BMZ Federal Ministry for Economic Cooperation and Development

Future-Makers. Building the future. Let's join forces.

Through Competence-Based to Employment-Oriented Education and Training

A Guide for TVET Practitioners

Published by: giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Through Competence-Based to Employment-Oriented Education and Training

A Guide for TVET Practitioners

How to facilitate the development of competences in learners
with examples from the water and automobile sector

Table of Contents

Foreword

In the present situation of widespread economic crisis and, linked to it, high unemployment rates namely of young people, the call for "employment oriented vocational education and training" is expressed by policy decision makers and representatives of civil society as well as everywhere in the world.

Very often, the introduction of competence-based education systems is considered to be the answer, assuming that the introduction of a competence-based education system will automatically have a positive impact on the employability.

Over the past 15 years in many countries worldwide competence-based education systems have been implemented at the systemic level under the umbrella of national qualification systems.

However, much less attention has been given how to convert and transfer such a system at the operational level into practice to ensure that the competencies having been identified to be necessary at the labour market are being acquired in the VET system.

There is a gap between educational practitioners and "system designers". Practitioners tend to be deterred by the complexity and new terminology used in CBET or simply apply the new terms to what they have done before. On the other side, decision makers tend to stop paying attention once the new system has been established, and underestimate the consequences and additional efforts needed to put it into operation.

To convert "competence-based" into "labour market oriented vocational education", teachers, school managers and subject matter specialists need to have an understanding of the conceptual framework but at the same time need assistance in how to apply it to really improve the competencies of their students required in the labour market.

The present manual provides practice-relevant conceptual knowledge about the CBET concept "in a nutshell" and demonstrates ways how to transform these concepts into TVET teaching practice. It also contains complementary insights to the ILO manual "Competency Based Training (CBT) – A Handbook for Technical and Vocational Education and Training (TVET) Institutions in the Arab Region" which is due to be published in 2013.

The manual is based on more than 45 years of personal TVET-experience of the author. In addition, relevant studies and publications were reviewed such as the ILO report of a study in 16 countries on "The implementation and impact of National Qualifications Frameworks" from 2010. Theoretical concepts are illustrated by practical examples from the water and automobile sector. Included are also experiences gained in a programme to assist the Holding Company of Water and Waste Water (HCWW) to reorient the vocational education and training in the Egytian water and waste water sector towards competence-based education and training. This programme had been implemented as part of the Human Capacity Development (HCD) project for "Development of sustainability competencies" implemented by GIZ and financed by the Federal Ministry of Economic Cooperation and Development (BMZ).

Dr. Klaus Bader-Labarre
Senior Project Manager
GIZ

Introduction

Purpose

The main purpose of this manual is to provide a condensed and simple overview of Competence Based Vocational Education and Training (CBET). As experience shows, many people who start to inform themselves about this topic soon become frustrated because of the complicated new language used for this new subject. That is why many simple graphics are used in this manual to present complex systems and processes. This – hopefully – will assist readers to better grasp the basic principles and processes of CBET. The graphics, however, are merely models and as such represent only a reduced reality.

Much has already been published about competence standards, qualifications and national qualifications frameworks, about assessment and quality assurance. But there is relatively little information available for training providers on how to facilitate the development of competences in learners. Therefore, the major part of the manual focuses specifically on this topic.

Target groups

The main target groups are vocational teachers and instructors in Vocational Education and Training (VET), working in school-based as well as in work-based training environments.

Content

Across the world, close to 130 countries were identified in 2010 that seem to be at some stage of introducing CBET and developing a national qualifications framework (NQF). In some cases the implementation of NQFs has been widely supported by international organizations and is often linked to aid money and even loans.

Some national CBET systems share their know-how and experience with others and publish a wealth of information on the Internet. Comparing this "published knowledge about CBET" there are three different groups which can be identified (although there may be more):

- English-speaking countries which provide a lot of information about competence standards, qualifications, assessment, and NQFs
- Spanish-speaking countries which provide a relative wealth of information about training modules related to competence standards and about school-leaving profiles
- German-speaking countries which provide information about modularized framework curricula and learning situations to facilitate VET learning.

For this manual material from the three groups has been selected, adapted, and integrated.

The manual has eight chapters.

Chapter 1: *Manpower Demand in the World of Work* gives a short introduction.
Chapter 2: *Development of Qualifications Worldwide* and
Chapter 3: *Searching for Qualifications and Competences* use material from English-speaking countries.
Chapter 4: *Developing Competences in Learners* is based on approaches from German-speaking countries, while
Chapter 5: *School-Leaving Profile* presents experiences from Ibero-America.
Chapter 6: *Modularization of VET* and
Chapter 7: *Facilitating Learning* are again from German-speaking countries, while
Chapter 8: *Assessment* is strongly influenced by Australian publications.

Some chapters or sub-chapters are organized in numbered blocks of text, which relate to steps in the presentation of the graphic data at the beginning of such a chapter. For these chapters very often there are tasks for group work attached which serve to apply the information and support learning.

1 Manpower Demand in the World of Work

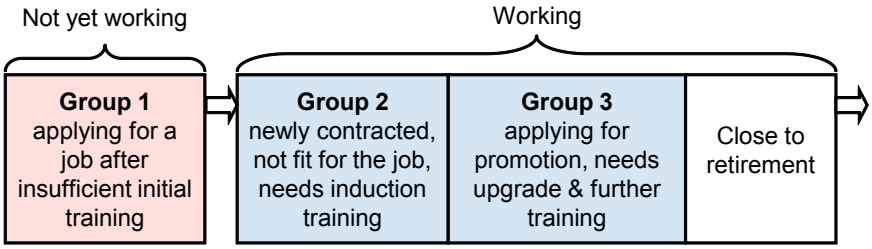
In 2012, two companies of the water and wastewater sector, one in North Africa, the other in South America, are facing similar problems: How to fill job vacancies with qualified personnel to meet the manpower demand of the company.

The problem is that available applicants do not always possess relevant qualifications for specific jobs. These problems exist in three major age groups.

"Graduates come out of university and vocational schools with no experience to qualify them to work practically in the water sector"

A Water Sector Report, 2009

Fig. 01: Three groups with a need for more and specific training



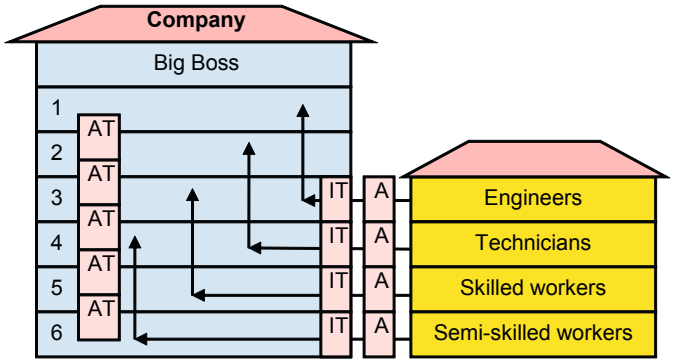
a. Group 1: Mostly young semi-skilled and skilled workers, technicians and engineers, coming from different institutions of initial pre-employment training who are applying for a job, but do not possess all the qualifications required for specific jobs.
b. Group 2: Successful applicants who have been selected and contracted, but are not yet „fit for the job". They need some induction training to familiarize them with the company and to fill „competence gaps" which have been detected.
c. Group 3: Workers and employees with several years of working experience who want to be promoted to higher and more complex jobs. The mere fact that they have been on the payroll of the company for some years does not automatically qualify them for promotion. They need to demonstrate competence to meet the job requirements at the next level. If necessary, they will receive further and upgrade training.

To solve these problems, the two companies are planning to do the following:

a. Related to Group 1, the companies will contact interested institutions of pre-employment initial training and discuss with them which competence profiles their graduates should have to better meet the competence requirements of specific jobs. In addition, a pre-employment assessment will be established to filter out the best applicants and to determine which skill gaps they still have (A in Fig. 02).
b. Related to Group 2, the companies will provide induction training (IT in Fig. 02) to familiarize newcomers with the company and to fill skill gaps which might still exist.
c. Related to Group 3, the companies plan to establish an assessment of applicants for promotion to make sure that they meet the job requirements of the next higher level in the company's job hierarchy. If necessary, applicants will undergo further and upgrade training (AT in Fig. 02).

Assessment and related Competence-Based Education and Training (CBET) are introduced to improve the actual situation

Fig. 02: Assessment and related training to improve the actual situation



A = Company pre-employment assessment of job applicants
IT = Induction training for successful applicants
AT = Promotion assessment plus further and up-grade training
6-1 = Levels in the company job hierarchy

An example: In Fig. 02 a technician, after completing his initial training in a training institution, is applying for a job in the water sector. He will undergo the pre-employment assessment (A) and – if successful – will be contracted at level 4 in the company job hierarchy. Then he will enter induction training to familiarize himself with his new working environment. At the same time, specific job skills which are required but are still missing will be provided.
After some years of work, a vacancy at level 3 opens up and the technician is interested in moving up in the company job hierarchy. He applies for promotion and undergoes an assessment to check whether he is competent to meet the requirements of the job at level 3. If there are skill gaps detected, further and upgrade training will be provided and the outcome will be checked again. Only successful candidates will be permitted to climb up to higher levels in the career path.

So these two companies from the water and wastewater sector, thousands of kilometers away from each other, have much in common and there is one more common feature: Both want to work with Competence-Based Education and Training (CBET) to improve the actual situation.

2 Development of Qualifications Worldwide

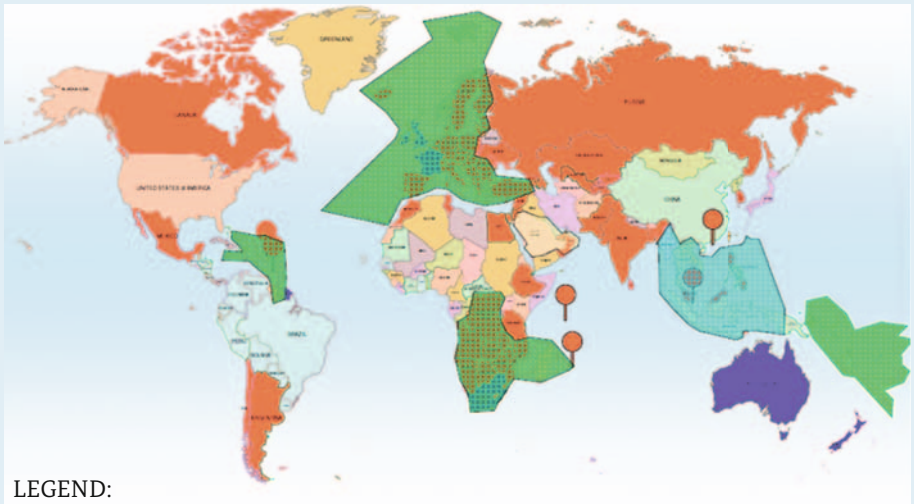
2.1 Competence-Based Education and Training (CBET) A mega-trend

A mega-trend: In 2010, 126 countries were introducing and/or applying Competence-Based Education and Training (CBET)

The focus on a career path and working with Competence-Based Education, Training and Assessment is not an isolated activity of these two companies. It is an approach which started in the 1990s and has now been introduced and applied in almost all countries of the world. It is applied to almost all levels of educational systems and extends into all sectors of a national economy. Usually, these systems are referred to as Competence-Based Education and Training (CBET). Across the world, 126 countries were identified in 2010[1] that seem to be at some stage of introducing CBET and developing a national qualifications framework (NQF). As each country is developing its own type of NQF, there might be 126 different NQFs. Therefore, transnational qualifications frameworks are being established to align regional networks, for instance the

a. European Qualifications Framework (EQF)
b. Southern African Development Community Qualifications Framework
c. Caribbean Vocational Qualifications Framework

Fig. 03: The world map provides an overview of current developments



LEGEND:

Dark blue:	Countries with fully functional qualifications frameworks
Red:	Countries that are developing qualifications frameworks
Light blue:	Countries that have introduced competencye-based training systems
Transparent green:	Regional or transnational qualifications frameworks under development
Transparent blue:	Mutual recognition sectoral arrangements of the ASEAN (the Association of Southeast Asian Nations)
Transparent orange:	Prospective Gulf Cooperation Countries regional framework (in principle agreed but not under development yet)
Not indicated: (transparent color)	the Virtual University for the Small and Island States of the Commonwealth Transnational Qualifications Framework (small states all over the world)

1 EQF Newsletter April 2010 "The External Dimension of the European Qualifications Framework Developments in EU Partner Countries and Beyond"

2.2 Some definitions

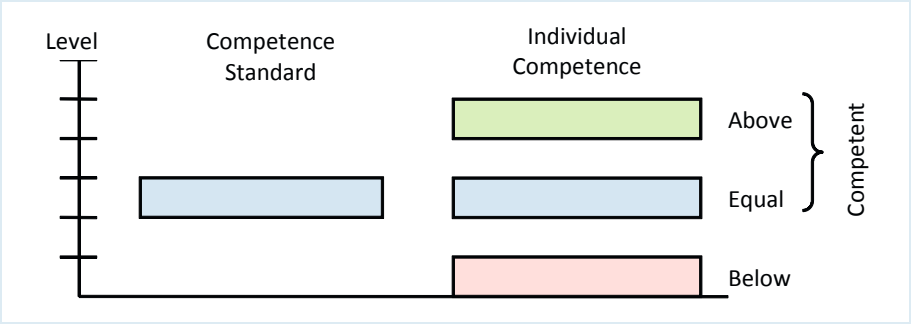
As mentioned above, close to 130 countries are now working in some form or another with CBET and NQF – developing their own national systems and using their own definitions of technical terms such as "Competence", "Qualification", or "Qualification Framework". Almost everybody nowadays talks about competency or competence, but not everybody means the same when using these words. For the use in this document the following definitions will be applied.

Competence means the capability to choose and use an integrated combination of knowledge, skills and attitudes to realize a task or work function

Competency, Competence
The two words are usually used synonymously. Their meaning is the capability of a person to choose and use (apply) an integrated combination of knowledge, skills and attitudes to realize a task or work function in a certain context.[2]

Competence standard means a document that specifies in a structured format how a person should perform a task or work function. In the world of work a competent professional will show a satisfactory (or superior) performance. His individual competence will be equal or above the level of the competency standard.

Fig. 04: Competence Standard and Individual Competence



Units of competence are the smallest units to determine, assess, and certify tasks or work functions

Level means one of the different levels of competences or a qualifications framework, arranged in ascending order from "1" to "n". These levels are of increasing complexity as a learner/employee progresses up the levels. The levels form part of the frameworks on which the different competences / qualifications are positioned.

Unit of competence means the "amount of competence" described in a competence standard. Units of competence are the smallest units to determine, assess, and certify tasks or work functions in a CBET system.

Units of competence are the "building blocks" of qualifications

Qualification means a document (professional title) which shows that someone has successfully finished a course of training or study which allows him or her to work in one of the occupations, trades, or professions. A qualification combines units of competence into groups which meet job roles and are logical skill clusters that meet workplace needs. Units of competence are the "building blocks" of qualifications.

A National Qualifications Framework (NQF) aims to integrate and coordinate national qualifications subsystems and their qualifications

National Qualifications Framework (NQF) is an instrument for the development, classification, and recognition of skills, knowledge, and competences along a continuum of agreed levels. NQFs structure existing and new qualifications, which are defined by learning outcomes, i.e. clear statements of what the learner must know or be able to do, whether

2 Adapted from "Competence-based curriculum development in higher education: some African experiences", Wim Kouwenhoven, http://dare.ubvu.vu.nl/bitstream/African/

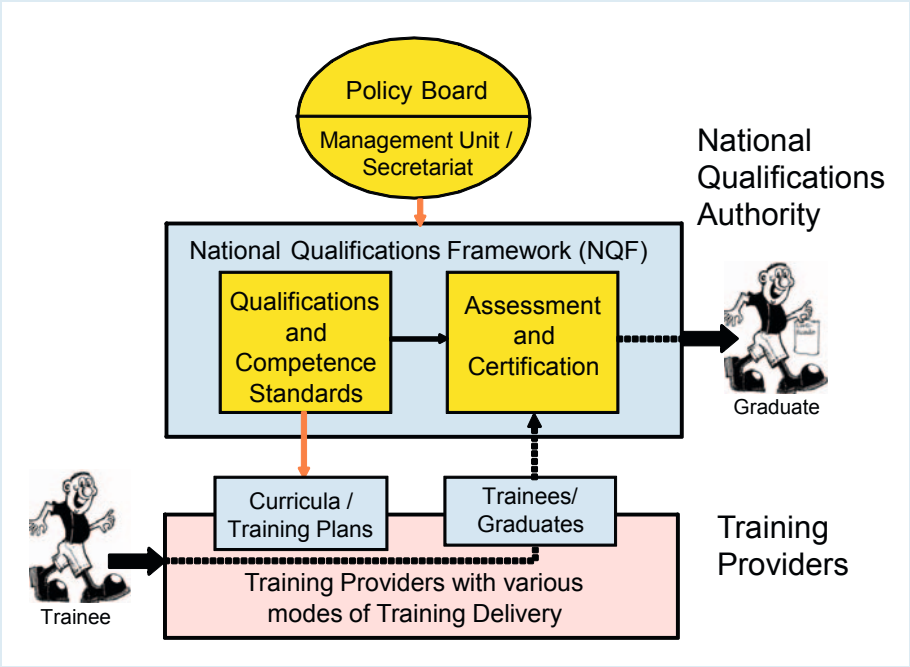
learned in a classroom, on-the-job, or less formally. The NQF indicates the comparability of different qualifications and how one can progress from one level to another, within and across occupations or industrial sectors (and even across vocational and academic sub-sectors).[3]

2.3 Elements of a CBET system

1. The graphic in Fig. 05 shows the **main elements of a CBET system**.
2. All countries today have some type of a VET system. To introduce changes into such a system – e.g. to make VET training more demand-oriented – somebody has to take care of this task. Many countries have therefore established a **National Qualifications Authority** (e.g. New Zealand Qualifications Authority NZQA, Scottish Credit and Qualifications Authority SCQA, South African Qualifications Authority SAQA). Other countries have attached this task to existing institutions, such as the Ministry of Education, Ministry of Labour, and National Training Organizations (especially in Latin America).
3. **Training providers** are in charge of facilitating the development of competences in individuals. There is a clear distinction between the two groups: National qualifications authorities set and validate standards, while training providers facilitate the development of competences in their students.

National Qualifications Authorities set and validate competence standards. Training providers facilitate the development of competences in their students

Fig. 05: General model of a CBET system



A National Qualifications Authority – through competence standards and qualifications – provides relevant information for the work of training providers

4. A national qualification authority is usually governed by a **policy board**, where representatives of the different stakeholders define the vision, mission, and major objectives of the institution. A **management unit**, supported by administrative staff in a **secretariat**, plans and implements necessary tasks and reports back to the board.
5. The major task consists in planning and establishing the **National Qualifications Framework** (NQF). Sector working groups determine and validate **competence standards and qualifications** in their respective economic sector or branch. These standards are then integrated into the competence and qualification matrix of the NQF.

Sector working groups determine and validate competence standards and qualifications in their respective economic sector or branch

3 Tuck, Ron: An Introductory Guide to National Qualifications Frameworks: Conceptual and Practical Issues for Policy Makers, ILO/EMP/SKILLS, 2007

6. These competence standards form the yardstick for future **assessment and certification** of competences. They consist of a hierarchy of statements which describe successful performance.
7. These competence standards also provide relevant information for training providers to develop modularized **curricula and training plans**. Such module development may take place on a central level (for all training providers) or on an individual level (each provider develops his own modules).
8. Based on these modules, **training is offered and carried out by** training providers. Continuous (formative) and final (summative) assessment of students' achievements accompany the training process. Yardsticks for assessment are performance criteria included in the competence standards.
9. Generally, it is a good idea to separate training and assessment, because trainers/ training institutions tend to evaluate the results of their training efforts with some bias. Therefore, **external assessment and certification**, under the charge of independent assessment institutions, have been established in some countries.

Competence standards provide relevant information for training providers to develop modularized curricula and training plans

Task 1 for group work
Each of the elements in the graphic above has to perform a specific function.
Which institutions are in charge of these functions in your country?

Function				Institution
1	Determine VET policy			
2	Manage, finance, administrate and quality control	a	Standard development	
		b	Curriculum development	
		c	Education, training	
		d	Assessment	
		e	Certification	
3	Provide education, training			
4	Assess and certify competences			

Countries are investing considerable resources to develop NQFs, but there is still little information about problems of implementation or evidence of actual measured achievements

2.4 Examples of National Qualifications Frameworks

2.4.1 The ILO Report on NQFs 2010

Qualifications frameworks seem to capture and represent many hopes and dreams. An international research project was conducted by ILO in 2009/2010 to gather empirical evidence about the impacts, strengths, but also the weaknesses of NQFs. The results might be particularly interesting for developing countries. The research focus was on the effectiveness of NQFs in bringing about change in skill-development systems or about their actual use by employers, workers, and training providers.

There is no single "right" model of an NQF

NQF may stand also for "No Quick Fix"

Three of the central findings of the ILO research report[4]:

a. There is no single "right" model of NQFs;
b. NQFs do not provide quick-fix or simple solutions to the complex problems facing countries in relation to education, skills development, and employment; and
c. Expectations that qualifications frameworks can achieve the ambitious policy objectives claimed for them in relatively limited time periods seem to be ill-founded.

4 S.Allais: The implementation and impact of National Qualifications Frameworks: Report of a study in 16 countries. ILO, 2010

2.4.2 How NQFs came into existence

In the mid-1990s NQF development started in Australia, England, New Zealand , Scotland, and South Africa

An outcomes-based approach to qualifications and curriculum from occupational psychology in the United States in the 1960s was introduced to vocational training in Scotland and the UK around 1990. Influenced by these experiences, "by the mid-1990s there were frameworks established or in the process of being established in Australia, England, New Zealand, Scotland, and South Africa. In the late 1990s and early 2000s, frameworks started to be established in other countries. Much of this spread was in vocational education, often using the British NVQ model as a basis".[5]

2.4.3 A tentative overview of NQFs around the world

Fig. 06 below provides information about which countries are involved in developing NQFs and their stages of development around 2010. The five stages of development applied in the overview[6] are:

1. **Established.** The NQF has been made official through formally announced policies or legislation. Structures exist or have been set in place to fulfill the various roles associated with the NQF. There are qualifications on the framework.
2. **Developing and implementing.** The country is in the process of developing policy and structures through which the NQF will be implemented.
3. **Planning and/or designing.** The country is exploring the form that the NQF should take, how it should work, and what the roles of various role-players and stakeholders should be.
4. **Considering.** The country is considering implementing an NQF.
5. **Competence framework or competence-based training system.** The country has established or is establishing competence-based training at different levels and covering various qualifications. This includes the development of mechanisms to identify competences and standardize them as well as recognizing prior learning. This usually occurs within a competence framework with different levels and areas, and does not necessarily imply a move towards a full NQF.

Nearly all the developing or middle-income countries in the ILO report have long lists of donor organizations supporting the reform of technical vocational education and training, with a particular focus on competence-based education. Policy borrowing is a major factor in the spread of NQFs. The borrowing country tries to replicate what it saw in the original country. Often official documents in the origin country make strong claims about ***what policy makers hope will be achieved****. But, in most instances, what is not available from the official documents, is whether or not any of the aims of the NQF in the origin country were achieved.*

Adapted from ILO Report 2010

5 ibid, p. 18, NVQ = National Vocational Qualification
6 Adapted from ILO Report 2010, p. 22 f.

In 2010, the stage of development of NQFs worldwide was very different: From beginning with competence frameworks to established qualifications frameworks

Fig. 06: A tentative overview of NQFs around the world in 2010

	1. Established	2. Developing and implementing	3. Planning and/or designing	4. Considering	5. Competence framework
Sub-Saharan Africa	Botswana, Mauritius, Namibia, South Africa	Lesotho, Seychelles	Angola, Ethopia, Kenya, Nigeria, Rwanda, Zambia	DRC, Ghana, Madagascar, Malawi, Mozambique, Swaziland, Tanzania, Uganda, Zimbabwe	
Americas & the Caribbean	OECS	Barbados, Canada, Honduras, Jamaica, Trinidad and Tobaco	Antigua and Barbuda, Chile, Colombia, Grenada, Guyana		Brazil, Costa Rica, Dominican Republic, El Salvador, Guatemala, Mexico, Nicaragua, Panama
Asia (South & East) & Pacific	Australia, Hong KONG, SAR, Malaysia, New Zealand, Philippines, Samoa, Singapore, Sri Lanka, Vanuatu	China, Fiji, Maldives, Paific Islands, Papua New Guinea, Thailland, Tonga, Viet Nam	Bangladesh, India, Pakistan	Afghanistan, Bhutan, Brunei, Cambodia, China, Japan, Laos, Macau, Mongolia, Nepal (has NVQs), Republic of Korea	Indonesia
European & Central Asia	England, France, Ireland, Malta, Northern Ireland, Romania, Scotland, Wales	Albania, Belgium Flanders, Bosnia, Czech Republic, Estonia, Georgia, Kosovo, Lithuania, Montenegro, Portugal, Slovenia, Turkey	Andorra, Armenia, Austria, Belgium, French, Croatia,, Cyprus, Denmark, Germany, Greece, Hungary, Iceland, Italy, Norway, Poland, Russian Federation, Serbia, Slovak Republic, Spain	Azerbaijan, Bulgaria, Kazakhstan, Kyrgyzstan, Latvia, Luxembourg, Macedonia, Switzerland, Ukraine, Uzbekistan	
Middle East & North Africa		Tunesia	Algeria, Egypt, Jordan, Marocco, United Arab Emirates	Iraq	

2.4.4 The Australian Qualifications Framework (AQF)

The Australian Qualifications Framework (AQF) was first introduced in 1995 and revised in 2011. The actual AQF is the national policy for regulated qualifications in Australian education and training. It incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework.

The new ten-level Australian Qualifications Framework (AQF) incorporates the
1. schools sector
2. VET sector
3. higher education (HE) sector

CBET is only applied in VET. Schools and HE sectors are based on syllabus and/or input models

Fig. 07: Australian Qualifications Framework (AQF) with ten levels

The users of the new ten-level AQF (Fig. 07) span schools, vocational education and training, and higher education and include the accrediting authorities and institutions providing education and training.

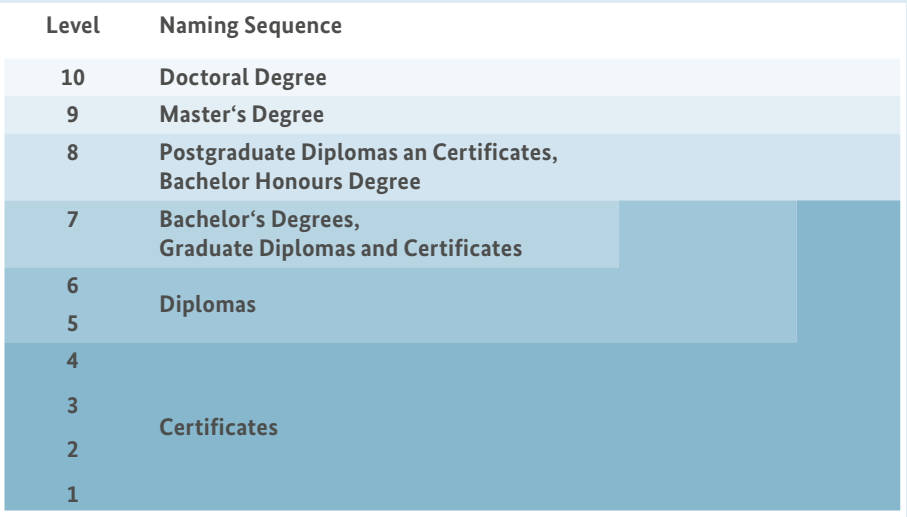
Vocational education and training qualifications are based on competence-based training, with specifications of required competences or outcomes in 'training packages', while higher education qualifications and senior secondary school certificates are based on syllabus or input models.

There are eleven national Industry Skills Councils (ISCs) that cover the main industry sectors in the Australian economy. Each organization develops sector-specific training packages.

2.4.5 The New Zealand Qualifications Framework (NZQF)

The New Zealand Qualifications Framework (NZQF) is a ten-level comprehensive list of all quality-assured, work-related qualifications in post-compulsory education. The NZQF starts with level one (usually age 17), with level 1 to 4 National Certificates and continues to level 5 and 6 National Diplomas (Fig. 08).

Fig. 08: New Zealand Qualifications Framework (NZQF)



The New Zealand Qualifications Framework (NZQF) is a ten-level list of work-related qualifications in post-compulsory education

The New Zealand Qualifications Authority (NZQA) is responsible for levels 1 to 6 only. Universities fill up levels 7 to 10

These qualifications are nationally recognized because they are designed by national industry representatives. There are now more than 800 National Certificates and National Diplomas in the NZQF, recognizing achievement in a variety of industries and subjects. They include the National Certificates of Educational Achievement (NCEA) levels 1–3 for senior secondary students.

The New Zealand Qualifications Authority is responsible for quality assurance up to higher education non-university institutions; the quality assurance of universities and university programmes is the task of the New Zealand Vice Chancellors Committee.

2.4.6 The South African National Qualifications Framework (SANQF)

The South African National Qualifications Framework (SANQF) with eight levels was an attempt to integrate all education and training into one single framework

Fig. 09: South African National Qualifications Framework (SANQF) 1995 to 2008

NQF Level	Band	Qualification Type
8	Higher Education and Training	– Post-doctoral research degrees – Doctorates – Master's degrees – Professional Qualifications – Honour's degrees – National first degrees – Higher diplomas – National diplomas – National certificates
7		
6		
5		
Further Education and Training Certificate (FETC)		
4	Further Education and Training	– National certificates
3		
2		
General Education and Training Certificate (GETC)		
1	General Education and Training	Grade 9 / ABET Level 4 – National certificates

Its implementation by the South African Qualifications Authority (SAQA) was a very ambitious top-down approach

The original design of the South African NQF (Fig. 09) and its implementation by the South African Qualifications Authority (SAQA) was an attempt to integrate all education and training into one single framework.[7] In addition, it was designed to remove the power of defining knowledge and skills from formal institutions, ensuring that industry could play a much larger role in defining standards. It has been seen internationally as one of the most, if not the most, ambitious qualifications framework. It was a typical top-down approach – and things did not go according to plan.

But things did not go according to plan

In 2001, after five years of SAQA being operative, increasing friction between the "education community" (Department of Education) and the "training community" (Department of Labour) resulted in a call for an independent evaluation.

"Discipline-based" and "occupational context-based" learning should be recognized as separate learning modes

The evaluation team noted that the "one size fits all" approach of a single integrated framework did not adequately accommodate learning in different contexts. The report recommended that "discipline-based" and "occupational context-based" learning be recognized as separate learning modes or pathways, with different qualifications and quality assurance models.

The new SANQF will have three sub-frameworks and ten levels

Finally, in 2008, the legal basis was provided to establish three NQF sub-frameworks, one for higher education qualifications, one for general and further education qualifications, and one for occupational qualifications, each managed by its respective quality council in collaboration with SAQA. The new SANQF 2.0 will have ten levels.

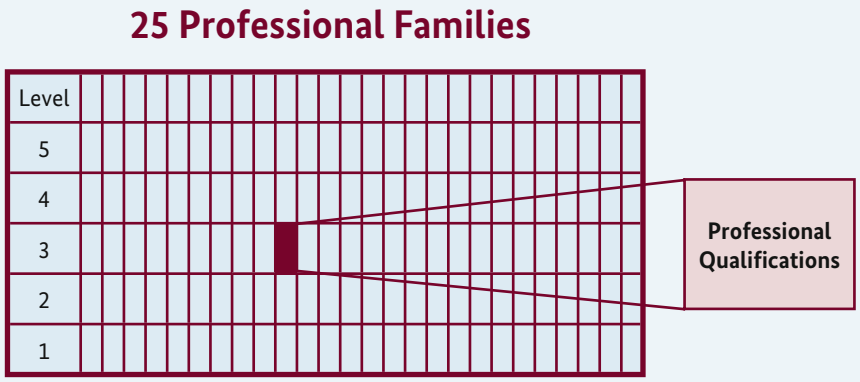
7 Adapted from Stephanie Allais: "The changing faces of the South African National Qualifications Framework" in: ILO 2009: Employment Working Paper No. 45, "Learning from the first qualifications frameworks"

2.4.7 The Ibero-American approach to NQFs

The Spanish National Catalogue of Professional Qualifications[8], known in Spanish as CNCP (Catálogo Nacional de Cualificaciones Profesionales), is an instrument of the Spanish National System for Qualifications and Vocational Education and Training (VET) which arranges the professional qualifications according to the competences required for a job role.

Ibero-American NQFs usually have five levels. Levels 1 to 3 are VET levels, with levels 4 and 5 reserved for university education

Fig. 10: The Spanish National Catalogue of Professional Qualifications



The CNCP consists of professional qualifications arranged in 28 professional families and at five levels. So far, about 700 qualifications have been developed, but only for levels 1, 2 and 3, which correspond to
Level 1 = semi-skilled workers (drop-outs from compulsory schooling)
Level 2 = lower technician or skilled workers (upper secondary school)
Level 3 = higher technicians (post-secondary, non-university technician schools)

The majority of Spanish-speaking countries in Central and South America have developed CBET systems which are very similar to the Spanish model. Sometimes, CBET is provided parallel by government agencies such as the Ministry of Education, and a national training provider (which is usually an institution close to the Labour Ministry).

Most Spanish-speaking countries in Central and South America have developed CBET systems which are similar to the Spanish model

Task 2 for group work
The two companies of the water and wastewater sector, one in North Africa, the other in South America, are in countries which have started to work with CBET. There is still a lot of work to be done until an NQF is in existence in the two countries. Which strategy would you recommend to these companies to solve their actual manpower problems?

8 Adapted from "National System for Qualifications and VET", INCUAL, Spain,

3 Searching for Qualifications and Competences

3.1 Experiences from other countries

Let's go back to the water and wastewater sector in the two countries. Providers of initial training (educational planning) as well as persons responsible for further and up-grade training (human resource planning) will be interested to learn from experiences gained in other countries.

Standards from other countries are useful for benchmarking and may provide "raw material" for adaptation

"Developing countries should obtain standards from other developed and developing countries for benchmarking purposes and with a view toward adapting selected standards, particularly those that are international in scope. This will save resources, speed development, help ensure the quality of standards, and facilitate labor mobility."
Source: D. Fretwell (World Bank), M. V. Lewis (The Ohio State University), A. Deij (European Union-European Training Foundation): "A Framework for Defining and Assessing Occupational and Training Standards in Developing Countries" World Bank/ ERIC/ETF, 2001

Adopt it if it fits, adapt it to make it fit, and develop it if it doesn't fit

A common rule of thumb is: Adopt it if it fits, adapt it to make it fit, and develop it if it doesn't fit.

Please note: The main focus in this manual will be on technical-vocational qualifications / competences for operation and maintenance tasks.

3.2 Occupational profiles and job descriptions

Occupational profiles provide useful information for trainers about tasks and duties in specific occupations

An **occupational profile** describes the tasks and duties to be carried out in a specific occupation; sometimes related knowledge, skills, tools, and equipment are also included. Occupational profiles are an essential part of standard classifications of occupations, such as the International Standard Classification of Occupations (ISCO-2008 from ILO), or the Australian Standard Classification of Occupations (ASCO-1997).
Occupational profiles provide a summarized description of an occupation.

Please note: From here onwards the examples in the manual will concentrate mainly on two occupations:

a. Water and Wastewater Plant Operator
b. Motor Mechanic.

Have you ever thought about the tasks of a water and wastewater plant operator? Here they are!

Occupational Profile
ASCO 7129-21 Water and Wastewater Plant Operator
Operates plant and equipment to store, distribute and purify water, and to remove wastes from wastewater.

Skill Level:
The entry requirement for this occupation is an AQF Certificate II or higher qualification or at least one year of relevant experience.

Tasks Include:
- *operates pumps, valves and gates to control the flow of water*
- *regulates flow through stages of treatment such as filtering, the addition of chemicals and aeration*
- *monitors flow meters, water pressure and level gauges*
- *takes samples for analysis*
- *prepares reports and logs detailing plant operations*

– *performs routine servicing and cleaning of plant, pipes and channels*
– *investigates and repairs faults in water supply and storage systems*
– *operates waste disposal or water purification equipment*

Specializations:
Irrigation Supervisor, Sewage Plant Operator.

Page last updated 07 September 2006
Source: http://www.abs.gov.au/ausstats/abs@.nsf/66f306f503e529a5ca25697e0017661f/33579991D7C1245FCA25697E00185185?opendocument

The occupational profile above from Australia is rather compact. In contrast, a detailed "Report for Water and Wastewater Treatment Plant and System Operators" from O*NET has 21 pages. The O*NET programme is the primary source of occupational information in the US. Central to the programme is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptions.
A detailed "Report for Automotive Master Mechanic" from O*NET has 23 pages.

The O*NET programme is the primary source of occupational information in USA

Occupational Profile
ASCO 4211-11 Motor Mechanic
Repairs, maintains and tests vehicle or other engines and related mechanical components.

Skill Level:
The entry requirement for this occupation is an AQF Certificate III or higher qualification. Registration or licensing may be required.

Tasks Include:
– *diagnoses faults in motor vehicles*
– *raises vehicles, using hydraulic hoists or jacks*
– *dismantles or removes engine assemblies, transmissions, steering mechanisms or other components, and checks parts*
– *repairs or replaces worn or defective parts, and reassembles mechanical components*
– *tests and adjusts repaired sub-assemblies, and re-installs them*
– *services or overhauls engines*
– *tunes engines to achieve smoother running and ensure compliance with pollution regulations*
– *relines and adjusts brakes and aligns wheels*
– *changes oil and filters, and lubricates vehicles or fuelled motor appliances*
– *may inspect vehicles and issue roadworthiness certificates or detail work required to achieve roadworthiness*

Specializations:
Automatic Transmission Mechanic, Automotive Airconditioning Mechanic.
Brake Mechanic, Diesel Motor Mechanic, Motorcycle Mechanic, Outboard Motor Mechanic
Page last updated 24 June 2009

Motor mechanics should be highly qualified experts to perform these tasks adequately

Job descriptions are another source of information about specific occupations, especially for in-company training.

Job descriptions are another source of information about specific occupations, especially for in-company training

Job descriptions are written statements that describe:

- duties,
- responsibilities,
- most important contributions and outcomes needed from a position,
- required qualifications of candidates, and
- reporting relationship and co-workers of a particular job.

Job descriptions are based on objective information obtained through job analysis, an understanding of the competences and skills required to accomplish needed tasks, and the needs of the organization to produce work.

Job descriptions may also include information about working conditions, tools, equipment used, knowledge and skills needed, and relationships with other positions.

A less voluminous job description for an Automobile Mechanic from the website of CareerPlanner.com (USA) is presented below.

Occupational profiles and job descriptions have a lot in common

AUTOMOBILE MECHANIC Job Description

Repairs and overhauls automobiles, buses, trucks, and other automotive vehicles: Examines vehicle and discusses with customer or AUTOMOBILE-REPAIR-SERVICE ESTIMATOR (automotive ser.); AUTOMOBILE TESTER (automotive ser.); or BUS INSPECTOR (automotive ser.) nature and extent of damage or malfunction. Plans work procedure, using charts, technical manuals, and experience. Raises vehicle, using hydraulic jack or hoist, to gain access to mechanical units bolted to underside of vehicle. Removes unit, such as engine, transmission, or differential, using wrenches and hoist. Disassembles unit and inspects parts for wear, using micrometers, calipers, and thickness gauges. Repairs or replaces parts, such as pistons, rods, gears, valves, and bearings, using mechanic's hand tools. Overhauls or replaces carburetors, blowers, generators, distributors, starters, and pumps. Rebuilds parts, such as crankshafts and cylinder blocks, using lathes, shapers, drill presses, and welding equipment. Rewires ignition system, lights, and instrument panel. Relines and adjusts brakes, aligns front end, repairs or replaces shock absorbers, and solders leaks in radiator. Mends damaged body and fenders by hammering out or filling in dents and welding broken parts. Replaces and adjusts headlights, and installs and repairs accessories, such as radios, heaters, mirrors, and windshield wipers. May be designated according to specialty as Automobile Mechanic, Motor (automotive ser.); Bus Mechanic (automotive ser.); Differential Repairer (automotive ser.); Engine-Repair Mechanic, Bus (automotive ser.); Foreign-Car Mechanic (automotive ser.); Truck Mechanic (automotive ser.). May be designated: Compressor Mechanic, Bus (automotive ser.); Drive-Shaft-And-Steering-Post Repairer (automotive ser.); Engine-Head Repairer (automotive ser.); Motor Assembler (automotive ser.).

Source: http://dot-job-descriptions.careerplanner.com/AUTOMOBILE-MECHANIC.cfm

3.3 Qualifications

3.3.1 Examples from Australia

Each country has developed its own type of qualifications

Qualifications in VET are created by combining units of competence into groups which meet job roles and are meaningful in the workplace. Typical names of qualifications are "Water Treatment Plant Operator", or "Motor Mechanic", or "Bank Customer Service Assistant".

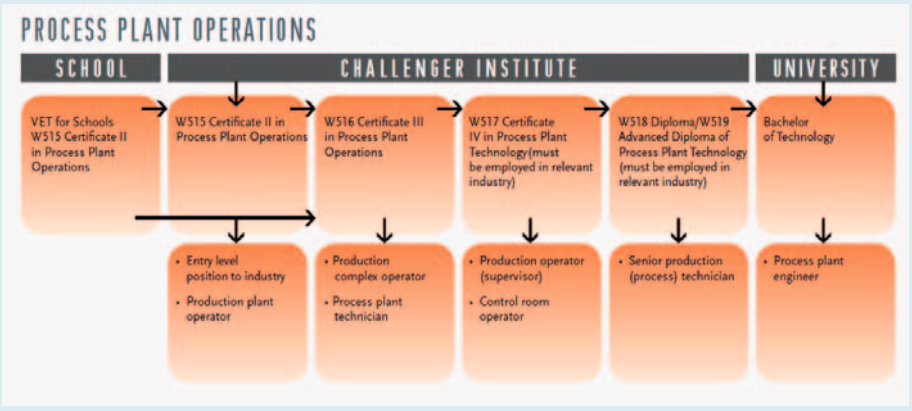
In Australia, a Training Package is an integrated set of qualifications, competence standards, and assessment guidelines for a specific industry

In Australia, a **Training Package** is an integrated set of qualifications, competence standards and assessment guidelines for a specific industry, industry sector, or enterprise. There is some type of hierarchical order:
A training package is composed of several qualifications, and each qualification is composed of several competence standards with related assessment guidelines and an employability skills summary.

VET training packages can incorporate the following six AQF qualifications, differentiated by their level:

- Level 1 Certificate I in ...
- Level 2 Certificate II in ...
- Level 3 Certificate III in ...
- Level 4 Certificate IV in ...
- Level 5 Diploma of ...
- Level 6 Advanced Diploma of ...

Fig. 11: Process Plant Operations Job Pathways



Job pathways show how school, VET, and university provide those qualifications required for different job levels in the world of work

Fig. 11 above shows the three sectors of the AQF: School, VET (represented by the VET Institute Challenger), and university, each with their respective qualifications. After each qualification there are two possibilities indicated by an arrow: Continue with the next higher qualification or exit into the world of work. Direct entry can be made at Certificate II level qualifications. Entry at other levels is through "Recognition of Prior Learning" (RPL) assessed on existing industry experience or qualifications.

Fig. 12: The NWP07 Water Training Package is a training package for the water industry and supports and provides training pathways for a diverse range of people working in water organizations across the nation.

Water Industry Job Pathways				NWP07	
Potential Australian Apprenticeships Job Outcomes				Further Study Options	
Stream	**Certificate II**	**Certificate III**	**Certificate IV**	**Diploma**	**Vocational Graduate Certificate**
Water Operations	Maintenance Assistant ■ Dams and Catchment Areas ■ Wastewater Treatment Plant ■ Water Distribution ■ Water Treatment Plant ■ Save Water Assistant	■ Maintenance Worker – Dams and Surrounding Catchments ■ Wastewater Collection System Operator ■ Wastewater Treatment Plant Operator ■ Senior Water Treatment Plant Operator ■ Save Water Officer	■ Trade Waste Controller ■ Supervisor – Water and Wastewater Treatment Plants ■ Save Water Controller	■ Manager – Trade Waste ■ Manager Treatment ■ Manager – Water and Wastewater Industry ■ Manager – Wastewater Collection (Sewerage) Systems ■ Manager – Water Supply Distribution Systems ■ Manager – Water Catchment ■ Manager – Stormwater ■ Save Water Manager	■ Dam Superintendent ■ Technical Officer ■ Project Manager – Water Treatment Plant ■ Operations Manager ■ Planning Engineer ■ Network Modeller

Fig. 13: The AUR05 Training Package is aimed at satisfying the training needs of RS&R sector of the automotive industry, including occupational areas covering outdoor power equipment, recreational boating, bicycles, farm machinery, and mobile plant and equipment.

Automotive Retail, Service and Repair Job Pathways				AUR05
Potential Australian Apprenticeships Job Outcomes				Further Study Options
Stream	**Certificate II**	**Certificate III**	**Certificate IV**	**Diploma**
Automotive Mechanical	■ Light Vehicle Serviceperson ■ Heavy Vehicle Serviceperson ■ Motorcycle Serviceperson	■ Heavy Vehicle Road Transport Mechanic ■ Heavy Vehicle Mobile Equipement Mechanic ■ Light Vehicle Mechanic ■ Motorcycle Mechanic ■ Agriculture Mechanic ■ Motor Mechanic	■ Technical Supervisor ■ Service Manager ■ Workshop Manager ■ Vehicle Performance Technician ■ Motor Mechanic – Senior ■ Automotive Electrical/ Mechanic Repairer	■ Automotive Specialist Technician ■ Diagnostic Specialist ■ Fixed Operations Manager
Automotive Specialist	■ Air Condition Serviceperson ■ Cooling System Serviceperson ■ Cylinder Head Reconditioner ■ Driveline Serviceperson ■ Transmission Serviceperson ■ Exhaust Fitter ■ Radiator Repairer ■ Steering & Suspension Serviceperson ■ Tyre Fitter – Heavy Vehicle ■ Tyre Fitter – Light Vehicle ■ Underbody Technician	■ Transmission Mechanic ■ Brake Specialist ■ Diesel Fitter ■ Diesel Fuel Specialist ■ Driveline Specialist ■ Engine Reconditioner ■ Gas Vehicle Installer ■ Fork Lift Mechanic ■ Steering & Suspension Specialist ■ Underbody Technican	■ Technical Supervisor ■ Workshop Manager ■ Service Manager ■ Mechanical Repairer	■ Automotive Specialist Technician ■ Diagnostic Specialist
Automotive Electrical Technology	■ Electrical Accessory Fitting	■ Automotive Electrician	■ Workshop Manager ■ Workshop Supervisor	■ Automotive Specialist Technician ■ Diagnostic Specialist
Direct entry can be made at Certificate II or III level qualifications. Entry at other levels is through Recognition of Prior Learning assessed on existing industry experience or qualifications.				

The qualification in Fig. 14 is composed of three compulsory and eight elective (non-compulsory) units of competence. Developers of qualifications must ensure that the way in which units of competence are grouped and packaged results in qualifications with a broad range of relevant competences that a majority of employers will find sufficient for normal job roles. The most common packaging models include combinations of core and elective, or specialist, units of competence.

A common packaging model for qualifications includes a combination of core (or compulsory) and elective units of competence

Fig. 14: An example for a Certificate III qualification from the NWP07 Water Training Package: Wastewater Treatment Plant Operator.

Wastewater Treatment Plant Operator
Certificate III in Water Operations – NWP30107

Job Description
Employees provide leadership in monitoring and promoting a safe workplace and coordinate teams to achieve maximum output in waste water plant operations. Also entails dealing with the general public in relation to wastewater issues.

Summary of Training
CORE UNITS (3 required)
Implement, monitor and coordinate environmental procedures
Organize personal work priorities and development
Contribute to OHS hazard identification and risk assessment

ELECTIVE SKILLS (8 required)
Monitor, operate and control aerobic bioreactor processes
Monitor, operate and control anaerobic bioreactor processes
Monitor, operate and control nutrient removal processes
Monitor, operate and control dewatering processes
Perform laboratory testing
Perform leak detection
Monitor, operate and control wastewater treatment processes
Monitor, operate and control granular media filtration processes

Note Please be aware that this Sample Training Programme is designed to be a guide only to the selection of non-compulsory competence units. Alternative combinations of competence units may be selected.

Industry Skill Councils prepare the unit standards for training packages and put them together in a "Unit Grid"

Industry Skill Councils prepare the components for training packages. For a Certificate III in Water Operations more than 50 "Technical Competences" were developed and published in a "Unit Grid", which is presented below.

Fig. 15: The "Unit Grid" for a Certificate III qualification from the NWP07 Water Training Package: Wastewater Treatment Plant

Operator Source: NWP07 p.87

Unit Grid

BSBOHS303A Contribute to OHS hazard identification and risk assessment
BSBWOR301A Organize personal work priorities and development
LGAWORK405A Plan and supervise roadworks
LGAWORK406A Supervise concrete works
NWP300B Provide and promote customer service
NWP301B Implement, monitor and coordinate environmental procedures
NWP302A Install meters for non-potable, non-urban water supplies
NWP303A Monitor and control maintenance of water and wastewater system assets
NWP304A Maintain meters for non-potable, non-urban water supplies
NWP305B Monitor and conduct minor maintenance on complex flow control and metering devices
NWP308B Test and commission wastewater collection systems
NWP309B Test and commission water distribution systems
NWP310B Monitor and operate water distribution systems
NWP311B Monitor and operate wastewater collection and transfer systems
NWP315B Investigate and report on breaches of water industry legislation
NWP316B Monitor and schedule water deliveries
NWP317B Control water quality in distribution systems
NWP318A Monitor and operate gated spillways
NWP319A Monitor and control dam operations
NWP320B Monitor and implement dam maintenance
NWP321B Inspect and operate groundwater regulation
NWP322B Inspect and operate surface water systems
NWP323B Monitor and coordinate catchment operations
NWP324B Inspect and report river regulation operations
NWP326A Conduct and report dam safety instrumentation monitoring
NWP327A Inspect and report on concrete dam safety
NWP328A Inspect and report on embankment dam safety
NWP330B Establish positions of underground utilities using locating devices
NWP331B Inspect conduit and report on condition and features
NWP332B Monitor and control drainage operations
NWP333B Monitor and control rural water distribution operations
NWP338B Perform infiltration and odour investigations
NWP339B Perform leak detection
NWP340A Measure and process hydrometric stream discharge data using wading gaugings
NWP342A Commission, decommission and monitor hydrometric sites, stations and facilities
NWP345B Monitor, operate and control water treatment processes
NWP346B Monitor, operate and control wastewater treatment processes
NWP347B Monitor, operate and control coagulation and flocculation processes
NWP348B Monitor, operate and control sedimentation and clarification processes
NWP349B Monitor, operate and control incineration processes
NWP350B Monitor, operate and control trickling filter processes
NWP351B Monitor, operate and control activated sludge processes
NWP352B Monitor, operate and control dissolved air flotation processes

NWP353B Monitor, operate and control anaerobic bioreactor processes
NWP354B Monitor, operate and control granular media filtration processes
NWP356B Monitor, operate and control ion exchange processes
NWP357B Monitor, operate and control reverse osmosis and nano-filtration processes
NWP359B Monitor, operate and control nutrient removal processes
NWP360B Monitor, operate and control dewatering processes
NWP361B Monitor, operate and control gas scrubber treatment processes
NWP362B Monitor, operate and control reclaimed water irrigation
NWP363B Monitor performance and control maintenance of treatment plant assets
NWP364B Perform laboratory testing
NWP365A Identify and confirm blue green algae outbreaks
NWP366A Monitor, operate and control chloramination disinfection processes
NWP367A Monitor, operate and control activated carbon adsorption processes
NWP368A Respond to blue green algae incidents

It is up to each Registered Training Organization (RTO) to select from this unit grid – according to packaging rules – those competence units which will best meet the regional and sector-specific competence demand. This procedure guarantees a high flexibility to adapt training programmes to changing manpower demands.

Registered Training Organizations (RTOs) select unit standards from this unit grid to package qualifications according to specific demands

Fig. 16: An example for a Certificate III qualification in Automotive Mechanical Technology from the AUR05 Training Package: Motor Mechanic

Automotive Mechanic (Motor Mechanic)
Certificate III in Automotive Mechanical Technology – AUR30405

Job Description
Employees will service, repair and diagnose faults in motor vehicles weighing up to 4.5 tonnes including light vehicle engines, transmission, suspensions, steering, brakes, electrical systems and other components

Summary of Training
Apply safe working practices
Carry out diagnostic procedures
Implement and monitor environmental regulations in the automotive mechanical industry
Inspect and service braking systems
Repair hydraulic braking systems
Test, service and charge batteries
Carry out repairs to single electrical circuits
Repair charging systems
Repair starting systems
Service and repair electronic spark ignition engine management systems
Service and repair electronic drive management systems
Service and repair electronic body management systems
Repair ignition systems
Inspect and service engines
Repair cooling systems
Inspect and service cooling systems

Packaging of qualifications has to be done according to preset packaging rules

Inspect and service emission control systems
inspect and service transmissions (manual)
Inspect and service transmissions (automatic)
Service final drive assemblies
Service final drive (driveline)
Inspect, service and/or repair clutch assemblies and associated operating system components
Repair transmissions – manual (light vehicle)
Repair transmissions – automatic (light vehicle)
Repair final drive assemblies (light vehicle)
Repair final drive – driveline (light vehicle)
Service petrol fuel systems
Repair petrol fuel systems
Inspect and service steering systems
Inspect and service suspension systems
Repair steering systems (light vehicle)
Repair suspension systems (light vehicle)
Remove, inspect, repair and fit tyres and tubes (light)
Overhaul engines and associated engine components

Note Please be aware that this Job and Training Description is designed to be a guide only to the selection of non-compulsory units. Alternative combinations of units may be selected.

These are the packaging rules for a Certificate III in Automotive Mechanical Technology

To be awarded the Certificate III in Automotive Mechanical Technology, competence must be achieved in thirty-six (36) units of competence,

- three (3) core units of competence
  - AURC270103A Apply safe working practices
  - AURT271781A Implement and monitor environmental regulations in the automotive mechanical industry
  - AURT366108A Carry out diagnostic procedures
- thirty-three (33) elective units of competence, out of a unit grid with some 250 units

Employability skills are "soft skills" required not only to gain employment, but also to progress within an enterprise

Employability skills

The definition of employability skills is "skills required not only to gain employment, but also to progress within an enterprise so as to achieve one's potential and contribute successfully to enterprise strategic directions". Employability skills are also sometimes referred to as generic skills, capabilities, or key competences.

The Employability Skills Framework identifies eight employability skills:

- communication
- teamwork
- problem solving
- initiative and enterprise
- planning and organizing
- self-management
- learning
- technology (IT, OHS)

These employability skills can be further described for particular occupational and industry contexts.

An Employability Skills Summary exists for each qualification

An Employability Skills Summary exists for each qualification. Summaries are designed to assist trainers and assessors to identify and include important industry application of employability skills in learning and assessment strategies.

3.3.2 Examples from New Zealand

Review of qualifications in 2009

In New Zealand, tertiary education providers and industrial training organizations offer non-university post-secondary VET at certificate and diploma level. Industry training is co-ordinated by 34 Industry Training Organizations (ITOs) on behalf of their industries.

In New Zealand, education providers and industrial training organizations offer non-university post-secondary VET

A review carried out in 2009 found that the New Zealand qualifications system at certificate and diploma level – established from 1992 onwards – had become complex and difficult to understand for both learners and employers. The review identified an increasing proliferation of certificates and diplomas, with education providers and ITOs often developing duplicate qualifications. In 2009, New Zealand had 5,937 registered qualifications, 76 per cent of which were certificates and diplomas, mostly in vocational areas. For example, there were 74 separate hairdressing and 96 different tourism studies certificates.[9] Therefore, in 2010, changes were initiated to simplify the NZQF system. The changes streamline the system at levels 1 to 6 on the ten-level NZQF.

In 2009 the New Zealand qualifications system at certificate and diploma level had become too complex and difficult to understand for both learners and employers. Therefore, changes were initiated in 2010

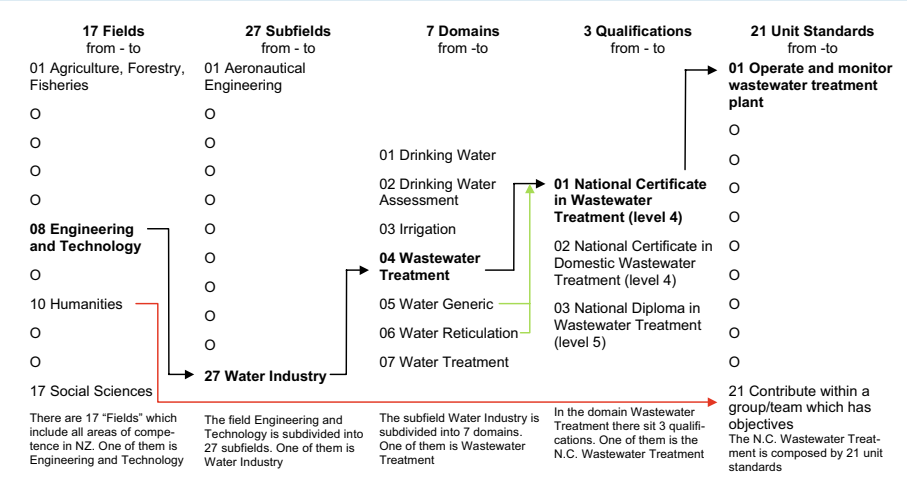
Example 1: "National Certificate in Wastewater Treatment (level 4)"

The classification system of the NZQF consists of fields, sub-fields, and domains. Qualifications and unit standards sit on this structure. The qualification "National Certificate in Wastewater Treatment (level 4)" is one of the three qualifications in the domain "Wastewater Treatment" (please refer to Fig. 17 below). The domain "Wastewater Treatment" is part of the sub-field "Water Industry", which in turn is part of the field "Engineering and Technology". Engineering and Technology, together with 16 other "fields", include all areas of competence[10] which are represented on the NZQF. A total of 21 unit standards are integrated into the "National Certificate in Wastewater Treatment (level 4)".

NZQF structure consists of fields, subfields, and domains. Qualifications and unit standards sit on this structure

Training for wastewater treatment is provided by some education providers and the Agriculture Industry Training Organization (AgITO).

Fig. 17: The hierarchical structure of the NZQF and the position of the qualification "National Certificate in Wastewater Treatment (level 4)", which is composed of 21 unit standards



9 Source: http://www.nzqa.govt.nz/about-us/news/new-operating-requirements-for-nzqf/

10 Source: http://www.nzqa.govt.nz/providers-partners/development-of-assessment-standards/additions-and-changes-to-the-classification-system/

Example: Wastewater treatment plant operator

National Certificate in Wastewater Treatment (level 4)
Level 4 Credits 136

Purpose
The National Certificate in Wastewater Treatment (level 4) [Ref: 0879] is designed to recognize the skills and knowledge required for people to work as site operators at wastewater treatment plants.

This qualification recognizes the skills required to operate a wastewater treatment plant; and knowledge of preliminary, primary, sludge digestion, as well as activated sludge, fixed growth reactor, and tertiary wastewater treatment processes, and of oxidation ponds, biosolids management, and pumping systems in wastewater treatment. The qualification also recognizes the required knowledge of science theory relating to water, mathematics, processes and process control, quality management, quality sampling techniques, and legislation relevant to wastewater treatment.

All standards in this qualification are compulsory because wastewater treatment involves a set of well-defined skills that apply across all types of wastewater treatment plants.

On completion of this qualification candidates can progress to the National Diploma in Wastewater Treatment (Level 5) [Ref: 0966].

Credit Range

The qualification includes unit standards from levels 2, 3 and 4

	Compulsory
Level 2 credits	5
Level 3 credits	78
Level 4 credits	53
Total	136

Compulsory
The following standards are required:

Fig. 18: Essential elements of the qualification "National Certificate in Wastewater Treatment (level 4)", which is composed of 21 unit standards with a total of 136 credits

Unit standards

Engineering and Technology > Water Industry > Wastewater Treatment			
ID	**Title**	**Level**	**Credit**
17877	Operate and monitor a wastewater treatment plant	4	18
17881	Demonstrate knowledge of primary processes in wastewater treatment	3	5
17882	Demonstrate knowledge of sludge digestion processes in wastewater treatment	4	10
17885	Demonstrate knowledge of oxidation ponds in wastewater treatment processes	3	7
17886	Demonstrate knowledge of fixed growth reactor processes in wastewater treatment	3	7

ID	Title	Level	Credit
17887	Demonstrate knowledge of tertiary processes in wastewater treatment	3	7
19188	Describe preventive maintenance and monitoring of product standards for wastewater treatment	3	3
24916	Demonstrate knowledge of the legislative framework and agencies relevant to wastewater treatment	3	5
24927	Describe, and undertake sampling and testing procedures for wastewater treatment	3	9
24928	Demonstrate knowledge of preliminary processes in wastewater treatment	3	2
24929	Demonstrate knowledge of biosolids management in wastewater treatment	4	10
24930	Demonstrate knowledge of activated sludge processes in wastewater treatment	4	10
24931	Demonstrate knowledge of pumping systems in wastewater treatment	3	6

Engineering and Technology > Water Industry > Water – Generic			
ID	**Title**	**Level**	**Credit**
17870	Carry out safe practices when working in water and wastewater treatment plants	2	2
17871	Describe safe practices when working with hazards in water and wastewater treatment plants	3	3
17874	Demonstrate knowledge of basic science theory relating to water	3	6
19200	Demonstrate knowledge of, and apply, mathematics in the water industry	2	3
24913	Describe processes, process control, and monitoring, in a water or wastewater treatment plant	3	5
24917	Demonstrate knowledge of water and wastewater treatment plants quality management	4	5
Engineering and Technology > Water Industry > Water Reticulation			
ID	**Title**	**Level**	**Credit**
19212	Demonstrate knowledge of wastewater collection and treatment systems	3	10
Humanities > Communication Skills > Interpersonal Communications			
ID	**Title**	**Level**	**Credit**
9681	Contribute within a group/team which has an objective(s)	3	3

New in this qualification are the items “credits” and “levels”.

What are credits?

One credit is equal to ten notional hours of learning

Notional learning hours include all time used on average for learning and assessment

A full-time single year programme is equal to 120 credits

Credit value

All qualifications on the NZQF have a credit value. The credit value relates to the amount of learning in the qualification.

In determing the amount of learning in a qualification, a qualification developer estimates how long it would typically take a person to achieve the stated outcomes in the context specified and to demonstrate that achievement through assessment. This determines the credit value for a qualification. One credit is equal to ten notional hours of learning.
Notional learning hours include:

- Direct contact time with teachers and trainers („directed learning“)
- Time spent in studying and doing assignments and undertaking practical tasks („self-directed“ or „on-task“ learning)
- Time spent in assessment.

For government funding purposes, a full-time single year programme is equal to 120 credits. However, the credit system allows for a range of ways to structure programmes, which is not limited by the concept of a single-year programme measure.

Source: http://www.nzqa.govt.nz/studying-in-new-zealand/nzqf/understand-nz-quals/

What are levels[11]?

Levels are based on complexity, with level one the least complex and level ten the most complex

Example: Automotive Mechanic

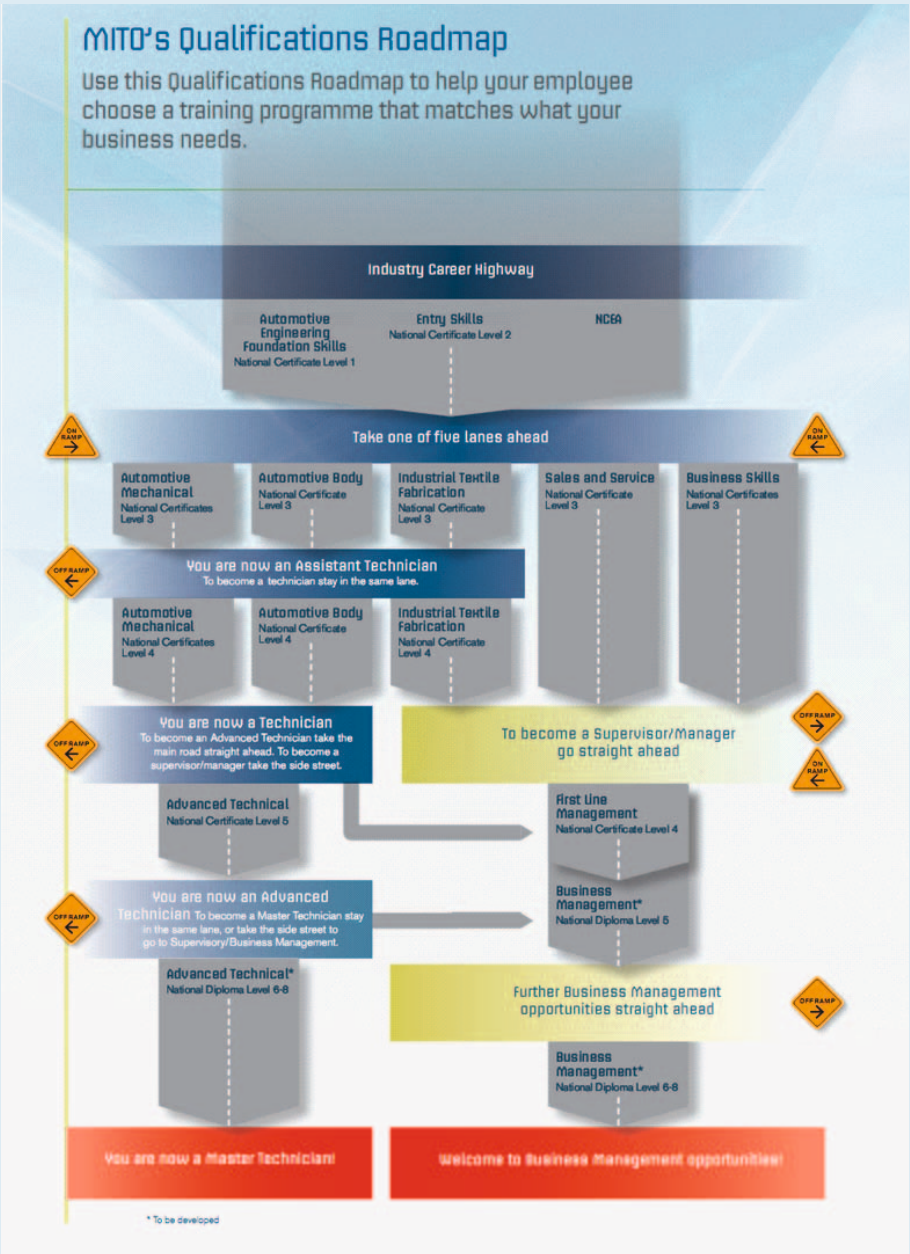
The NZQF has ten levels. Levels are based on complexity, with level one the least complex and level ten the most complex. All qualifications on the NZQF are assigned one of the ten levels. It is possible for qualifications to include credit achieved at levels above and below the overall level at which the qualification is listed.

The levels are described in terms of the knowledge and skills a graduate at any level should have, as well as how that knowledge and skill should be able to be applied, for example under supervision or independently.

11 Adapted from “The New Zealand Qualifications Framework”, April 2011

Example 2: "National Certificate in Motor Industry (Automotive Engineering) (level 4)"

Fig. 19: Motor Industry Qualifications Pathway, provided by the Motor Industry Training Organization (MITO)



National Certificate in Motor Industry (Automotive Engineering)
Level 4 Credits 271

Example: Automotive Mechanic

This qualification is expiring. The last date to meet the requirements is 31 December 2016.

Purpose
This certificate is designed as the national qualification for those persons working in the automotive engineering sector of the motor industry. Holders of this qualification are able to inspect vehicles for mechanical, electrical, and electronic faults and to diagnose and rectify faults in mechanical, electrical, and electronic components in vehicles. The certificate is

designed for those wishing to work in a safe and professional manner; to maintain standards in the automotive engineering industry; and to provide a means of recognizing prior learning for those already working in the industry.

Special notes
It is expected that most people will undertake training towards this qualification in the form of an apprenticeship with the use of record-of-achievement books and training manuals. It is recommended that in the first instance a "training plan" be developed with the assistance of a NZ motor industry training organization representative.

Credit range

The qualification includes unit standards from levels 1,2,3, and 4

	Compulsory	Elective
Level 1 credits	2	0-15
Level 2 credits	75	0-45
Level 3 credits	93	0-59
Level 4 credits	42	0-59
Minimum credits	212	59

Detailed requirements

Compulsory
The following standards are required (condensed presentation):

Compulsory unit standards from twelve different domains

Field >	Sub-Field >	Domain >	Unit Standards
Engineering and Technology >	Motor Industry >	Automotive Administration >	1 Unit Standard
Engineering and Technology >	Motor Industry >	Automotive Air Conditioning >	1 Unit Standard
Engineering and Technology >	Motor Industry >	Automotive Electrical and Electronics >	13 Unit Standards
Engineering and Technology >	Motor Industry >	Automotive Fuel Systems and Exhaust >	6 Unit Standards
Engineering and Technology >	Motor Industry >	Automotive Preventative Maintenance >	3 Unit Standards
Engineering and Technology >	Motor Industry >	Automotive Transmission Systems >	7 Unit Standards
Engineering and Technology >	Motor Industry >	Automotive Workshop Engineering >	4 Unit Standards
Engineering and Technology >	Motor Industry >	Engine Repairs >	9 Unit Standards
Engineering and Technology >	Motor Industry >	Vehicle Bodywork >	2 Unit Standards
Engineering and Technology >	Motor Industry >	Vehicle Braking Systems >	5 Unit Standards
Engineering and Technology >	Motor Industry >	Vehicle Steering and Suspension >	1 Unit Standards
Service Sector >	Service Sector Skills >	Service Sector – Core Skills >	1 Unit Standards

Elective
A minimum of 59 credits

Elective unit standards from any domain of the motor industry subfield

Subfield	Domain
Motor Industry	Any

The 271 credits signify 2,710 notional hours of learning

The qualification presented above integrates compulsory unit standards from ten technical domains, and two non-technical domains. In addition, all elective unit standards will be from the subfield of Motor Industry but can be from any domain. The 271 credits signify 2,710 notional hours of learning.

Task 3 for group work

Let´s assume that one of the companies of the water and wastewater / automobile sector is located in your country. You are called in as a VET/CBET consultant to advise on the development of a qualification for a Wastewater Treatment Plant Operator / or for a General Automobile Mechanic.

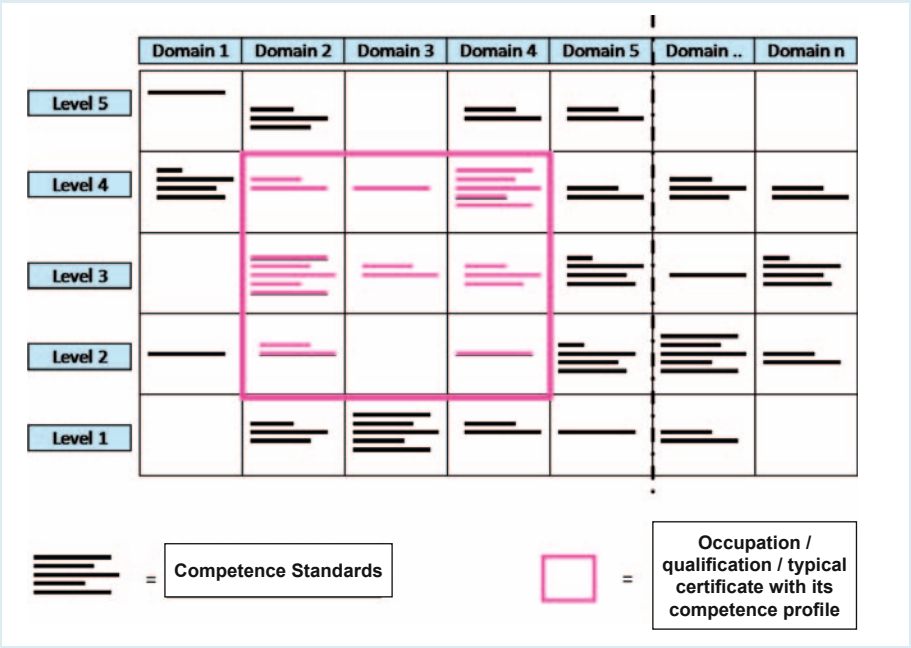
For each of the two occupations select three qualifications from three different countries, which have published their NQF-qualifications on the Internet.

Which of the three examples would you recommend to your clients as a good example? Please give reasons for your selection!

3.4 Competence standards

3.4.1 Competence standards and qualifications

Fig. 20: A simplified model of an NQF with a Qualification A



A simplified model of an NQF with a Qualification A

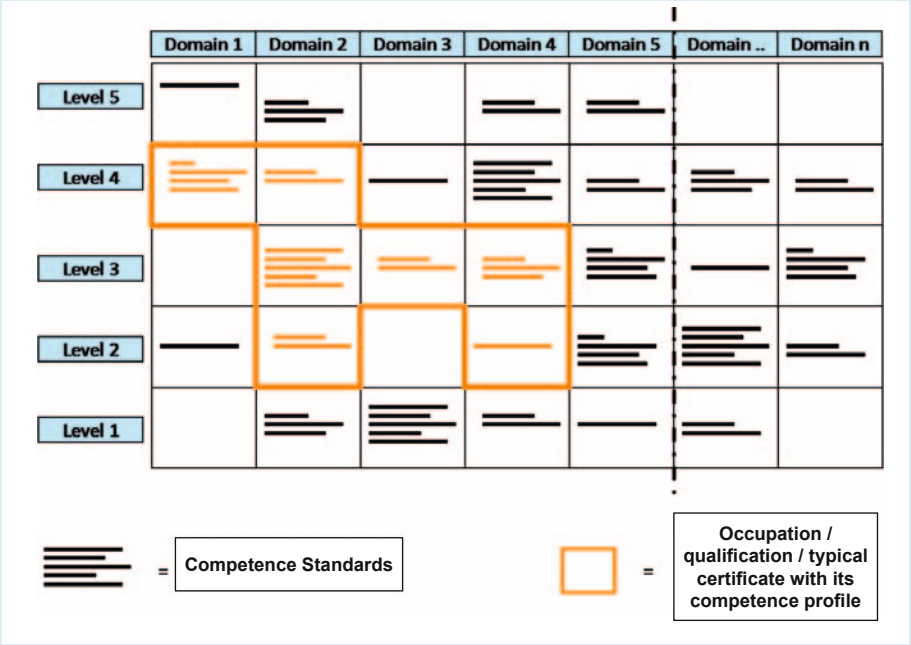
Short lines mean competences, square means qualification

1. To present a complete framework on one sheet of paper is impossible. Therefore a simplified model is used to present a simplified **National Qualifications Framework** of – let's say – the **motor industry**.
2. The framework matrix is determined by two dimensions.
3. The **domains**, which go from 1 to n, with the first five being, for example, Engine, Transmission, Brakes, Electrical & Electronics, Fuel & Exhaust.
4. And, of course, there are more domains.
5. **The levels**, which go in this case **only from 1 to 5**, to cover only the levels where we usually find qualifications of skilled workers and technicians.
6. **Competence standards** are shown by a dark line, the length of the line indicating the credit value of each standard.
7. Actually, what we have here should be better called a "framework of competences".

8. The red square represents a **qualification (occupation, certificate)**, which – in this case – includes competence standards of levels 2, 3, and 4 and of domains 2, 3, and 4.

Another selection of competences determines another qualification, Qualification B

Fig. 21: A simplified model of an NQF with a Qualification B



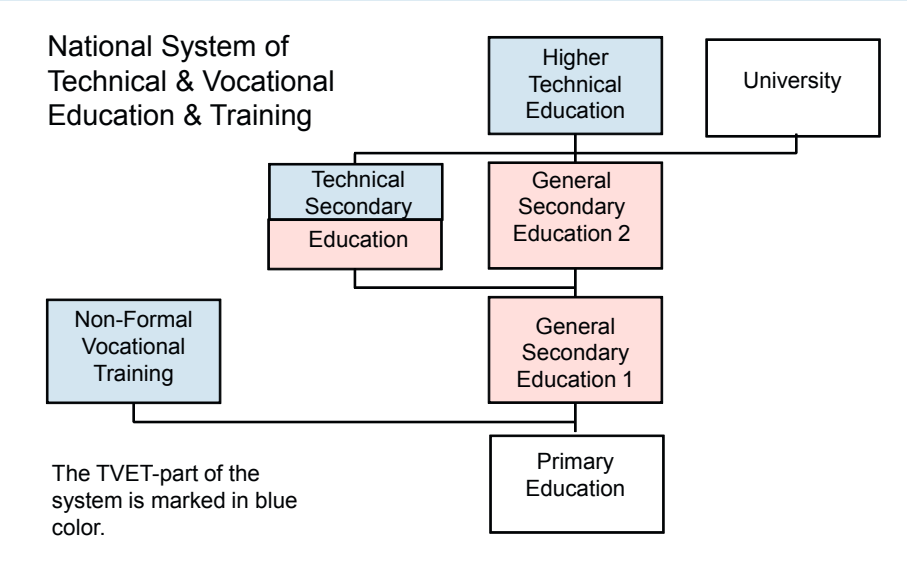
9. Theoretically, competence standards can be combined to whatever competence profile or qualification might actually be required.
10. The National Framework of Qualifications – which we better should call a "framework of competences" – can be compared with a menu in a good restaurant. Each domain would represent a category of food, for instance aperitifs, starters, fish, meat, vegetarian, desserts, beverages.
11. Each of these categories would list different items – for example in main courses with meat we may find pork, veal, beef, chicken, duck and ostrich dishes, at different price levels.
12. Each customer is able to "create" a sumptuous meal according to his/her appetite. Similarly, a client (learner or employer) of the VET system can design a competence profile (qualification) according to his/her specific needs.
13. When it comes to national qualifications, however, then design rules provide a template for the combination of individual national standards into complete nationally recognized qualifications.

Recognition of Prior Learning (RPL)

3.4.2 Recognition of Prior Learning (RPL)

1. Fig. 22: Let's have a look at a typical system of Vocational Education and Training (VET).
2. Usually these systems are organized in a 6-3-3 cycle, namely six years of primary education, followed by three years of general secondary education 1 and three years of general secondary education 2.
3. Primary school leavers may join non-formal vocational training courses of different length.
4. General secondary education 1 leavers may also go for a three-year technical secondary education.
5. At tertiary level there are usually several offers for higher technical education, with university being an extra option for the academically best qualified students.

Fig. 22: A simplified model of a VET system

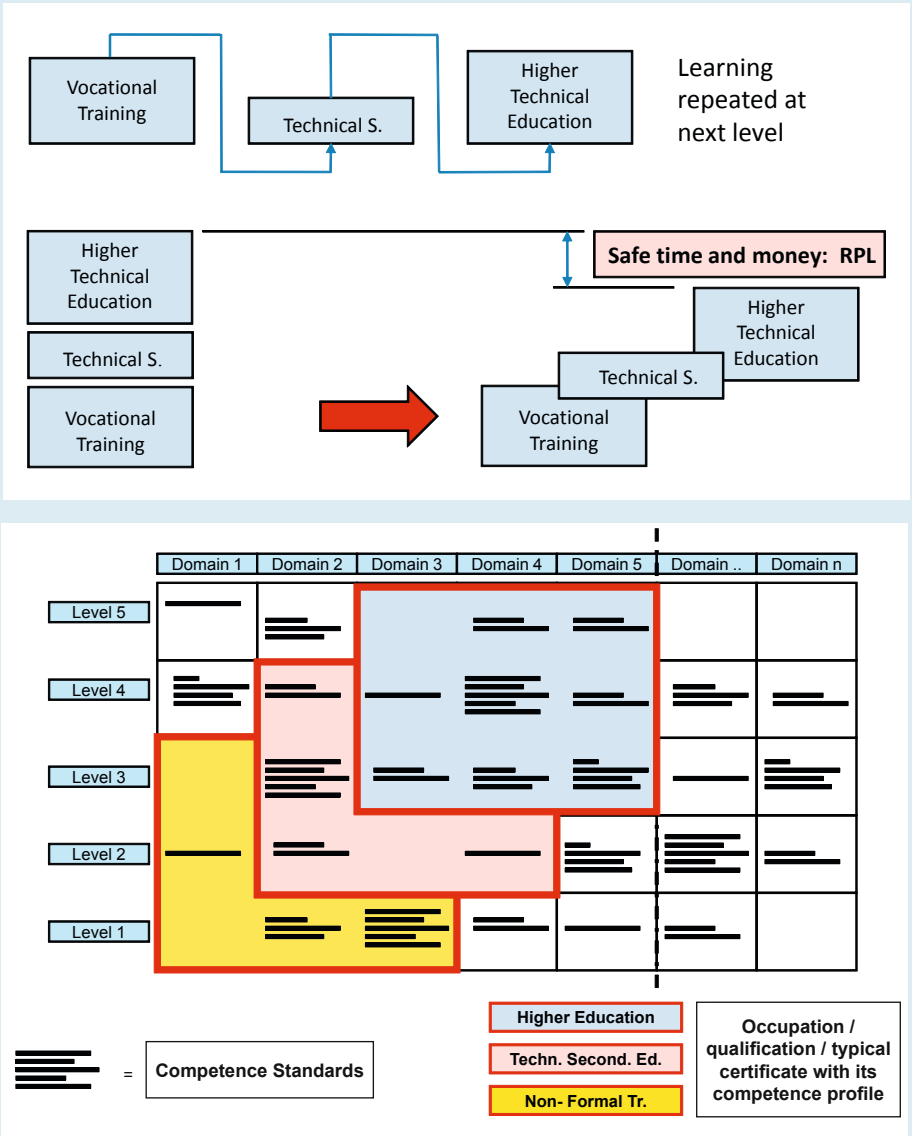


A simplified model of a VET system (blue colour) integrated into a national system of education

6. The VET part of the system is marked blue.
7. As "Learning throughout life for all citizens" has become an urgent issue in most countries, those who have gone to vocational training may continue to technical secondary education and finally can attend higher technical education courses.
8. Almost everywhere, those who leave vocational training have to start from scratch in technical secondary education and those who leave technical secondary education have to start from scratch in higher technical education.
9. Although there is considerable overlapping of content and competences at the three levels and therefore a high potential to save time and money, learning – already successfully achieved at a lower level – has to be repeated at the next higher level.
10. The central problem is a lack of transparency, hence a lack of comparability and in turn a lack of recognition of certificates from different VET levels.
11. Frameworks of qualifications and competences showing the overlapping of qualifications establish the required transparency, as can be seen in Fig. 23 below.
12. As we see, a graphical National Framework of Qualifications can serve as a reference frame to compare different certificates.
13. Let's take a certificate of Non-Formal Training, of Technical Secondary Education and of Higher Technical Education.
14. Locate these three certificates in a framework matrix with its domains and levels.
15. Add the competence standards for each domain and level.
16. And there is the transparency we were looking for.
17. Overlapping areas with their respective competences can be clearly identified. There should be no further obstacle to compare certificates and to determine and recognize competences already achieved at lower levels.

Almost everywhere, those who leave vocational training have to start from scratch in technical secondary education and those who leave technical secondary education have to start from scratch in higher technical education

Fig. 23: Creating more transparency for RPL



Overlapping areas with competences in common can be clearly identified in a graphical NQF. This creates more transparency for RPL

3.4.3 What are competences?

The European Union, in its Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning, applies the following definitions:

'Competence' means the proven ability to use knowledge and skills

'Knowledge' means the outcome of the assimilation of information through learning

a. 'Competence' means the proven ability to use knowledge, skills, and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.
b. 'Knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories, and practices that is related to a field of work or study.
c. 'Skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) or practical (involving manual dexterity and the use of methods, materials, and tools and instruments);

d. ‘Learning outcomes’ means statements of what a learner knows, understands, and is able to do on completion of a learning process, which are defined in terms of knowledge, skills, and competence.

‘Learning outcomes’ means statements of what a learner knows, understands, and is able to do on completion of a learning process. They are defined in terms of knowledge, skills and competence

The European Qualifications Framework (EQF) and its definitions refer to a very broad concept of competence. Countries which have introduced CBET so far and are working with NQFs have been concentrating mostly on workplace-related competences. This, of course, is exactly what is required in our two companies of the water and wastewater sector.

For this reason, from here on, we will concentrate on workplace-related competences. Our definition of competence therefore is:

Competences stand for the ability to perform particular tasks and duties to the standard of performance expected in the workplace.

A competence in this context covers all aspects of workplace performance and involves performing individual tasks; managing a range of different tasks; responding to contingencies or breakdowns; and, dealing with the responsibilities of the workplace, including working with others.

Competences – from here onwards – stand for the ability to perform particular tasks and duties to the standard of performance expected in the workplace

3.4.4 Workplace competence

1. Fig. 24: As mentioned before, we will now concentrate more on competences required **to act competently in work situations**.
2. Let’s analyze the **work situations** and put them into the **competence** categories **technical**, **social**, **and human**.
3. Technical competences are: Competent to do the work. Workers use personal and organizational resources (tools) to perform their work and adapt to changing work demands.

Tools are

a. language, symbols, and text
b. knowledge and information
c. technology (such as technical processes, hand and machine tools, raw materials)

Fig. 24: Competences to act competently in work situations

Competences	Work Situations
Technical	**To do the work:** Workers use personal and organizational resources to perform their work and adapt to changing work demands
Social	**To work with others:** Workers interact one-on-one and participate as members of a team to meet job requirements
Human	**To plan and direct personal and professional growth:** Workers prepare themselves for the changing demands of the economy through personal renewal and growth

In work situations people need technical, social, and human competences

4. **Social competences** are: **Work with others. Workers interact one-on-one and participate as members of a team to meet job requirements.** Social competence is focusing on "interacting in heterogeneous groups", which includes
   a. relating well to others
   b. operating and working in teams
   c. managing and resolving conflicts.
5. **Human competences** are:
   To plan and direct personal and professional growth. Workers prepare themselves for the changing demands of the economy through personal renewal and growth.
   Human competence is focusing on "acting autonomously", which includes
   - forming and conducting life plans and personal projects
   - acting within the big picture or the larger context of norms, goals, expectations, and personal networks
   - defending and asserting one's rights, interests, limits, and needs.

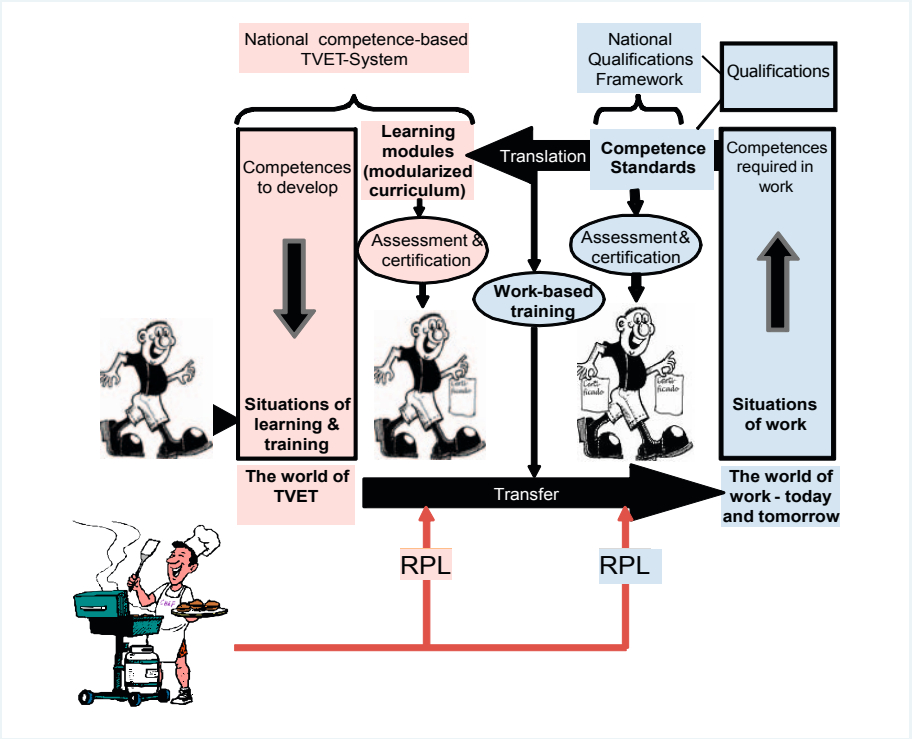
Task 4 for group work
Select one of the six "competent workers" and try to determine the competences required by such a person 1. to do the work, 2. to work with others, 3. to plan and direct personal and professional growth, and 4. to work within the big picture

3.4.5 Demand and supply of competence

Demand and supply in a CBET system

1. Vocational Education and Training (VET) prepares for the world of work – today and tomorrow.
2. Analyzing different situations of work leads to the competences which are required to work competently.
3. These competences are determined by "experts" of each type of work and are laid down in competence standards.
4. Many countries have arranged these competence standards in qualifications and a National Qualifications Framework (NQF). An NQF is a type of matrix, organizing competences and qualifications according to their level and content.
5. Qualifications are standardized competence profiles, which are also called occupations or professions.
6. To facilitate the development of competences in individuals, the system of VET has to "translate" the competence standards into the language of VET – from the logic of work to the logic of training. Please note: The competence as such is not altered during this process.
7. Usually one or more related competence standards are combined into a "training module". Modules are "learning standards" and constitute the building blocks of a modularized curriculum.
8. Modules describe the competences to develop and the situations of learning and training to facilitate such development.
9. If the world of VET is organized in this way,
10. it can be called a national competence-based VET system.

Fig. 25: Competence standards provide information required to design initial or further training programmes, related assessment, and RPL



Competence standards and qualifications describe what is required at the workplace

Based on this information the VET system can develop adequate situations to facilitate learning, ssessment, and RPL

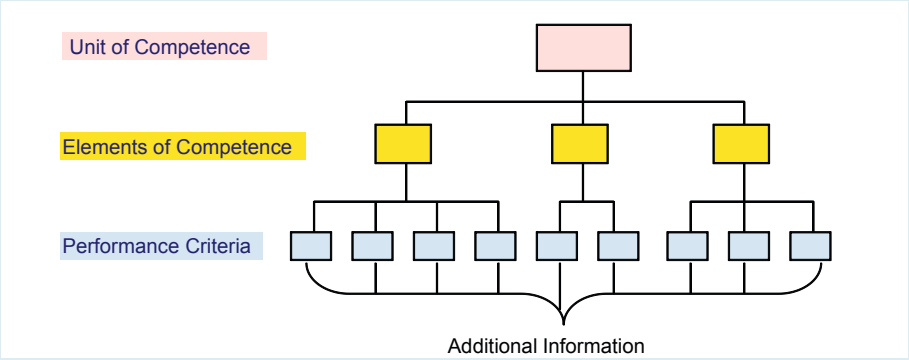
11. Students enter the system and are exposed to different situations of learning and training.
12. During and at the end of their training students are assessed and their competences evaluated and certified.
13. Students leave the VET system with a VET certificate of their competences.
14. The individual person is a carrier of competences and transfers these competences to the world of work.
15. Frequently, the world of work has established its own system of assessment and certification.
16. So, before entering the world of work, the potential future worker has to undergo other exams and tests to provide evidence of his "competence". Again, certificates are issued and sometimes registered in a national register.
17. In addition, many competences cannot be trained in school-based training and have to be acquired in "work-based training" on-the-job. Such competences are usually assessed and certified also by institutions of the world of work.
18. There are many people with competences which they have acquired through previous learning or work, sometimes in other countries. These competences exist, but they have never been assessed and certified. Therefore there is a recognition of prior learning (RPL), sometimes also called "recognition of current competences" (RCC). Institutions may offer RPL from the world of VET or the world of work.
19. A CBET system can be considered as a traditional VET system into which quality assurance has been integrated. The world of work is the client and defines the quality of the product (competence standards). The VET system facilitates the development of these competences in its students. Internal quality assurance is done during and after training at training providers. In addition, clients may have established their own quality assurance system to make sure they get the quality they need. Quality assurance is, however, only one of CBET's major aspects.

The world of work is the client and defines the quality of the product (competence standards). The VET system tries to facilitate the development of these competences in its students

Task 5 for group work
With the help of the graphic presented above, please analyze the situation in your country.

1. Which of the various functions/activities of the graphic are already implemented and working?
2. Which institutions are in charge of each function?
3. What are the plans for future development?

Fig. 26: Basic structure of a competence unit: elements of competence and performance criteria



A unit of competence is composed of elements of competence and each element of competence is composed of performance criteria

Usually there is some additional information added

3.4.6 Basic hierarchical structure of a competence unit

1. **Competence standards** have a **hierarchical structure**.
2. The hierarchy within a competence standard starts with a **unit of competence**, as determined, for example, in a functional analysis.
3. A unit of competence is a work activity which:
   - describes a broad area of professional performance;
   - can be undertaken by one individual;
   - has a real meaning as a "marketable component" of work-based activity;
   - can be grouped with other units to form a qualification.
4. Each unit of competence is composed of **elements of competence**, which describe what is done in the workplace to ensure that the unit can be fulfilled.
5. **Performance criteria** describe the overall evidence from which competent performance of an element can be assumed. They specify competent performance in "output" terms.
6. **Additional information:** While the basic structure of a competence remains the same in most countries, the amount and type of additional information provided with each unit of competence varies from country to country. Below, the items from a) to j) show additional information[12] in units of competence from Australia.
   a. Unit title
   b. Unit descriptor
   c. Employability skills
   d. Prerequisite units
   e. Application of the unit
   f. Competence field (optional)
   g. Unit sector (optional)
   h. Required skills and knowledge
   i. Range statement
   j. Evidence guide

12 Source: Online Training Package Development Handbook, www.tpdh.deewr.gov.au

3.4.7 Analyze existing competence standards

Competence standards provide very important information to module and curriculum developers, to trainers as well as to assessors. **The more relevant information a competence standard provides, the better it serves its purpose.**

The more relevant information a competence standard provides, the better it serves its purpose

Task 6 for group work
From the Internet, select four competence standards from each the wastewater and the automobile sector.
Please analyze the four selected competence standards (either wastewater or automobile):

a. How many elements of competence and performance criteria does each have?
b. Which of the four would be the "best" for you as a trainer or assessor with regard to "additional information"? Why?

3.4.8 Methods to determine competence standards

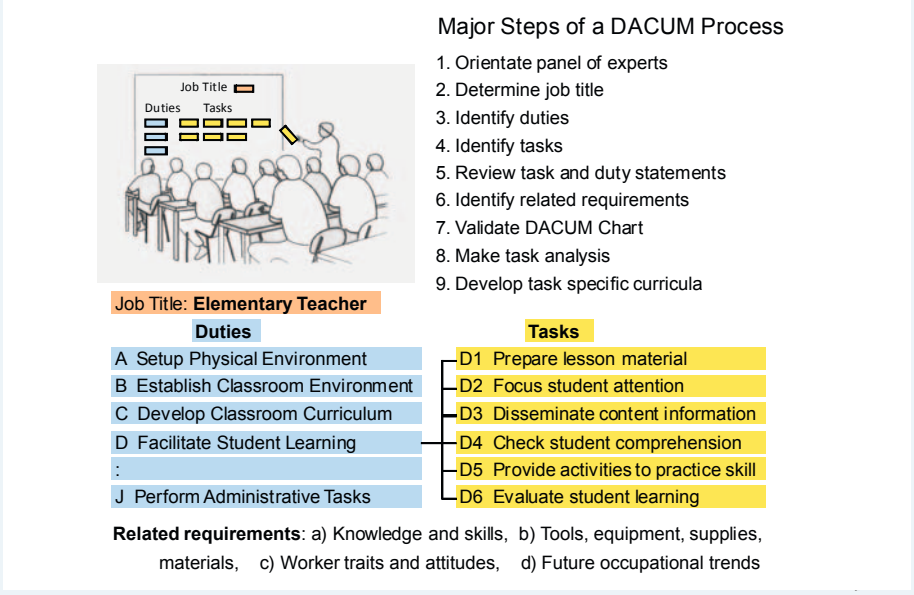
Competence standards are determined either by a functional analysis, a **DACUM**[13] process, or a job/task analysis with the help of "expert workers".

Competence standards are determined either by a functional analysis, a DACUM (Developing A Curriculum) process, or a job/task analysis with the help of "expert workers"

The **job/task analysis** is the oldest method. It was predominant in many industrialized countries for analyzing tasks in mass production. Although the world of work has changed, it is still used for specific purposes. Job/task analysis divides and subdivides jobs and tasks into smaller elements in order to provide information for piece-rate wages and training courses.

DACUM is an acronym for **D**eveloping **A** **C**urricul**UM**. In DACUM a trained facilitator leads a small group of expert workers to describe their work. The result, a DACUM chart, consists of duties and tasks, which has little to do with a curriculum. Therefore, the name DACUM is somewhat misleading.

Fig. 27: Major steps of a DACUM process



13 DACUM = Developing A Curriculum

The DACUM process has been used for over 40 years to conduct job analysis in every field imaginable all over the world. The analysis typically results in the identification of six to twelve duties involving 50 to 150 tasks that define what a successful worker in a particular job or cluster of related jobs must be able to do

The result is a DACUM chart

Functional analysis starts with the key purpose of an economic sector or branch and subsequently analyses down to individual functions, called functional units. These units are outcomes that an individual might be able to achieve. The results of a functional analysis are presented in a **functional map**.

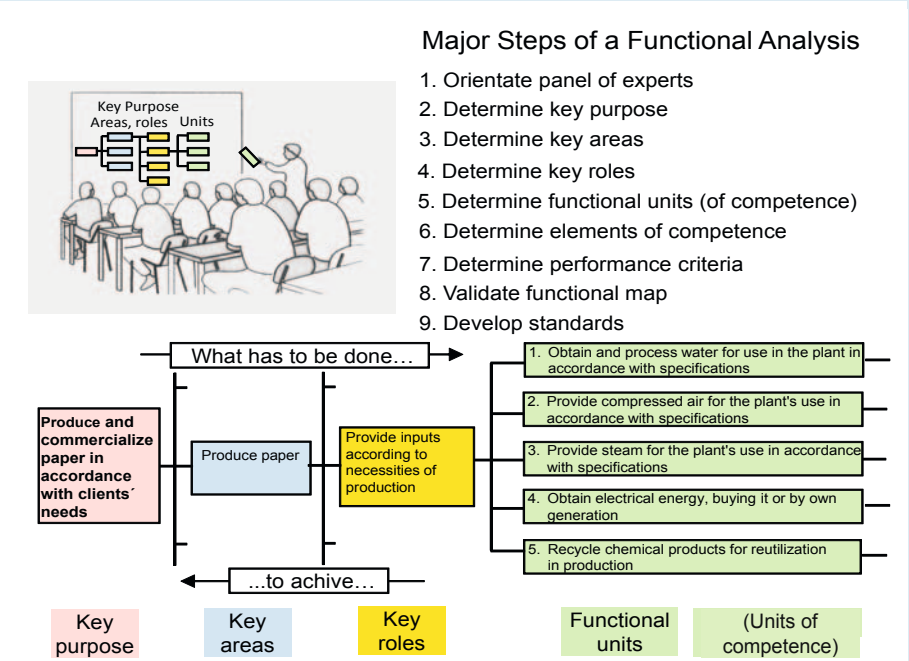
1. A **DACUM process** in its initial phase is a guided group discussion. A trained facilitator leads a group of between seven and twelve expert workers in a discussion about their work. A typical DACUM workshop takes about two to three days and follows a sequence of **major steps**.
2. The **panel of experts** has to be **orientated** that through guided brainstorming techniques they will discuss and reach a consensus on a job title, on duties, tasks and related requirements. Each suggestion should be written on a card and attached to the wall for easy viewing by all panel members.
3. A mutually acceptable **job title** – for example "Elementary Teacher" – for the job under revision has to be **determined**.
4. **Duties** or general functional areas of responsibility, under which tasks will fit, are then **identified**. For example, for an Elementary Teacher these may include
   A Setup physical environment
   B Establish classroom environment
   C Develop classroom curriculum
   D Facilitate student learning ...
   J Perform administrative tasks
5. The **tasks** that make up the duties are then **identified**. A task description uses an action word, an object, and sometimes qualifying words. As more and more tasks are listed, the facilitator asks the group to sort them into the work flow sequences in which they are usually performed. So for the duty "D Facilitate Student Learning" the group may come up with the following tasks:
   D1 Prepare lesson material
   D2 Focus student attention
   D3 Disseminate content information
   D4 Check student comprehension
   D5 Provide activities to practice skills
   D6 Evaluate student learning
6. **Task and duty statements** are **reviewed** and refined.
7. **Related requirements**, such as a) knowledge and skills, b) tools, equipment, supplies, and materials, c) worker traits and attitudes, d) future occupational trends are **identified**.
8. The **DACUM chart** has to be **validated** by workers outside the discussion group. Sometimes a special validation workshop will be organized.
9. A **task analysis** is **made** to determine the specific skills, knowledge, and abilities the worker needs to perform each task. The information resulting from the task analysis is then incorporated into learning outcome statements, learning activities, instructional materials, and detailed assessment criteria.
10. Persons who validate the DACUM chart are asked to rate the importance of each task and how difficult it is to learn to perform the task. The ratings are essential information to identify tasks that are both important and difficult to learn. Around these tasks, **task-specific curricula are developed**.

The DACUM process, originally developed in Canada, has been used for over 40 years to conduct job analysis in every field imaginable all over the world. The analysis typically results in the identification of six to twelve duties involving 50 to 150 tasks that define what a successful worker in a particular job or cluster of related jobs must be able to do. The process has been further developed and refined over the years by Robert E. Norton from the Ohio State University in Columbus, Ohio, USA.

Task 7 for group work
What is your opinion – how useful for curriculum development are the statements made about

a. Duties
b. Tasks,
c. General Knowledge and Skills
d. Worker Behaviors
e. Tools, Equipment, Supplies and Materials
f. Future Trends and Concerns?

Fig. 28: Major steps of a functional analysis



1. **Functional analysis** is a deductive process which follows a sequence of **major steps**. Results are achieved by consultation, clear decision-making processes, and consensus of experts.
2. The **panel of experts** has to be **orientated** that through guided brainstorming techniques they will discuss and develop a functional map. All statements in this map are outcomes which describe results of activities.
3. A mutually acceptable **key purpose** – for example "Produce and commercialize paper in accordance with clients' needs" – for the economic sector under revision has to be **determined**. The key purpose statement describes the characteristics of this specific sector.
4. The key purpose is sub-divided into a number of major functions called key areas. In our example the following key areas were **determined**:
   a. Develop products and processes
   b. **Produce paper**
   c. Provide the products to clients
   d. Administer and manage the enterprise
5. Key questions to determine next lower level functions are "What has to be done *at the lower level* to achieve *the outcome of the present level*?" Appling this method leads to functions called key roles. One of these key roles is **Provide inputs according to necessities of production.**

Functional analysis – like DACUM – is a tool used to determine competence standards. It is a deductive process which analyzes areas of work and identifies the outcomes that people should achieve

The result is a functional map

6. At the next lower level (usually at level 4 or 5) we reach a level of detail where each statement represents an outcome for which an individual worker, alone or as part of a team, would be responsible.[14] The map is completed when we reach this level of detail, where functions are called **functional units or units of competence**. In our example functional units are:
   a. Obtain and process water for use in the plant in accordance with specifications
   b. Provide compressed air for the plant's use in accordance with specifications
   c. Provide steam for the plant's use in accordance with specifications
   d. Obtain electrical energy, buying it or by own generation
   e. Recycle chemical products for reutilization in production
7. Further stages of analysis are required to disaggregate with the participation of subject-experts.
   - Units of competences into **elements of competence**
   - Elements of competence into **performance criteria**
8. The **functional map** has to be **validated** by workers and experts out-side the discussion group. Sometimes a special validation workshop will be organized.
9. The results will provide the required input for **standards development**.

Mapping an entire economic sector (or field) – e.g. "Paper Production" – is useful in countries where no lists of training occupations exist or where VET reform processes drastically change already existing occupations. More often, countries already have official classifications of occupations, so the mapping may start with each occupation. The key purpose describes the occupation, but as an outcome – what actually has to be achieved.

Task 8 for group work
Compare "Mapping an entire economic sector or field" with "Mapping an occupation". Which approach would you prefer to apply in your work? Why?

14 Source: Adapted from Bob Mansfield/Lindsay Mitchell: "Towards a Competent Workforce" 1996.

4 Developing Competences in Learners

4.1 Components of competences

A competence is a more or less complex function that includes the underlying knowledge, mental abilities, psychomotor skills, and attitudes/values necessary for optimal performance. It must be performed according to a specific standard under specific conditions. This requires the ability to orchestrate these components into the full range of activities necessary for professional practice.

Competences consist of standard trainable components (knowledge, abilities, skills) and components that are more difficult to alter (beliefs, attitudes, values)

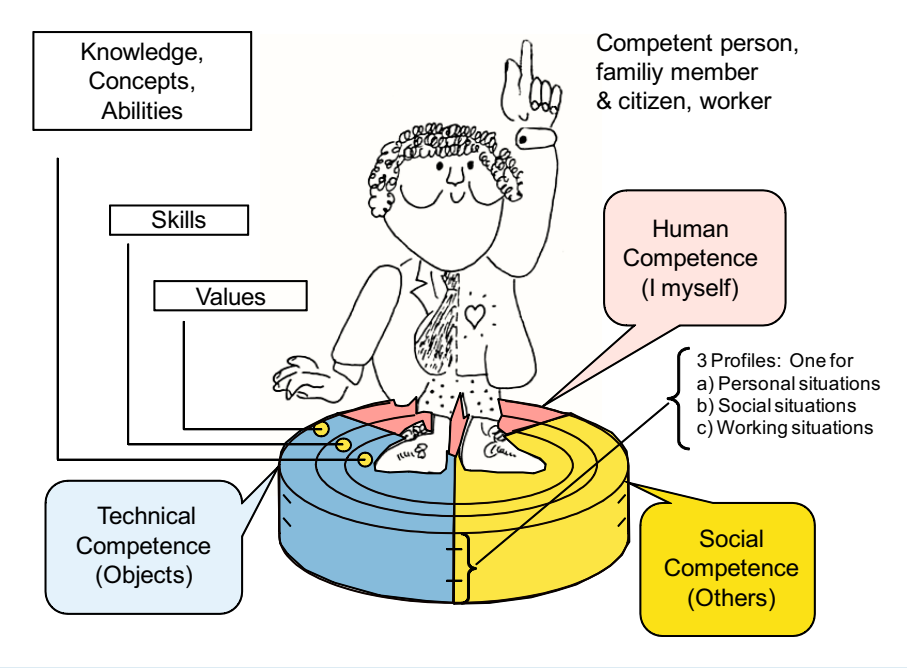
Competences consist of trainable components (knowledge, abilities, skills) and components that are more difficult to alter (beliefs, attitudes, values).

Please note: The European Qualifications Framework (EQF) defines skills as *"the ability to apply knowledge and use know-how to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools, and instruments)."*

This means that mental abilities and psychomotor skills were put together as cognitive and practical skills; attitudes/values are not mentioned at all. This is certainly a different approach, but not necessarily a better one.

In recent publications mental abilities and psychomotor skills are often put together as cognitive and practical skills or simply "skills"; attitudes/values are not mentioned at all

Fig. 29: Components of a person's total "competence of action" in different situations of life



A person needs a human competence (I myself), a social competence (others), and a technical competence (objects) to act competently in personal, social, and working situations

1. Fig. 29: A competence is not something we can touch or see – a competence is a hypothetical construct.[15] Therefore we are working with models of competence.
2. Our competence model assumes that there are three main sectors of the total competence of action which a person possesses. Each sector has a hierarchical structure and is composed of sub-competences and sub-sub-competences. (There are other models, too.)

15 But we can observe activities and their results, when a competence is applied

3. One sector is what we call **human competence**. Human competence includes all competences related to the individual, to the **"I myself"** as a person.
4. The next sector is called **social competence** and includes all competences which are relevant in the interaction of an individual with **"Others"**, i.e. with other persons.
5. The third sector is named **technical competence** and comprises all competences related to interactions with **"Objects"**. The concept of objects is a very broad one and includes everything that is not the individual or other persons[16].
6. Each competence is made up of components. The first group of these elements is cognitive (located somewhere in our brain) and includes **knowledge**, **concepts**, and mental **abilities**.
7. The next group is that of psychomotor **skills**, which are activities in which our brain and our body are involved.
8. Finally there are **values**, which guide us in our decisions about what is "good" and what is "bad".

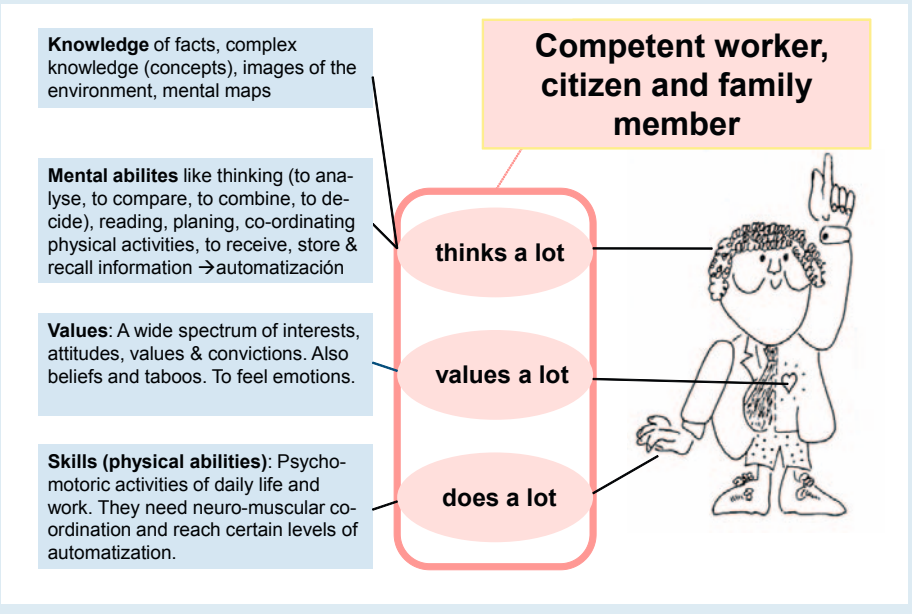
Each of these competences is made up of components

9. With the help of these components we can better describe and define what a **competent person, family member, citizen, and worker** is.
10. Competences are usually organized in competence **profiles**.
11. As we already know, situations of life can be categorized into
    a. **Personal situations** (as an individual)
    b. **Social situations** (in family and society)
    c. **Working situations** (at work)

    So for each of these situations we can arrange the relevant competences
    - Human competences
    - Social competences
    - Technical competences

    into a competence profile.

Fig. 30: Components of competences



16 This model is based on T.Parsons: Some Highlights of the General Theory of Action. In: Hartmann, H. (Ed.): Moderne amerikanische Soziologie. Stuttgart, 1973, p. 218-244

1. The aim of VET is to educate and train the **competent person, family member / citizen, and worker**. As we already know, competences are built up from components. A competence is just like a magnetic field, which binds together specific components and mobilizes them in a more or less complex action.
   Let's take a closer look at these components of competences in a competent person.
2. Simply speaking, this person uses his head and **thinks a lot**.
3. This person uses his heart and **values a lot**.
4. And this person uses his hands and **does a lot**.
5. In the cognitive area, which is the brain, we store data, just like a computer hard-disk does. These data may be relatively simple, like the knowledge of facts. Or they may be combined to form more complex knowledge, such as concepts. Concepts may be organized in cognitive maps, but we can also store sounds, smells, and images of the environment. And a lot more besides.
6. In the cognitive area we not only store but also process data, again just like a computer does. For data processing in our brain we need **mental abilities such as thinking** (which includes the more basic processes of **analysis, comparison, data combination, and decision** between alternatives). These basic processes combine and so enable more complex processes such as **reading, planning, co-ordinating physical activities**, but also **receiving, storing, and recalling information**.
7. When learning complex mental processes, such as interpreting a technical drawing (for example of an engine) or reading in a foreign language, at first we will proceed step by step, word by word, slowly but surely. But gradually, after many applications and repetitions, the mental process becomes more fluent and finally reaches a certain level of **automaticity**. We see the drawing and almost immediately, almost automatically, we can "recognize" the engine. Or we see the text in a foreign language and almost immediately, almost automatically, we can "read and understand" the content.
8. **Values** have to do with emotions and we feel emotions usually near our heart. Values include **a wide spectrum of interests, attitudes, values, and convictions. Beliefs and taboos** also fall under this heading. Values can be considered as the stored results of our and other peoples' experiences, of experiences with ourselves, with other persons and with "objects". As a result of our (and other peoples') good or bad experiences we have felt "good" or "bad" emotions. These feelings provide the necessary charge in the development of a value, if something is considered to be "good" or "bad". So **to feel emotions** is an essential step in developing values.
9. **Skills** – sometimes called **physical abilities** – are the **psychomotor activities of daily life and work. They need neuromuscular coordination and reach certain levels of automaticity**. When learning complex psychomotor processes, such as driving a car, at first we proceed step by step, slowly but surely. But gradually, after many applications and repetitions, the psychomotor process becomes more fluent and finally reaches a certain level of **automaticity**. We enter the car and almost immediately, almost automatically, we can start and drive the car, move it to where we want to go, pay attention to traffic and at the same time still have an interesting conversation with our friend sitting next to us.

The aim of VET is the competent person, family member / citizen and worker

The competent individual thinks a lot with his head, does a lot with his hands and values a lot with his heart

Storing and processing of information are mental skills. Mental skills can become automatic to a certain degree, like interpreting a technical drawing

Values are stored results of our experiences – they are connected with emotions

Psychomotor skills are activities of brain and body. They also can become automatic to a certain degree, like riding a bicycle

4.2 Facilitating development of competence components

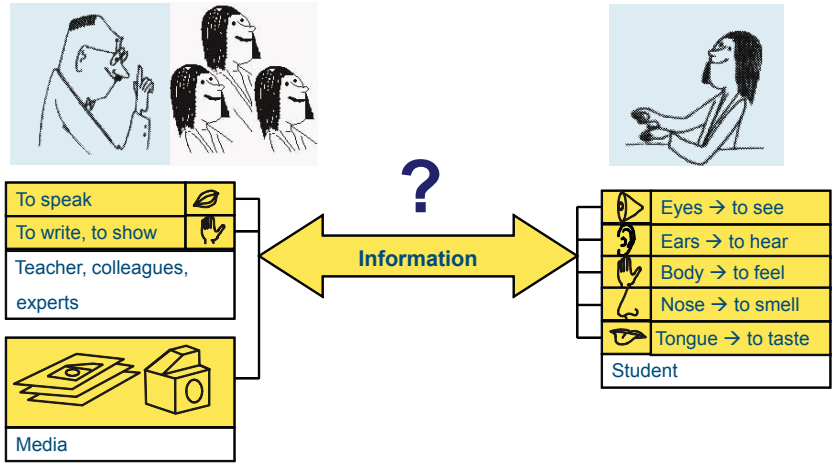
4.2.1 Transmitting information

1. Fig. 31: There is a **student**, there is a **teacher**, there are **other students**.
2. If we want to increase the competence of a student, what can we send to this student? What can we exchange with him/her?
3. **The teacher, colleagues** (other students) and **experts**
   – can **speak** with their mouth or
   – can **write** or **show** something with their body
4. There are also **media** which transport learning content to learners, such as **transparencies, drawings, manuals, models** etc.

To facilitate the development of competence components in learners a teacher can only send information to a student – nothing else. All the rest has to be done by the learner, applying the information in relevant learning situations

5. What is it, what we can send to a student?
6. It is **information**. Only information. Nothing else. A teacher can only send information to and receive information from his students.

Fig. 31: Transmitting Information



A learner receives the information via his five senses
- Eyes
- Ears
- Body
- Nose
- Tongue

The student has different channels to receive information – **his five senses**.
- **Eyes to see** (e.g. written and printed information, originals, models)
- **Ears to hear** (e.g. spoken and stored audio information, original sounds)
- **Body to feel** (e.g. an auto mechanic checking the clearance of a wheel ball-bearing)
- **Nose to smell** (e.g. an auto mechanic checking a liquid: Is it diesel or gasoline?)
- **Tongue** to taste (e.g. a cook checking how much salt to add to a sauce)

7. While teaching, the teacher is also gaining new experience; information is transmitted to him by the student and leads to an increase of competence.

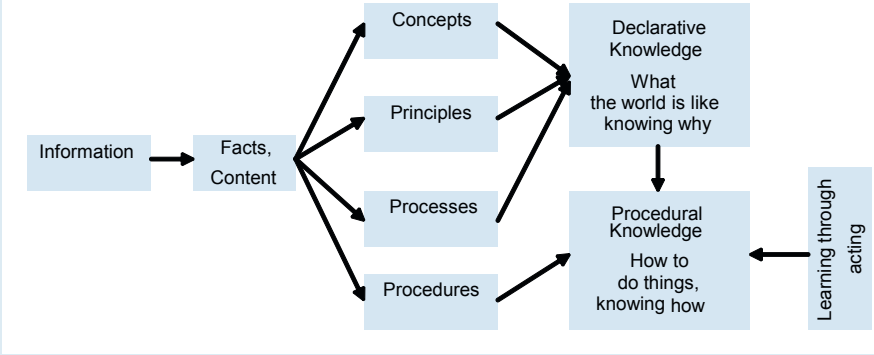
Summary: A teacher cannot transfer his/her competence directly to his/her students. He/she only can transmit information via the five senses

Task 9 for group work

1. Describe which type of information you send to students when teaching "Names of elements of a water-pump"
   a. via the eyes
   b. via the ears
   c. via the body
2. Which channel will be the one which is used mostly?
3. As a rule, information should be offered via as many channels as possible. Select an example where this is true for all five senses.

4.2.2 Declarative and Procedural Knowledge

Fig. 32: From Information to Declarative and Procedural Knowledge



Declarative Knowledge is knowledge about something. It contrasts with Procedural Knowledge, which is knowing how to do something.

Declarative knowledge refers to objects and events. The focus is on the what and why rather than on the how. It allows us to think and talk about the world.

Declarative Knowledge is knowledge about something (what, why). Procedural Knowledge is knowledge about doing (how)

Procedural knowledge focuses on tasks that must be performed to achieve a particular objective or goal. It is characterized as knowing how. Procedural knowledge can vary in complexity from simple, such as touching a key on a keyboard, to very complex, such as riding a bike. Most procedural knowledge is tacit![17] – it has not been, nor can it be, articulated.

According to Gagné et al., basic units of declarative knowledge are learned relatively swiftly and also can be modified quickly. In contrast to this, procedural knowledge can only be acquired slowly, but once automated it is very hard to modify.

Facts, concepts, principles, and processes are declarative knowledge, procedures are procedural knowledge

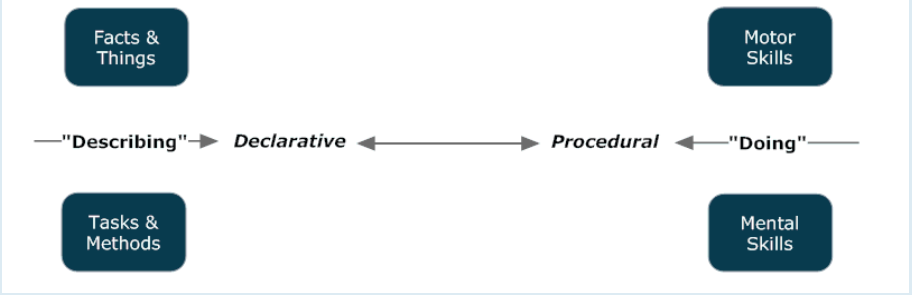
There are five primary types of artifacts of knowledge: facts, concepts, principles, processes, and procedures. Facts, concepts, principles, and processes are declarative knowledge, procedures are procedural knowledge.

1. **Fact**
   Event, item of information, or state of affairs existing, observed. Something known or proved to be true.
   Water is liquid. Cairo is the capital of Egypt.
2. **Concept**
   A class of items, words, or ideas that are known by a common name. A concept includes multiple specific examples which share common features.
   There are two types of concepts: concrete (e.g. what is a **water pump?**) and abstract (e.g. what does **quality** mean?).
3. **Principle**
   Guidelines, rules, and parameters that govern. It includes not only what should be done, but also what should not be done. Principles allow one to make predictions and draw implications. Given an effect, one can infer the cause of a phenomenon. Principles are the basic building blocks of causal models or theoretical models (theories).

17 Tacit knowledge is knowledge that cannot be articulated. As Michael Polanyi put it, "We know more than we can tell." Polanyi, M. (1997). "Tacit Knowledge," Chapter 7 in Knowledge in Organizations, Laurence Prusak, Editor. Butterworth-Heinemann: Boston

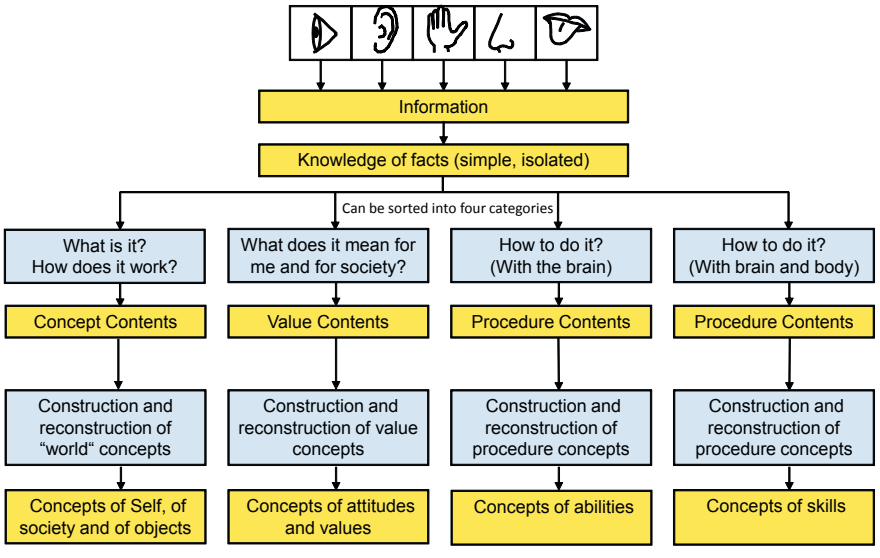
4. **Process**
   A flow of events or activities that describe how things work rather than how to do things. There are normally two types: Business processes that describe workflows, and technical processes that describe how things work in equipment or nature. They can be thought of as the big picture of how something works.
   a. **Business process (a workflow)** is the formal definition of the process used to manage cases of a specific kind (e.g. a major leakage in the water network is reported: How to react properly? What is the standard procedure?).
   b. **Technical process (how things work),** e.g. How does a pump work? How does a water treatment plant work?
5. **Procedure**
   A series of step-by-step actions and decisions of a person that result in the achievement of a task.
   There are two types of actions:
   a. Mental actions (mental skills, abilities), e.g. **reading the drawing of a pump**
   b. Psychomotor actions (motor skills), e.g. **replacing a defective ball-bearing in a pump**

Fig. 33: Declarative & Procedural Knowledge (describing vs. doing)



4.2.3 Transforming information into concepts

Fig. 34: Transforming information into concepts[18]



18 "Concepts" – for reasons of space – stands for concepts, principles, processes, and procedures.

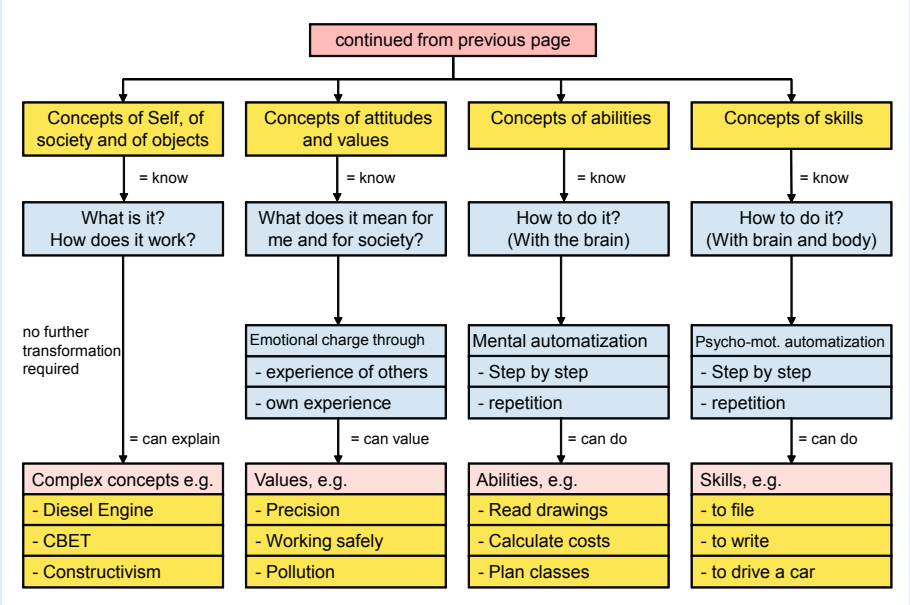
1. **Information**, which we receive **via our five senses**, is the foundation of competence.
2. Information is already **knowledge of facts**, which are still **simple** and **isolated**. This information can be sorted into four categories.
3. Information about **"What is it? How does it work? Why is it so?"** are **concept contents**.
4. We need them to construct new (or to **reconstruct** already existing) **concepts** "of the world".
5. These are **concepts** and principles **of** my**self** (I as an individual), **of society** (all other persons), **and of objects** (the rest of the world)
6. Information about **"What does it mean for me and for society?"** are **value contents**.
7. We need them to construct new (or to **reconstruct** already existing) **value concepts**.
8. These are **concepts of attitudes and values**.
9. Information about **"How to do it? (with the brain)"** are **procedure contents**.
10. We need them to **construct** new (or to **reconstruct** already existing) mental **procedure concepts**.
11. These are **concepts of abilities**.
12. Information about **"How to do it? (with brain and body)"** are also **procedure contents**.
13. We need them to **construct** new (or to **reconstruct** already existing) psychomotor **procedure concepts**.
14. These are **concepts of skills**.

In a first step information has to be transformed into "concepts". "Concepts" stand for knowledge of concepts, principles, processes, precedures, attitudes, and values

Summary: There are concept contents, value contents, and process contents. They are needed to construct (or to reconstruct) concepts of the "world" (self, other persons, and objects), of values, of abilities, and of skills.

4.2.4 Transforming concepts into values and procedures

Fig. 35: Transforming concepts into values and procedures



1. In the previous chapter we discussed how contents can be transformed into concepts. Now we want to transform concepts into values and procedures. Here are the four categories: Concepts of the "world" (self, society, objects), of values, of abilities, and of skills.
2. Concepts of the world explain "What is it? How does it work?" They present our knowledge of the world.

3. They are already elaborated and need no further work. Possible results are complex concepts such as
   a. What is a diesel engine?
   b. How does a diesel engine function?
   c. What is CBET?
   d. How to implement CBET in our country?
   e. What is constructivism?
   f. . How to apply constructivism in learning and teaching?
4. Concepts of attitudes and values explain "What does it mean for me and for society?" They present our knowledge about attitudes and values.

In a second step "concepts" of declarative knowledge remain, but "concepts" of procedural knowledge have to be transformed into attitudes and values, into mental abilities and into psychomotor skills

5. If these concepts are to become values, such as precision, working safely, or protecting the environment against pollution, they need to be "charged".
6. Charging means to load value concepts with an emotional experience. This experience can be the experience of other persons (e.g. a serious accident as a result of not obeying safety regulations) or own experience (positive feedback from teacher for good quality work = precision). Values are tacit knowledge issues anchored in the subconscious mind. (for "tacit knowledge" please refer to chapter 5.2)
7. Concepts of abilities explain "How to do it (with the brain)?" They present our knowledge about abilities.
8. If these concepts are to be transformed into mental processes, such as "how to read a technical drawing, to calculate costs of a production job, to plan classes for teaching", an additional step has to be included.
9. Abilities come into existence by applying knowledge. This is mental automatization: Plans (= knowledge) are applied step by step and automated by repetitions and training.
10. Concepts of skills explain "How to do it (with the brain and body)?" They present our knowledge about skills.
11. If these concepts are to be transformed into psychomotor processes, such as "how to file, to write, to change gear in a car", an additional step has to be included.
12. Skills come into existence by applying knowledge. This is physical automatization: Plans (= knowledge) are applied step by step and automated by repetitions and training.

Summary: The understanding of knowledge results in complex systems of knowledge (concepts including principles, processes, and procedures), the charging of concepts results in values, and by application of concepts our students develop abilities and skills.

Task 10 for group work

1. Please select one example for the transformation-process
   a. Concept Content → Concept
   b. Value Content → Value Concept → Value
   c. Process Content → Process Concept → Ability
   d. Process Content → Process Concept → Skill
2. What would you do, what should the students do to guarantee the success in each of the four transformation processes?

4.2.5 Developing knowledge: Concepts and processes

Example: Elements and functioning of a water-pump. Knowledge of a water pump is a description of the "what is it" and the "how does it work".

Method: Describing elements and explaining relations between elements

Fig. 36: Theory class: Elements and functioning of a water pump

Example for knowledge of concept and process: Elements and functioning of a water-pump: "What is it" and "how does it work"

4.2.6 Developing knowledge: Concepts and mental procedures

Example: Reading a technical drawing
Method: Describing elements and explaining the procedure step by step

Examples for mental abilities are

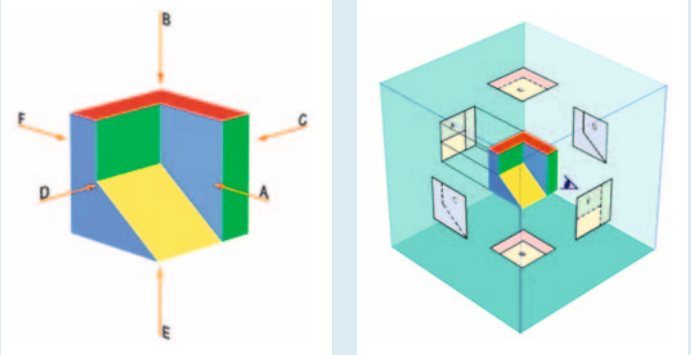
- interpreting a technical drawing
- estimating costs for the repair of a pump
- planning a lesson.

Example for knowledge of concept and mental procedure: Reading a technical drawing: "What is it" and "how to do it"

The knowledge of a mental process (of a procedure) is a description of the "what is it" and the "how to do it". It is like a cognitive map. To explain how to interpret a technical drawing, you already need to possess auxiliary concepts such as

- the meaning of different lines
- the six views of an object

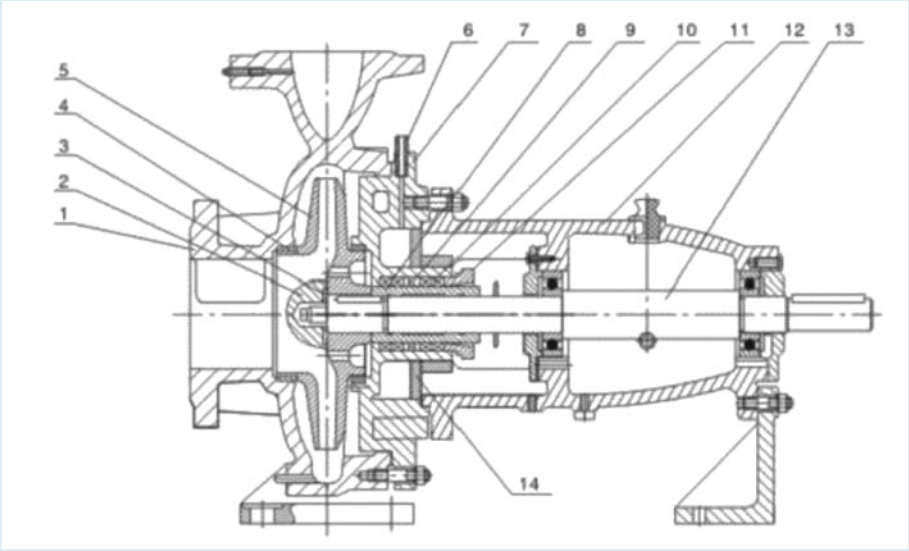
Fig. 37: The six aspects of an object in a technical drawing



4.2.7 Developing mental abilities

Example: Reading a drawing of a water pump to order spare parts

Fig. 38: Reading a drawing of a water pump



Example for developing a mental procedure: Plans "how to read a drawing" are applied step by step and automated gradually by repetitions and training

Method:

a. Procedures of abilities explain "How to do it (with the brain)". They present our knowledge about abilities.
b. If these concepts are to be transformed into mental procedures, such as "reading a technical drawing, calculating the costs of a production job, planning classes for teaching", an additional step has to be included.
c. Abilities come into existence by applying knowledge of mental procedures. Plans (= knowledge of cognitive maps) are applied step by step and automated gradually by repetitions and training.
d. That means: To learn how to read technical drawings students have to try to read different technical drawings and repeat it again and again.

4.2.8 Developing knowledge: Concepts and psychomotor procedures

Examples for psychomotor procedures (skills) are

- filing,
- writing,
- dismantling and repairing a pump

Example for knowledge of concept and psychomotor procedure: Dismantling a water pump: "what is it" and "how to do it"

The knowledge of a psychomotor procedure (skill) is a description of the "what is it" and the "how to do it." It is like a cognitive map. A cognitive map is an internal representation of a person's experienced world.

To explain "How to dismantle and repair a pump" you already need to possess auxiliary concepts such as

- the elements and function of a pump
- possible defects of pumps (such as wear, corrosion, leakages)
- typical tools for assembly, measuring instruments, and how to use them
- mental "pictures" of the sound of a "defect ball-bearing" or a "defective gearbox"

Methods:
A cognitive map of the procedure to dismantle and repair a pump can be developed in the mind of students by

- making them study a repair manual
- demonstration and explanation of the procedure by an instructor
- giving them the task to develop the working steps in group work or a combination of these methods.

4.2.9 Developing psychomotor skills

Example: Dismantling a water pump

Method:

a. Procedures of skills explain "How to do it (with the brain and body)". They present our knowledge about skills.
b. If these concepts are to be transformed into psychomotor procedures, such as "filing, writing, dismantling and repairing a pump", an additional step has to be included.
c. Skills come into existence by applying knowledge of the psycho-physical procedures. Plans (= knowledge of cognitive maps) are applied step by step and automated gradually by repetitions and training.
d. That means: To learn how to dismantle pumps students have to try to dismantle different types of pumps and repeat it – again and again.

Example for developing a psychomotor procedure: Plans "how to dismantle a pump" are applied step by step and automated gradually by repetitions and training

Fig. 39: Dismantling a water pump

According to Bloom, time and overlearning "is necessary to develop automaticity in the many subskills required to reach top-level performance in a talent field".[19] This is so because "once a skill has been developed to a high level of automaticity, it requires frequent use but very little special practice to maintain at that level" (ibid.)

At this stage, the goal-directed processes are "intentional but effortless mental processes"[20]

It is quite necessary for teachers to emphasize in teaching the great importance of practice, practice, and practice until the procedural knowledge (motor skills or cognitive skills) becomes automated.[21]

19 Bloom, B. S. (1986). Automoticity: The hands and feet of genius. Educational Leadership, 43 (5), 70-77.

20 Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. American Psychologist, 45, 462-479.

21 Adapted from CHEN JIAMU (2001) The great importance of the distinction between declarative and procedural knowledge, Análise Psicológica (2001), 4 (XIX): 559-566

4.2.10 Developing knowledge: Values at the workplace

Example for knowledge of value and its charge: Safety rules for working in confined spaces. Applying the rules will protect your safety

"What is it", "how to do/to use it" and "what does it mean for me, which benefit do I and other people have if I do it"

Important values at the workplace are occupational safety, health and environment which help to prevent harm to workers, property, the environment, and the general public. Values of equal importance are – for example –

a. **Professionalism**
   Employers value employees who exhibit professional behavior at all times. Professional behavior includes learning every aspect of a job and doing it to the best of one's ability.
b. **Dependability and responsibility**
   Employers value employees who come to work on time, are there when they are supposed to be, and are responsible for their actions and behavior.
c. **Adaptability**
   Employers seek employees who are adaptable and maintain flexibility in completing tasks in an everchanging workplace.
d. **Honesty and integrity**
   Employers value employees who maintain a sense of honesty and integrity above all else. Good relationships are built on trust.

Value education deals with two aspects:

1. A knowledge base of a value, which states what the value is all about (very simple examples are presented in a) to d) above). A knowledge base for occupational safety, health, and the environment is presented in the ILO International Hazard Datasheets on Occupation, which can be located in the Internet at: http://www.ilo.org/legacy/english/protection/safework/cis/products/hdo/htm/ index.htm
2. An "emotional charge" of the value – either positive or negative – resulting from individual experiences of each learner. This emotional charge will be explained in more detail in section 4.2.11.

Example:
Accident hazard
Suffocation hazard while carrying out maintenance or installation jobs, such as working in a confined place (tank, boiler) or when doing excavation work (collapse of excavation or a tunnel)
Preventive measures
Apply safety rules while working in a confined space: check air quality and, if necessary, exhaust ventilation before entering into a confined space; use harnesses that are held by your co-workers; use respirators and gas masks; etc.

Fig. 40: Safety equipment for working in confined spaces

Method:
The knowledge about "Working safely in confined spaces" is a description of "what is it", "how to do/to use it", and "what does it mean for me, which benefit do I and other people have if I do it".

A cognitive map of "working safely in confined spaces" can be developed in the mind of students by

- making them study-relevant safety manuals and procedures
- demonstration and explanation of the procedure by an instructor
- giving them the task to determine the necessary equipment and steps in group work or a combination of these methods.

4.2.11 Developing values

The knowledge base of a value is a description of "what is it", "how to do/to use it", and "what does it mean for me, which benefit do I and other people have if I do it". With that knowledge base a student knows what he/she is supposed to do. But how can we be sure that he/she actually does do it? This needs some type of motivation.

There are three major steps in this process of motivation:

1. **Initiate**
   Somebody must tell the student: "You have to wear safety goggles to protect your eyes, you have to wear a helmet to protect your head from falling objects. This is a safety rule for everybody etc."

2. **Reinforce**
   Reinforcement can be made in two ways:
   a. The teacher should give a positive feedback to the student when the student is wearing goggles and/or a helmet where this is required. Being praised creates a positive emotion in the student, which gives a "positive charge" to wearing safety goggles and a helmet. It is also important that the teacher himself sticks to the rules and uses safety equipment as required. The teacher as a leader has to demonstrate correct behavior.
   b. The teacher may give negative examples of persons how have suffered accidents because they didn't comply with the safety rules.

Example for charging a value concept: Wearing a safety helmet

1. Initiate
Tell student to wear a helmet

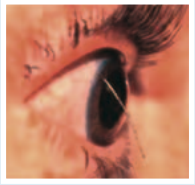
2. Reinforce
– Give positive feedback for wearing a helmet
– Show negative examples of accidents for not wearing a helmet

3. Show limits
Apply sanctions

Fig. 41: Deterrent pictures of accidents

The Falling Tile
Workers were putting tiles on the roof in 22 m height. Someone kicked a tile, which fell on the crane driver who **was not wearing a helmet**.

Eye Injury
The young worker was using an angle grinder with wire disc.
He **was not using protective glasses**, and a piece of broken wire penetrated his eye.



Immediately after such a training session held by the teacher, the students usually will

- start wearing the protective equipment previously ignored
- pay attention to their own safety.

Looking at such pictures will cause negative emotions in the students and will provide a negative charge to "not wearing protective equipment".

3. **Show limits and apply sanctions**
   Students should be informed about what will be tolerated and what will certainly not be tolerated. "If you do not respect existing values, rules and regulations in an institution (be it at school or at work) this may lead to sanctions."

Developing the knowledge base of a value is done rather quickly, but it requires a lot of time to charge this knowledge base with emotional experiences, either positive or negative, either by own experiences or experiences of other persons. Therefore, developing or changing values takes time.

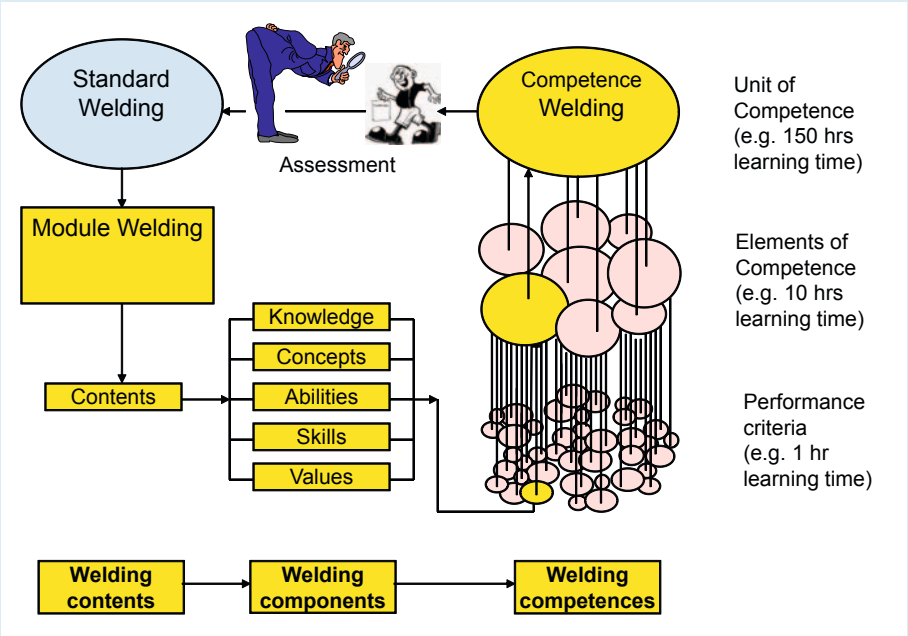
In the teaching of values, it's not about finger-wagging. Talking about values is easy, but not enough. More important is that your students make their own value-based experiences: Ideally these are experiences of their own, bad experiences of other persons should be presented through pictures or films.

4.3 Facilitating the development of competences

4.3.1 Major steps in competence development

Major steps to develop a competence are: From standards
- to modules
- to contents
- to components
- to performance criteria
- to elements of competence
- to unit of competence
- to assessment and certification

Fig. 42: Major steps in competence development



1. The starting point is formed by the competence standards of a country. Here, for example, the competence standards for welding.
2. VET providers have to ensure that competence standards are "translated" into suitable VET programmes and curricula which adequately reflect the occupational requirements and the specific context relevant for VET delivery of the respective VET provider.
3. In many countries the responsible authorities (such as the Ministry of Education) provide "sample learning modules" as a "helping hand". So there should also be a "Welding" learning module.

4. As we already know, only contents can be transmitted to students. Therefore contents relevant for facilitating the development of the competence "Welding" have to be determined.
5. Out of these contents students have to construct those clusters of components (knowledge, concepts, abilities, skills, and values) which are required in smaller welding competences (performance criteria).
6. The next step is that students integrate these components into such small competences (performance criteria).
7. Steps 5 and 6 – for one performance criteria – may take approximately one hour of learning time.
8. Out of a cluster of performance criteria students then have to "assemble" elements of competence.
9. The whole process – from contents via components via performance criteria to an element of competence – may take approximately ten hours of learning time.
10. Finally, out of a cluster of elements of competence, the students have to "assemble" the unit of competence "Welding". Usually, the "construction" of a unit of competence may take from 40 up to 180 hours of learning time.
11. Although training providers usually make an internal assessment of training outcomes, an independent external assessment is required in many countries.

Summary: The major steps are
1. from standards
2. to modules
3. to contents
4. to components
5. to competences
6. to the assessment and certification of competences.

4.3.2 Didactical analysis and constructing a competence

Didactical analysis: Competence → components → contents

1. The most basic building blocks of a competence are contents (or information). In a didactical analysis contents relevant for teaching and learning are determined.
2. Let's start from the top down with a unit of competence.
3. At the next lower level there are the elements of competence.
4. Each element of competence is composed of performance criteria.
5. Performance criteria are composed of components.
6. Components are constructed from contents in various teaching-learning steps.
7. In our model (Fig. 43) there are four performance criteria, which form two elements of competence, which ultimately establish the unit of competence.

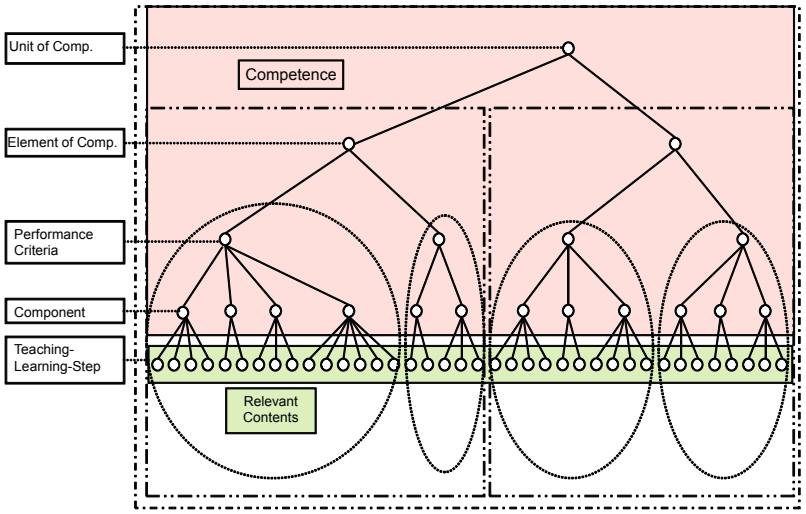
Top-down analysis of competences determines relevant contents. Relevant contents are then sequenced by the logic of learning. From teaching-learning steps upward a unit of competence is constructed

Constructing a competence: Contents → components → competence

8. When we want to construct a competence, we have to start with the relevant contents which we have determined in our didactical analysis.
9. Relevant contents are transmitted to students. There is, however, one important difference: The sequence of contents is changed. Their sequence is determined by the logic of learning.[22]
10. Now everything is simply reversed to a bottom-up approach. Contents (or topics) build components.
11. Components are assembled to form performance criteria.
12. Performance criteria build elements of competence.
13. Elements of competence are assembled to form units of competence.

22 For more details on sequencing of topics please see I.Reece, S. Walker: "Teaching Training and Learning", 4th edition, 2000. p. 306ff

Fig. 43: Didactical analysis (top down) and constructing a competence (bottom up)

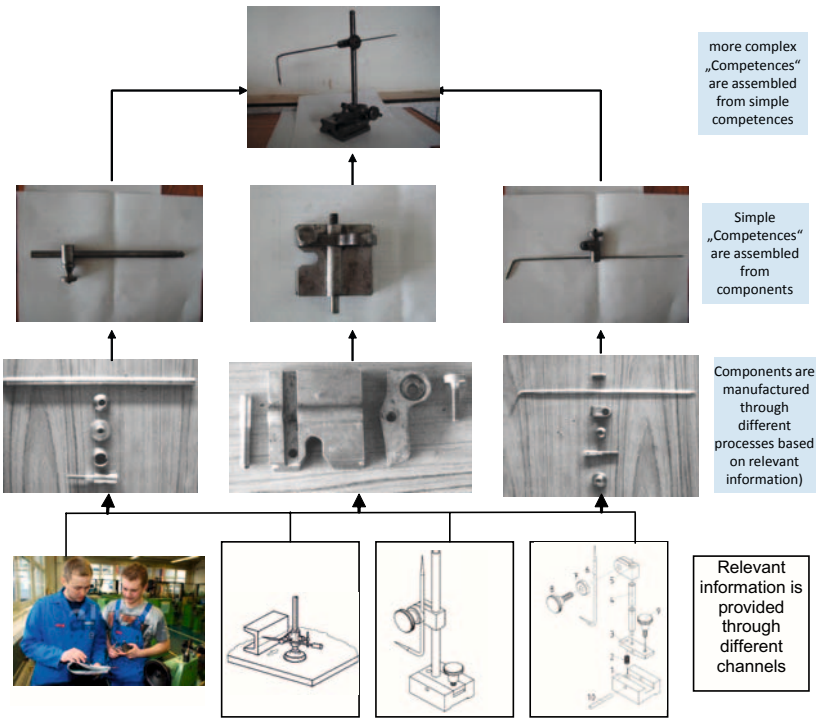


Summary: Top-down analysis of competences determines relevant contents. Relevant contents are then sequenced by the logic of learning. From teaching-learning steps upward a unit of competence is constructed.

4.3.3 A "model" from mechanical engineering

A "model" from mechanical engineering: Components have to be "manufactured", competences are then assembled from components

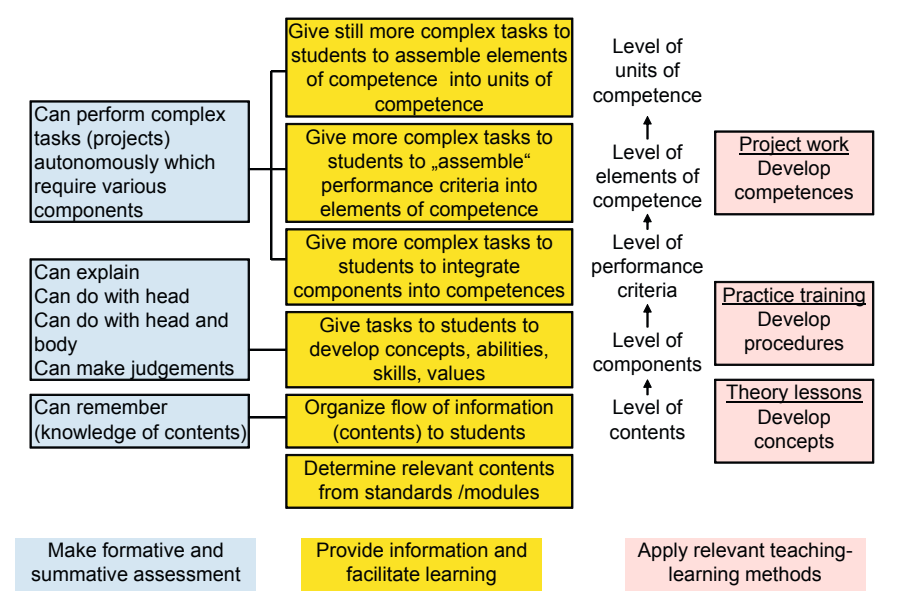
Fig. 44: A model: Information → components → simple competences → complex competences



1. The model from the mechanical engineering field shows quite neatly the three major production steps necessary to produce a complex height gauge: Getting the required information, manufacturing, and assembling. A similar differentiation can be made in the construction of a complex competence unit.
2. In the workshop, relevant information may be provided through working drawings and instruction by a foreman. During manufacturing, materials are shaped in different processes to produce the required components. Components are assembled to sub-assemblies, which, in turn, are put together to build the required height gauge.
3. In training situations, the trainer facilitates the learning of students. This includes that relevant information has to be selected and made available to students.
4. Then the students, through applying different learning techniques, have to develop the required components (concepts, principles, processes, and procedures, as well as values, abilities, and skills).
5. The next step will be integrating (or assembling) all relevant components of a specific performance criteria into one body of competence. This is usually achieved by solving tasks provided by the trainer. More complex tasks assemble performance criteria into elements of competence and still more complex tasks assemble elements of competence into units of competence.

4.3.4 Role of teachers

Fig. 45: The role of VET teachers in the development of competences in a learner



1. One major task is to provide information and facilitate learning.
2. Therefore VET teachers have to determine relevant contents from occupational standards and learning modules.
3. Then they have to organize the flow of information (of contents) to students. VET teachers have to make sure that the relevant information is made available to the student – by a variety of different means.
4. Teachers have to give adequate tasks to students so that students can develop ("construct") their own concepts, abilities, skills and values.

Main roles of VET teachers are: Apply relevant teaching-learning methods to provide information and facilitate learning. Make formative and summative assessment

5. Teachers have to give more or less complex tasks to students. By performing these tasks, students integrate the various components into small competences (performance criteria).
6. Through more complex tasks students can "assemble" performance criteria into elements of competence.
7. Even more complex tasks are required so that students can assemble elements of competence into units of competence.
8. To achieve these goals VET teachers have to apply relevant teaching-learning methods.
9. From the level of contents, via the level of components to the level of performance criteria teachers will provide
   a. theory lessons (essentially to develop concepts) and
   b. practical training (essentially to develop mental and physical procedures and values).
10. When it comes to the level of elements and units of competence, project work is required to develop more complex competences.
11. Before, during, and after teaching and learning, VET teachers are supposed to make a formative and summative assessment.
12. At the level of contents students should show they can remember (that they have a knowledge of contents).
13. At the level of components students should demonstrate that they can explain concepts, can apply principles, can perform abilities with their head and skills with their head and body, and that they can make judgments by applying values.
14. At the level of competences students should be more or less autonomously able to perform complex tasks (projects) which require various components.

Summary: The main roles of VET teachers are to apply relevant teaching-learning methods to provide information and facilitate learning, and to make a formative and summative assessment.

Task 11 for group work
Based on the information given above, please design a simple "Observation Sheet" for observing and evaluating the activities of VET teachers during
1. teaching processes,
2. facilitating learning processes, and
3. assessing learning outcomes.

5 School-leaving competence profile

5.1 The Dreyfus model of skill acquisition

There is a gap between what can be achieved in initial training (competence profile of a school leaver) and what tasks have to be performed on the job (competence profile of an expert worker). The Dreyfus model of skill acquisition is a model of how people acquire skills through formal instruction and further practicing. The Dreyfus model is used fairly widely (a) to provide a means of assessing and supporting progress in the development of skills or competences, and (b) to provide a definition of acceptable level for the assessment of competence or capability.

There is a gap between what can be achieved in initial training (competence profile of a school leaver) and what tasks have to be performed on the job (competence profile of an expert worker)

Fig. 46: Novice-to-Expert scale (1)

	Characteristics	How knowledge etc. is treated	Recognition of relevance	How context is assessed	Decision making
1. Novice	Rigid adherence to taught rules or plans Little situational perception No discretionary judgement	Without reference to context			
2. Advanced beginner	Guidelines for action based on attributes or aspects (aspects are global characteristics of situations recognizable only after some prior experience) Situational perception still limited All attributes and aspects are treated separately and given equal importance		None	Analytically	
3. Competent	Coping with crowdedness Now sees actions at least partially in terms of longer-term goals Conscious, deliberate planning Standardized and reutilized procedures	In context			Rational
4. Proficient	Sees situations holistically rather than in terms of aspects Sees what is most important in a situation Perceives deviations from the normal pattern Decision-making less labored Uses maxims for guidance, whose meanings vary according to the situation		Present		
5. Expert	No longer relies on rules, guidelines or maxims Intuitive grasp of situations based on **deep tacit understanding** Analytic approaches used only in novel situations or when problems occur Vision of what is possible			Holistically	Intuitive

Fig. 47: Novice-to-Expert scale (2)

	Knowledge	Standard of work	Autonomy	Coping with complexity	Perception of context
1. Novice	Minimal, or 'textbook' knowledge without connecting it to practice	Unlikely to be satisfactory unless closely supervised	Needs close supervision or instruction	Little or no conception of dealing with complexity	Tends to see actions in isolation
2. Beginner	Working knowledge of key aspects of practice	Straightforward tasks likely to be completed to an acceptable standard	Able to achieve some steps using own judgment, but supervision needed for overall task	Appreciates complex situations but only able to achieve partial resolution	Sees actions as a series of steps
3. Competent	Good working and background knowledge of area of practice	Fit for purpose, though may lack refinement	Able to achieve most tasks using own judgment	Copes with complex situations through deliberate analysis and planning	Sees actions at least partly in terms of longer-term goals
4. Proficient	Depth of understanding of discipline and area of practice	Fully acceptable standard achieved routinely	Able to take full responsibility for own work (and that of others where applicable)	Deals with complex situations holistically, decision-making more confident	Sees overall 'picture' and how individual actions fit within it
5. Expert	Authoritative knowledge of discipline and deep tacit understanding across area of practice	Excellence achieved with relative ease	Able to take responsibility for going beyond existing standards and creating own interpretations	Holistic grasp of complex situations, moves between intuitive and analytical approaches with ease	Sees overall 'picture' and alternative approaches; vision of what may be possible

As can be seen from Figs. 46 and 47, there is a considerable competence gap between a novice and an expert worker. One major difference between the two is the amount of tacit knowledge which the expert worker has acquired during many years of practice.

5.2 Tacit knowledge

Tacit knowledge has been described as "know-how" – as opposed to "know-what" (facts), "know-why" (science), or "know-who" (networking).

The term "tacit knowledge"[23] was first introduced by Michael Polanyi in 1958. He describes the fact that "we can know more than we can tell." Some examples of daily activities with tacit knowledge are: riding a bike, playing the piano, driving a car. Recognizing a face, being punctual, being concerned about quality are other aspects that fall within this category. Subjective insights, intuitions, emotions, mental models, values, and "automatic" actions are also examples of tacit knowledge.

Tacit knowledge is "silent knowledge" – we are able to do something but very often we are not able to explain how we do it. For example "riding a bicycle"

Tacit knowledge is "silent knowledge" – we are able to do something but very often we are not able to explain how we do it. The concept of tacit knowledge refers to a knowledge possessed only by an individual and difficult to communicate to others via words and symbols. Therefore, an individual can acquire tacit knowledge without language. Apprentices, for example, work with their master craftsman and learn craftsmanship not only through language but mostly by observation, imitation, and practice. The key to acquiring tacit knowledge is experience – and this needs time.

Effective transfer of tacit knowledge generally requires extensive personal contact, regular interaction, and trust. The existence of this kind of knowledge can only be revealed through practicing in a particular context, like riding a bike.

The "theory" of how to ride a bike is that in order to balance, if the bike falls to the left, one steers to the left. To turn right the rider first steers to the left, and then when the bike falls right, the rider steers to the right. Knowing only the theory, however, is not sufficient to ride a bicycle, but it helps to orientate practicing.

Tacit knowledge – through subconscious "automatization" – helps to free capacity of our mind for other tasks. Tacit knowledge is stored in the sub-conscious mind and is not easy to document.

5.3 School-leaving vs. expert competence profile

Let's have a look at the school-leaving competence profiles of graduates from normal VET centers. Compared with the levels of the Novice-to-Expert Scale (Figs. 46 and 47 above), the training outcomes in many countries will be between level 1 and 2, with level 3 being more the exception than the normal case.
There are several good reasons for this.

Competence standards are determined by taking expert workers as reference

Competence standards

a. Competence standards are determined by the world of work, taking expert workers as reference. The results are often very "demanding" competence standards.
b. Competence standards are available in a country, but not used yet in training institutions

Training providers often suffer from a lack of essential inputs, such as finance, qualified teachers, required infrastructure, etc.

Training providers

a. Private providers are profit-oriented, but underfinanced → low-cost training
b. Public financing supports mostly short-term training of three to six months' duration
c. Limited fees for VET centers → limited salaries for staff → limited qualification of trainers → poor quality of training and trainer absenteeism
d. Infrastructure deficiencies

23 Adapted from http://en.wikipedia.org/wiki/Tacit_knowledge

e. Lack of appropriate teaching materials
f. Equipment and curricula not sufficient or not up-to-date
g. Training staff lacking
   – academic and technical qualifications
   – relevant industrial experience
   – training methodology
h. Lack of accountability for results by institutions and trainers
i. Funds are transferred to public institutions regardless of performance
j. Examinations done by the providers themselves

Students

a. Low quality intake levels experienced by most training providers
b. Behavioral problems with the attachment as on-the-job training in industry
c. High drop-out rates
d. VET graduates have a lower social status, therefore VET is frequently the least attractive alternative for general education graduates.

VET is frequently the least attractive alternative for general education graduates

Under these circumstances it is quite understandable that very often there are critical remarks from the world of work about "poor quality output" from VET centers, especially measured along industry-made competence standards.

VET centers and national institutions responsible for VET, for instance ministries or national training institutions, are well aware of these shortcomings. Therefore, especially in Latin America, these institutions have created the "school-leaving profile ("perfil de egreso" in Spanish), which takes into consideration the strengths and weaknesses of the VET sector. It also takes into consideration the "holistic educational objectives" of VET centers: to develop a competent person, family member, and citizen.

In Latin America, VET institutions have created the "school-leaving profile ("perfil de egreso"), which takes into consideration the strengths and weaknesses of the VET sector

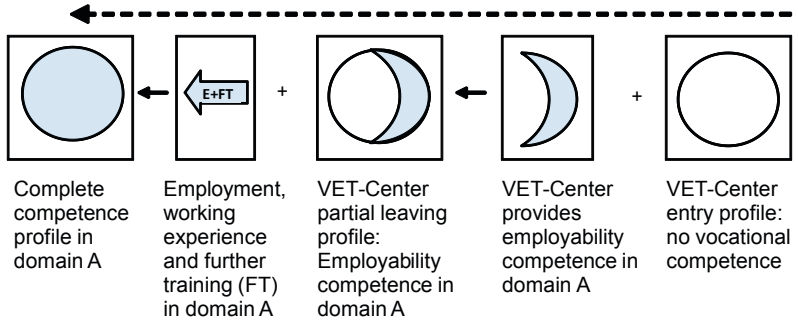
The "school-leaving profile" is the yardstick for VET, it is the training standard that guides course development and assessment. Training institutions claim that they are committed to these training standards.

Very often, however, there is a gap between the vocational part of VET school-leaving profiles and industry-made competence standards. Or, as a high-level official of the VET sector recently put it: "The problem is not making a very demanding school-leaving profile, the problem is what is feasible with what we have!"

5.4 Training for employability

The objective of training for employability is – simply speaking – to provide sufficient competences to get a job – and to maintain the job.

Fig. 48: Employability in one domain



The objective of VET training for employability is – simply speaking – to provide sufficient competences to get a job – and to maintain the job

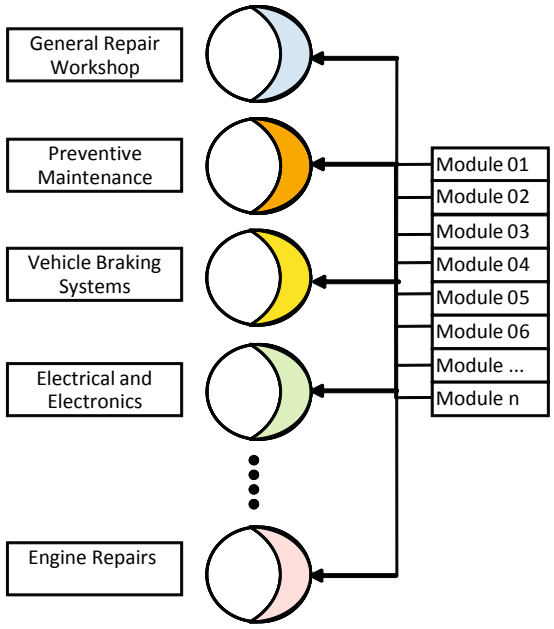
So this is another important aspect of a school-leaving profile: Providing employability, if possible, in several domains. As is shown in Fig. 48, general education graduates enter VET centers with almost no vocational competence. During training they may achieve a basic competence, sufficient for employment as a beginner in a specific domain, let's call it domain A. If they manage to get a job in domain A, through working experience and further training they will gradually reach the complete competence profile in domain A.

In the automobile sector, a school-leaving profile may include basic competences in the following domains:

1. General repair workshop
2. Preventive maintenance
3. Vehicle braking systems
4. Electrical and electronics
5. Fuel systems and exhaust
6. Transmission systems
7. Vehicle steering and suspension
8. Engine repairs

Such a profile will be fairly wide, but hopefully will be also sufficiently deep to enable the VET graduate to get a job in one of the eight domains.

Fig. 49: School-leaving profile with employability in several domains



After that, in-plant training for already employed workers helps to ensure that front-line workers have the skills, knowledge, and abilities required to perform their jobs properly, safely, and effectively. In addition to competence-based training, assessment based on the performance of actual work competences helps to ensure that employees perform their work tasks safely and that training can be implemented to improve competences.

6 Modularization of VET

6.1 Modules

6.1.1 General characteristics of modules

The logic of work is different from the logic of learning. Therefore competence standards have to be "transformed" into the logic of learning, into modules

Qualifications are composed of competence units. Competence units describe tasks from the world of work, using the logic of work. The logic of work is different from the logic of learning, therefore competence standards have to be "transformed" into the logic of learning. The result is called a training module. These modules have measurable outcomes that are assessed (and in some instances certified) and contribute to a larger overall educational outcome, primarily a qualification.

A module is a standardized learning package that, in conjunction with other such packages, constitutes an educational course, training program, or a modularized curriculum. Wherever modularized curricula are to be developed on a national scope, the responsible ministries tend to provide only a framework for the content and procedures of VET provision. Training providers and trainers usually are given considerable freedom to tailor VET modules to the needs of regional labor markets, local companies, individual learners, and community development (such as for citizenship and lifelong, self-directed learning).

A module consists of a sequence of learning situations (teaching/learning activities)

A module consists of a sequence of learning situations (teaching/learning activities) which are closely related to the world of work and enable learners to develop the knowledge, concepts, mental abilities, and psychomotor skills, as well as the values and attitudes required to perform one or more competences effectively. The duration of a module is usually between 40 and 120 hours.

The transformation from significant work processes to learning situations entails a series of steps.

Fig. 50 presents a template for a module outline (without details). The outline presents only the major characteristics of a module. Details of learning situations have to be elaborated later by the responsible teachers.

6.1.2 A template for a module

A template for a module

Fig. 50: Template for a draft module

1. Title of cccupation	Draft No	Date:	
2. Level			
3. Module title			
4. Duration			
5. Objectives/competences			
6. Knowledge			
7. Assessment/certificates			
8. Learning situations			
9. Remarks			
10. Originator			
11. Annexes			

Adapted from: Staatsinstitut für Schulqualität und Bildungsforschung „Leitfaden zur Entwicklung und Zertifizierung von Modulen" Munich, April 2006

1. **Title of occupation**
   e.g. Motor Vehicle Mechatronics Technician

2. **Level**
   The level of the competence(s) which is to be developed through this module, e.g. No. of learning field, year of training, level in the NQF

3. **Module title**
   The module title should be short and concise, e.g. Maintenance and care of vehicles or systems.

4. **Duration**
   In this field the duration of the module in hours is to be mentioned, usually it is between 40 and 120 hours.

5. **Objectives / competences**
   This is one of the two major blocks of information in this template. The field contains a description of specific objectives to be achieved which are the competences students are expected to develop in this module. The description should also put an emphasis on student activity, using text blocks such as:
   a. Students procure relevant information on their own, in groups, etc.
   b. Students plan their working steps as a team, using appropriate media, etc.
   c. Students document their working steps
   d. Students organize and implement their work
   e. Students check and evaluate their results
   f. Students present their results (in a group, to customers, with appropriate media, etc.)

   For an example please refer to chapter 6.1.3.

6. **Knowledge**
   Knowledge – on the one hand – should be named precisely to provide a clear idea of the lesson content. On the other hand, there should be sufficient flexibility left to allow teachers to make final adjustments. For an example please refer to chapter 6.1.3.

7. **Assessment/certificates**
   Already during the design of a module, initial considerations about monitoring results, performance evaluation, and possible certification can be made. These considerations are documented here.

8. **Learning situations**
   The motivational aspects of different learning situations are always important. The following examples from the module “Customer-oriented sales” demonstrate possible variations.
   a. Lessons with the whole class in orientation and information phases
   b. Group work or individual work for acquisition of knowledge about goods and their presentation
   c. Group work about collecting of sales arguments, about creating a criteria list to assess sales talks, when creating a foreign language manual
   d. Partner work: Role-playing in sales talks (possibly with video recording)
   e. Visits to companies for acquisition of knowledge about goods

9. **Remarks**
   Whatever may be necessary at this point.

10. **Originator**
    Contact details of the person(s) who developed this draft (name, address, e-mail etc.)

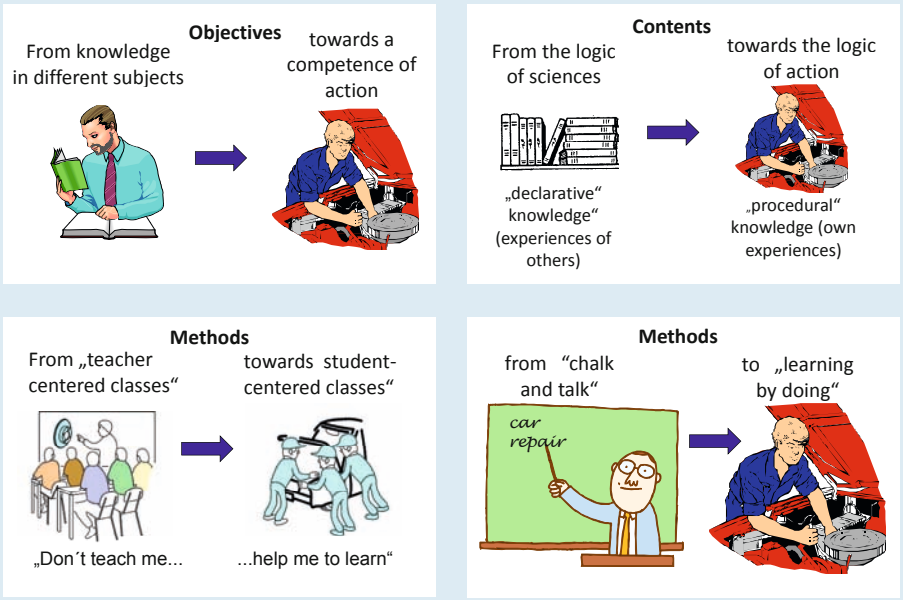
11. **Annexes**
    Annexes can be hints about already existing materials, references to websites, or relevant literature.

6.1.3 Two examples of VET school modules

In the German dual system there is one framework curriculum on a national level for the apprenticeship in companies and there is one frame-work curriculum for VET schools in the federal states. Framework curricula for VET schools are modularized, with a module being called a "Lernfeld" ("learning field" or "learning arena" are suggested translations for this term). Since the 1990s there has been a paradigm shift away from subject-oriented curricula in VET schools towards work-oriented and competence-based curricula.

In Germany, framework curricula for VET schools are modularized

Fig. 51: Big changes in VET: Objectives, contents, and methods



Example Module 1
Occupation: Motor Vehicle Mechatronics Technician
Level: Learning field 01, 1st training year
Module title: Maintenance and care of vehicles or systems
Duration: Suggested time allocation: 100 hours

Objectives/Competences/Skills[24]:
Students carry out care and maintenance work to retain functionality or value of vehicles or on systems typical to the occupation.

Motor Vehicle Mechatronics Technician: Competences in a 1st year module

They identify customer expectations in respect of order processing and react to customer wishes. They conduct discussions with line managers, employees, and suppliers and pay due regard to the importance of customer care. They demonstrate a positive personal attitude towards their work in the workshop and accept responsibility for the business process.

24 Source: OUTLINE CURRICULUM for vocational education and training in the occupation of Motor Vehicle Mechatronics Technician. (Culture and Education Ministers Conference Resolution of 16 May 2003), Bonn

The students analyze functional units of the vehicles or systems typical to the occupation and describe the functions of subsystems. They deploy procedures relating to the analysis and exemplification of the interrelation of functions.

They use service plans and repair guides, obtain technical documentation, and deploy data processing means to procure information and documentation. They implement the rules, norms, and procedures forming the basis of the service.

They ensure communication with upstream and downstream functional areas.

Within the scope of the service work, they develop awareness of safety and quality and apply regulations relating to health and safety at work and protection of the environment in a secure way.

They document maintenance work carried out and provide information in respect of the nature and scope of this work.

Motor Vehicle Mechatronics Technician: Knowledge in a 1st year module

Knowledge

- Work planning
- Manufacturers' documentation
- Service concepts and extent of service provision
- Repair guides and service plans
- Block diagrams, diagrams, and functional schemes
- Technical systems and subsystems
- Technical information, communications, and documentation systems
- Procedures and devices for measuring and testing
- Tools, company resources, auxiliary materials
- Spare-part and material-requisitioning lists
- Vehicle registration and road traffic regulations
- Health and safety at work and prevention of accidents
- Disposal and recycling
- Quality of work
- Conducting discussions and communication rules
- Verbal and non-verbal communication
- Conflict avoidance strategies
- Chairing discussions and making presentations

Example Module 2
Occupation: Sewage Engineering Technician
Level: Learning field 01, 1st training year
Module title: Planning of an environmental concept
Duration: Suggested time allocation: 80 hours

Sewage Engineering Technician: Competences in a 1st year module

Objectives/Competences/Skills[25]:
Students design a concept for the operation of an environmental plant (a plant with environmental interfaces, such as a brewery).

For this purpose they collect information on material flows in environmental engineering systems and make themselves familiar with the functioning of supply and disposal facilities as well as of pipe, sewer, and industrial services.

25 Adapted from: Federal Institute for Vocational Education and Training (BIBB), Sewage Engineering Technician, Explanatory notes to and practical assistance for the nationally recognized vocational training regulations, 2002

Their planning takes into account the causes and effects of environmental pollution of air, water, and soil which originate from plant facilities and analyzes impacts on living creatures. They take into account possibilities for the avoidance and minimization of environmental pollution.

While developing the environmental concept in group work they learn to work in a team, to plan and process together and jointly agree on tasks. They apply information and communication systems to meet objectives, and they document and evaluate results.

Sewage Engineering Technician: Knowledge in a 1st year module

Knowledge

- Eco system
- Water cycle and water quality
- Water pollution: eutrophication, contamination, acidification
- Air pollution : soil pollution, biotope destruction
- Avoidance of wastes
- Design and function of wastewater treatment plants
- Design and function of water supply facilities
- Design and function of recycling and waste management plants
- Design and function of facilities of pipe, sewer, and industrial services
- Laws and regulations, technical rules and standards
- Work organization
- Structuring the work place
- Use of information systems
- Data protection regulations
- Procurement of work equipment
- Accident prevention, occupational safety

For further information about the three-year training of **Sewage Engineering Technicians** and the three-and-a-half-year training of **Motor Vehicle Mechatronics Technicians** please refer to the website of the Bundesinstitut für Berufsbildung (BIBB) in Germany.

Catalogue of VET training modules in Spain

Catalogue of VET training modules in Spain

The Modular Catalogue of Vocational Education and Training consists of all the learning modules. Each module is associated with one of the competence units which form a professional qualification. The Modular Catalogue provides a common reference for the integration of the vocational education and training offer in order to enable the capitalization of learning and the promotion of lifelong learning.

The Modular Catalogue of Vocational Education and Training promotes a quality vocational education and training (VET) offer, which is updated and appropriate for the different target groups, according to their expectations for professional promotion and personal development.

Besides, the catalogue meets the productive sector's demands for vocational education and training (VET). The catalogue aims to increase competitivity by reinforcing the working population's qualifications.

Source: http://www.educacion.gob.es/educa/incual/ice_catalogoWeb_ing.html

6.2 Modularized courses and curricula

6.2.1 Definitions

Curriculum is the totality of learning experiences provided to students so that they can attain general skills and knowledge at a variety of learning sites.

Source: Dom Fearon: "Curriculum Development Practice" Northumbria Built and Virtual Environment Working Paper Series • Vol. 1 No. 2, 2008

A modularized curriculum comprises the particular combination and arrangement of modules which have to be completed in order to achieve the competence requirements for a course or a qualification.

6.2.2 Examples of curricula from Germany

Examples of curricula from Germany

On the following pages two sets of dual framework curricula, one for work-based training in companies and the other for related school-based training in VET schools are presented.

Fig. 52: Training curriculum for Water Supply Engineering Technician
Work-based training in company

Ser. No. Training Framework Plan	Description of required competences	Training Time in weeks per Training Period	
		1st-15th month	16th-36th month
Core competences			
1	Vocational training, employment and collective bargaining law	To be imparted during the complete training	
2	Structure and organization of the firm providing training		
3	Safety and health protection on the job		
4	Environmental protection		
5	Operational processes, work organization	4	
6	Information and documentation, quality assurance measures	4	
7	Environmental protection technology, ecological cycles and hygiene	8	
8	Fundamental principles of mechanical and process engineering, measurement technology, numerical control engineering and control technology	19	
9	Dealing with risks posed by electricity	4	
10	Application of scientific principles	10	
11	Materials, ancillary materials and dangerous materials, dangerous working substances, materials processing	12	
12	Storage, tools and equipment	4	

Ser. No. Training Framework Plan	Description of required competences	Training Time in weeks per Training Period	
		1st-15th month	16th-36th month
Specialized competences			
13	Safety of personnel and plant		2
14	Water management		2
15	Water extraction		4
16	Water condition, water treatment		12
17	Water delivery, storage and distribution		24
18	Analysis of water		9
19	Measurement technology, numerical control engineering and control technology		8
20	Electrical plant in water supply		16
21	Documentation		4
22	Protection of drinking water and consumer facilities		4
23	Customer orientation		4
24	Legal provisions and technical rules and standards		26

Fig. 53a: Training curriculum for Water Supply Engineering Technician in VET school-based training

Learning fields (LFs)		**Recommended Time (hrs)**		
Serial No.		1st year	2nd year	3rd year
1	Planning of an environmental concept	80		
2	Handling of micro-organisms	40		
3	Employ environmental chemicals	80		
4	Operate pipeline systems	80		
5	Examine content substances of water and waste		60	
6	Operate and maintain machines and installations		80	
7	Operate and maintain electrical plant		40	
8	Water extraction		40	
9	Make domestic connections		60	
10	Investigate water characteristics			40
11	Process water			60
12	Connect electrical equipment			40
13	Deliver, store and distribute water			100
14	Control and regulate water treatment facilities			40
	Sum (in total 840)	**280**	**280**	**280**

Fig. 53b: Traditional Learning Areas (Subjects) Wastewater

	Year 1	Year 2	Year 3
Water Supply and Environmental Engineering	LF 1	LF 8,9	LF 11,13
Techniques of Analysis	LF 2,3	LF 5	LF 10
Machine and Apparatus Technology	LF 4	LF 6	LF 14
Electrical Engineering	–	LF 7	LF 12

Traditional domains have been divided into smaller, self-contained units, called Learning Fields (LFs) ➔ modules

In Figs. 53a / 53b the four subjects/domains of the water sector

1. Water, Wastewater and Environmental Engineering
2. Techniques of Analysis
3. Machine and Apparatus Technology
4. Electrical Engineering

have been divided into smaller, self-contained units, called learning fields (LFs) and arranged from "general basic" (LF1) to "specific occupational" (LF14). The same principle was applied in creating the training curriculum for Motor Vehicle Mechatronics Technician for VET-school-based training in Figs. 54a / 54b.

Fig. 54a: Training curriculum for Water Supply Engineering Technician in VET school-based training

Learning fields (LFs)		Recommended Time (hrs)			
Serial No.		1st year	2nd year	3rd year	4th year
1	Maintenance and care of vehicles or systems	100			
2	Disassemble, repair and assemble technical vehicle subassemblies or systems	80			
3	Test and repair electrical and electronic systems	80			
4	Test and repair open-loop and closed-loop control systems	80			
5	Test and repair energy supply and starting systems		80		
6	Test and repair engine mechanics		80		
7	Diagnose and repair engine management systems		100		
8	Conduct service and repair work on exhaust systems		40		
9	Maintain power transmission systems			60	
10	Maintain chassis and brake systems			80	
11	Retrofit and put additional systems into service			60	
12	Test and repair networked systems			80	
13	Diagnose and repair body work, comfort and safety systems				80
14	Conduct service and repair work for a statutory inspection				80
	Sum (in total 1020)	**320**	**280**	**280**	

Fig. 54b: Traditional Learning Areas (Subjects) Motor Vehicle

	Year 1	Year 2	Year 3	Year 4
Maintenance service	LF 1	LF 8,	LF 10	LF 14
Dismantling, repair, assembling	LF 2	LF 6	LF 9	–
Testing and installation techniques	LF 3, 4	LF 5	LF 11	–
Diagnosing	–	LF 7	LF 12	LF 13

6.2.3 Learning situations

Learning fields are fairly big "packages", ranging from 40 to 120 hours in duration. Therefore – for better handling by trainers, instructors, and students – they are broken down into Learning Situations (LSs).

Learning fields (LFs) range from 40 to 120 hrs duration. Therefore they are broken down into smaller Learning Situations (LSs)

Learning situations are complex teaching-learning arrangements to facilitate the learning of knowledge, skills, and competences. They include phases of developing, applying, practicing, and deepening bits and pieces of competences as well as formative and summative assessment.

Fig. 55: Example for a learning situation (presented in a recommended template)

Learning Field No. 1: **Planning of an environmental concept**	
Learning Situation No. 1: **Analysis of location and operating data for a small brewery** 30 hrs	
Introduction / Motivation: A small brewery with a restaurant intends to build a new facility at another location in a rural area. The operating data should be identical to those of the parent company.	***Expected outcomes / learning results:*** Analysis and evaluation of the new facility with regard to its environmental compatibility – to know parameters of water pollution – to know parameters of air pollution – to know and consider legal requirements – to know individual and social responsibility for the environment
Contribution to develop the following competences: Personal / social competences: – communication skills – teambuilding and teamwork – willingness to analyze new situations and problems – willingness to contribute knowledge – willingness to accept other opinions	***Major contents:*** Content areas: – water cycle – eutrophication, contamination, acidification – habitat destruction – soil pollution – emissions, immersions – technical rules and regulations
Learning and working techniques: Six phases of project method in group work	
Didactical material and where to find it: All relevant technical data will be provided by the teacher(s) in printed form	
Organization: Classroom organized for group work, if possible a visit to a local brewery	

Example for a learning situation from the water sector

6.2.4 Semestral didactical plan

Fig. 56: Schematic presentation of a semestral didactical plan for the 1st semester of a one-year full-time school-based "Basic Training Metal" course

Full-Time "Basic Training Metal" – 1st Semester																			
Weeks	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Subjects	LF 1: Product planning – 120 hrs																			
	LF 2: Product manufacturing – 120 hrs in Workshops																			
	LF 3: Work planning – 60 hrs																			
	LF 4: Maintenance – 40 hrs																			
Occupation-specific Learning																				
Product planning		G	LS1			LS2			G	LS2				G					LS3	
Work planning																				
Product manufacturing	LS1		LS2			LS3			LS4			LS5			LS6			LS7	
Maintenance	LS1							Training	LS2				LS3				Training	LS4		
Mathematics	S1						S2		S3			S4			S5			S6		
English	S1				S2				S3					S4				S5		
Learning not linked to specific occupations																				
German / Communication	S1					S2		Good Manners	S3					S4			Job Applicationn	S5		
Religion / Ethics	S1					S2			S3			S4						S5		
Sports / Health promotion	S1	S2			S3				S4					S5				S6		
Social sciences / Politics	S1								S2									S3		
General subjects																				
Physics	S1				S2				S3			S4			S5			S6		
ICT usage	S1				S2				S3					S4				S5		
Weeks	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20

LF = Learning Field LS = Learning Situation G = Occupation-specific learning package S = Subject-specific learning packages
(For reasons of space and readability, all field, situation, and package titles have been omitted)

The semestral (or annual) didactical plan provides an overall view of complex training courses with some details (duration, title of major content, sequencing) about

a. **Occupation-specific learning**
   - Learning fields (LFs)
   - Learning situations (LSs) per learning field
   - Courses to complement learning situations
   - Occupation-related mathematics
   - Occupation-related English
b. **Learning not linked to specific occupations**
   - German / Communication
   - Religion / Ethics
   - Sports / Health promotion
   - Social sciences / Politics
c. **General subjects**
   - Physics
   - Information and Communication Technology (ICT)

There are many more interesting details in the document for this one-year training course – exactly 87 pages. And there are many more documents. For those interested, here is the website address:
http://www.berufskolleg-wipperfuerth.de/Didaktischeplanungengesamt.htm

6.2.5 Cross-check: Learning field vs. Learning situations

As mentioned before, learning fields are fairly big "packages", which is why they are broken down into learning situations. Fig. 57 shows an example as planned by a team of Motor Vehicle Teachers for implementation in their VET school. Note that they have also reduced the duration of LF 1 from the recommended 100 hrs to 48 hrs to create time for other learning fields.

All learning situations in Learning Field 1 of Motor Vehicle Mechatronics Technicians

Fig. 57: Overview of learning situations in Learning Field 1 of Motor Vehicle Mechatronics Technicians

Learning-situation	Title	Time hrs
LS 1.1	A customer comes into the workshop	12
LS 1.2	To plan and perform professionally the "winter check"	12
LS 1.3	Oil change – in the scope of an inspection – carried out professionally	8
LS 1.4	Quality consciousness at work in the workshop	8
LS 1.5	Preparation of a new vehicle for delivery to a customer	2
LS 1.6	To check a vehicle for a long journey to be performed during summer vacations	6
	Total time (hrs)	**48**

Cross-check: Are all competences and knowledge from Learning Field 1 covered by the six learning situations?

Learning situations are complex teaching-learning arrangements to facilitate the learning of knowledge, skills, and competences. Fig. 58 below is a checklist to make sure that all objectives, competences, and skills listed in the official framework curriculum for Learning Field 1 (please refer to 6.1.3, example 1) are sufficiently covered by the six learning situations, determined and developed by the teachers of this VET school (other VET schools – according to their specific conditions and possibilities – may have developed a very different set of learning situations to achieve the required outcomes).

Fig. 58:
Checklist: Learning situations 1 to 6 vs. objectives for Learning Field 1

Objectives/Competences/ Skills of Learning Field 1 (LF1):	Learning situation					
	1.1	1.2	1.3	1.4	1.5	1.6
Identify customer expectations in respect of order processing	X			X		
React to customer wishes	X			X		
Conduct discussions with line managers, employees, and suppliers	X			X		
Pay due regard to the importance of customer care	X			X		
Demonstrate a positive personal attitude towards own work	X			X		
Accept responsibility for the business process	X			X		
Analyze functional units of the vehicles or systems typical to the occupation		X	X		X	X
Describe the functions of subsystems		X	X		X	X
Deploy procedures relating to the analysis and exemplification of the interrelation of functions.		X	X			
Use service plans and repair guides		X	X	X	X	X
Obtain technical documentation			X	X		X
Deploy data processing means to procure information and documentation			X		X	X
Implement the rules, standards, and procedures forming the basis of the service		X			X	X
Ensure communication with upstream and downstream functional areas			X	X	X	
Develop awareness of safety and quality within the scope of the service work	X	X		X	X	
Apply regulations relating to health, safety, and protection of the environment in a secure way		X		X	X	X
Document maintenance work carried out		X		X	X	X
Provide information in respect of the nature and scope of this work	X	X		X		

The check applied to objectives/competences/skills of Learning Field 1 in Fig. 58 has to be applied in a similar way with regard to the required knowledge listed in the official framework curriculum for Learning Field 1 (please refer to 6.1.3, example 1). This is done and presented in Fig. 59.

In Figs. 58 and 59 there is no check-line left uncrossed – therefore all objectives and all knowledge are covered in at least one learning situation.

Fig. 59:
Checklist: Learning situations 1 to 6 vs. knowledge for Learning Field 1

Knowledge of Learning Field 1 (LF1):	Learning situation					
	1.1	1.2	1.3	1.4	1.5	1.6
Work planning		X	X			X
Manufacturers' documentation		X	X			X
Service concepts and extent of service provision	X	X	X	X		X
Repair guides and service plans	X	X	X		X	X
Block diagrams, diagrams, and functional schematics			X			
Technical systems and subsystems		X	X			X
Technical information, communications, and documentation systems	X		X			
Procedures and devices for measuring and testing		X	X		X	X
Tools, company resources, auxiliary materials		X	X		X	X
Sparepart and material requisitioning lists		X	X		X	X
Vehicle registration and road-traffic regulations		X			X	X
Health and safety at work and prevention of accidents		X		X	X	X
Disposal and recycling		X	X			X
Quality of work	X	X	X	X	X	X
Conducting discussions and communication rules	X			X		
Verbal and non-verbal communication	X			X		
Conflict avoidance strategies	X			X		
Chairing discussions and making presentations			X	X		

6.2.6 Modular courses in the United Kingdom (UK)

Modular courses in the UK – a different approach

Modular Courses are short units of learning, which are separately assessed and can be assembled over time into larger courses and qualifications. Often one can study for the separate modules at different times and places, and assessment can be by different bodies. They therefore require detailed specifications of outcome, and systems of quality assurance and external verification to accredit the training providers and the assessors. They enable great flexibility: trainees can study at their own pace, in a style and at a place of their choosing, common modules can be shared by several specializations, new modules can be added to reflect new specializations. They therefore reflect the realities of life-long learning: trainees with jobs, family responsibilities, changing careers. The UK has universally committed itself to modular courses and qualifications to such an extent that it is taken for granted, and it is forgotten that other countries have yet to do so. There is no single explicit methodology of modularization, but everyone thinks and acts in a modular way.

Source: N. Lloyd, N. A. Khan, M. Jacyniuk-Lloyd: "Modular education and examples of good practice in United Kingdom" in: MODULAR VOCATIONAL EDUCATION AND TRAINING. EXAMPLES OF GOOD PRACTICE IN EUROPE, Radom (Poland) 2007

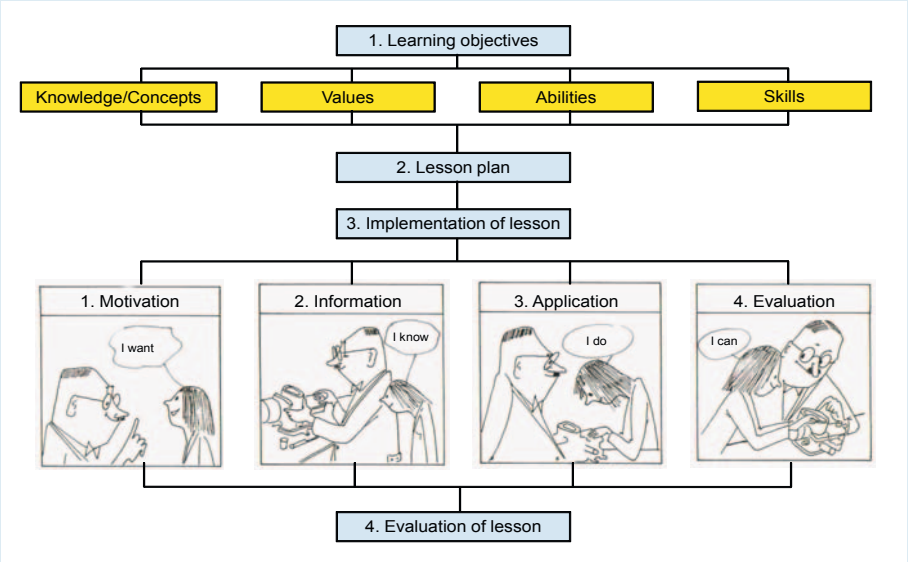
Modular courses in the UK – a different approach

7 Facilitating Learning

After all this planning of phases for developing, applying, practicing, and deepening bits and pieces of competences as well as formative and summative assessment, it is time to present some essential instruments.

7.1 What are the basic steps in theory lessons and practical training?

Fig. 60: The four-step method to facilitate skill and knowledge development



The four-step method to facilitate skill and knowledge development

There are four basic steps in systematic and organized teaching /learning processes. The first step is to determine learning objectives.

1. Learning objectives may be single
   a. contents (knowledge of facts)
   b. components (concepts, values, abilities, skills)
   c. competences
   or a mixture of these.
2. The second step is to make a lesson plan. Here all relevant contents for each objective are determined, methods selected, teaching and learning aids prepared, and a time-schedule elaborated.
3. Once the lesson or training has been planned, then the third step will be the implementation of teaching and learning. There are four distinctive steps.
   Step 3.1 Motivation: To motivate students so that they say: I want to learn this.
   Step 3.2 Information: To inform students so that they say: I know what it is, how it functions, how to do this.
   Step 3.3 Application: To let students apply the new content so that they say: I'll do it now.
   Step 3.4 Evaluation: To evaluate the learning outcomes and give feedback to students, so that they say: I can do it now by myself. Here new experiences are summarized and further applications/repetitions for new knowledge, abilities, skills, and attitudes are provided.
4. The fourth step is an evaluation of the whole teaching-learning process. Here the teacher reviews his activities and their results and draws conclusions which improvements to make in future.

Summary:

The four steps in systematic and organized teaching /learning processes are

1) determining learning objectives
2) developing a lesson plan
3) implementing a teaching-learning process
4) evaluating and revising steps 1 to 3 above (auto-evaluation)

The teaching-learning process (3) is also subdivided into four steps:

1) Motivation -> I want
2) Information -> I know
3) Application -> I do
4) Evaluation -> I can

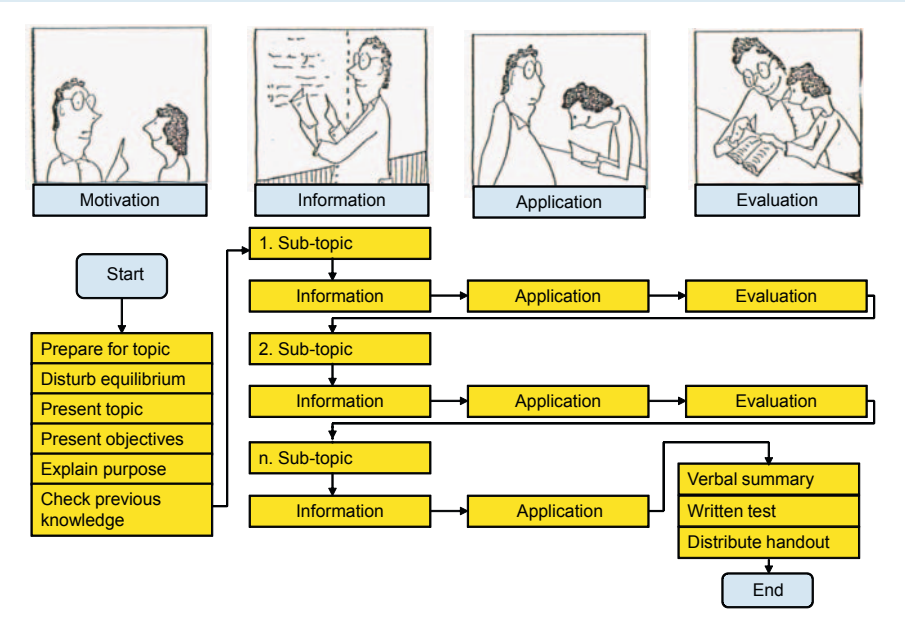
Task 12 for group work

Make an analysis of the teaching-learning process of this lesson.

1. What were the learning objectives?
   a. Contents (knowledge of facts)?
   b. Concepts / principles?
   c. Competences?
2. Which of the four steps of the teaching-learning process were implemented?
   a. Motivation?
   b. Information?
   c. Application?
   d. Evaluation?
3. Which of the 4 steps of the teaching-learning process are still missing?
4. In which of the 4 steps of teaching-learning are you now?
5. In which form the evaluation will most likely be made?

7.2 The four-step method for theory classes

Fig. 61: The four-step method for theory classes



The four-step method for theory classes

The phase of motivation is subdivided into smaller steps:

a. **Prepare for topic:** The teacher should not start immediately with a new topic, but should try to connect the new content with already existing experiences of the students.
b. **Disturb equilibrium:** Motivation theory states that presenting a problem to somebody will disturb this person's internal equilibrium, make this person curious, and motivate this person to find a solution.
c. **Present topic:** Usually the topic of the lesson – once achieved – will give a solution to the previously stated problem. The topic should be written on some type of black- or whiteboard.
d. **Present objectives:** It is useful to describe the objectives of the lesson or work. Students should know what exactly the expected result / outcome of their learning effort will be.
e. **Explain purpose:** The purpose of the exercise should also be explained, showing the importance of the lesson content or work result for the students' future career.
f. **Check previous knowledge:** To make sure that those who have previous experience about the subject will not get bored, their knowledge has to be asked for. Students with experience should be given special tasks to keep them motivated.

The second step is information.
In a theory class the content usually is "a big block of information", which can be compared with a big loaf of bread. Too big to eat all in one session. Therefore we cut slices from the loaf, which will better suit our eating capacity.

Cutting slices from the loaf

Similar to cutting slices of bread, the big block of information is divided into "logical sub-topics", better suited to our learning (and teaching) capacity. Each sub-topic represents a part of information, which in itself makes sense.

For example, topics from training Car Mechanics can be:

A. Units of automobiles, such as
   a) Hydraulic brakes
   b) The carburettor
   c) The cooling system

Logical sub-topics for these topics could be

a) Main tasks of a ...
b) Basic function
c) The basic unit, its elements and their names
d) Typical models of different suppliers and their function
e) Typical maintenance and repair work, safety regulations

The objective of this type of lesson is to develop mental models (concepts and principles) of automobile units which are required for working with automobiles, especially when searching for faults.

B. Working processes, such as
   a) Oxyacetylene welding
   b) Fault-finding in an automobile ignition system
   c) Balancing of car wheels

   Logical sub-topics for these topics could be
   a) Objective, purpose, and basic principle of the working process
   b) Tools, equipment, instruments required
   c) Working steps for a typical work sequence = work plan
   d) Safety regulation
   e) Quality control (measuring, checking, testing)

   The objective of this type of lesson is to develop mental models (concepts and principles) of working processes which form the mental background for working with automobiles.

C. Applied calculations, such as
   a) Gear transmission ratios
   b) Pressures in braking systems
   c) Speed of engine piston

   Logical sub-topics for these topics could be
   a) Name and function of the different parts (including a drawing)
   b) Developing the formula
   c) Graphical representation, such as a diagram of piston speed
   d) Calculation exercises, related to shop practice

   The objective of this type of lesson is to develop and consolidate mental models (concepts, principles) about the design and function of an automobile, to foster the ability for logical thinking, and to train the ability to make relevant calculations.

For each of the subtopics there is a sequence of information, application, and evaluation.

First sub-topic:
Information: Usually by applying the developing method (asking questions and using the correct answers to gradually build the content of the sub-topic). Ping-pong, with ping = teacher question and pong = student answer.
Application: The students may be given tasks (questions) to check their understanding and give them the possibility to apply their new knowledge.
Evaluation: After a short summary the teacher may ask more complex questions to make sure that everything has been understood.

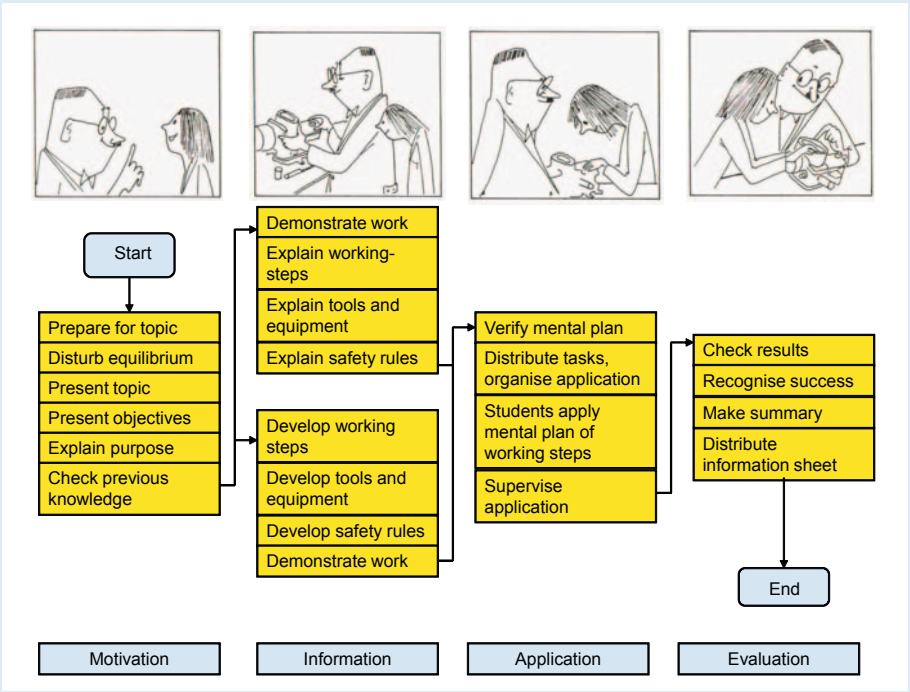
Second sub-topic:
Same sequence as first sub-topic.

And so on, until the last sub-topic, where during evaluation a **verbal summary** of the whole topic is made, followed possibly by a **written test** and a distribution **of handouts**.

Task 13 for group work
Based on the information given above, please design an "Observation Sheet" for observing and evaluating the activities of VET teachers during a theory lesson with regard to
   a. teaching processes,
   b. facilitating learning processes and
   c. assessing learning outcomes.

7.3 The four-step method for practical training

Fig. 62: The four-step method for practical training



The four-step method for practical training

The basic sequence of the four steps

1. motivation
2. information,
3. application and
4. evaluation

is maintained. So the first step is motivation.

1. The phase of **motivation** is subdivided into smaller steps:
   1.1 Prepare for topic: The teacher should not start immediately with a new topic, but should try to connect the new content with already existing experiences of the students.
   1.2 Disturb equilibrium: Motivation theory states that presenting a problem to somebody will disturb in this person's internal equilibrium, make this person curious, and motivate this person to find a solution.
   1.3 Present topic: Usually the topic of the practical training – once achieved – will give a solution to the previously stated problem. The topic should be written on some type of black- or whiteboard.
   1.4 Present objectives: It is useful to describe the objectives of the lesson or training. Students should know what exactly the expected result / outcome of their learning effort will be.
   1.5 Explain purpose: The purpose of the exercise should be also explained, showing the importance of the lesson content or work result for the students' future career.
   1.6 Check previous knowledge: To make sure that those who have previous experience about the subject will not get bored, their knowledge has to be asked for. Students with experience should be given special tasks to keep them motivated.

2. **Information**

2.1 If the students are regular, the following method is recommended:

a. **Demonstrate** the **work** completely with brief explanations
b. Now start to show and **explain** each **working step** in detail
   a) Show and explain, what to do, how to do it and why to do it that way
   b) Show and **explain tools**, **equipment**, materials etc.
   c) **State safety regulations** and show their application
c. If necessary, demonstrate the work again completely

2.2 If the students are bright, the following method is recommended:

a. **Develop** (asking questions) the **working steps** required
b. **Develop the tools**, **equipment**, materials required
c. **Develop** necessary **safety regulations**
d. **Demonstrate** the **work** completely with brief explanations

3. **Application**

a. As a result of the information phase, the students should have developed a mental image of the working process, a **mental plan**. It is important to make sure that this plan is correct, because this plan will determine the students' next activities.
b. If different students will have to perform **different tasks**, this has to be **organized**, so that everybody knows exactly what to do and nobody is left idling around.
c. **Students apply** their individual **mental plan of the working steps**
d. When students are active, the teacher has to **supervise** – and, if necessary – correct students' activities. Safety!!

4. **Evaluation**

a. The teacher, together with students, will **check the results**.
b. The teacher will **appreciate good results**.
c. The teacher will **summarize** what has been done and gives an evaluation of the results.
d. The teacher should **distribute** some **hand-outs** where the **essential information** has been stored for further reading and learning.

Task 14 for group work

Based on the information given above and on the next page, please design an "Observation Sheet" for observing and evaluating the activities of VET teachers during a practical training session with regard to

a. teaching processes,
b. facilitating learning processes and
c. assessing learning outcomes

Additional information (demonstration and explanation)

Place the student so that he/she is standing in the same direction to the work piece as you are

- 1st demonstration: demonstrate the whole procedure in original time
- In the case of complicated procedures divide them into smaller packages and teach these packages step by step
- 2nd demonstration: repeat the demonstration and make the single steps visible; demonstrate difficult steps repeatedly
- Say what you are doing, how and why you are doing it in that way (what? how? why?); go into detail, give the opportunity to ask questions
- 3rd demonstration: summarize and demonstrate uninterrupted

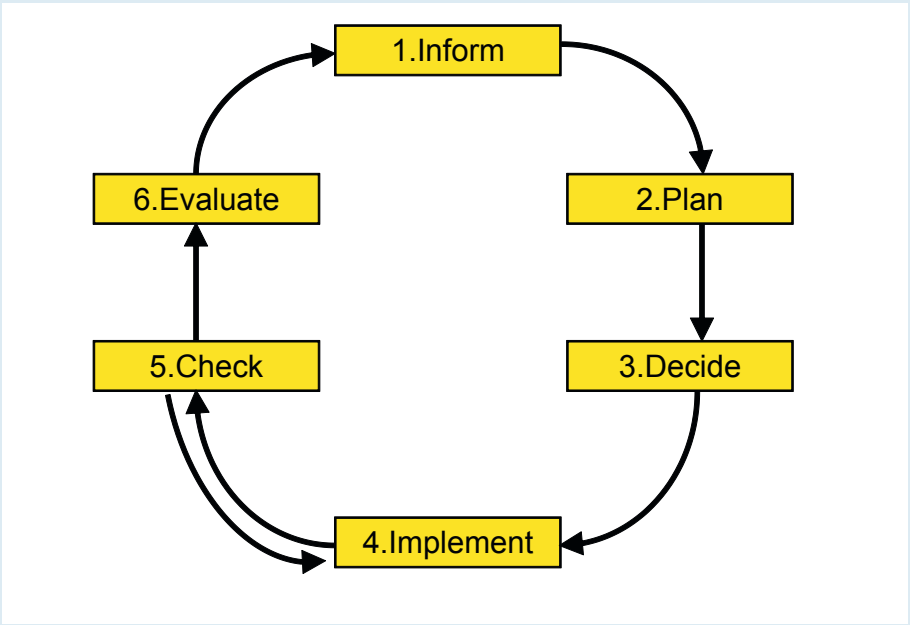
Application (Student activity)
- Encourage the student to try it on his/her own
- Don't interrupt the student in his/her first attempts unless there is a risk of accident
- Make comments only on serious mistakes
- Precision is more important than speed
- Let the student say what he/she is doing, how and why

Further application (Exercising and strengthening)
- Give enough time to exercise
- Acknowledge progress
- Control that no mistakes are done during exercising
- Change conditions of exercising
- Gradually adapt to real working conditions (speed, quality, quantity)

7.4 Model of a complete action

Model of a complete action – the basis for competence development

Fig. 63: A model of a complete action



An action starts when a person has a motive, when a person wants to achieve something.

1. **Inform:** Based on the motive – which is a drive directed towards a goal – relevant information is collected. Where am I? Where do I want to go? Which obstacles exist? What can I use to reach my goal?

2. **Plan:** Usually parallel to the process of collecting relevant information, a process of planning starts. There may be different ways to achieve a goal, with different risks and efforts.

3. **Decide:** Out of these plans the best plan – according to present circumstances of the individual – will be selected.

4. **Implement:** The plan will be implemented, step by step, monitoring the progress, adapting the plan to unforeseen obstacles, bypassing problems. The goal will be the guiding element, which will re-orientate plans and actions for final achievement. This is why the arrow shuttles back and forth between 4 and 5.

5. **Check:** Once the goal is reached, there may be a check, comparing the goal that was to be reached and the actual result. Are they the same? Are they different?

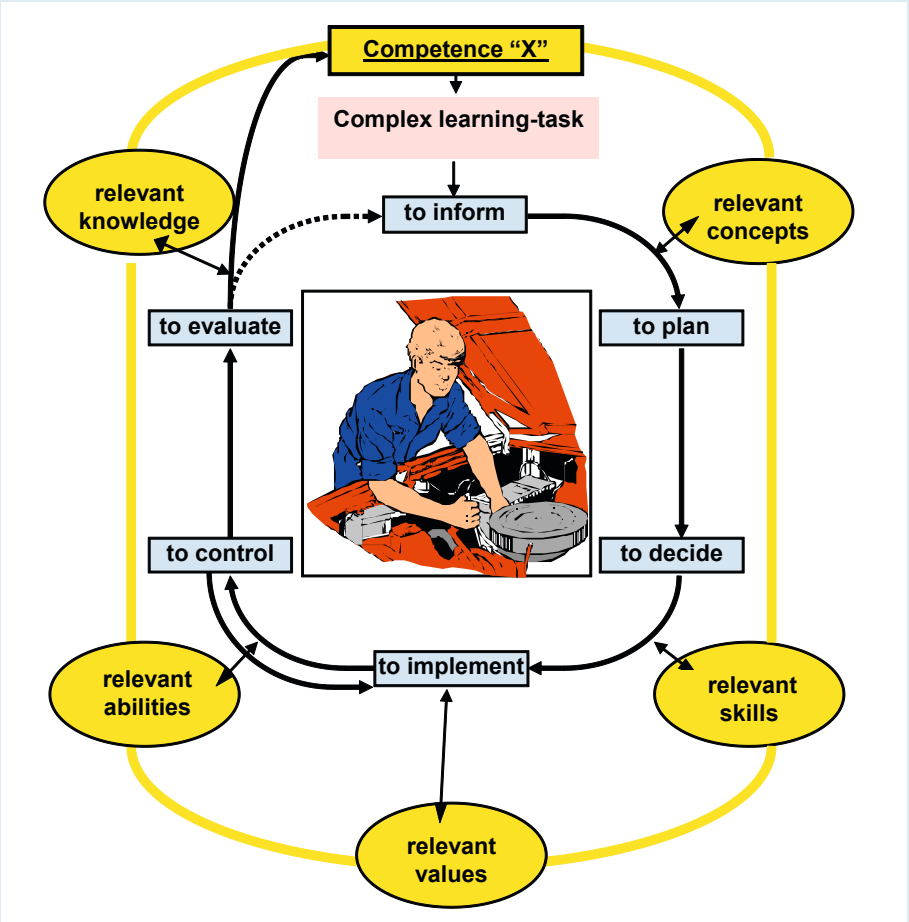
6. **Evaluate:** A final evaluation will draw conclusions about the quality of result, usefulness of plans, adequate tools and instruments used, and feedback received from other persons.

The construction of a competence "X" in a complete action

The application of this model in developing competences is presented in Fig. 64. There is a "blue circuit" – the complete action. And there is a yellow circuit – the relevant components. These components already exist – as a prerequisite of the action – or else have to be developed during the action process. They will to be put together (interconnected) to form the competence "X". The objective of the whole action is to develop, i.e. construct, the competence "X".

The action is structured through a learning situation, which is a complex learning task.

Fig. 64: The construction of a competence "X" in a complete action, structured through a complex learning-working task / learning situation



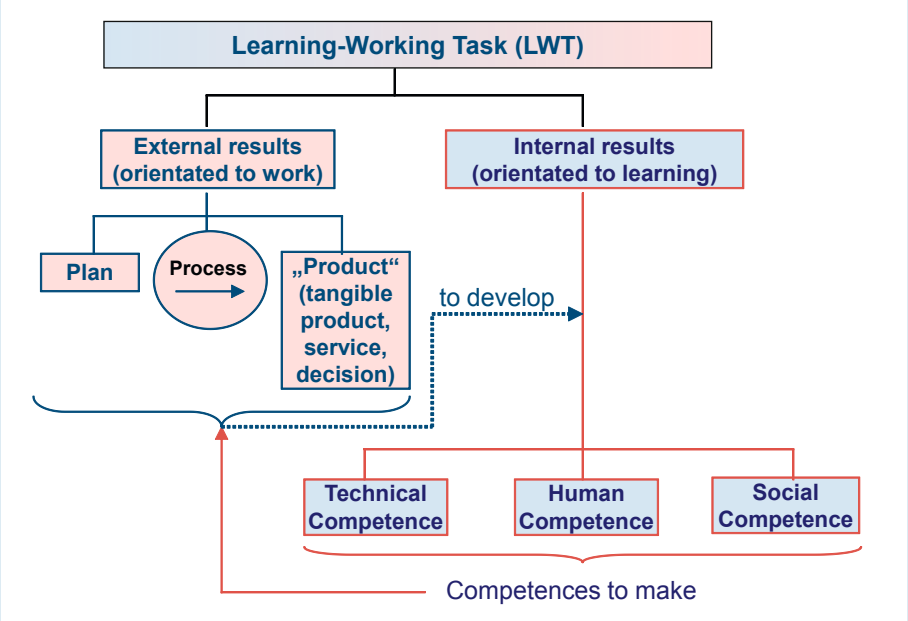
Task 15 for group work
Take the model of a complete action as it is presented above. Using this model, plan and simulate a journey from where you are now to a big city some 200 km away.
Apply the six steps of a complete action

1. Inform
2. Implement
3. Plan
4. Check
5. Decide
6. Evaluate

After each step, present your plans, findings, decisions and experiences!

7.5 Internal and external results of an action

Fig. 65: Internal and external results of an action



Learning-working tasks are used to train actions – or to develop the "competence of action"

Learning-working tasks are used to train actions – or to develop the "competence of action".

1. Working-learning tasks have two types of results.
   a. External results, which can be considered as products of a worker.
   b. Internal results, which can be considered as experience of a worker.
2. External results can be:
   a. A plan how to perform a complex task
   b. An observable process when the task is performed
   c. A "product" or result, which can be a tangible product, or a service to somebody or an item of information (such as a number after calculating something, or a decision or a reply in Spanish)
3. When all these external results are produced, the person makes some experiences. These experiences will develop or improve competences within the person.

4. These competences can be technical competence, human competence, or social competence.
5. All these are competences required to achieve the external results.

Summary: Working-learning tasks have external and internal results. For a worker the external results are more important, for a student the internal results are more important. Students learn to work by working.

Task 16 for group work

1. Provide an example for a learning situation:
   a. What are typical "external results" and what are they used for?
   b. What are typical "internal results" and what are they used for?
2. Provide an example for a working situation:
   a. What are typical "external results" and what are they used for?
   b. What are typical "internal results" and what are they used for?

7.6 The "Project Method"

The "Project Method" is a method of VET, where:

1. Students do not learn various isolated concepts or processes,
2. but instead work on a complex project,
3. which helps to integrate (assemble) all relevant components of a more or less complex competence.
4. Students apply the six steps of a complete action,
5. so they learn to collect relevant information, make plans, take decisions, implement the best plan, check their progress, and evaluate their results autonomously (development of technical competence and personal competence).
6. Students usually work in groups, which will enable them to develop also employability skills.

The "Project Method" is the application of the six steps of a complete action to facilitate the development of competences

1. The methods of "theory lesson" and "practical training" focus on developing components (knowledge, concepts, principles, processes, procedures, abilities, skills, and values) from contents.

2. In contrast, the Project Method is a method where students are given a fairly complex task, which aims at integrating (or assembling) all relevant components of a specific competence into one body of competence. This body of competence is usually at the level of performance criteria. More complex tasks assemble performance criteria into elements of competence and still more complex tasks assemble elements of competence into units of competence.

3. If students have to find relevant information on their own, this will develop their ability to do this also once they have left school. Then – in the future – there will be no teacher to assist them. They have to learn and search for information on their own.

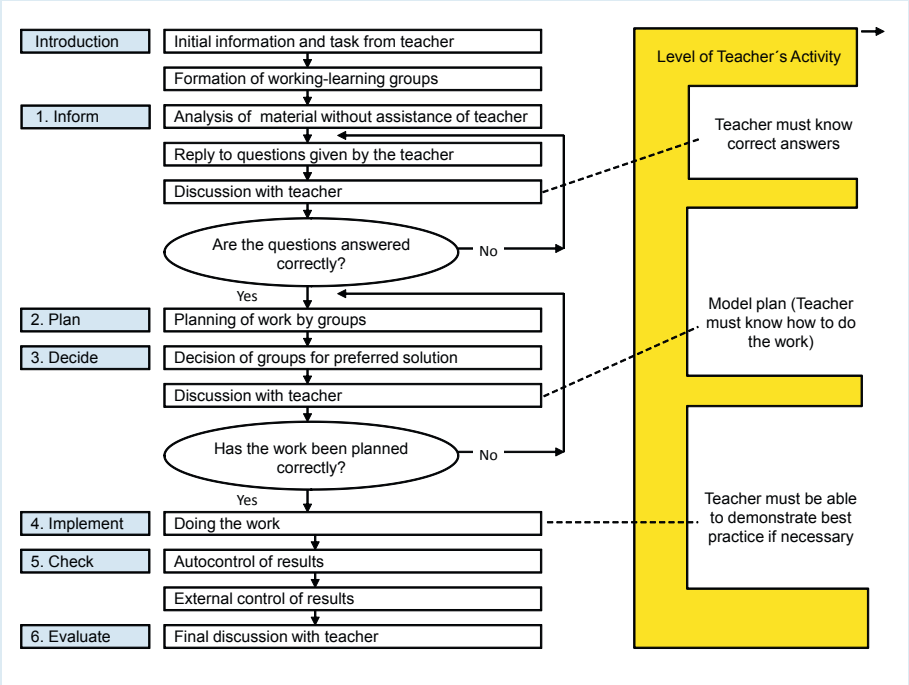
4. The preferred social form for the project method is group work. Students will learn to communicate and to co-operate in a team.
   a. Advantages
      – More interesting for students
      – Learning by doing (almost 100% retention)
      – Development of technical, social, and self-competence

b. Consequences and limitations
   - Requires more time than traditional methods
   - Changes the role of instructor to facilitator
   - Need to prepare lots of information-material for students
   - Students have to get accustomed to new method

Task 17 for group work
Please describe one typical learning outcome for each of the following teaching-learning methods
   - Theory lesson
   - Practical training
   - Project method

7.7 Steps of the "Guiding Text" project method

Fig. 66: Six steps of the "Guiding Text" project method



The "Guiding Text" project method uses questions. These questions guide and orientate students in solving a complex task

The "Guiding Text" project method uses a text with questions. These questions guide and orientate students in solving a given task, following the six steps of a complete action.

Introduction: Before starting the lesson, the teacher has to give an introduction. He will inform about the method (if necessary), provide some introduction to the topic, try some motivation, present the **task** to be performed, and explain available sources of **information**.

Then **working-learning groups** will be formed (four to six students per group).

1. Inform: Students begin to make an **analysis of the material** without assistance of the teacher

1.1 Which result is expected?
1.2 What does the result look like?
1.3 What do we know about the result?
1.4 What do we know about the way to the final result?
1.5 Which information is missing?
1.6 Where could we find such information?
1.7 Who is searching what?

Reply to questions given by teacher: Students will answer questions and store the replies

1.8 How do we store the information?

Discussion with teacher starts

1.9 Are the questions answered correctly?

If the reply is **no**, students have to find the correct answers, going through the relevant questions again. If the reply is **yes**, the next step can begin.

2. Plan: Planning of work by working groups starts.

2.1 Where are we, where do we want to go to?
2.2 Which are the major steps towards the goal?
2.3 What do we need to implement that?
2.4 How long does that take?
2.5 How much does it cost?
2.6 Who will do what?
2.7 Which alternatives exist?
2.8 What is feasible for us?
2.9 What does the working plan look like?

3. Decide: There is a **decision** made by the groups about what is the **preferred solution**

3.1 Which alternative plans do exist?
3.2 What are criteria to evaluate alternative plans?
3.3 What is the best plan for us?
3.4 Who will do what?
3.5 By when and using what?
3.6 Which external assistance do we need?

Discussion with teacher starts

3.7 Has the work been planned correctly?

If the reply is no, students have to go through their plan again. If the reply is yes, the next step can begin.

4. Implement: Implementation of **work** starts. If necessary, the teacher should demonstrate new skills which the students have not learned yet.

4.1 Do we have all we need to start work?
4.2 Which safety regulations do we have to observe?
4.3 Are we still working according to our plan?
4.4 Do we have achieved our intermediate goals?
4.5 Do we have to adapt our plan?
4.6 Are we within our time schedule?
4.7 Are all colleagues participating as planned?
4.8 Has the plan been worked off completely?

5. Check: During implementation students have to check the progress of work (questions 4.3 to 4.7).

After completion of the work, students will control their results (auto-control)
5.1 What was the goal we wanted to achieve?
5.2 Did we achieve it?
5.3 Which quality criteria do we use to evaluate the result?
5.4 Who checks what?
5.5 How do we record the results of our check?

Then there will be an **external control** of the results by the teacher.

6. Evaluate: There is a **final discussion with the teacher**.
6.1 How was everything?
6.2 How well designed was our plan?
6.3 What is the quality of our result?
6.4 What didn´t turn out so well? Why?
6.5 What went perfectly well? Why?
6.6 What could be done better the next time?

The diagram on the right hand side indicates the **level of a teacher's activity** during the various steps.There is a high level of activity during
– introduction
– discussing right answers to questions
– discussing the quality of the plans made
– checking results and evaluating the whole process

When discussing right answers to questions the **teacher must know the correct answers**.

When discussing the quality of the plans made, the teacher should have a **"model plan"**. This means, the **teacher must know how to do the work**.

When the implementation of work starts, there may be a need to demonstrate skills and working techniques which are new for students. Therefore the **teacher must be able to demonstrate best practices** if necessary.

8 Assessment

8.1 Competence-based assessment in Australia

The "Guiding Text" project method uses questions. These questions guide and orientate students in solving a complex task

This chapter provides a very reduced and condensed compilation of original text from the *"Guidelines for competency based assessment in vocational education and training in Western Australia", A working document for trainers and assessors to help you assess to the Australian Quality Training Framework standard. Produced by the Western Australian Department of Training, February 2002.*

"People are considered to be **competent** when they are able to apply their knowledge and skills to successfully complete work activities in a range of situations and environments, in accordance with the standard of performance expected in the workplace.

Competence-based assessment is the process of collecting evidence and making judgements on whether competence has been achieved

Competence-based assessment is the process of collecting evidence and making judgments on whether competence has been achieved. This confirms that an individual can perform to the standard expected in the workplace as expressed in the relevant endorsed industry/ enterprise competence standards (or outcomes of accredited courses if there are no competence standards for an industry).

Most assessments will be based on competence standards from a relevant training package. If there is no **training package**, relevant competence standards from an accredited course will form the basis of the assessment. Where no competence standards exist, accredited course-learning outcomes form the basis of the assessment.

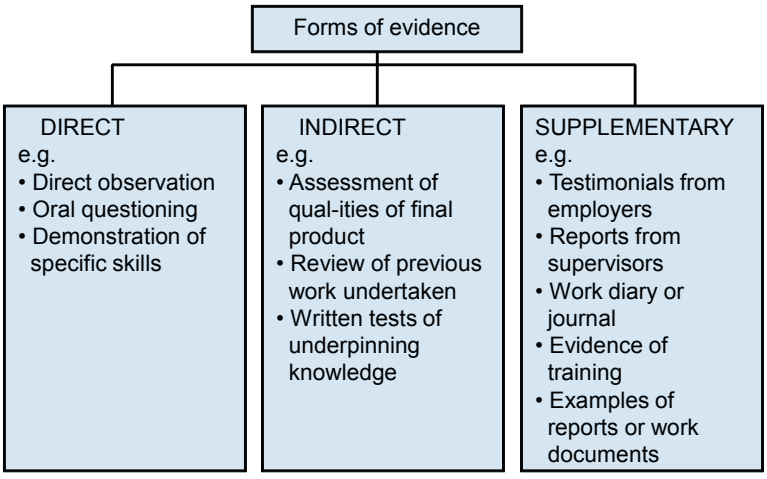
In considering the training delivery and assessment, trainers may want to cluster certain competence standards so that they can cover all relevant knowledge and skills required for a workplace task while still maintaining the integrity of each standard. These clusters of competences can then often be assessed together.

Evidence is the information gathered which, when matched against the performance criteria, provides proof of competence. Evidence can take many forms and be gathered from a number of sources.

Evidence can be direct, indirect, or supplementary, as shown in Fig. 67.

Evidence can be direct, indirect, or supplementary

Fig. 67: Different types of evidence



No one form of evidence is better than another. Real work does not usually fall into categories that reflect individual units or elements of competence. In general, a real work activity draws on a range of competences from a number of competence standards at once.

Sources of evidence

Fig. 68: Different evidence-gathering techniques

Evidence-Gathering Technique	Source of Evidence
Observation	Real work activities at workplace
Simulation	Role play Work activities in simulated workplace environment Case study
Questioning	Self-assessment form Verbal answers Written questionnaire Interview
Review of products	Work samples/products
Portfolio	Testimonials/references Work samples/products Training record Assessment record Journal/work diary Life experience information
Third-party feedback	Interviews with employer, supervisor, peers
Structured activities	Project Presentation Demonstration Progressive tasks

A good assessment method will involve **clustering** a number of competences to reflect a real work task. Appropriate clustering is a key way to ensure that assessments are holistic. The assessor can gather evidence and cross-reference it across a number of competence standards. Clustering may also result in reducing the time and costs associated with assessment.

Some guidelines for workplace simulation

Some guidelines for workplace simulation

- If you are assessing within a VET training institution, consider forming a partnership with local enterprises which may provide access to a workplace or equipment, authentic workplace documents, or advice on how to create a realistic simulated environment.
- Review the entire qualification or units of competence to be assessed to build in opportunities for assessing whole work tasks or clusters of competences. Where appropriate include opportunities to assess relevant generic competencies such as teamwork, communication, occupational health and safety, and leadership.
- Include contingencies as part of the assessment design. For example, candidates might be required to deal with the pressures of telephone calls, time constraints, and interruptions of the workflow.
- Focus the assessment activity as much on processes as on the product.
- Apply operational procedures and occupational health and safety requirements as they would be in a real work setting.
- Validate methods, context, and concepts with industry/workplace representatives to ensure the accuracy of the assessment approach". (End of Guidelines)

The Evidence Guide in Fig. 69 is from the Australian Unit Standard NWP346B "Monitor, operate and control wastewater treatment processes".

Fig. 69: Evidence Guide "Wastewater Treatment Processes"

Evidence Guide	
The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.	
Critical aspects for assessment and evidence required to demonstrate competence in this unit	The candidate should demonstrate the ability to monitor, operate and control routine aspects of wastewater treatment processes, including: conducting routine plant inspections taking samples and performing basic tests preparing and applying chemical dosing according to instructions identifying and reporting system faults making allowed system adjustments according to instructions completing required documentation.
Context of and specific resources for assessment	Access to the workplace and resources including: documentation that should normally be available in a water industry organization relevant codes, standards, and government regulations. Where applicable, physical resources should include equipment modified for people with disabilities. Access must be provided to appropriate learning and/or assessment support when required. Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed. Validity and sufficiency of evidence requires that: competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice a decision of competence should only be made when the assessor has complete confidence in the person's competence over time and in various contexts all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit. In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in a manner appropriate to the skill levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the competency and the work being performed.

Evidence Guide "Wastewater Treatment Processes"

Competence assessment in Germany

8.2 Competence assessment in Germany

Vocational training in the Federal Republic of Germany[26] is provided on the job and in vocational training schools. Based on what is referred to as the dual system, practical vocational training is given at work, backed up by theoretical training and general education provided in vocational training schools which are generally attended on one or two days a week.

Attendance at the vocational training schools, which accompanies on-the-job training, is compulsory for every trainee for twelve hours of instruction a week. The schools are state-run. The emphasis in instruction is on the training occupation, and instruction is generally given in classes specializing in one occupation.

Framework curricula of state-run schools are synchronized with training regulations for work-based training. In final examinations, trainees must show that they have acquired "the necessary skills, the necessary practical and theoretical knowledge" (from their companies) and that they have mastered "the course material, as taught in vocational schools, that is central to the vocational training in question".

Examinations of school-based training are organized and implemented by the state, while examination of work-based training is one of the principal tasks undertaken by the professional chambers.

Chambers organize and supervise examinations for work-based training

8.2.1 Examinations for work-based training

Chambers organize and supervise interim and final examinations for work-based training.

Every trainee must sit an intermediate examination in the course of his period of training. The examination serves to ascertain the level the trainee has reached. The competent chamber establishes boards of examiners to hold these examinations.

Every trainee may sit a final examination at the end of his period of training in order to show that he has acquired the necessary professional qualifications. To hold these examinations, the responsible chamber will establish boards of examiners consisting of at least three members, being employers' and employees' representatives in equal numbers and at least one vocational school teacher.

Rules to be observed in connection with final examinations are issued by the Vocational Training Committee of the chamber, consisting of employers' and employees' representatives in equal numbers and vocational school teachers as consultant members. These rules set out the entry criteria, the form of the examination, the criteria for marking, the arrangements for issue of examination certificates, the consequences of breaches of the rules, and the possibilities for repeating the examination.

The skills to be examined are laid down in the training regulations. Depending on the occupation, they may provide for a test of practical and/or theoretical skills. The practical examination will call for samples of work and/or test workpieces. The theoretical test is conducted as a written and/or oral examination.

After having passed the examination, the trainee will receive an examination certificate issued by the responsible chamber. This certificate is not an authorization. Its principal

26 Source: Adapted from: Federal Ministry of Education and Research: "Germany's Vocational Education at a glance", Bonn, 2003
HK Hamburg http://www.hk24.de/en/training/348086/duale_system.html

purpose is to show that the person concerned has acquired the qualifications necessary for a specific occupation. It is, however, also the basis for professional progress and career advancement.

Final exam for Water Supply Engineering Technicians

Example: Final exam for Water Supply Engineering Technicians[27] (Overview only)

1. The final examination comprises the skills and knowledge listed in the training regulation and the syllabus of vocational school instruction so far as it is important for the occupational training.
2. The examination in the practical part is to be carried out in a practical task over a maximum of ten hours, which can be divided into several subtasks.
3. The candidate, in the written part of the examination, is to be tested in the examination fields of water supply and electrical engineering tasks as well as economic and social studies.

In Fig. 70 the structure of the final examination for Sewage Engineering Technicians is presented graphically (with more details).

Final exam for Sewage Engineering Technicians

Fig.70: Structure of final examination for Sewage Engineering Technicians

Final Examination – Sewage Engineering Technician

Practical Part	**Written Part**		
A practical task, which can consist of several subtasks: operation and maintenance of drainage systems and wastewater treatment facilities including the carrying out of analytical and electrical engineering tasks	**Written tasks:**		
The candidate is to show that he/she can: – plan the sequence of work economically, – identify work results, – document work results, – take measures for safety and for the protection of health at work, – take measures for environmental protection, – take quality assurance measures, – identify possible dangers of electrical current, – assess electrical tasks, – carry out electrical tasks safely.	The candidate is to show that he/she can: – solve practice-related tasks with associated work-organisational, technical and mathematical-scientific contents – here measures for safety and protection of health with the work as well as quality assurance measures are to be presented		
	Wastewater engineering a) Operation and maintenance of drainage systems, b) Operation and maintenance of wastewater treatment facilities, c) Sampling methods, analysis methods and analysis equipment.	**Electrical engineering tasks** a) Basic elements of electrical engineering, b) Electrical plant and components, c) Electrical measuring equipment and safety devices.	**Economic and social studies** General economic and social interrelationships of the professional and working world.
Max. 10 hours	Max. 180 minutes	Max. 60 minutes	Max. 60 minutes
	Weighting: 60 %	Weighting: 20 %	Weighting: 20 %
Restrictive function: minimum sufficient performance Examination field electrical engineering tasks: minimum sufficient performance	Restrictive function: minimum sufficient performance Examination field wastewater engineering: minimum sufficient performance		

27 Federal Institute for Vocational Education and Training: Explanatory notes to and practical assistance for the nationally recognized vocational training regulations "Water Supply Engineering Technician" and "Sewage Engineering Technician", 2002

External assistance for examiners (Assessors) via internet platform

8.2.2 External assistance for examiners (Assessors)

The German Federal Institute for Vocational Education and Training (BIBB) offers assistance to examiners via an internet platform called the Assessor's Portal (Prüfer Portal). The website offers a wide range of topics related to the preparation, implementation, and administration of intermediate and final examinations in vocational training. The website can be found at http://www.prueferportal.org/html/index.php

Ready-made intermediate and final examinations from chamber "examination providers"

Ready-made intermediate and final examinations from chamber "examination providers"
In training occupations with a high number of trainees such as

- commercial and commerce-related trades
- vocational-technical trades
- printing and media trades

the responsible chambers have established specialized institutions for test development.

These "examination providers", such as the ZPA[28] and AkA for commercial trades, PAL for vocational-technical trades, and ZFA for printing and media trades, develop intermediate and final examinations which are applied all over Germany – but, of course, only once. Each year a new set of examinations has to be developed.

Examination sets comprise detailed written und practical tests and a list with all machines, tools, measuring instruments, and materials required for testing. The equipment and material list will assist those companies where the examination takes place to provide in time all what is required.

Examinations are prepared and distributed by state ministries in charge of VET schools

8.2.3 Examinations for school-based training

Vocational education and training schools work under the education law of each federal state. Therefore examinations are also rigidly prescribed by statutes. Examinations are prepared and distributed by state ministries in charge of VET schools.

8.3 Assessment for competence component development

There are different forms of assessment.

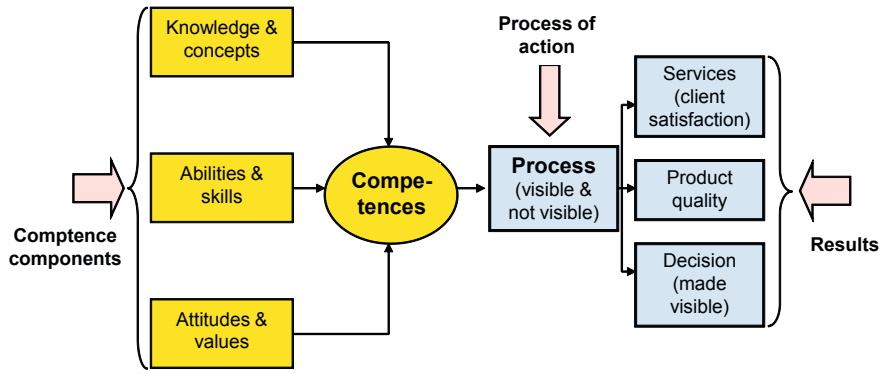
With regard to its function	Summative (initial, final) Formative (monitoring progress)
With regard to its reference of comparison	Normative (group average) Criterion (objective standards) Idiographic (individual progress)
With regard to the point in time in the teaching-learning process	Before (initial) During (continuous) After (final)
With regard to assessors	Auto-assessment (student) Co-assessment (other students) Hetero-assessment (assessors)

The assessment forms presented so far in chapters 8.1 and 8.2 are summative, final, criterion-based, and carried out by assessors. They focus mainly on the overall occupational competence of a person at the examination date.

29 For details please check http://www.prueferportal.org/html/650.php

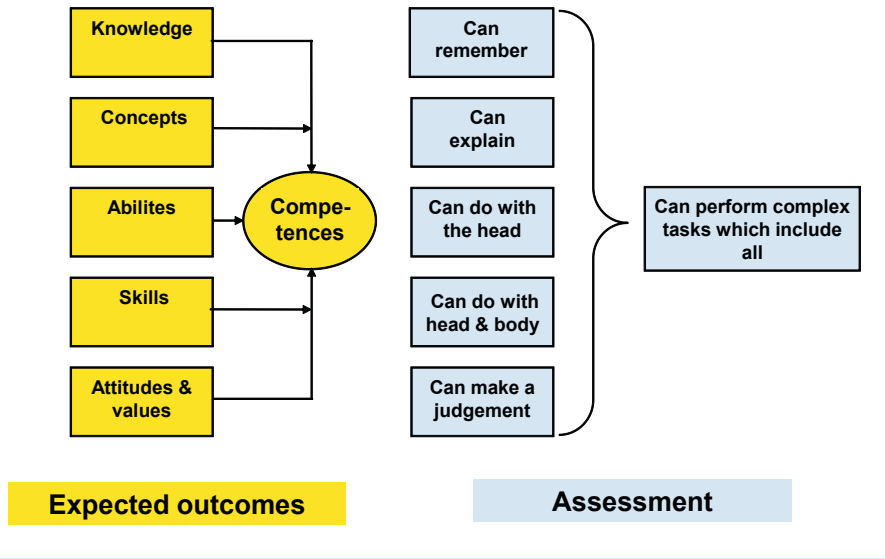
There is, however, also a need from training providers (learning facilitators) to know about the bits and pieces (components) which have to be developed and assembled during the process of competence formation. This is **formative assessment**.

Fig. 71: ”Measuring points” for assessment



”Measuring points” for assessment

Fig. 72: “Expected outcomes” are assessed

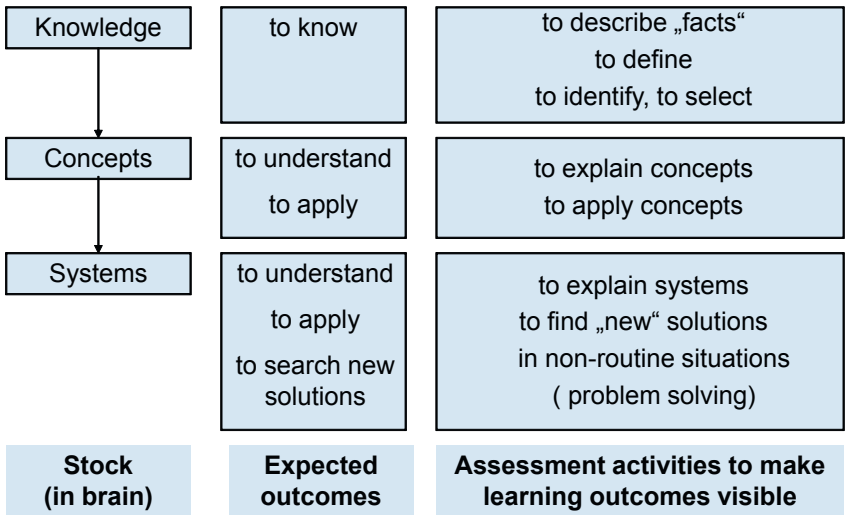


“Expected out-comes” are assessed

The existence of expected learning outcomes (components and competences) is made observable through related assessment tasks.

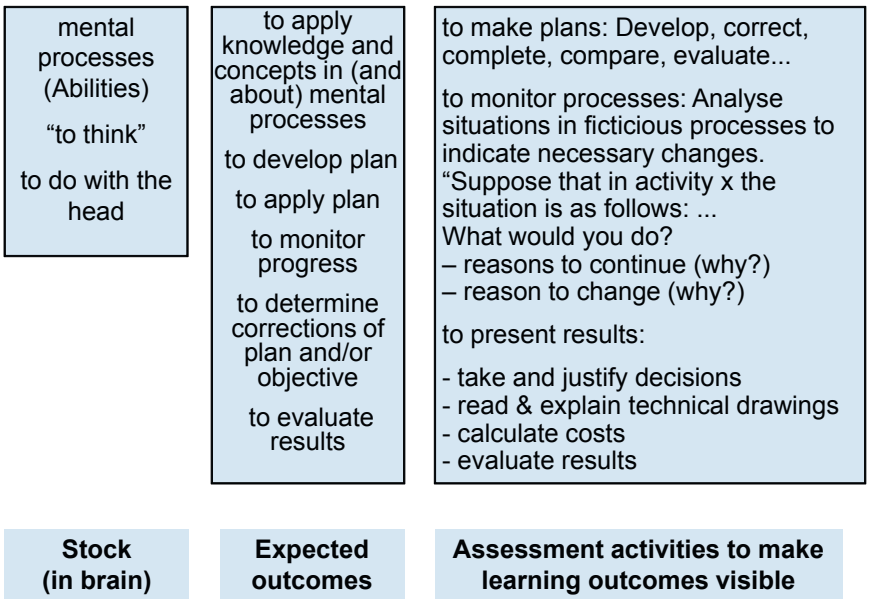
Assessment of the cognitive area ("the head") I

Fig. 73: The cognitive area ("the head") I



Assessment of the cognitive area ("the head") II

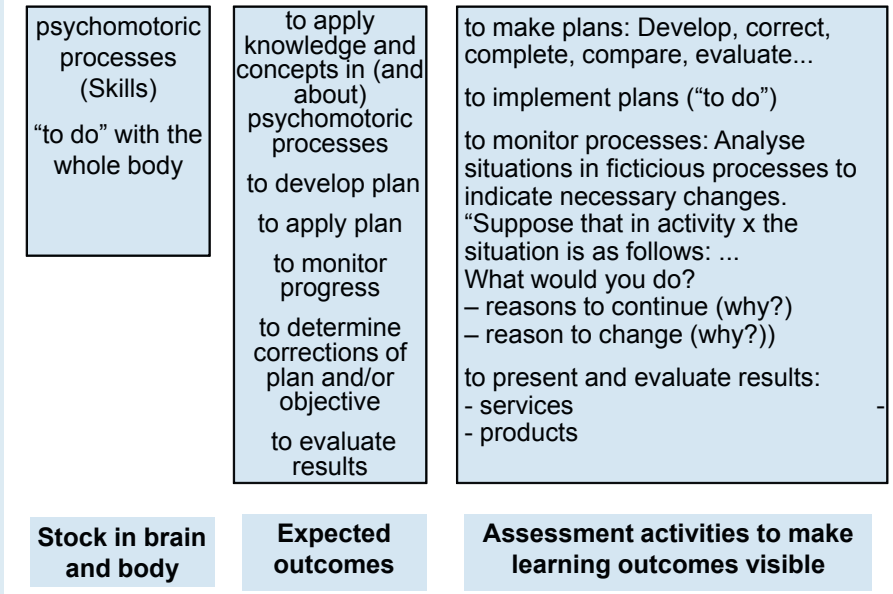
Fig. 74: The cognitive area ("the head") II



In Figs. 73 and 74 the cognitive area (the head) has an invisible "stock" of knowledge and mental abilities. In related assessment activities students will provide observable evidence that expected learning outcomes are – or are not yet – "in stock" and ready for use.

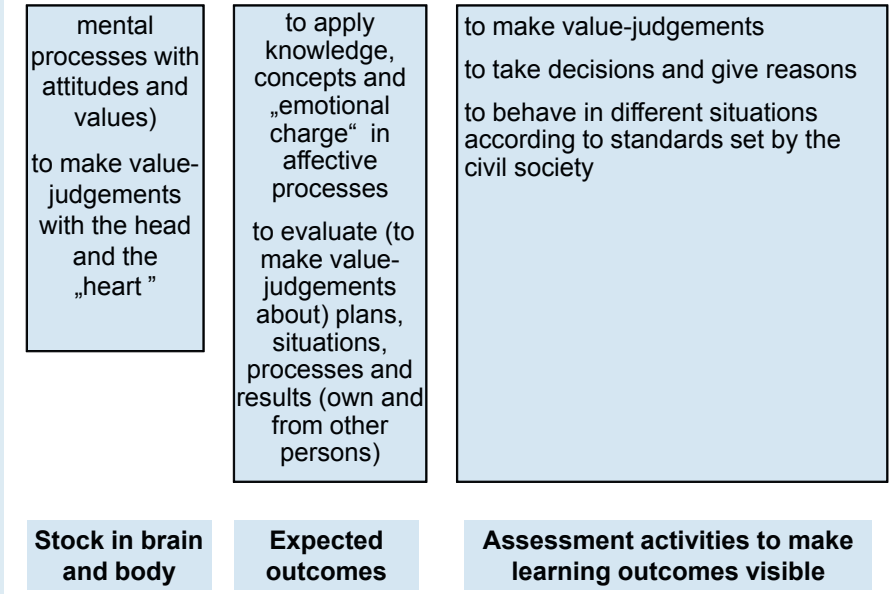
Assessment of the psychomotor area ("the whole body")

Fig. 75: The psychomotor area ("the whole body")



Assessment of the affective area ("the head and the heart")

Fig. 76: The affective area ("the head and the heart")



In Figs. 75 and 76 the psychomotor area and the affective area (both in brain and body) have an invisible "stock" of knowledge, abilities, skills, and values. In related assessment activities students will provide observable evidence that expected learning outcomes are – or are not yet – "in stock" and ready for use.

List of abbreviations

AgITO	Agriculture Industry Training Organization
AQF	Australian Qualifications Framework
ASCO	Australian Standard Classification of Occupations
ASEAN	Association of Southeast Asian Nations
AUR05	Automotive Industry Retail, Service & Repair Training Package
BIBB	German Federal Institute for Vocational Education and Training
BMZ	Federal Ministry of Economic Cooperation and Development
CBET	Competence-Based Education and Training
CBT	Competence-Based Training
CNCP	Catálogo Nacional de Cualificaciones Profesionales
DACUM	Developing a Curriculum
EQF	European Qualifications Framework
FETC	Further Education and Training Certificate
GETC	General Education and Training Certificate
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HCD	Human Capacity Development
HCWW	Holding Company of Water and Waste Water
HE	Higher Education
ICT	Information and Communication Technology
ILO	International Labour Organization
ISC	Industry Skills Council
ISCO	International Standard Classification of Occupations
ITO	Industry Training Organization
LF	Learning Field
LS	Learning Situation
LWT	Learning-Working Task
NCEA	National Certificate of Educational Achievement
NQF	National Qualifications Framework
NWP07	National Water Training Package
NZQA	New Zealand Qualifications Authority
NZQF	New Zealand Qualifications Framework
O*NET	Occupational Information Network
OHS	Occupational Health and Safety
RCC	Recognition of Current Competences
RPL	Recognition of Prior Learning
RTO	Registered Training Organization
SANQF	South African National Qualifications Framework
SAQA	South African Qualifications Authority
SCQA	Scottish Credit and Qualifications Authority
VET	Vocational Education and Training

Annex:

References for material used in Fig.01 to Fig.76

Fig.	Source Details
01	Own design
02	Own design
03	http://ec.europa.eu/education/lifelong-learning-policy/doc/eqf/news1_en.pdf, page 10, 120820
04	Own design
05	Own design
06	http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@ifp_skills/documents/meetingdocument/wcms_126589.pdf, page 23, 120820
07	http://www.aqf.edu.au/Portals/0/Documents/Handbook/AustQuals%20FrmwrkFirstEditionJuly2011_FINAL.pdf page 19, 120820
08	http://www.nzqa.govt.nz/assets/Studying-in-NZ/New-Zealand-Qualification-Framework/requirements-nzqf.pdf page 6, 120820
09	http://www.saqa.org.za/docs/pubs/bulletins/bullvol12_2.pdf page 107, 120224
10	http://www.educacion.gob.es/educa/incual/pdf/2/Web_Folleto_castellano.pdf page 4, 120820
11	http://www.challenger.wa.edu.au/SiteCollectionDocuments/Planning%20Your%20Career/Career%20Pathways%202011%20pdfs/Energy-Gas_2011.pdf . page 1, 120820
12	http://www.aapathways.com.au/Search/Job-Pathway-Charts/Charts?ind=13333, page 1 120820
13	http://www.wats.sa.edu.au/docs/pathways/automotive_job_pathways_chart.pdf, page 1, 120820
14	Adapted from http://www.witc.com.au/pdf/module_information_book.pdf,page 4, 120820
15	http://www.developmyskills.com.au/course/water-operations-2 page 1 120820
16	http://www.developmyskills.com.au/course/automotive-mechanical-technology, page 1, 120820
17	Own design, adapted from http://www.nzqa.govt.nz/about-us/news/new-operating-requirements-for-nzqf/
18	http://www.nzqa.govt.nz/nqfdocs/units/pdf/17877.pdf page 1ff 120820
19	http://www.mito.org.nz/files/Qualifications%20Roadmap.pdf page 1 120410
20	Own design
21	Own design
22	Own design
23	Own design
24	Adapted from http://eff.cls.utk.edu/fundamentals/role_map_worker.htm Page 1, 120820
25	Own design
26	Own design
27	Own design
28	Own design
29	Own design
30	Own design

31	Own design
32	Adapted from http://www.nwlink.com/~donclark/learning/artifacts.html, page 1, 120820
33	http://www.nickols.us/Knowledge_in_KM.htm, page 1, 120820
34	Own design
35	Own design
36	Own design
37	Own design
38	http://www.hbtdgroup.com/products/ISR-Hot-Water-Pump/ISR-65-40-200-A-D-hot-water-pump.html
39	Adapted from http://www.rbapump.com/news/
40	http://bibliothek.arbeitssicherheit.de/content/bgvr-147b3573cd5d4f6590fc4387760a6dca/resource/content-cache-pdf, pages 9,15, 120820
41	http://safety102.blogspot.de/2010/07/falling-from-11st-floor-father-and-son.html
42	Own design
43	Own design
44	Own design
45	Own design
46	http://www.sld.demon.co.uk/dreyfus.pdf, page 2, 120820
47	http://www.sld.demon.co.uk/dreyfus.pdf, page 3, 120820
48	Own design
49	Own design
50	Adapted from: Staatsinstitut für Schulqualität und Bildungsforschung „Leitfaden zur Entwicklung und Zertifizierung von Modulen“ München, April 2006
51	Own design
52	Adapted from: Federal Institute for Vocational Education and Training (BIBB), Sewage Engineering Technician, Explanatory notes to and practical assistance for the nationally recognized vocational training regulations, 2002
53	Adapted from: Federal Institute for Vocational Education and Training (BIBB), Water Sopply Engineering Technician, Explanatory notes to and practical assistance for the nationally recognized vocational training regulations, 2002
54	Adapted from: OUTLINE CURRICULUM for vocational education and training in the occupation of Motor Vehicle Mechatronics Technician. (Culture and Education Ministers Conference Resolution of 16 May 2003), Bonn
55	Adapted from: http://www.berufsbildung.schulministerium.nrw.de/cms/bildungsganguebergreifendethemen/didaktische-jahresplanung/ und Lehrplan zur Erprobung für den Ausbildungsberuf Fachkraft für Wasserversorgungstechnik, Ministerium für Schule, Jugend und Kinder des Landes Nordrhein-Westfalen , Düsseldorf, 2003. 120820
56	Adapted from: Berufskolleg Wipperfuerth, Didaktische Jahresplanung Berufsgrundschuljahr Metalltechnik, June 2011, 120420
57	Adapted from: http://www.berufskolleg-wipperfuerth.de/Didaktischeplanungengesamt.htm, Berufsschule für KFZ-Mechatroniker/in 120820
58	Adapted from: http://www.berufskolleg-wipperfuerth.de/Didaktischeplanungengesamt.htm, Berufsschule für KFZ-Mechatroniker/in 120820

59	Adapted from: http://www.berufskolleg-wipperfuerth.de/ Didaktischeplanungengesamt.htm, Berufsschule für KFZ-Mechatroniker/in 120820
60	Own design
61	Own design
62	Own design
63	Own design
64	Own design
65	Own design
66	Own design
67	Own design
68	Own design
69	http://cffet.net/water/content/NWP346B-Evidence-Guide.pdf . 120820
70	Adapted from: Federal Institute for Vocational Education and Training (BIBB), Sewage Engineering Technician, Explanatory notes to and practical assistance for the nationally recognized vocational training regulations, 2002, page 25
71	Own design
72	Own design
73	Own design
74	Own design
75	Own design
76	Own design

Imprint

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Human Capacity Development (HCD) for Vocational Education and Training
Academy for International Cooperation
Käthe-Kollwitz-Str. 15
68169 Mannheim
Germany
T +49 621 3002-0
F +49 621 3002-132
tvet@giz.de
www.giz.de

As at
April 2013

Design
Andreas Hesse
Berlin

Photo credits
Ursula Meissner: front page
(for further references see Annex)

Text and editing
Dr. Günter Rösch
Dr. Klaus Bader-Labarre (GIZ)
Laura Roser (GIZ)

GIZ is responsible for the content of this publication.
However, the opinions and analyses expressed in this manual do not
necessarily reflect the views and official policies of GIZ.

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)