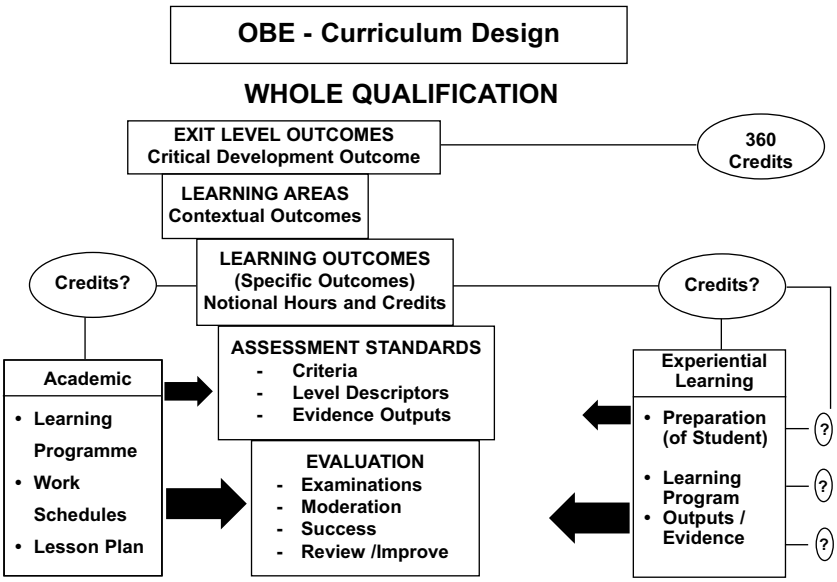

Figure 5: OBE Curriculum design

The approach would be to select a Learning Area (i.e. a discipline context such as Civil Engineering, Tourism Management or Information Technology, etc.) and then to make statements of specific outcomes of achievement along with the assessment standards. The assessment standards would include:

- The criteria itself
- The level of complexity (level descriptor)
- Evidence of outputs

The outcomes would now be negotiated with industry to select which outcomes can best be achieved in the work environment. Agreement then has to be reached on assessment criteria, assessment instruments and outputs of evidence.

Work-based learning outcomes can now be structured based on notional hours as a generic critical outcome and then credit allocations can be guided by the time frame of 1 Credit = 10 Notional Hours (i.e. the time it takes an average learner to learn, experience and achieve [through assessment] a particular learning outcome).

Prescriptions on time used in this context are not intended as a judgement for success but rather an incentive to motivate acceptable standards for work ethic and productivity considerations.

Conclusion

A higher education institution faces many challenges as it strives to position itself as a major player in the development of human capital through qualifications which are responsive to technological developments, economic and social development needs.

Work-integrated experiential learning programmes are a specific learning intervention strategy that has significant benefits for students, academic staff and industry. The challenge is to ensure that quality and adequate resourcing underpins service delivery and implementation that can guarantee the student a vertical added value knowledge learning progression through the work-based learning programme as part of the curriculum.

Work-based learning must be viewed as a learning programme experience whereby the “classroom” is transferred to the workplace and therefore the Institution and the Department of Co-operative Education have an obligation to ensure that the necessary infrastructure and support to underpin successful

learning outcomes is given the same *priority and financial support* as is done in a more controlled and managed environment for the academic programme at the institutions. Similarly work-integrated curriculum design must ensure that the assessment criteria and instrument can match the intellectual and pedagogic rigour of pure academic programmes.

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ESSENTIAL EMBEDDED KNOWLEDGE - THE FORGOTTEN DIMENSION

Christoph Vorwerk

Background

Tucked away in Section 7 of the National Qualifications Framework (NQF) Regulations of March 1998 (RSA 1998) there are two references to essential embedded knowledge. Section 7 describes what is required for unit standards. Elsewhere in the regulations there are several references to "knowledge, skills and values" in relation to specific outcomes and to levels but otherwise there is no further definition, explanation or set of criteria given for this term.

As a person who has been involved in the development of processes related to the NQF, and of the NQF itself, from its earliest beginnings to its implementation and current re-configuration, the role of knowledge in the NQF has been a constant challenge.

This paper allows me to review some of the experiences, describe some current practices and make some proposals which I trust will contribute to the learning revolution which forms the theme of this conference. Many of the observations I will make and the experiences I will describe have been derived from facilitating countless workshops with a broad range of actors in the NQF. In posing questions, both theoretical and practical, and in enabling people to discuss these questions, the generally accepted understanding of concepts and mental models held by people become evident.

Introduction

Knowledge forms a key part of the NQF. From its earliest conceptualisation to its current implementation, knowledge and how to treat it has formed an integral part of the debates and discussions. It still lies at the heart of the current debates on reconfiguring the NQF, as is evidenced by the long discussion in Chapter 2 of the Consultative Document published by the Ministries of Education and Labour in 2003:

> The distinction between the learning of "espoused", "formal" or "declarative" knowledge and the learning of "knowledge-in-use" or "practice-based learning and activities". (Department of Education (DoE) and Department of Labour (DoL), 2003).

SAQA also describes applied competence in terms of foundational, practical and reflexive competence which "are all necessary for the meaningful accomplishment of a task in any real world context" (SAQA, undated).

If one poses the question, “What knowledge is required for each kind of competence?” it becomes clear that traditional views of knowledge need to be reconfigured and adapted. As SAQA itself stated:

> Associated with the recognition that knowledge needs redefinition is the recognition that sites of learning are many and varied (SAQA, undated).

The most common knowledge taxonomy is one based on fields and disciplines. Knowledge is allocated to categories such as those used to distinguish fields of learning at universities. The choice of learning fields used by the National Standards Bodies (NSBs) is an example of this type of classification. Knowledge and knowledge classification of this kind is quite appropriate to foundational competence.

Practical and reflexive competence, however, require a broadening of the concept of knowledge. It can no longer just be simply that which is passed on during formal learning processes (explicit knowledge, theory, etc).

Practical competence may require a whole range of other forms of knowledge which allows the learner to become a competent practitioner. But what of reflexive competence? What knowledge is required in order to achieve this kind of competence?

The challenge then becomes how we should:

1. ascertain what knowledge is required for the full range of competences
2. reflect that knowledge in standards (unit standards and qualifications)
3. integrate such knowledge in curricula and learning programmes
4. assess such knowledge during formative and summative assessment, including assessment for purposes of recognising prior learning

However, even a cursory glance at registered unit standards and qualifications shows that knowledge is treated in an inconsistent, often cursory, way. This leads to inconsistencies in other aspects of the overall system, such as difficulties in implementing and assessing learning.

Some of the current practices evident in registered qualifications and unit standards are:

1. the lack of a specification of knowledge overall
2. unit standards which only specify the acquisition of declarative knowledge

3. limiting knowledge to that required to comply with company or industry standards

To achieve a more consistent approach, we would need to have the following:

1. a model of the learning process
2. a tool for unpacking requisite and relevant knowledge
3. a method of describing it
4. a method for building the acquisition of knowledge into learning programmes
5. a method of assessing the acquisition of requisite and relevant knowledge

What is essential embedded knowledge?
In the Regulations the concept of essential embedded knowledge is referred to in section 7, which specifies the contents of a unit standard:

> ...the assessment criteria, including essential embedded knowledge; and a "notes" category which must include the critical outcomes contemplated in regulation 7(4) supported by the unit standard; should include references to essential embedded knowledge if not addressed under assessment criteria and may include other supplementary information on the unit standard.

Elsewhere knowledge is referred to in a much more general way, mostly in the phrase "knowledge, skills and values".

These statements highlight the important role of knowledge in the unit standards and, by implication, in the associated qualifications. Yet despite that, approaches to recording essential embedded knowledge are varied and in many cases inadequate. As curriculum and material developers are now discovering, there is often inadequate information in the unit standards on which to base decisions relating to content. Nor are assessors finding it easy to assess knowledge in an integrated way.

Why has essential embedded knowledge as a category not evolved into a substantive component of unit standards? There are a range of factors that could have led to essential embedded knowledge not being sufficiently developed in unit standards and other aspects of the NQF:

1. The NSB Regulations of 1998 did not provide any clues on how to deal with essential embedded knowledge

2. It was a new term
3. Essential embedded knowledge is confused with Learning assumed to be in place
4. Qualifications do not have to reflect knowledge in any particular way
5. Unit standard-setting methodologies based on imported models do not have a way of formally dealing with essential embedded knowledge
6. The most common approach to developing essential embedded knowledge items in unit standards is to brainstorm a few at the end of the standard setting process
7. The lessons learned from pilot projects have not been incorporated into the standards-setting methodologies

Nor is this phrase a generally accepted term outside of the NQF. We will have to arrive at a meaning.

In order to arrive at a meaning for this term, it would be quite instructive to look at early attempts to define the role of knowledge in competence.

Some early attempts

Two stage process

During the early 1990's when I was reviewing overseas trends in preparation for developing a training strategy for the Plastics Industry Training Board, for the first time I was exposed to National Vocational Qualification Awards in the United Kingdom. The notion of developing standards for workplace performance was a fairly new one at the time. To specify the end-performance rather than the inputs seemed such an elegant way of dealing with the issue of curriculum design for workplace performance and of ensuring transfer of learning.

But even then I felt it wasn't an entirely satisfactory approach. Apart from the odd fact that the standards had to be purchased and were kept secret until they had been purchased, the standards themselves seemed to be very superficial. They dealt with tasks and not decision making. Nor did they specify what a leaner had to know in order to perform effectively.

My first attempt to construct standards was to try and combine the acquisition of knowledge and the performance standard. This early approach was based on the most commonly held theory of action relating to teaching and learning, which can be summarised as follows:

> If we put learners through learning processes which expose them to a relevant body of knowledge and if we evaluate whether they have successfully acquired the salient parts of this body of knowledge, then the

learners will be able to apply that knowledge in a practical context and they will rapidly become competent practitioners.

In diagrammatic form this could be described as a two-stage learning process:

Stage 1	Stage 2	
Formative Qualification	**On-job Experience**	= Award

The first "skills standard" I developed as a prototype was based on this theory of action. I specified the outcomes in terms of performance as well as the inputs in terms of subjects or courses. While this at first seemed to be a good solution, there was still an area of uncertainty.

What was missing, of course, was the link between the two. How would the workplace influence the content of courses in public institutions? How would we ensure that what was learned in the classroom was applied in the workplace? To provide those linkages a generic course map (see Annexure 1) was formulated which specified types of learning and to some extent the sequence in which learning took place. This first attempt also made use of a taxonomy of skills and knowledge for the manufacturing environment, namely Material, Process, Quality, Care & Maintenance, Safety, Management & Interaction and Personal Skills. This taxonomy was based on work we had done in developing a programme for a specific company in the plastics industry during the mid-1980s. The programme would today be called a learnership. Personal Skills was, broadly speaking, what we today refer to as the critical cross-field education and training outcomes which are embedded in the NQF.

Achieving the award was then based on successfully first passing the courses and then completing a trade test type evaluation after acquiring the requisite practical experience.

To this end we developed and registered N2 and N3 Plastics Technology syllabi with the Department of Education. At the higher level there was already a Diploma in Plastics Technology that would form the basis of the formal learning processes.

An integrated learning model

These early attempts coincided with the release of the National Training Strategy Initiative document published by the National Training Board in early 1994 after an extensive process, one in which for the first time unions participated on an equal footing with other constituencies. These proposals were

presented, along with proposals from other industries, to various forums and workshops which initially were extensions of the National Training Strategy Initiative process. This process eventually culminated in the HSRC publication *Ways of Seeing the National Qualifications Framework*.

What I presented, although called a skills standard, was in fact more like a qualification or an occupation award. The main thrust of the discussions and debates centred on how to break individual components down to what we today call unit standards. The motivation was to improve the integration of the stage one and stage two types of learning. One of the strongest influences on this process was Robert Mager's criterion referenced instruction (CRI). This approach was based on, amongst other things:

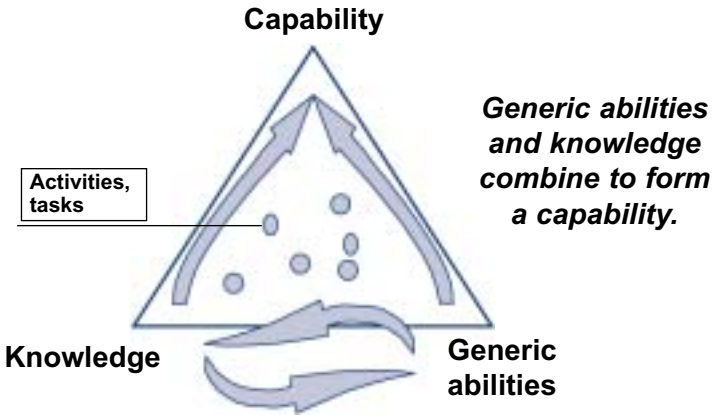
1. detailed analysis of the task or skill to establish what needed to be learned
2. performance objectives which specified exactly what outcomes were to be accomplished and how they were to be evaluated (the criteria)
3. criterion referenced testing which evaluated the learning in terms of both the knowledge and the skills specified in the objectives
4. learning modules tied to the specific objectives.

Using the CRI approach shifts the focus away from courses and large chunks of learning to smaller units of achievement, allowing for a more modular basis for learning. Each module could then represent credits towards a qualification or award.

In addition to knowledge and skills, a third element was also emerging in stating performance objectives, namely key competencies based on the Mayer report in Australia (Mayer, 1992). Our local shorthand for these key competencies was generic abilities.

The debate was still continuing vigorously and I was reluctant to settle for the previous solution if it was going to be overhauled by a new national model. But the Plastics Industry Training Board eventually insisted that in order to implement their plan, they needed to have something to guide the learning. I then was requested to develop standards for the workforce in the industry for levels equivalent to NQF levels 1-5.

To do this I conceptualised a new model of learning. The model looked as follows:



For each skill or activity, the requisite knowledge and how the generic abilities applied were described. Based on this, I then generated capabilities for three levels of worker, from operator to technical supervisor. For an example of such a capability see Annexure 2.

The original document was not conceptualised as a collection of individual unit standards but as a learning programme. The document had to provide sufficient guidance for actors and role players to engage in:

- Assessment (pre-, self, formative, summative)
- Curriculum and course development
- Contextualisation for various materials, products, processes and contexts.

To further assist curriculum and course development, the final section at each level listed knowledge items extracted from the capabilities (see Annexure 3) but organised into a discipline- or subject-based taxonomy. This provided the bridge between context specific performance and learning processes in the classroom. But even the knowledge component was described in terms of performance by using verbs such as “describe” or “explain”. The verb that was used often to ensure the connection between concept and reality was “relate”, e.g. *Relate the various types, grades and mixes found in my company to the final product and its properties.*

Assessment criteria would then have been developed in context since the document covered a host of different processes, materials and manufactured products. Assessment criteria would also have differed depending on the size of the company, the level of technology being used and the type of product being produced, the market which would be using the product, etc. Products intended for the packing of foodstuffs would have been dealt with differently from products being made for the automotive industry.

This approach resulted in the development of some innovative learning programmes. It allowed companies and individuals to structure the learning in a variety of ways. While it made the learning outcomes more explicit, it also did not dictate where one started. It was an open system. The most common approach was to allow learners to establish what they did know and then to structure learning processes that built on this for what they did not know. Between 1995 and 2000, when the industry training board was absorbed into a Sector Education and Training Authority (SETA), 14 000 employees and new entrants were assessed, trained and qualified using this system. Feedback from many plants, participants and trainers indicated that the document allowed learners to understand the connection between knowledge and performance.

A revised knowledge taxonomy

During 1996, the model described above was used as the basis for developing unit standards in the Department of Labour's NQF pilot project: Engineering and Manufacturing Processes. Some of the working groups tested the knowledge taxonomy I had developed for the plastics industry, i.e. materials, processes, quality, etc, (as listed above) when dealing with what we then called under-pinning knowledge. Others tested alternative approaches. The "plastics"' taxonomy was, however, not quite broad enough.

In analysing the content of the items listed under the "plastics" taxonomy headings, it became apparent that there was another classification system, one based on types of knowledge rather than types of content. The first list consisted of about six items. Using these as a base, it was further extended as working groups started to apply the technique. This resulted in the following list which was then used to generate and refine all unit standards:

1. Names & functions of ...
2. Attributes, descriptions, characteristics & properties of ...
3. Sensory cues
4. Purpose of ...
5. Events, causes and effects, implications

6. Categories
7. Procedures
8. Regulations, legislation
9. Rules, principles, laws
10. Relationships

This taxonomy has been used in slightly modified form since then and has proved to be fairly robust and flexible enough for a wide range of contexts.

Arriving at a definition of essential embedded knowledge
Defining knowledge and what knowledge means, how it is derived and how it is used, has been the subject of discussion and debate in the Western tradition since the time of classical Greece.

To offer a simplistic definition in the present context would be to ignore the complexity of what knowledge represents. Knowledge can range from casual recall of facts or bits of information to deeply held convictions; it can be derived from the external environment through our sensory organs or be constructed by cognitive processes; it can be articulated through language or be tacit understanding at a pre-conscious level; it can be at the level of consciousness or part of the "gut-feeling".

To work with knowledge for purposes of unit standards I propose to use four broad categories or types of knowledge as the basis for defining essential embedded knowledge:

Type	Also called	Examples
1. know what	declarative	explicit information, rules, principles based on language mostly
2. know how	procedural	actions, responses, ways, options, often tacit or embodied knowledge
3. know why	causal	causes and effects, symptoms, issues
4. know about	contextual	familiarity with people, situations, contexts and even cultures

Types 1-3 are identified fairly commonly as constructs for the development of curricula and learning materials. Contextual knowledge is not commonly emphasised. However, the development of a contextual qualifications model within the South African framework highlights the importance of this aspect of knowledge (Vorwerk, 2002).

Essential knowledge is that which is required in order to achieve the outcomes. Without this key knowledge, the performance cannot be considered adequate and, therefore, the performer cannot be considered competent. The outcomes will not just require doing something but will also require having a level of understanding appropriate to the level of the activity. Essential may be considered at two levels:

1. required in order to perform in general terms
2. required in order to perform in that particular context

Essential knowledge could also include such aspects as:

- what can go wrong and how to anticipate and prevent that
- the key quality requirements (e.g. what constitutes acceptable practice or performance)
- the tools, materials and processes that are used in the performance
- values and ethical requirements
- safety, health and environmental considerations
- customer relations

Embedded implies that something is inextricably bound in, stuck in or linked to a greater whole, e.g. the process of making concrete is a process about embedding sand, stones and steel rods in cement.

Embedded in the context of unit standards means the knowledge is intimately linked to the performance and the understanding of the performance, its purpose and context. This implies such elements as:

- experience
- internalisation
- common practice, common sense and conventions
- history, tradition, rules, laws, principles
- contextual issues related to ethical, legislative and policy-related considerations

Another way of describing this kind of knowledge would be **requisite knowledge** - i.e. that knowledge which is required to perform successfully in a specific context. In assessing learners we want to ensure that they have the requisite knowledge. In terms of SAQA Regulations this means assessing the degree “to which knowledge, skills and values in a sub-field have been acquired and the critical sub-field outcomes incorporated into the assessable performance as a whole” (RSA, 1998).

The specified requisite knowledge is so embedded in the learner that applied competence as defined by the NQF Regulations really means that the proficient learner embodies the knowledge - it is embodied knowledge that guides the surgeon's knife at the moment of the first cut.

In the context of unit standards and the NQF, essential embedded knowledge specifies the:

1. general material which is embodied in the theory, principles and practice
2. specific knowledge which is derived through the conscious and unconscious learning processes which lead to competence

What is specified as essential embedded knowledge in the standards is then built into learning programmes both in the form of content as well as in terms of activities. After the learning process the assessor assesses the knowledge embodied in the assessable performance of the learner to determine applied competence.

A proposed taxonomy for essential embedded knowledge

Just as critical cross-field education training outcomes have been broken down into 12 types; it is useful to have a taxonomy of knowledge items that need to be considered during standard-setting. Having a taxonomy enables us to consistently determine what knowledge is required for a particular skill. This consistency makes it easier to develop learning programmes, activities and materials, as well as devise a more repeatable assessment process across different contexts.

Categories in the taxonomy

The following categories make up the taxonomy:

1. Names, functions, locations	objects, concepts or phenomena, entities, components
2. Attributes, descriptions, characteristics, properties	features or qualities that characterise objects, etc, in 1 above or differentiate them from other similar ones
3. Purpose	the meaning of or reason for objects, activities, etc
4. Processes, events, incidents	planned or structured ordering of activities, occurrences

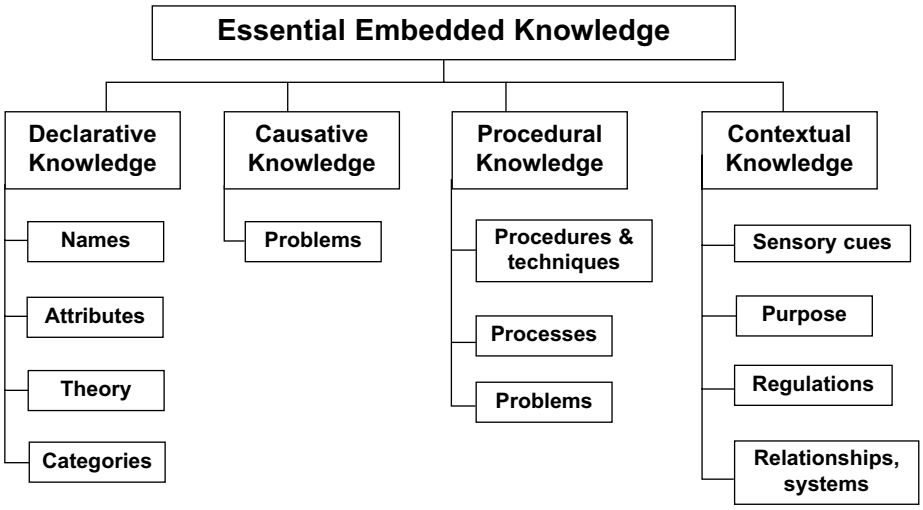
5. Problems, causes and effects, implications	knowledge which underpins and derives from problem solving, responsibility and accountability
6. Procedures, techniques	formalised ways of carrying out tasks and activities; different methods of performing tasks and activities
7. Sensory cues	signals or signs relating to conditions or changes in the environment; seldom found in text books but passed on by experts or acquired through experience
8. Regulations, legislation, agreements, policies, standards	the legal or agreed framework which guides or circumscribes what we do
9. Theory (rules, principles, laws)	explanations or proposals that try to explain the physical or natural world
10. Categories	ways of grouping, ordering or classifying information
11. Relationships, networks, systems	components of systems thinking links between elements within a larger view; the way in which things work together

The order of the categories is not particularly important. There is a slight shift in emphasis for different levels of learning:

- Categories 1-5 dominate in the Further Education and Training (FET) band
- Categories 5-11 dominate in the Higher Education and Training (HET) band

But most categories are required for each skill or activity at all levels.

Using the four types of knowledge identified above we can also arrange the categories into a taxonomy:



This taxonomy is merely indicative as there are overlaps and linkages between the categories, e.g. regulations can influence both processes and procedural issues.

Knowledge and the language trap

Knowledge is a noun representing a complex set of concepts. Because it is a noun it appears to be something tangible and concrete. Observations, past experiences and understanding can be distilled, sorted and organised into words - the knowledge becomes frozen. Once frozen in the form of text, it can be further worked with as summaries, quotations and building blocks in the development of new knowledge. It can be:

- encapsulated into greater texts
- linked to other kinds of knowledge
- learned as an entity by others
- the object of scrutiny, critical thinking, translation, abuse and derision

This way of dealing with knowledge creates a view of knowledge that makes it external to us - a thing. This results in the classical Cartesian split, the division of mind and matter.

But knowledge also implies knowing, and knowing is something dynamic, changing and individual. Knowing is the result of processing information, translating it into models, scripts and decisions, reflection, learning and

experience. It derives from sifting information from the environment, linking the information with acquired knowledge and then shifting or adapting in response to minute changes in the environment. Knowing is heuristic, learning for one's self. In this way knowledge then actually becomes embedded in the performance - the skill represents knowledge in action.

Many of the discussions and arguments relating to the nature and shape of the NQF are based on two viewpoints which are sometimes perceived to be in conflict:

- Knowledge production or the epistemic imperative (Mouton, 1996)
- Knowledge utilisation

For the purposes of the NQF the knowledge that we are focused on is primarily the individual learner's knowledge production and utilisation, i.e. personal knowledge, and not knowledge production and utilisation in the broader sense as in research and knowledge management processes.

Essential embedded knowledge and standards-setting

Developing unit standards is hard work. Adding to the workload by interrogating the knowledge requirements stretches participants, not just physically but intellectually and emotionally too.

For participants new to the standards-setting process, there is the first learning period when they are uncertain of what is required of them. Once familiar with the process, participants become result driven and the "race course" effect becomes apparent: "let's see how quickly we can complete this one".

These situations result in superficial treatments of essential embedded knowledge. The process of identifying requisite knowledge can be made easier if one uses the following techniques:

1. Step through each of the knowledge categories in turn to establish the kind of knowledge required for each specific outcome and each assessment criterion
2 Use training manuals, text books and course outlines as a further resource to identify requisite knowledge

This can become tedious after a while, but across a range of related unit standards similar lists emerge, so it is only the first few which are a problem.

An example of the use of this method is contained in Annexure 4.

Essential embedded knowledge and learning

Curriculum

Learning programmes describe and sequence learning activities. A learning activity encompasses the internalisation and application of discrete and relevant information which leads to the development of new skills and ultimately competence (i.e. when assessed). A curriculum guides the process of developing learning programmes and designing learning activities. It specifies at the very least:

1. what must be learned (content)
2. how it should be learned and how to adapt it to different groups of learners
3. how it can be assessed

The following points should, however, be made.

1. A unit standard is not a curriculum, learning programme or module - it is a set of learning outcomes (RSA, 1998). A learner does not learn the unit standard but his or her learning is assessed against the unit standard.
2. Unit standards are generally linked to other unit standards for the purpose of a qualification or part of a qualification.
3. To quantify and organise what has to be learned we need to analyse the group of unit standards as a whole. There will be repetition and related items running across the standards.
4. In the case of essential embedded knowledge items these can then be compiled and linked to instructional units (modules, courses, projects)

For a learner to be successful during an assessment, the learning programme should contain activities which link the explicit knowledge to the procedural components while developing the contextual and causative knowledge as well.

By creating unit standards and qualifications which explicitly list requisite knowledge, the construction of learning programmes is in fact made easier. Learning programmes can also make use of the knowledge taxonomy (see above) to structure and sequence learning. By applying the taxonomy, explicit knowledge can be linked to the development of competency through sets of graded exercises or activities. Context can be introduced first in a simulated fashion and then later in real time to build up the learner's personal knowledge of the performance and to develop competence.

What we discovered in the plastics industry in the late nineties was that learning processes were invoked in learners by providing a context for knowledge, by

systemising it and by linking it to specific activities. Workers who engaged in reading the “Learning Programme” would start to engage in conversations or discussions about what was written there: they approved, agreed with, disputed or re-interpreted the information. While we conducted no formal studies, our observations and reports received from learning facilitators indicated that people were able to assimilate this information and then directed themselves to wider and deeper levels of enquiry.

By creating relationships between various kinds of knowledge, between explicit knowledge and the critical cross-field education and training outcomes and between knowledge and context, learning becomes purposive. Adult learners, especially, engage more readily in this type of situation.

Learning materials

By applying the above approach, we can reduce the role of learning materials as a substitute for curriculum. Knowledge can be acquired from a wide variety of sources, not just text books or course manuals. Authentic documents related to the skills and knowledge areas can replace standardised learning texts.

Assessment

Including a detailed guide to the requisite knowledge enables the assessor to more easily develop an assessment guide which focuses on the knowledge and understanding. The assessor can test for the “knowing” in a number of ways:

1. responses to directed questions
2. observations of the actual performance, including
    - discussions and problem solving conversations
    - assisting, training and educating others

One aspect that creates confusion is the role of knowledge tests. Assessors report that often within the first few minutes of engaging in or observing a discussion, they can conclude that the learner has an understanding of the explicit, procedural and contextual knowledge. This is especially the case in the assessment of prior learning. In these instances, the explicit knowledge has become internalised to such an extent that often the learner has “forgotten” the “text book” knowledge. However, this is not so much the forgetting, as the inability to reconstruct the knowledge in that form. Through discussing the issues or listening to the stories, the assessor can more easily establish if the learner has the requisite understanding of the issues, the dynamics, the relationships and the structures.

Conclusion

In the context of unit standards and the NQF, the part played by essential embedded knowledge has not been sufficiently acknowledged or reflected in unit standards. The knowledge category is, however, crucial to the development of applied competence and learning processes. A systematic analysis and capturing of the essential embedded knowledge related to a specific set of activities provides a platform to improve the linking of knowledge and action, to transform teaching and learning practices and to improve the value of assessment.

To be systematic the analysis and capturing process needs to be guided by a knowledge taxonomy as well as a set of knowledge categories.

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ANNEXURE 1

Generalised Course Map for all Skill Levels

EXTERNAL EVALUATION		
Elective Stage	2 of any extra modules at core or specialist stage, if preceding modules have been done	Personal skills
Specialist Stage	Company, product and process specific skills. The modules at this level would generally contain the so-called "company secrets" under the headings below	Additional personal skills
Core Stage	Knowledge and skills common to all companies and people involved in a specific process and with specific materials, under the headings below	Additional personal skills

Skill areas	***Material***	***Process***	***Quality***	***Care & Maintenance***	***Safety***	***Management & Interaction***	***Personal skills***
Formal Stage	N1 - N6 T1 - 6	Plastics techno-logy	Maths, Science, Polymer chemistry	Basic hand skills			
Remedial Stage	Literacy, Numeracy, Adult Basic Education, Matric, N1-N3						
Induction	Company	Plastics Industry Training Board (PITB) & training		Plastics Industry			
Sign a Training Contract : Register with the PITB for a development phase							

ANNEXURE 2

Extract 1 from Plastics Learning Programme - the 'standards component'

1.1.3 Feed the machine with the correct material or monitor the machine feeding process.

Typical activities would include one or more of the following:

- Slit open bag, lift and pour into hopper, mould or bin
- Open drum, lift and pour into...
- Attach feeding hoses, insert feeding hoses, start feeding equipment
- Reseal and store leftovers
- Replace lids or covers
- Place sheets on feed rack
- Attach reel
- Measure and pour powder into mould

M ***What I must learn about:***
What is the function, purpose and meaning of labels, signs, and batch or grade numbers? What is the correct appearance or material? Things like the state of the material, the consistency, colour, particle size and shape, other constituents to mix.

P What are the names, functions and purpose of feeding components or assemblies to related marks, sight glasses or instrumentation? What are the correct procedures for using these, what are the steps involved in carrying out the feeding process: slitting of bags, opening of valves, the insertion of hoses necessary to begin the feeding process?

Q What are the effects and consequences of feeding incorrect materials? What damage can be caused by not feeding the machine at all?

What I must learn to do **(my fundamental abilities):**

Communicate

In many cases what you learn to do here will have to be in a second language such as English

I must learn to:

- Use correctly the words related to materials and material feed.
- Read or listen to, understand and follow instructions or procedures for feeding material into the process.
- Complete documentation required for the ordering, indenting, requisitioning or returning of materials.
- Make oral reports about incidents, problems and difficulties or make requests to team members, superiors or partners in other departments.

What are the most common problem areas, checking procedures? How do I clear blockages?

C What are the general requirements for moving and lifting materials? How should I try to avoid injury?

General requirements and procedures for feeding the machine.

S Effects and consequences of unsafe and unauthorised actions.

Management: What is my programme of checks and actions?

- At the start of the shift, week, order or job?

I& • At the end of the shift, week, order or job?

- During the shift, each hour, each cycle or at the times that the process requires, instruments or

M measuring checks suggest or procedures require?

- What checks should I be conducting regularly, at what intervals?

Interaction: Whom can I call for help?

- When, how and to whom should I report when I see the material is wrong, or things start to go wrong?
- What documentation is required for the transfer, drawing or return of materials?

What else should I know that will help me do this better, more quickly or more safely?

Solve problems and make decisions

I must learn to:

- Observe material feed or read instructions or check sight glasses or read any other checking devices relating to material feed.
- Recognise point at which a decision needs to be made, and determine when to feed, call for more material.
- Recognise the early warning signs of regular problems.
- If there are additional problems, decide whether to act on my own or call in assistance or advice.

Use and look after hand tools, power tools and instruments

I must learn to:

- Use and look after hand tools and equipment, typically: lifts and hoists, trolleys, bins, racks, steps, ladders, knives, blades and shears.

Learn to learn

I must learn to:

- Recognise and connect the names, functions and purpose of things to my activity.
- Connect these things with the other parts and the process or equipment as a whole.
- Formulate and ask questions which help me understand how to work better.
- Describe the effects and consequences of incorrect material feeding procedures.