Project Report
COMET-Pilot Test South Africa

including

- Pilot Test Vocational Identity/Occupational Commitment
- First QRC Results

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Project Report: COMET-Pilot Test South Africa including the Pilot Test Vocational Identity/Occupational Commitment and Results of the QRC Pilot Project

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This final report was prepared as part of the project: Implementing modern VET Research Tools in South Africa: QRC, COMET and VI.

by:

in collaboration with

University Bremen
TVET Research Group (FG I:BB)

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Foreword

Quality measurement instruments are an essential factor for TVET practice, planning and policy to establish and maintain an innovative TVET system. Based on this rationale the project partners merSETA and the University of Bremen (I:BB) have initiated an ambitious transfer project titled “Implementing modern VET Research Tools in South Africa: QRC, COMET and VI”.

COMET stands for Large Scales Competence Diagnostics (LS-CD) in technical and vocational education and training and is an essential instrument for assuring and developing quality. LS-CD allows to measure occupational competence across occupations, across VET systems and on international scale. For the first time, COMET LS-CD allows to measure, if and at what level future expert workers are able to solve occupational tasks completely. The COMET competence model including the context research VI (an instrument to simultaneously measure the apprentices occupational commitment and vocational identity) has been tested and verified in an international perspective in Germany and China before and has proved its relevance as a reference model to shape vocational education processes in practise.

The adaptation, implementation and testing of the online measurement instrument QRC to evaluate costs benefits and quality of in-company training in South African companies is also of major importance in this context. Apart from the project aim to provide a “VET controlling system” for companies based on self-evaluation, QRC is now available as consultancy instrument, which can be used by various VET advisory bodies. The preliminary results of the QRC study put forward the assumption, that benefits gained by in-company training of apprentices are often exceeding its costs and that this core part of technical and vocational educational and training can as well be organised as a self-financing system, notably if the quality of training is high.

The overall project results of these pilot studies justify our hypothesis that the recourses of the South African TVET system allow for a considerable rise of training quality on a long-term basis.

The merSETA/I:BB pilot study has shown that all parties concerned, internal trainers, TVET facilitators and as well apprentices in South Africa are highly motivated to work on quality issues in TVET. But without the extraordinary and highly professional support by merSETAs project co-ordinator Ms Helen Brown as well as her project team, execution of this project would not have been possible. The close co-operation with the steering committees established for COMET (including VI) and QRC in South Africa was another prerequisite for the success of this extensive and innovative comparative study. We are grateful for all support given within the frame of these projects.

Prof. Dr. Dr. h.c. Felix Rauner

1 Measuring occupational competence on the basis of a three-dimensional competence model

After years of experience, the COMET diagnostics of competence in VET (electro-technology) more than fulfilled the initial expectations.

COMET was developed to get insight into vocational education's effects on the learners' development of competence (KATZENMEYER u. a. 2009). Measuring occupational competence is not seen as an alternative to the established forms of examination and testing (during the course of education or at its end), but as the possibility to get insights into strengths and weaknesses of vocational education according to different forms of school-based and on-the-job training as well as according to location, region and nation. This is done by assembling competence levels as well as competence profiles, the development of vocational identity and occupational commitment of test groups.

The test groups' competence profiles show which individual levels of competence have been reached and as well different test group's performances. This is an important step to improve the practice of feed-back. In a depth of sharpness previously unknown, learners and teachers get insights into learning results as well as into the learning and training situation. COMET results thus allow for further insights into VET quality in practice.

Standardisation of competence diagnosis is a step forward to comparative analysis of the quality of different forms of vocational education. This includes cross-professional and international comparative studies.

The new quality to diagnose the development of occupational competence by the COMET test procedure is based on a competence and measurement model as the foundation to develop test tasks and to evaluate the test results.

The competence model connects the guiding principles and objectives of vocational education and the construction of test and learning tasks (fig. 1).

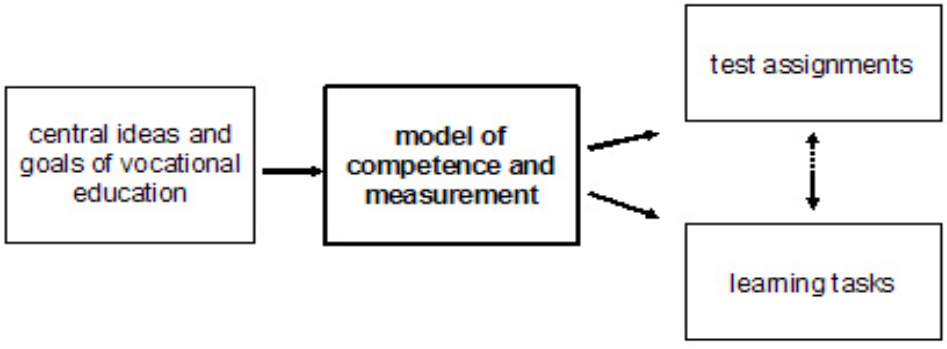

Fig. 1: The competence model connects the guiding principles and objectives of vocational education and the construction of test and learning tasks

The COMET competence model contains the dimensions that are typical for modelling competence:

- the requirement dimension,
- the content dimension, and
- the action dimension.

Operationalisation of the three dimensions (see fig. 2) was done with reference to basic guiding ideas and theories of vocational learning. Thus, the competence model takes in the basis of the concept of learning areas (*Lernfelder*) as well as being connected to international research and practice. The model and its inherent concepts of work process knowledge and holistic shaping competence (*Gestaltungskompetenz*) have triggered broad interest in the international VET discussion and VET development.

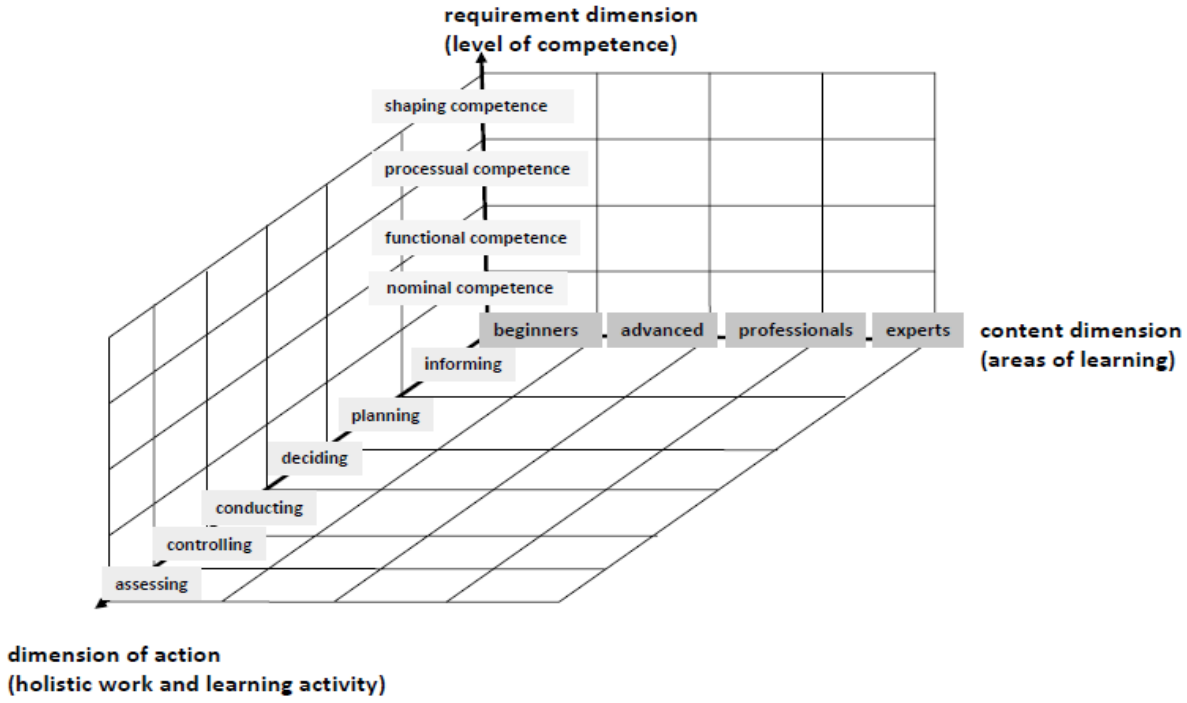

Fig. 2: The COMET competence model

1.1 The content dimension

The content dimension of a competence model describes the contents of teaching and learning in a specific subject or area of learning as a basis for the development of test assignments. In projects of international comparative competence assessment it is crucial to identify, following the idea of a "world curriculum" (PISA), contents that are characteristic for a discipline or an area of learning. This makes it necessary to abstract from the specific national or local curricula. Accordingly a derivation of the test contents from existing vocational curricula or training plans is ruled out for several reasons.

One of the justifications for a comparative large-scale measurement in the field of vocational education lies in the perspective of using the test results for comparing the strengths and weaknesses of existing VET systems and programmes, provided that the specific curricula can be assigned to the same fields of professional activity. Therefore the COMET project adopted the concept of *professional validity* as a criterion for the definition of the contents of test assignments. The validity has to be demonstrated for the fields of professional activity in question. The World Skills were mentioned as an example. With a striking naturalness the professional communities manage to reach a consensus on occupational profiles and above all on the project tasks for the 'professional contests'. For the members of the relevant "community of practice" it is plain to see, as it were, what it is that defines real mastery in their profession.

Vocational curricula are oriented towards specific forms and systems of vocational education. A comparative competence assessment therefore cannot be based on a specific type of training, e.g. dual vocational education and training. Already the countries that have established systems of dual VET, like Denmark, Norway or Switzerland, would be too different from each other. Especially the relation between the definition of overarching (national) standards and their implementation at the local level in the form of training plans is organised in very different ways. Both in Switzerland and in Denmark the responsibility for the implementation of the lean national occupational profiles is with the actors at the local level. The structuring of training programmes in terms of content and time can be based on highly divergent concepts. Apart from an organisation according to the subject matter, the structure of the temporal sequence of the contents is largely based on pragmatic considerations. Training concepts that have a scientific basis are an exception.

Therefore the definition of a validity criterion for the contents of the curriculum and the corresponding test assignments is very important for vocational education and training as one and the same field of activity can be trained in different ways. School-based, company-based and dual types of training are competing with each other in the national and international context. What is undisputed is the idea that the goal of vocational education and training is professional aptitude. The latter comprises the qualifications that enable a person to exercise an occupation. In colloquial language and policy debates the terms "qualification" and "competence" are often used interchangeably. In the first chapter we have explained why it is necessary, in the scientific foundation of assessment and diagnostic procedures, to observe the distinction between these two concepts. To what extent different forms of VET programmes succeed in imparting cognitive performance dispositions at the level of professional aptitude (*Berufsfähigkeit*) can be investigated by competence diagnostics. The same is true for the measurement of competence development at different steps of the training process. The evaluation of professional aptitude in the sense of professional *action* competence (*berufliche Handlungsfähigkeit*), on the other hand, is a topic for assessment and examinations.

If the content dimension is described in the form of a model for the systematisation of contents that can be applied to vocational education and training, the novice-expert paradigm makes it possible to arrange the occupation-specific training contents according to learning areas. Granted that the legitimacy of vocational education and training is based first and foremost on the fact that it supports the integration into a profession – the development from novice to expert – by giving learners the opportunity to develop their professional competence through the solution of professional tasks, the most promising approach to the structuring of the content dimension is a model based on development theory. The organisation of work tasks according to the levels of

novices, advanced beginners, competent performers and proficient performers offers a basis across different occupational areas for the systematic identification and selection of contents for the construction of occupation-specific test assignments.

The COMET competence model thus has a content dimension that is justified by learning and development theory. The application of this dimension in the development of test assignments for specific occupations and occupational areas makes it possible to achieve an *occupation-specific implementation of a trans-occupational test concept.* This way the competence levels and competence development of learners in different occupations and different VET systems can be assessed comparatively. At the same time this concept provides the opportunity to systematically evaluate the competence development at different stages of a vocational training process (see fig. 3).

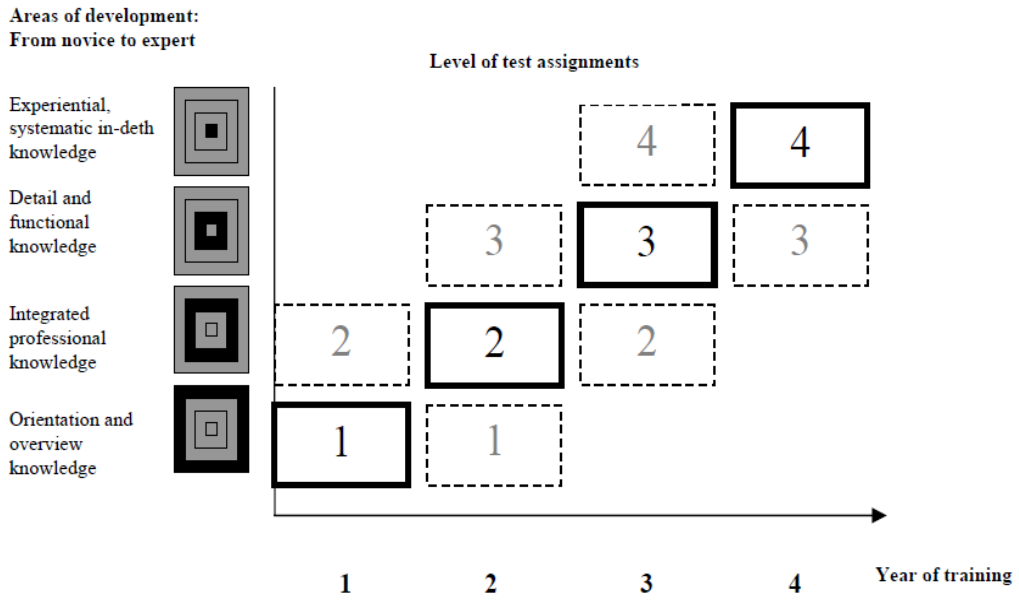

Fig. 3: Correspondence of test assignments and learning areas in vocational education and training as basis for a cross-over design

When the content dimension of the competence model is applied and specified, one has to distinguish the phases of competence development (from novice to skilled worker or professional) and the professional competence attained upon completion of the vocational training programme. If the acquisition of qualifications in the course of the incremental development of professional aptitude is organised in accordance with the developmental logic of qualifications and corresponding fields of activity and learning, the result is a structure that serves as the basis for the development of test assignments.

Whenever the competence development is to be assessed over the entire training period it is necessary to identify the characteristic work tasks and to arrange them as developmental tasks. The situation is easier when the competence level towards the end of the training programme has to be evaluated. In this case the point of reference is the professional aptitude as described in the relevant occupational profiles. In international comparative studies it does not make sense to refer

to the more formalised descriptions in the form of standards or training regulations, for this would lead to an overrating of the formal aspects and impede the development of test assignments. The experience of the international COMET study (German and South African students in the area of electrical engineering and electronics) shows that the selection of appropriate (characteristic) work tasks is possible without much difficulty. The implicit validity criterion applied by the educators involved consists, besides their common vocational discipline, in the professional work in the area of electrical engineering and electronics. The communication about the contents of competence development takes place at the level of professional fields of activity on the one hand and through the selection and development of test assignments on the other.

1.2 The action dimension

Alongside the pedagogical differentiation of the categories of vocational education and professional competence the paradigm of 'complete professional action' gained support and acceptance in theory and research in labour studies, which aimed at a humanisation of the world of work. The manifold efforts in labour studies to develop a scientific foundation of this concept obscure the fact that the category of complete professional action ultimately has a normative basis. The concept is rooted in the critical reflection of the Taylorist organisation of work and the interest to counteract the dequalification in fragmented work processes with a shaping concept based on labour studies. Empirically the concept of complete professional action is supported by many HdA (*Humanisierung des Arbeitslebens*, humanisation of the world of work) and 'Arbeit und Technik' (work and technology) projects, which demonstrated that non-Taylorist types of work organisation were an advantage under the conditions of international competition (GANGUIN 1992).

Referring to HELLPACH (1922, 27), TOMASZEWSKI (1981), HACKER (1986), and VOLPERT (1987), ULICH emphasises five characteristics of "complete" or "holistic tasks":

- the independent definition of objectives that can be embedded into overarching goals,
- independent preparatory activities in the sense of exercising planning functions,
- selection of instruments including the relevant interaction for adequate goal attainment,
- executive functions with process feedback for a continuous opportunity to correct activities,
- review and feedback on outcomes with the opportunity to evaluate the matching of results of one's activities with the defined objectives (ULICH 1994, 168).

What is remarkable here is that ULICH emphasises the category of "holistic tasks", thereby referring to the shaping of work as a core research topic in labour studies. When the action dimension is adopted in the COMET project, we follow this tradition of labour studies where the design of work tasks is always viewed also as an aspect of personality development. This is one of the roots of the programmatic relevance that the idea of holistic tasks has gained in vocational pedagogy. Another one is the degree of medium-level operationalisation in the form of the differentiation of the complete work and learning action in successive steps of activity. This scheme provides some degree of orientation and security for the didactic activities of teachers and trainers. Moreover, this structural model of agency was disseminated also at the international

level through the introduction of the concept of learning areas in curriculum development.

A reservation must be made with regard to the description of the action dimension because the steps of the complete professional activity suggest an approach of instrumental rationality in didactics that is appropriate for the situation of beginners and less so for advanced learners and experts (see above all DREYFUS/DREYFUS 1988). In the debates in vocational pedagogy a distinction is drawn between an instrumental-rational type of activity on the one hand and a design-oriented and dialogical type on the other (BRATER 1984). The two types of activity are essential for each occupation, but their relative importance varies. Professional tasks with a clearly defined objective, e.g. the specification of a solution for a technical problem, require a structured and systematic approach. The objective determines how one proceeds in problem solving. The concept of holistic work activity has a clear affinity to this instrumental type. This type is prevalent in specified work processes and projects where the room for manoeuvre is relatively small. If the opportunity for design exists at the stage when the work assignment is formulated, this opportunity is diminished or removed already in the phase of work preparation by exactly defined work steps.

The design-oriented and dialogical type of activity is characterised by an openness of objectives and by a course of activities that can be foreseen and planned only to a limited extent. The sequence of work steps emerges no sooner than in the work process itself. For instance, educational processes are largely open. Schoolteachers and kindergarten teachers respond to the impulses, suggestions, questions and answers of the children/pupils. This means that the learners, being the subjects of the learning process, co-determine the course of the educational process. To some extent the teacher anticipates, in the preparation of a lesson, the potential reactions of the pupils. He simulates the lesson in his mind, considering the possible ramifications. The actual course of events, however, can be anticipated only to a limited extent. The situation is similar with regard to activities in diagnostic work processes, e.g. in industrial and technical occupations where error diagnosis plays an important part. A particular relevance of the design-oriented and dialogical type of activity can be found in artistic professions. A painter is guided by a specific idea in the painting of a picture, but the way the picture ultimately takes shape is the outcome of a constant dialogue between the artist and his work of art.

In the practice of professional work the two types of activity overlap. When the design-oriented and dialogical type dominates, it is reasonable to use open test assignments in the form of situation descriptions in such a way that the time frame can be overlooked by the test persons and the opportunities for action as well as the ramifications can still be described. These conditions need to be taken into consideration in the development of test assignments. Two assignments are appropriate for the comprehension and solution of a technical problem when the instrumental-rational aspect is dominating. The anticipation of a teaching situation in the context of a test with a working time of approximately 120 minutes for each assignment, on the other hand, seems rather unrealistic because normally the pedagogical activity of teachers can be anticipated only for shorter time cycles. Here a comparison with a chess player can be drawn. The planning of possible moves depends on the anticipation of the opponent’s behaviour. More than four or five moves cannot be estimated in advance because the number of potential courses of the game grows exponentially (which is why the actual behaviour of chess players is based above all on the knowledge of typical patterns). Therefore our recommendation is to raise the number of open test

assignments in occupations with a distinct design-oriented and dialogical profile to four. The working time is then reduced to a maximum of 60 minutes per assignment. The opportunity to analyse and reflect complex processes should be retained because this is a sign of professionalism and competence in occupations with a high degree of design-oriented and dialogical activities. At the same time this test method reaches its limits when the time frame for the work situations is overstretched. Therefore the following rule has to be observed: the alternative courses of action associated with the test assignments must be easy to oversee.

It will be possible only on the basis of empirical investigations to formulate this rule more precisely. This includes studies on the limitations of a standardised competence diagnostics that are constituted by the contents of professional work.

The supplementation of the COMET competence model with the action dimension and the diversification of the latter into six steps of activity took place with a view to justifying the concept of holistic problem solving (chapter 1.4). This concept is constituted by the requirement and action dimensions. This way the competence model as basis for the development of test assignment and the rating of the solutions are further refined.

1.3 The levels of professional competence (requirement dimension)

The requirement dimension represents the levels of professional competence that build on top of one another. These competence levels are defined on the basis of skills that are associated with the (holistic) solution of professional work tasks. The objective and subjective requirements for the work on and the solution of professional tasks are directly related to the relevant professional skills.

The requirement dimension in the COMET model follows the criteria of the holistic solution and thus allows for the concrete description (in terms of content) of empirically tested competences at different levels. It can describe how the solution of tasks looks like when the professional has a high level of competence and how it looks like when the competence level is low. What is of interest here are the *quantitative* and *qualitative* differences between the competence levels as well as the competence profiles that arise from the assessment of the eight competence criteria. The evaluation of the test results allows for a *criteria-oriented interpretation* of the quantitative scores (performance indicators).

The framework for the interpretation is constituted by the eight criteria of the competence model with its three levels (fig. 4). The criteria-oriented interpretation of the quantitative values includes a pragmatic definition of rules as described below, for the transition from one competence level to the next requires the definition of threshold values as well as rules according to which a participant is assigned to a competence level. This feature distinguishes the COMET methodology from norm-oriented test procedures where the boundaries between the competence levels are drawn on the basis of the complexity and degree of difficulty of the test assignments.

A multi-level model implies the idea that the competence levels represent a ranking in the sense of an increasingly higher value of competences. In the case of the COMET model the first competence level is the lowest and the third one the highest possible level of competence. The levels that can be attained by a trainee are independent of the phases of the training process.

The competence model presented here makes it possible to determine, with the help of open test assignments, the competence level that a solution belongs to. This is independent of the phases of competence *development* in the course of a training programme of several years.

When one reviews concepts of competence assessment in empirical educational research one encounters the concept of 'literacy'. The PISA project interpreted basic education in the natural sciences as 'literacy'. Following BYBEE'S (1997) design for the study of successive literacy levels it is possible also in VET research to draw a distinction of a total of four competence or literacy levels (see table 1).

Competence levels	**Bybee (1997)**	**COMET 2008**	**PISA, scientific literacy**
Nominal	*I Nominal literacy*: some technical terms are known. The understanding of a situation is largely limited to naïve theories. Narrow and superficial knowledge.	*I Nominal competence*: superficial conceptual knowledge that does not guide activity, the meaning of the professional terms remains at the level of colloquial language.	*I Nominal competence*: simple factual knowledge and the ability to draw conclusions without extending beyond everyday knowledge.
Functional	*II Functional literacy*: scientific vocabulary is used adequately in a narrow area of situations and activities. The terms are hardly reflected and the background remains unknown.	*II Functional competence*: basic technical knowledge leads to technical-instrumental skills. "Professionalism" is displayed as decontextualised technical knowledge and corresponding skills ("know that").	*II Functional competence I*: common scientific knowledge constitutes the ability to evaluate simple situations on the basis of facts and simple rules.
			III Functional competence II (scientific knowledge): scientific concepts can be used for the prediction or explanation of events.
Conceptual-processual	*III Conceptual and processual literacy*: concepts, principles and their context are understood, as are basic modes of scientific thinking and working.	*III Processual competence*: professional tasks are interpreted in the context of company work processes and situations. Work process knowledge leads to professional action competence ("know how").	*IV Conceptual-processual competence I*: elaborate scientific concepts can be used for the prediction and explanation of events.
Multidimensional, holistic	*IV Multidimensional literacy*: at this level an understanding of the essence of science, its history and its role for culture and society is attained.	*IV Holistic shaping competence*: the complexity of professional work tasks is fully realised, and tasks are solved with a view to diverging demands and in the form of intelligent compromises.	*V Conceptual-processual competence II (models)*: analyse scientific studies with regard to the design and the hypotheses tested, develop and apply simple conceptual models.

Tab. 1: Competence levels in scientific literacy and industrial training

The further development of BYBEE'S concept of scientific literacy was achieved by the Science Expert Group (2001) on the basis of an analysis of the test items. The result was a division of the functional and the conceptual-procedural competence levels into two sub-categories each. It remains to be seen whether this improves the understanding of scientific literacy. The epistemic value of BYBEE'S concept lies certainly in the fact that a clear distinction is drawn between functional and procedural competence or literacy. From a didactical point of view there is also an interesting parallel between the competence level of multidimensional literacy (BYBEE) and the concept of holistic shaping competence (COMET).

1.4 Requirement dimension II - The criteria of holistic problem solving as competence criteria

The theoretical definition of the competence levels on the basis of the eight criteria for the holistic solution of tasks is based on the following considerations.

The *functionality* of a solution and its clear presentation must be given before the relevance of the other criteria comes into play. When the aspects of economy, utility and sustainability as well as business and work process orientation are considered in the solution of test assignments, then the candidates have a *professional concept of work* (as opposed to an academic and merely *functional* understanding of the tasks).

The solutions that can be classified under this competence level demonstrate that the competences that are essential from an occupational as well as organisational point of view.

The third competence level is defined by skills that reach beyond business and work processes and aim at aspects of *social* relevance. This means that there is a hierarchical order of competence components and solution aspects in the sense that an increase in competence is associated with a wider perspective of the trainees of the issues to be considered in problem solving. A purely technical or functional competence is followed by organisational and social problem solving competences at the higher levels.

Nominal competence has to be excluded from the field of *professional* competences when competence development is defined, as in the case of the COMET model, as a characteristic criterion for the success of a vocational training programme. Trainees who attain only the level of nominal competence are regarded as a risk group. When one looks at the definition of the first competence level (functional competence) it becomes clear that trainees who do not reach this level are likely to fail in the training programme. Their actual competence level is equivalent to the level of unskilled or semi-skilled work. It remains to be investigated as to whether and in what time they can develop into skilled workers on the job.

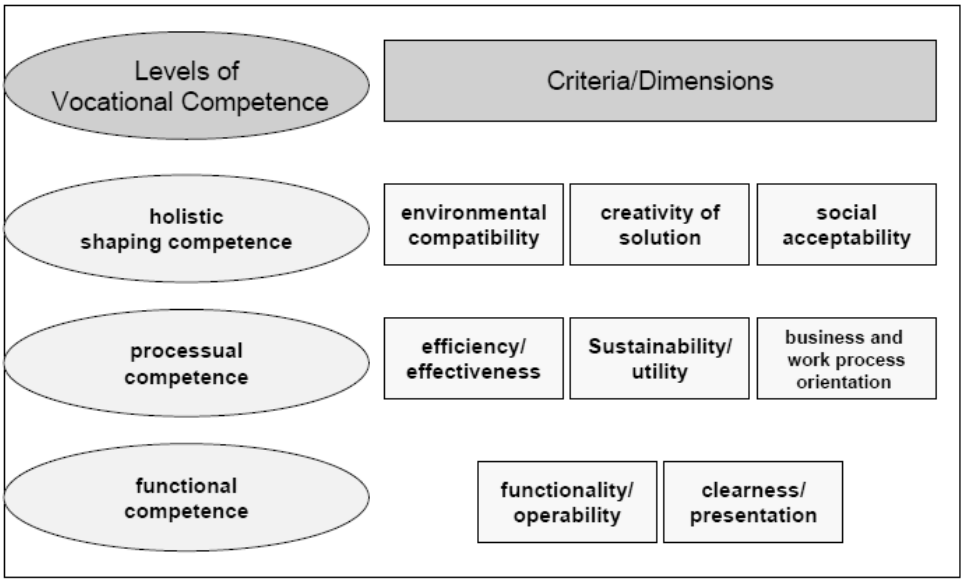

Fig. 4: Levels and criteria of professional competence (RAUNER/GROLLMANN/MARTENS 2007, 23)

- *Functionality/operability*: The functionality of a proposed solution is an evaluation criterion that immediately presents itself. Functionality refers to the instrumental technical competence or the context-independent, subject-specific knowledge and skills. Evidence of the functionality of a solution is fundamental and determines all further requirements that are posed for the solution of work tasks.
- *Clearness/presentation*: The results of professional tasks are anticipated in the process of planning and preparation, and they are documented and presented in such a way that principals (customers, work superiors) can understand and review the proposed solutions. Accordingly the explanation and presentation of a solution is an instance of professional learning and professional work. A core element of communication in the work context is the ability to express one's thoughts in a clear and organised way by giving accounts, drawings and sketches. The adequacy of the presentation with regard to the facts is a sign of professionalism.
- *Efficiency/effectiveness*: Professional work is in principle subject to the aspect of economy. The context-specific consideration of economic aspects in the solution of professional tasks is a characteristic of the competent activity of professionals. There is a constant necessity in professional work to evaluate how economically a task is carried out, and to consider quite diverse types of costs and influences. Costs that will be incurred in the long run (derivative costs) need to be taken into account as well. Decisions are made on a summative assessment of the ratio of expenses and benefits. In addition, economic responsibility also includes an awareness of the societal aspects as not all strategies that make sense at the organisational level may also be acceptable for the national economy.
- *Sustainability/utility*: Professional activities, workflow, work processes and work assignments are ultimately oriented towards a customer, whose concern is the utility of the work result. In highly diversified production and service processes the aspect of utility often gets out of sight when subtasks are performed and vocational education is reduced to the aspect of action. The criterion of utility orientation therefore points at the utility of a solution in the entire context of work. A high utility of a solution depends not only on its immediate applicability for the customer, but also on the prevention of liability to failure and the consideration of aspects of easy maintenance and repair. Sustainability of application and the perspectives for enhancement must also be taken into account when the utility is assessed.
- *Business and work process orientation*: This criterion refers to the preceding and the following operations in the organisational hierarchy (the hierarchical aspect of the business process) and in the process chain (the horizontal aspect). This aspect is particularly relevant in an environment characterised by programmed work systems in networks in and between companies. A business process oriented solution takes into account the linkages with the preceding and following processes and includes also the aspect of cooperation beyond the boundaries of one's own professional work.
- *Environmental compatibility*: By now this criterion has become relevant for almost all work processes. What is at stake here is not the aspect of environmentalism in general, but the professional and technical requirements for professional work processes and their results that can be considered relevant for the criteria of environmental compatibility. It has to be taken into consideration whether environmentally friendly materials are used and whether an eco-friendly work organisation is followed in the solution of the work

task. Other issues that need to be considered are energy saving strategies and aspects of recycling.

- *Creativity*: The creativity of a solution is an indicator that plays an important part in professional problem solving. This is due to the fact that the room for manoeuvre for the solution of professional tasks varies strongly in the different work situations. The criterion of a "creative solution" has to be interpreted and operationalised in an occupation-specific way. In the arts and crafts, creativity is a core aspect of professional competence. In other domains the aspect of "creative solution" is a relatively independent concept of professional work and learning. The distinction of creativity in a specific solution also shows the sensitivity for the problems to be solved. Competent professionals are expected to find creative and unusual solutions which at the same time make a meaningful contribution to the attainment of the goal.
- *Social acceptability*: This criterion refers above all to the aspect of a humane organisation of work, health protection as well as the social aspects of professional work that go beyond the work context (e.g. the often divergent interests of principals, customers and society). This includes aspects of work safety and prevention of accidents as well as the potential impact of a specific solution on the social environment.

1.5 Occupational (professional) validity

A competence model's content dimension shows the content of a curricular subject or area as the basis for constructing test tasks. In international comparative projects of competence diagnosis, it is important to specify a content that is seen as characteristic for a subject or area in the sense of a 'world curriculum' (PISA). Necessarily, this way one has to abstract from specific national or local curricula. So, developing test contents from curricula is not feasible because of various reasons.

- One of the justifications for comparative large scale competence diagnostics in vocational education is the possibility to identify and compare strengths and weaknesses of different systems and organisations of vocational education. Thus, the COMET project chose professional validity as a criteria to determine the test tasks' contents. Test tasks have to be valid in respect to the relevant occupational fields. In this context, we mentioned the World Skills. Here with astonishing simplicity professionals are able to decide upon tasks for these 'professional contests'. For the representatives of the respective 'community of practice', criteria for real mastership in a given profession are rather obvious (HOEY 2009).
- Vocational curricula refer to specific forms and systems of vocational education. Comparative competence diagnostics cannot focus on a specific form of VET - e.g. the German dual system. Already the countries' curricula that possess a developed dual system like Switzerland, Denmark, and Norway would be too different. Additionally, the relation between national standards and local arrangements (e.g. curricula) is quite different.
- For competence diagnostics in VET, foundation of validity criteria for the contents is quite important, as there are strong differences in the ways of training for the same profession. General school, VET school, company and dual systems all form a possible base for vocational education and compete on national as well as international level. The common ground is that vocational education all the time aims at professional aptitude, the

possibility to act as an expert in a profession. This contains the qualifications that enable to act in a profession. To what degree different forms of vocational education are able to impart cognitive dispositions on the level of professional aptitude, is a purpose of competence diagnostics. This holds for measuring the development of competence at specific times during VET.

2 What the COMET test instruments are able to measure?

During the first project phase, inside the COMET consortium as well as during presentations of the COMET project and its results the topic was discussed, what the test instruments are able to measure and what are the differences between this form of standardised competence diagnostics and other methods of evaluating professional skills and competencies. Addressing this question is of crucial importance to neither link unrealistic expectations nor underestimate the potentials of large scale competence diagnosis.

What can (not) be measured

Defining the scope of large scale competence diagnostics it is advisable to first clarify what is beyond its methods. These are first of all the following aspects of capacities and learning (see in detail COMET vol. III).

<table>
<tr><th colspan="2">Measurement</th></tr>
<tr><th>possible</th><th>requiring a great deal of effort</th></tr>
<tr><td>Cognitive domain-specific dispositions</td><td>Situated professional qualifications</td></tr>
<tr><td rowspan="3">Competence levels
related to professions as well as trans-professional, independent of VET forms and structures
of test groups on the basis of individual test results</td><td>Implicit professional knowledge
(tacit knowledge)</td></tr>
<tr><td>Individually situated professional ability (professional aptitude)</td></tr>
<tr><td rowspan="3">Learning gains related at curricula</td></tr>
<tr><td>Competence profiles and shapes</td></tr>
<tr><td rowspan="2">Heterogeneity of competence levels and shapes</td><td>Craftsmanship</td></tr>
<tr><td rowspan="2">Social competences (with reservations)</td></tr>
<tr><td rowspan="2">In combination with context data, insights into a multitude of relations relevant for steering and developing VET.

E.g.:
Educational systems
Contents and forms of occupational learning
Co-operation of learning venues and curricula
Work organisation
School organisation
International comparisons</td></tr>
<tr><td>Skills and capacities displayed in the interactive course of work (with reservations)</td></tr>
<tr><td></td><td>Competences displayed in creative skills</td></tr>
</table>

Tab. 2: Possibilities and limits of measuring occupational competence

What is large scale competence diagnostics measuring?

The first row of table 2 describes the objects of competence diagnostics: cognitive domain specific dispositions. These dispositions are *cognitive* as competence diagnostics does not look at performance during the work process, but looks at the test persons' ability to comprehend occupational tasks in its complexity, to weigh up different aims and to develop a viable approach. Occupational competence is domain-specific as it is based in a given world of labour that holds different requirements according to different occupations.

The strengths and peculiarities of large scale competence diagnostics are based in the standardisation of tasks on the basis of a competence model. This is not restricted on measuring individual occupational competence but holds for comparing different groups in different forms and systems of vocational education. Good and very good results express a good or very good VET practice.

The characteristics of COMET competence diagnostics can be summarised in seven points:

1. **The COMET model of competence can be applied in the whole range of VET - cross-professional and cross-system. This has not seen as possible before and opens up a new quality in VET research, quality assurance, qualification and curriculum research as well as in international comparative VET research.**
2. **Test results are not only presented in terms of competence levels but as well by competence profiles. This way the results become important in terms of organising learning and didactics.**
3. **For the first time, COMET offers a method to measure occupational competence that allows statements on how specific VET systems are able to impart the central idea of vocational education: *professional holistic shaping competence*.**
4. **Longitudinal studies (of about one year) offer an identification of qualitative and quantitative aspects of competence development.**
5. **Apart of testing occupational competence, the COMET test instruments contain scales to measure- vocational identity**
   - occupational and organisational commitment
   - abstract work ethics (or working morale).
   This enables the measurement of different occupations' attractiveness (cross-professional).
6. **Collecting context data on the test persons' biography as well as on the learning environment at school and company allows far-reaching interpretations of the COMET results. This enables to derive recommendations for**
   - Teachers and trainers,
   - VET research and VET planning as well as
   - VET policy.
7. **The COMET competence model is at the same time a didactic model to develop and evaluate instruction and education according to the concept of learning areas.**

3 COMET South Africa's point of departure

At the time of this research, various media articles refer to South Africa's economic structure with a highly developed industrial sector as well as an informal sector of about 25% of the labour force. Apart from a short recession during the financial crisis, the economy has steadily grown in the last years, in 2010 about 6%. Well-known international companies (global players) make a considerable factor for South Africa's economical development. The formal labour market is about 50%, the informal labour market about 25%. The unemployment rate is at 25%, the youth unemployment being considerably higher. At the same time, a substantial shortage of skilled labour has emerged. Therefore employment and education policy's big challenge is to resolve the contradiction between a high demand for skilled labour and a high rate of youth unemployment.

South African educational policies deal with this contradiction for some time already. Since the 90ies, they have reacted by a series of legislative initiatives, the implementation of a national qualification framework according to the British model, a series of consecutive reforms at all levels of the education system, including curriculum development, as well as new forms of assessment and examination. As a result, different reform concepts co-exist side by side.

The quest for an integrated modern educational architecture is an outstanding task for educational politics. Some attributes are characteristic for the dynamics of reform of South Africa's VET system:

- There is (at present) no distinction between training occupation and occupations (SASCO).
- The occupational classification system SASCO is based on ISCO and shows 28.000 job titles of which 1.413 are 'apprenticible' occupations. The characteristics of a modern training occupation still have not been defined. This large number of 'occupations' is differentiated into 8 major groups, 44 sub-major groups, 100 minor groups and 366 unit-groups. At the same time, this constitutes a hierarchy of occupations with different values. According to the 10-level national qualification framework, the 1.413 distinct occupations are dedicated to 4 different levels of qualification *(The National Skills Development Handbook, 2010/2011, pp. 260, 264)*..[1].
- Additionally, there is a system of 15.000 unit standards as well as a system of 11.000 qualifications. (*The National Skills Development Handbook, 2010/2011, p. 222).* The systems' separation increases because of specific assessment formats for unit standards qualifications and occupations. Furthermore, there are 12 areas of (training) occupations, but 23 social or economic sectors.
- To date, all efforts failed to transform these very diverse forms of depicting occupational skills and capacities into a modern system of occupations. The attempts to relate the three systems to each other in one form or another have further increased the complexity of the South African system of occupations.
- To maintain this highly complex and intransparent system, this inevitably leads to higher

1 Unlike this, countries having a developed dual system universally dedicate their training occupations to just one level.

bureaucratic effort in order to govern this system.

- As a political guideline for the development of the VET system, the "National Skills Development Handbook" (2010/11) states: *"Public FET colleges are the primary tool by which the state hopes to develop the intermediate level of education required by this skills crisis"*.
- In contrast, justifying the occupational learning system (OLS), the same handbook states: *"the separation of the world of education and training (skills supply) from the world of employment (skills demand) was therefore the first barrier that needed to be crossed in developing a more efficient approach to skills development. Once the skills researchers had developed a classification system to describe accurately the skills needs of the labour market, the next step was to identify qualifications to match the needs. Here they came up against several problems linked to the fact that the NQF at the time was insufficiently geared to accommodate workplace learning which is, of course, critical when dealing with occupations" (The National Skills Development Handbook, 2010/2011, p. 222).*
- Now, the National Skills Development Strategy III gives a guideline with a program according to international standards: *"The National Skills Development Strategy III responds to the following pressing challenges that are impacting on the ability to our economy to expand and provide increased employment opportunities: The inadequate skills levels and poor work readiness of many young people leaving formal secondary and tertiary education and entering the labour market for the first time. This is compounded by inadequate linkages between institutional and workplace learning, thus reducing the employability and work readiness of the successful graduates from FET and HET institutions, not to mention the many who enter the world of work without a formal qualification.*
- *The desperate plight of so many of the longer term unemployed who lack basic numeracy and literacy do not possess entry-level skills, and do not have the work experience and work-based training needed to enable them to seek and obtain work.*
- *Continuing skills shortages in artisanal, technical and professional fields that are fundamental to the development of growth of our economy.*
- *An over-emphasis on NQF level 1–3 learnerships with insufficient progression towards more appropriate (intermediate and higher) skills required for growth sectors in a knowledge economy. There is a need for much more substantial programmes that improve qualifications, support career-pathing, enable greater flexibility and mobility and increase productivity"(The National Skills Development Strategy III, 2011 – 2016,* p. 3-4).

Conclusion

The merSETA's attempt to address the contradictions between progressive policy objectives regarding vocational education and training and the prevailing reality might become path-breaking.

Using two well-tried methods of quality assurance:

- COMET: to measure occupational competence (development)
- QRC: a self-evaluation instrument to depict the relation of costs and benefits as well as the quality of in-company learning

for the first time, one can sum up a VET system's quality and cost-effectiveness on the level of concrete learning processes.

The context analysis of the COMET project allows to find out the reasons for adequate and deficient VET practice. The internationally established COMET competence model at the same time is a didactical model for teachers and trainers to shape vocational education.

On the basis of the results, one can draw sound conclusions for the gradual modernisation of vocational education on the levels of

- learning processes
- development of curricula and occupations, and
- governance of the VET system.

To put into practice in essential parts and empirically grounded the guidelines of the path-breaking National Skills Development Strategy is something that requires the empirical analysis of vocational education's quality and cost-effectiveness.

In the last decade, quality assurance and quality development in VET came into the focus of discussion in vocational education. At first, the aspect of organisational development was emphasised. This contains the quality of vocational learning and teaching. Here, satisfying answers can only be given by standardised methods of measuring occupational competence and its development. As the development of occupational competence and vocational identity are two sides of the same developmental process, standardised competence diagnosis has to embrace measuring the development of occupational identity and commitment. The PISA project considerably strengthened interest in the establishment of large scale competence diagnosis.

For South Africa, qualification of skilled workers at the intermediate employment sector (skilled workers, technicians, etc.) is of utmost economical importance, as a rising part of the companies is exposed to international competition.

The project's aims in detail:

- Testing the competence model 'vocational education' as a basis to develop test and learning tasks that refer to the didactic concept of learning areas.
- Testing and implementation of COMET competence diagnostics to measure occupational competence, the development of competence, vocational identity, and occupational commitment.
- Realisation of a comparative project: German apprentices (electro-technology) and students at German technicians' colleges as well as South African VET students (VET schools, VET colleges, and skilled workers schools).
- Analysis of test results referring to context data:
    - Data on VET schools and colleges,
    - Data on companies,
    - Biographical data,
    - Test motivation.

4 The test instruments

4.1 Psychometric properties

Using psychometric tests, one has to regard the quality criteria objectivity, reliability, validity, and fairness. For these criteria to reveal something about the test's quality, one has to thoroughly study how to interpret them according to the specific test procedure.

Objectivity

A test's objectivity relies on the results being independent of the user. One can distinguish *objectivity of application*, *scoring objectivity* and *objectivity of interpretation*. In the COMET project, objectivity is granted by the measurement model as well as the rater training.

Objectivity of application – the test result's independency of the person conducting the test - is secured by the following measures:

- same time spent on working on the task for all test persons (2 hours per task)
- same resources for all test persons
- same test instruction for the teachers conducting the test

Scoring objectivity – the scoring's independency of different raters – is secured by using a standardised item sheet by specially schooled raters as well as an anonymous rating. Schooling the raters leads to more than sufficiently high values of inter rater reliability (see. COMET Vol. 2, 62 as well as Vol. 3, Chap. 4.2).

Objectivity of interpretation is secured as there is no margin in interpreting the test result. The raters' evaluations (by means of 40 items) are converted into scores on the eight competence criteria, the three competence dimensions, and a total score by a standardised procedure.

Reliability[2]

A test's reliability is the accuracy to measure the tested material. In pedagogical and psychological performance measurement, test tasks often are selected and adjusted according to their difficulty and discriminatory power in order to get an average difficulty of 0,5. That is to say that half of the population is able to solve the task, implying the highest possible discriminatory power. In measuring occupational competence, this form of norm-oriented test tasks is totally inappropriate, as the accuracy gained this way constrains the test tasks' content validity (RADEMACKER 1975).

The COMET project's challenge here was to use realistic, open test tasks while at the same time achieving a high degree of accuracy in evaluating the results (see COMET volumes I to III).

2 On inter rater reliability, s. Chap. 5.2

Validity of test tasks

A test's validity indicates, how well the test tasks enable to measure what we want to measure.

The COMET volumes I and II establish, that the test tasks' content validity is indicated by the contents being representative related to the specific occupational profiles respectively the work practice of the specific 'community of practice' that these occupational profiles represent (see Vol. I, Chap. 4, pp. 39). For international comparative diagnostics of competence, the concept of *occupational validity* is suitable, that successfully is used at the international world skills (IWS). The experts of the different countries taking part in a specific contest agree on a short characterisation of an occupation as well as on a description of occupational tasks. On this basis, the contest's projects are selected. The descriptions are revised every two years according to the rhythm of IWS (table 3).

Name and description of skill	**Marking (objectives and subjects)**
Scope of work	Design criteria and procedure development and implementation of the test projects (the task or tasks to be completed)
Tasks to be carried out	
Theoretical Knowledge	

Tab. 3: Technical description applying to each skill (HOEY 2009)

Workshops are available to handle the complex test tasks. The handling time is 22 hours (three days). The rating developed by IWS allows comparing projects in diverse occupations according to superior excellence (HOEY 2009).

The development and selection of test tasks in the COMET project confirms the IWS experience that experts in an occupational field easily agree on the validity of a task. This is eased by the concept of realistic, open, and complex test tasks. Once a set of tasks is developed for a defined population (e.g. electro-technicians), experts can check in how far these tasks are applicable on comparable forms of VET.

Using the competence and measurement model for the informal assessment of students (see Vol. II, Chap. VI), becomes unproblematic. The German teachers taking part in the COMET project accentuated, that this concept offers an effective didactical concept first of all for the development and self-evaluation of learning projects.

Curricular validity of test tasks

The reference for constructing test tasks is professional work in form of informal and formal occupational profiles and not specific curricula (see chapter 1.5). Even if in international comparative competence diagnostics, curricular validity cannot be a *basis* for developing test tasks, as the performance of different forms of vocational education is in fact one of topics to assess, it is important to check, to what degree the test tasks are valid for the different structures, forms, and settings of vocational education. A lack of curricular validity makes it more difficult for the students to work on the test tasks.

Fairness

According to the criteria fairness, test tasks should be related to the test persons' learning experiences. But if (like in COMET or PISA) a primary goal is the assessment of educational systems and educational forms, one assesses the practice of curriculum development and the practice of vocational education - and not a student's individual score. In this case, a test is fair, if vocational education accepts the competence model and its foundations. In the COMET project, the competence model as well as the test procedure was developed in co-operation between the academic support and the steering group (teacher team). If the test procedure is used for international comparisons, all partners taking part have to be in accordance with the competence model and the test procedure. If additionally, test results are used for instruction, students first must be aware of the test's aims.

But on the other hand, a minimum of familiarity is necessary with the structure of open test tasks as used in the COMET project. Only this way, the test takers are able to express the occupational competences they have got. Such a familiarity exists, if students have learned during their training to work on complex work tasks without external guidance. One can take it as a given, too, if instruction at VET school addresses realistic work tasks in their whole complexity. The more learning is organised along subject-oriented modules - e.g. in the South African system of certifiable units -, the less familiar working on open, realistic test tasks becomes. This may lead to the result, that 'in principle' competent test takers not know what to do with this kind of tasks - something that obviously has big influence on the results. For test psychology, 'fairness' is an important criterion first of all for tests in the pedagogical field. The development in direction of 'cultural-neutral' intelligence tests in the last 60 years would be an example.

For the project COMET South Africa this means:
Solutions with a score that is so low, that it implies a total lack of understanding of what was required, were not used for further evaluation.

4.2 The test instruments

Development and selection of test instruments follow the aims of the project and considerations immanent to it. The following test instruments were used on both test dates:

- Open test tasks
- Context questionnaire
- Questionnaire on the students' test motivation
- Teacher questionnaire on students' motivation
- Teacher context questionnaire

The open test tasks

The four open test tasks are COMET's main test instrument. The form of open test tasks, as developed and used in the COMET project, is in accordance with order transactions in professional work. The amount of 120 minutes to work on the complex, open tasks allows diagnosing occupational competence in a way representing the core and occupation-specific competences and capacities of a skilled worker.

The competence model's as well as the rating sheet's high acceptance had a positive influence on inter-rater reliability (see chap.5). Additionally, this was secured by another instrument in addition to the competence model and the rating scale: every rater got a solution space for every test task. The solution space demonstrates, what possibilities and varieties of solutions are inherent into the open test tasks (see example for solution space Vol. I, Chap. 8.3).

Learning tasks

Not being test instruments in the narrow sense, learning tasks were used throughout the COMET project South Africa. The tasks' purpose is twofold. First, they help the test takers to familiarise with this sort of tasks. Secondly, they serve as guidelines for learning projects that have the potential to close the gap between school-based learning and its inherent organisation of learning objects according to a 'school-subject' structure and learning according the novice-expert paradigm.

If competence-oriented learning forms take place and the learners enable to solve occupational tasks *in a way related to real life* while paying attention to all relevant aspects of a solution, then, they acquire *cohesive knowledge* of their occupational field as well as competence to act in and shape their profession (*Handlungskompetenz* and *Gestaltungskompetenz*). Learning according to fragmented modules does not allow the development of occupational *Handlungskompetenz*. If one introduces forms of learning and teaching that are informed by the COMET competence model, i.e. learning tasks as well as other forms of learning projects, than - according to experience - the level of competence may rise significantly (fig. 5). Although the majority of teachers and trainers had indeed used COMET learning tasks, this had only a limited effect.

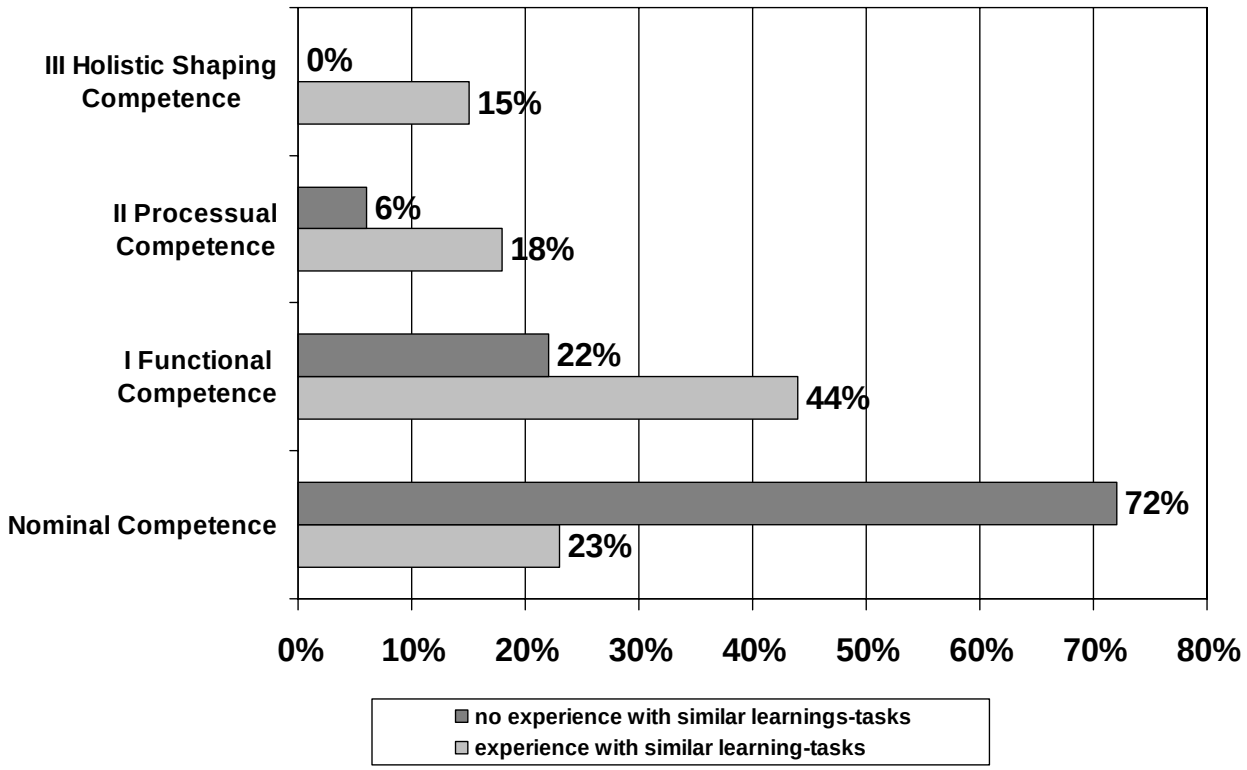

Fig. 5: Competence levels of electrician (industry) Hessen 2010, with and without prior test experience

The context questionnaire

In addition to the two test tasks, a questionnaire was presented that captures the students' background as well as the context of learning at school and at the workplace. Tab. 5 sums up the questionnaire's contents.

Personal background	Context of in-company training	VET school context
• Socio-economic background • School performance and previous learning career • Training motivation	• General characteristics of company • Work-process orientation of training • General training situation at company	• General characteristics of school • Pedagogical context • Work process orientation

Tab. 5: Contents of context questionnaire

Aim of the context survey is to identify possible variables influencing the development of occupational competence. Only if one gains insights into these variables' modes of operation, practical and political argumentation is possible.

The first objective is to collect those data about the learners themselves that are relevant for professional competence development (Tab. 6). These include predominantly the educational attainments before the beginning of the training programme and biographical data like socio-economic background, data about possible previously completed or discontinued vocational education, information about prevocational education and preparatory measures and finally the question of motivation for training.

Personal background	Educational attainments and previous learning pathway	Motivation for training
• language spoken at home • support from parents • educational background of parents • living area • general cognitive abilities	• school qualification • prevocational education • final marks in German, mathematics and English	• target occupation • relative importance of the occupation in comparison to the training company • additional information about vocational orientation

Tab. 6: Personal characteristics of learners (example)

The *direct* investigation of prior knowledge and general cognitive abilities does not make sense at the present stage of the development of the methodology, given the considerable workload to be expected for such tests. Final marks at important school subjects work as an indirect measure of prior general knowledge.

The question of the motivation to choose a particular training occupation is the starting point for analysing the development of professional identity and its connection with competence development. The attitudes to the occupation and to the training enterprise is presumably an important predictor with regard to competence and identity. The scales that are surveyed by the instrument are described in tab. 7.

General characteristics of the enterprise	Work process orientation of the training programme	Training situation in the enterprise
• number of employees • number of trainees • economic sector • status of the enterprise (branch, independent company)	• learning venues (training workshop, corporate work process) • organisation of training (full-time trainers, part-time trainers)	• work climate • social inclusion • measures to promote transparency • inclusion into the expert culture • complexity of tasks • variety of tasks • autonomy • matching of demands and skills • relevance of tasks

Tab. 7: Context variables of in-company training

The analysis of the characteristics of the *vocational schools* takes place by surveying the views of trainees (tab. 8). The scales that are used have been validated in several projects on the quality of schools conducted by the DIPF (GERECHT et al. 2007). Not the complete inventory was used, however, but only such items that were adequate for the specific situation of vocational schools. For instance, the involvement of parents plays a less important part in vocational schools than in general schools. Some items were added that referred to specifically vocational dimensions of teaching quality, e.g. cooperation of learning venues and practice orientation.

School environment	Pedagogical context data	Work process orientation
• size of the school and the vocational department • age structure and composition of teaching staff	• teacher/student ratio • cooperation among teaching staff • school culture (student orientation and deviant behaviour) • individual support • self-reliance of learners • teaching attitudes	• connection of teaching and professional practice • cooperation of learning venues • teacher's overview on professional work • acceptance of the school by the training enterprise

Tab. 8: Context variables of the vocational school

Test motivation: Surveying students as well as teachers

With reference to the results of an experiment on test motivation at the PISA project (2000), we refrained from gathering test motivation in earlier COMET projects (Rauner, F. u.a. (2008), Chap. 5.6). However, the feedback from the teachers concerning the test behaviour of their students suggests that the motivation is subject to considerable variation. Some of the trainees used the time available for the work on the test only in part. Some others obviously did not take the test assignments seriously. Given the experience of the first test date it was decided to evaluate the test motivation and test behaviour at the pilot project COMET South Africa. The formulation of the questions follows the PISA test practice.

In addition, the teachers who supervised the classes during the tests filled in a questionnaire that collects information about the motivation in the class and the working atmosphere. The teachers give an assessment of the trainees' commitment concerning the work on the test assignments, information about the number of test absentees, and information about whether and how many questions there were on the part of the students and what aids were used to what extent. These data can be used for the comparison of test results at the class level.

Additionally, the South African teachers answered a short questionnaire on their use of COMET learning tasks prior to the test as well as on their general attitude towards this sort of tasks.

Representation of results

One possibility to show the test results is via a radar chart. Such a diagram is created for each participant (fig. 6). This presentation, which shows not only the three competence levels but also the eight competence criteria, emphasises the multidimensional character of the competence model.

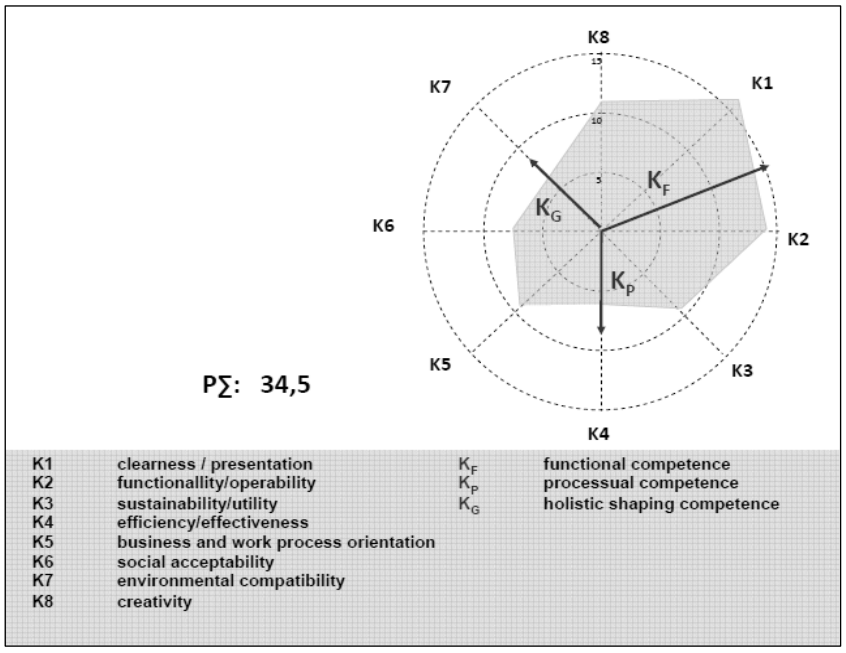

Fig. 6: Example of a competence profile

It is also possible to compare the average scores of different groups by means of percentile bands. The differences and the dispersion of competence scores between test persons and test groups, which are selected according to various criteria like occupation, age, prior learning etc., give information about the degree of heterogeneity to be expected in vocational education and training. An appropriate means for the visualisation of this heterogeneity are the percentile bands developed in the PISA studies.

The visualisation by percentile bands makes it possible to give a clear presentation of three different characteristics of the various groups. First, the marking in the centre shows the mean of the group. By comparing the means of the different groups it becomes possible to identify differences with regard to the average performance.

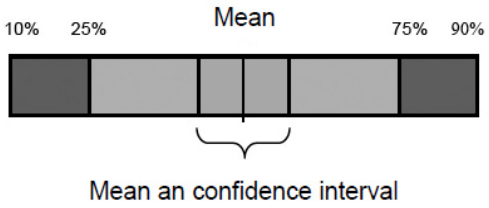

Fig. 7: Example of a percentile band

Second, whether or not these differences are significant is expressed by the highlighted parts of the percentile bands, the confidence intervals. With a probability of 95% the 'true' mean, i.e. the average that can be inferred from the sample for the entire population, lies within this interval. This means that differences between two groups are significant and most likely not due to random when the mean of one of the bands lies outside the confidence interval of the other.

The third important aspect covered by the percentile bands is the dispersion of the results, i.e. the distance between better and worse test scores. The lighter parts of the bands represent the scores for 25–50% and 50–75% of a group. This range includes the scores of those 50% of the trainees who are grouped around the mean. The darker parts include the cases that constitute the lower (10–25%) and upper ends (75–90%) of the scale. The best and the worst 10% of the test scores are not included in order to avoid distortion by freak values. To summarise: The lighter parts of the percentile bands represent the range in which the middle-ranking 50% of the test scores are located. The band as a whole represents the scores of 80% of the participants. The best and the worst 10% of the test results are not represented.

In the PISA study it proved useful to translate competence differences between groups into approximate development phases (school years). A rule of thumb was formulated according to which differences of about 40 points are interpreted as a difference of one school year (PISA-KONSORTIUM DEUTSCHLAND 2005, 38). In the context of the COMET project it can be assumed that there is a difference of about 50 to 60 points between a novice and a top expert. This is equivalent to the amount of time required for a complete vocational education and training programme. According to the PISA rule of thumb, one training year thus has a value of about 15 points. This method is appropriate for benchmarking studies and is also used in the PISA publications (fig. 8).

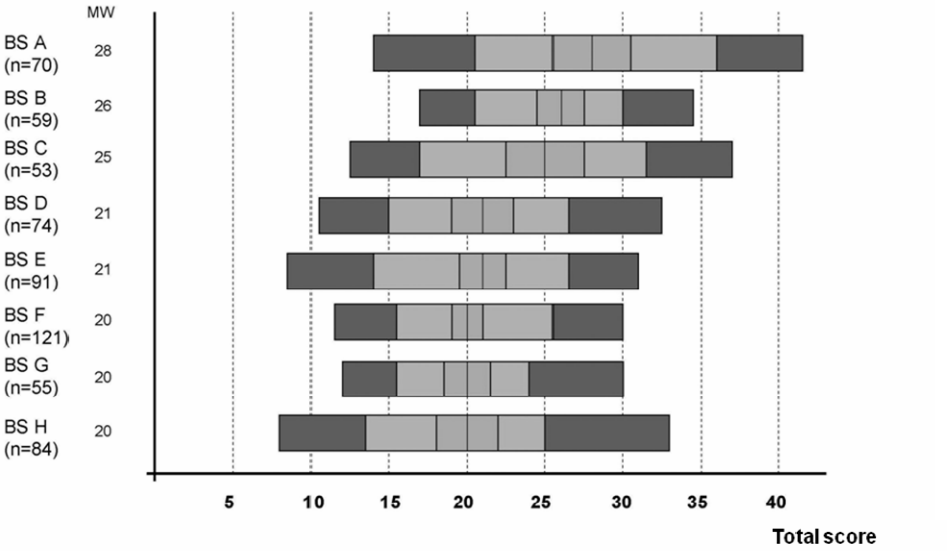

Fig. 8: Example of a comparative presentation of competence distributions ("MW" means "arithmetic mean")

4.3 The scales' pre-test

Implementation of the COMET competence and measuring model as well as of the test tasks

To use the open test tasks of the COMET test procedure, one has to meet various requirements.

- First, one has to secure the tasks' content validity. Are the tasks developed in Germany applicable on South Africa's reality?
- Secondly, the tasks' solutions have to be evaluated using the rating scale's items. This requires a high degree of understanding of the tasks by the experts doing the rating. It is necessary that the raters show a high degree of concordance in their rating. This is secured by the rater training. Another effect of this training is to enable teachers and trainers via their deepened understanding of test tasks to develop similar tasks as learning tasks for teaching projects.
- To assess whether the standards of reliability obtained at the rater training are met at the rating procedure itself, too, some solutions were not only rated by two, but by all raters.
- Finally, the context questionnaire had to be pretested. The scales for vocational identity, organisational commitment, and occupational commitment had to be analysed psychometrically to make sure, that the items form a scale in the South African context as well.

Pretest of scales on occupational and organisational commitment, work ethics, and vocational identity

An important precondition for the development of occupational competence is a student's development from novice to expert. Only by developing vocational identity, one can take over the role of an expert, and put into use adequately the knowledge and skills acquired during training. As a consequence, the COMET project attempts to measure this part of competence development as well. This requires additional instruments apart from the test tasks.

As the project aims at large scale surveys, the adequate form to survey vocational identity is via questionnaires. To this end, the project developed four different scales. The scales cover vocational identity, occupational and organisational commitment, and work ethics.

Occupational and organisational commitment are seen as sources to develop motivation and thus vocational identity. Another source of motivation was widespread in tayloristic work environments: a work ethics that does neither refer to the organisational environment nor to the contents of work, but relies on an abstract sense of duty.

For the COMET project, commitment is not in the first place relevant as a predictor of work performance, which is the predominant view in the research literature. This would be difficult already because commitment is conceptualised as a disposition of employees in favour of their job and/or their company that has consolidated over time and that is strong enough for reliable tests only after some years. In addition, the construct of organisational commitment usually includes the tendency to continue employment with the enterprise. These two facts make it difficult to apply the commitment approach to trainees when commitment is to be interpreted as a reliable predictor of work performance. Instead, commitment is relevant in connection with the development of professional identity when the assessment of professional competence is at stake. The *normative areas* to which commitment refers are decisive. Occupational commitment is defined as orientation towards the job and is distinguished from organisational commitment as orientation towards the enterprise and work ethic as the general motivation to work. Professional identity, on the other hand, denotes a combination of attitudes corresponding to the development from novice to skilled worker in the course of the training process, e.g. quality awareness or self-initiative. These scales offer a sufficiently selective instrument for the monitoring of competence acquisition during a vocational training programme, provided that they are related not only to the professional competence of trainees, but also to the organisation of the training process in the company and the vocational school.

The COMET project investigates organisational and occupational commitment with the help of established scales that were modified so as to be applicable to the attitudes of trainees. For the measurement of professional identity a new scale was derived from theory. The scales and other survey instruments were tested in two pretests for their reliability and practical applicability in the COMET project Germany.

In order to assess commitment and professional identity, four different scales were developed. These were tested first at vocational schools in Hessen and then in a second pretest in Bremerhaven with 1640 trainees from more than 50 occupations.

The scales' pretest

The various COMET projects have to meet the challenge of 'translating' the four scales into different contexts. This does not only hold for language differences, but even more so for different VET systems. These systems enable and constrain different attitudes towards work and occupation. Therefore, it is necessary to test if the scales still 'work' in different environments, i.e. if the student's answers to the scales' items form a coherent pattern. In case of this pattern not emerging, one has to rely on the different items without the possibility of converting them into a scale or to slightly change the scale. To allow for the latter measure, additional items were added to each of the four constructs.

Before analysing the scales' psychometric properties, one has to check the data base itself. A total of 51 questionnaires were filled in by students of ArcelorMittal (27) and VW South Africa (24). 41 students were male, 10 female. The students' age ranges from 19 to 34, with a mean of 24,3 years. Only 7 students provided their year of training, so it is impossible to analyse the data according to this variable.

After constructing the scales that in the next parts are analysed according to their psychometric properties, scales and items first were analysed in view of detecting irregularities. This is done because one does not want a sub group of the pre-test with unique answers being able to determine the overall results. Most of this analysis was unremarkable, though some of the results may lead to further investigation (see last chapter). Still, there is one astonishing difference: organisational commitment according to training institution.

If one looks at the students' occupational commitment according to training institution, one easily sees that there are no significant differences (fig. 9). The medians are similar, as are the whole boxes.

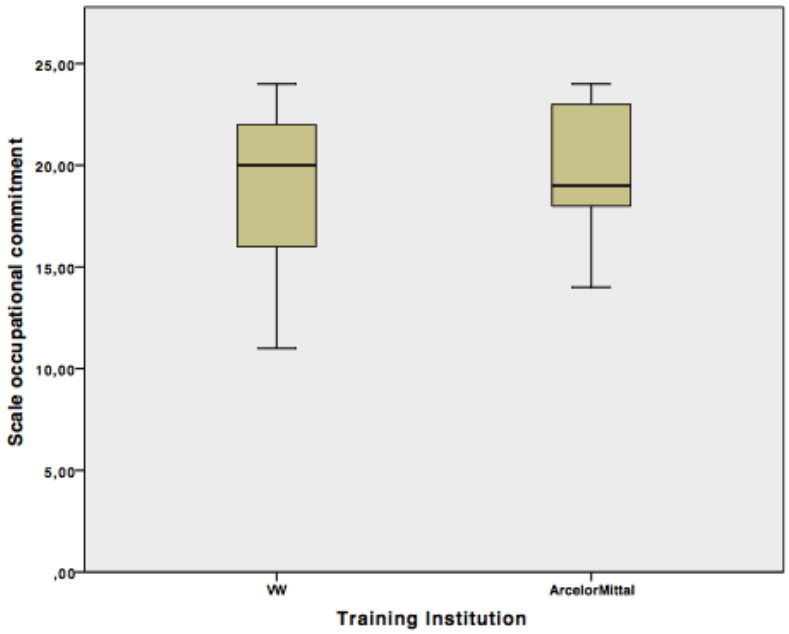

Fig. 9: Occupational commitment according to training institution. The black line in the boxes represents the median, the boxes themselves the interquartile range of 50% of values around the median (i.e. from 25% to 75%), the whiskers representing the data inside 1,5x the interquartile range

This pattern changes dramatically if one analyses the organisational commitment according to training institution (fig. 10).

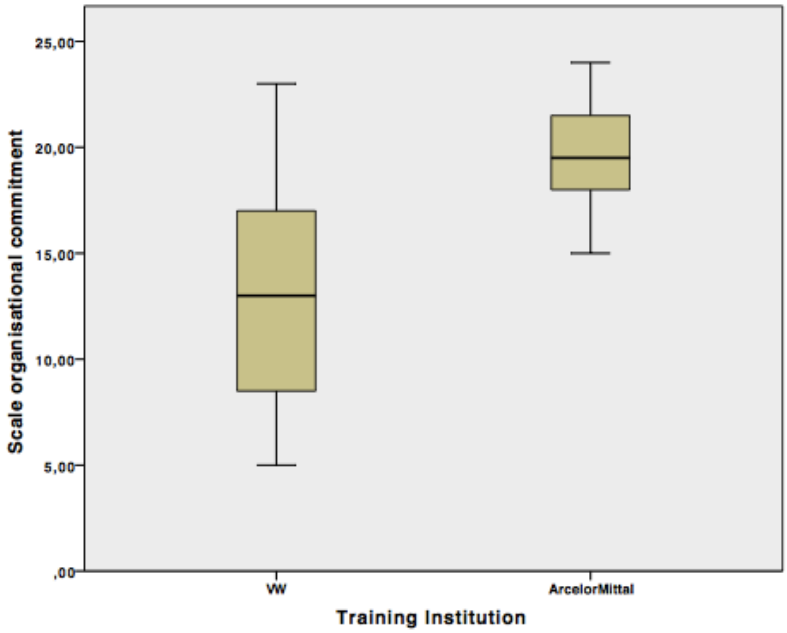

Fig. 10: Organisational commitment according to training institution

Here, one observes a clear difference between the two groups, ArcelorMittal students scoring clearly higher than VW students. The difference in between the two means of 13,2 and 19,6 is strongly significant. For the purpose of analysing the scales' psychometric properties, this means to analyse if one of the two different groups is influencing the scales' coherence and/or discriminatory power (for the COMET research, obviously it is interesting to find out the reason of these differences, too. But this is a task for the main survey).

As each of the groups comprises in roughly 25 students, some group specific analysis becomes difficult. From our calculations, it looks like that the different groups did not have any severe effect on the scales' psychometric properties. Still, the following analyses contain a grain of salt and will have to be validated in the main survey.

Organisational commitment

The original scale contains 6 items (table 9):

I feel at home at the company.

I like to tell others about my company.

I do not feel very attached to my company (reverse scaled).

I want to continue working for my training company - even if I have the opportunity to work for another company.

My company suits me.

I care about my company's future.

Tab. 9: Items Organisational Commitment

To analyse the items' coherence, one popular measure is Cronbach's alpha. In this case, it has the value of 0,882 which is exceptionally high (values over 0,8 generally are considered 'good', values over 0,7 can be acceptable). So the responses to the six items form a common pattern.

Additionally, one has to test if the scale is one-dimensional, i.e. if the underlying pattern can be traced back to one common factor influencing the answers (this factor, then, one can consequently name 'organisational commitment'). To test this, a factor analysis was carried out.

As the screeplot in fig. 11 shows, to extract only one factor is the adequate procedure in this case (only one factor has got an 'eigenvalue' higher than 1.

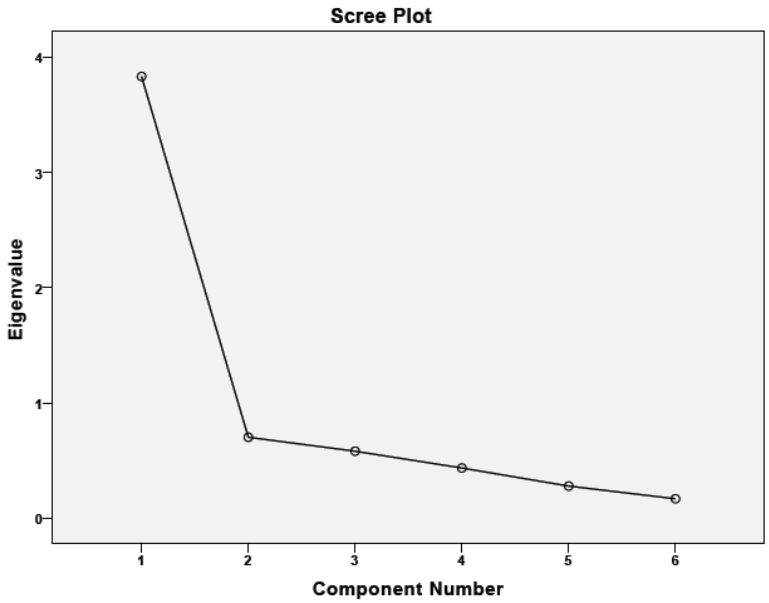

Fig. 11: Screeplot scale 'organisational commitment'

This factor counts for 64% of the variations in the pattern, i.e. 64% of the variation in answers to the different items can be traced back to this common factor. All in all, one can conclude, that the translated original scale 'organisational commitment' is coherent and suitable for use in COMET South Africa.

Occupational commitment

The original scale to occupational commitment consists in the following 6 items (table 10):

I live, eat, and breathe my job.
I am suited to my profession.
I want to continue working in my profession after training.
I am proud of my profession.
I am not this interested in my profession (reverse scaled).
I feel at 'home' in my profession.

Tab. 10: Items Occupational Commitment

Cronbach's alpha for this scale has a value of 0,813, which means that the items are coherent enough to form a scale. As fig. 12 shows, the construct is one-dimensional as well, one factor accounting for 56,4% of variance.

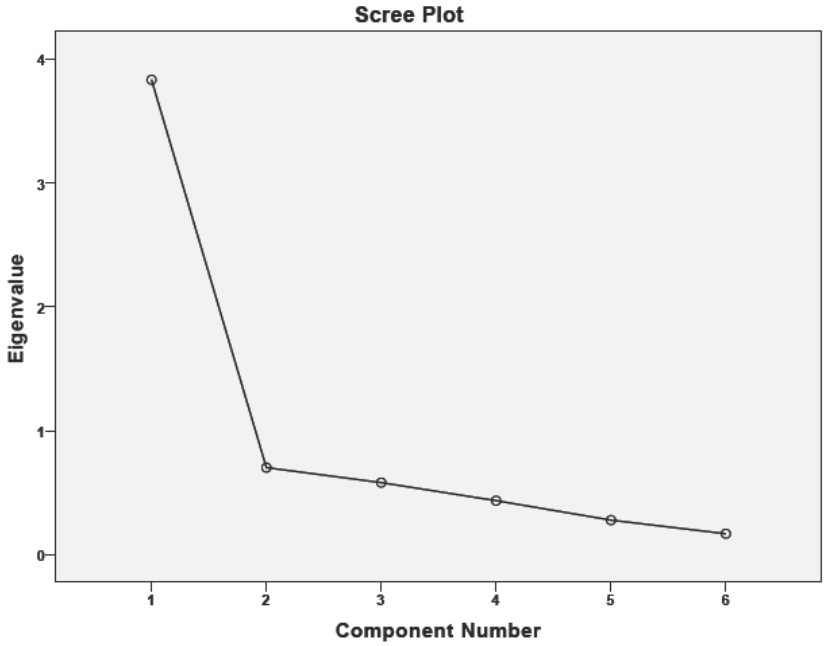

Fig. 12: Screeplot scale 'occupational commitment'

As the scale on organisational commitment, the translated original scale on occupational commitment can successfully be used for the COMET South Africa project.

Work ethics (working morale)

This scale only contains three items that all centre around an identification with work itself, regardless of its contents and meaning:

I am reliable, no matter what tasks I get.
I feel motivated no matter what my work tasks are.
I am always on time, no matter if required by the work or not.

Tab. 11: Items Work Ethics

Cronbach's alpha for this scale is 0,582. This value is acceptable for such a short scale, as Cronbach's alpha becomes bigger the longer the scale gets. If one calculates the alpha value that would emerge if this scale was extended to six items, one gets 0,754, a value that is acceptable for a scale. As it is obvious that a scale of three items is one-dimensional, a screeplot is not listed here. All in all, the translated scale on work ethics, too, can be used for COMET South Africa.

Already for designing the initial scale it was interesting to see to what extent these items form a pattern together with other items of 'classical' work ethics scales, e.g. the 'Protestant Work Ethic

Scale' or 'Arbeitsmoral' (JAEGER 1989). This would mean a correlation with items describing a general positive attitude towards work regardless of its content (e.g. "Hard work makes one a better person", "Wasting time is as bad as wasting money") and/or items that designate a more authoritarian character that does rely on carrying out orders by authorities (e.g. "I follow the instructions of my superiors without further discussion - even if they do not make sense to me"). As in the German COMET projects, this assumption did not hold - for the participants in this pretest, punctuality, reliability, and motivation are values that are not separated from identification with the occupation and the company.

Vocational identity

Given that vocational identity always refers to an occupation, it was impossible to develop a scale that would be based on hypotheses on the occupation-specific content of this identity. This would also have undermined the comparability of professional identity as a dimension of professional competence in general. Instead the scale refers to those dispositions that correspond to the advancement from novice to expert and that lead to professional aptitude. To this end three aspects were identified: the interest in the connection of one's own activities with the professional or organisational context (orientation), the interest in participating in the shaping of work and technology (shaping) and the interest in a highly proficient exercise of one's own work (quality).

This scale, too, consists of six items, two items each covering one of the aspects mentioned above:

I am interested in how my work contributes to the overall company's work flow.
I know what the tasks I carry out have to do with my profession.
I would like to have the same responsibility as the skilled workers.
I want to have a say on my work content.
In my view professionalism means to deliver quality.
I sometimes think about ways how to improve my work or its quality.

Tab. 12: Items vocational identity

For this scale, the value of Cronbach's alpha remains at 0,675, a value slightly lower than necessary for combining the items into a scale. A factor analysis reveals that for the participants, the three aspects of developing vocational identity do not form a whole. The items on 'orientation' are unrelated to the ones on 'quality' and 'shaping'. This means that the South African students that took part in this pretest do not relate having an overview on the work process towards the idea of being able to shape the work context and to deliver quality. The latter aspects, though, form a common pattern. In the main study, we will have to analyse if this result holds and if - together with the test results and the context data - we will be able to draw conclusions on aspects of South African VET that enable or constrain the development of vocational identity. If it will not be possible to form a scale on vocational identity, one may pragmatically either (depending on the results of the first test) use two scales or the items as they are.

Organisational and occupational commitment

In addition to test the scales on internal coherence and one-dimensionality, it is important to evaluate weather they are independent or overlapping, i.e. the scales measuring partly the same construct. In a first step, the relation of occupational and organisational commitment was analysed. To this end, one first has to look to what extent the two scales are related. In this case, a significant correlation coefficient of 0,297 was obtained, showing a light to medium relation between the two scales (fig. 13).

Fig. 13: Scatterplot of scales 'occupational commitment' and 'organisational commitment'

This figure shows the same pattern as in the German studies: there is some relation between organisational and occupational commitment (one may argue that it consists of a general factor of students' motivation). But this relation is quite small. Thus, it can be argued that the two scales really measure constructs that are quite different in the students' minds.

To deeper scrutinise this relation, another factor analysis was carried out, this time containing the items on both of the respective scales. According to the results of the screeplot and the eigenvalues, this time two factors were extracted. Fig. 14 shows how the items group together after an oblique rotation (an oblique rotation of factors is the choice if factors are correlated).

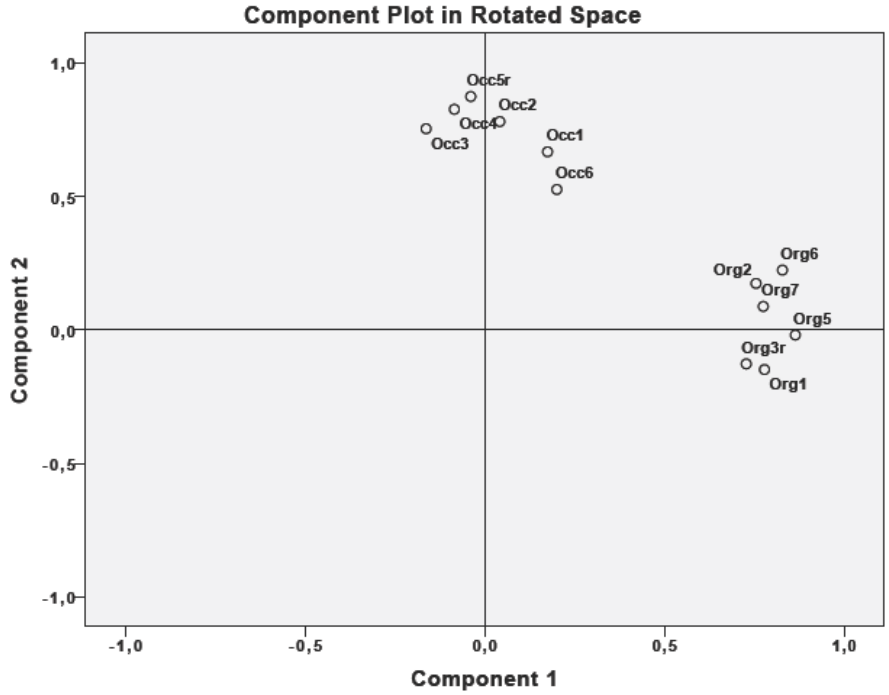

Fig. 14: Component diagram of the two factors explaining the relation of items on organisational and occupational commitment (extraction: main components; rotation: oblimin).

This figure shows that the different items on organisational commitment (org 1–6) and the ones on occupational commitment (occ 1–6) are grouped together on different dimensions. This means, that the two scales indeed relate to different constructs. The scales are not only coherent and one-dimensional, but have a strong discriminatory power as well. If the figures of the main survey do not differ extremely from this result, the scales can successfully be used in the COMET project South Africa.

Further results

Although the pretest was rather small, some interesting results appeared during the analysis.

First, there are the differences in between Volkswagen and ArcelorMittal students regarding organisational commitment. It is possible that these differences partly are due to different circumstances of the survey, like trainers being in the same room etc.

There was no significant relation between age and occupational commitment. Older students do not identify themselves stronger with their occupation. Regarding organisational commitment, one even notices a weak but significant negative correlation. Older students are slightly less committed to the training company than younger ones. The same pattern emerges when analysing according to gender: women have a stronger organisational commitment than men. Both effects are stable - they persist when being controlled for other variables influencing the commitment, i.e. training company, age, and gender. These effects may have to do with general motivation or recruiting policies and other personal variables that form part of the main survey.

4.4 Rater training and inter-rater reliability

Rater training in the COMET project South Africa

The first rater training following the first COMET test in South Africa was held at the merSETA in Johannesburg on October, 26th to 27th 2011 (see app. 1). The training was organised for 14 South African raters representing the following test institutions

- Arcelor Mittal
  Participants: Flikkers Ferreira, Bertie Ferreira and Johan Riekert)
- VW Training Academy
  (Participants: Rian Swanepoel, Nkosiathi Clay, Leon Meintjes, Hennie Lots and Gerald Hooper)
- Fundi Training Centre
  (Participants: Goodman Sokhela and Desmond Uithaler)
- Sedibeng College
  Victor Kolisang, Bernard Motlung and Johan van Rooyen)
- East Cape Midlands College
  (Participant: Petrus Barnard)

The rater training followed the structure of the training which has been provided for all other international COMET projects. For the workshop a relevant manual was translated and handed out to the participants beforehand. The manual included

- the four test assignments as well as the descriptions of the solution spaces;
- two examples of students' solutions for each of the four assignments, which had also been used for the training of raters in Germany and China; and
- the list of items for the rating of the solutions (rating scale).

The translation of the test assignments, the solution spaces and exemplary solutions was unproblematic because the test assignments are derived from professional work tasks that represent international standards of professional practice. Cultural differences do not play a considerable role in this domain of technology and professional work.

Inter-rater reliability

TASK	SA Day 1	SA Day 1	SA Day 2	SA Day 2		Comparison: China 2010
	Finn unjust					
Signals 2	.70					.54
Drying area 1		.84				.84
Skylight control 1			.84			.82
Pebble treatment 1				.89		.85

Tab. 13: Finn $_{(just)}$-coefficients of rating the different test tasks

The South African rater training has proved very successful in terms of securing a very high level of inter-rater reliability -also compared to results from similar rater trainings for example in China. As it can been seen from table 2, Finn coeffients (representing the degree of correspondence in the rating) calculated after the end of the training seminar in Johannesburg have reached scores higher than in China. Already in the second round of ratings, the score of the inter-rater coefficient increased remarkably form .70 to .84. reaching .89 in the last round of rating.

5 The main test's results including an analysis of vocational identity and occupational commitment

5.1 The test participants

Response rate, age structure and previous schooling of students

Test Takers in Total	COMET Test including context questionnaires (VI)	COMET Test only	Context Questionnaire (VI) only
445	90 (!)	300	2,3

Tab. 14a: Response rate

445 learners took part in COMET South Africa, 300 of them were test takers who received a COMET test task as well as the context questionnaire (VI). Still, only some 90 test takers filled in the context questionnaire as well (see table 14 a). This leaves some error margins for some of the calculations done below. Wherever possible, it was checked whether the data patterns hold for the part of the population that gave no response. When there were some significant differences, this is indicated in the text.

80% of the learners and test takers were male, 20% female. They came from 6 different training institutions. Roughly 42% learned a Arcelor Mittal Steel, 1% at Eastcape Midland Colleage. 12% at Fundi Training Centre, 10% at Sedibeng College, 17% at Vaal University, and 17% at Volkswagen (tab. 14).

Training Institution	number	average age	average year of training	male/female ratio
Arcelor	127	24,3	2,3	89/11
Eastcape M.C.	4		2	100/0
Fundi	36	26,5	1,6	83/17
Sedibeng	31	22,4	3	65/35
Vaal	51	23,2	2,6	92/8
VW	51	26,4	3	74/26
Total	300	24,5	2,4	84/16

Tab. 14b: Test participants according to training institution, age, year of training and sex

The participants' age differs only slightly in between the training institutions and at the time of the test the average age is around 24,5 years, the age range being between 20 and 40 years. At Sedibeng College and Vaal University, the average age is slightly lower, at Fundi Training Center and Volkswagen slightly higher.

Almost all participants that provided information (228) were in the second or third year of training, the exception being Fundi Training Center, where more than 60% of the participants

were in the first year. At Arcelor Mittal Steel, 73% were in the second, 27% in the third year of training. At Fundi, 61% in the first, 22% in the second, and 17% in the third year. At Sedibeng and Volkswagen, all participants third year. At Vaal University, 43% were second year and 57% third year.

Many more males than females study electro-technology trades. The ratio between males and females is 84 to 16%. In between the training institutions, there are slight differences, notably Sedibeng College and Volkswagen having a higher female percentage.

89 students provided information on their prior entry qualifications into VET. As many of them did not take part in the test, no clear relation could be found between these and the test scores.3

For the overwhelming majority of the students, their profession is something they always wanted to learn. A bit more than 20% of the students claim that they originally intended to learn a different profession. This is a much lower value than for German apprentices, where 45% (crafts) respective 22% (industry) claim they originally intended to learn a different profession.

The commitment to the training institutions/companies is very high. More than 90% claim that it was important for them to do the training at this specific institution or company. This holds for the test-takers as well as for all respondents.

For more than 60% of the respondents, the FET provides all training that is not carried out at the work place. For 40%, the FET provides only the fundamentals (maths, English), the rest is either done in-house (20%) or by an external provider (20%). No significant differences in test results were obtained according to the FET's role in training.

5.2 High motivation, but relatively low scores

The test takers were highly motivated and interested in the test tasks. Still, the results are often below the level of functional competence. Processual and holistic shaping competence have only rarely been reached. On the other hand, the South African learners were very motivated to take the test and are very committed to their learning in general, as well. This points at some unused potential in the training organisation.

Of the 300 test takers, 118 only reached a total score of less than 5 points. As explained above, we do not analyse these cases as they show a lack of understanding of the open test tasks that inhibits the display of competences. Still, in the analyse of different training institutions these are shown to give a full picture of the situation. Of the remaining 182, 1,6% reached the level of holistic shaping competence, 1,1% the level of processual competence, 37,9% the level of functional competence, and 59,3% are at the level of mere nominal competence (fig. 15) The

3 As many test takers did not fill in the context questionnaire and/or scored less than 5 points and many respondents to the questionnaire did not take the test, interpretation of data often becomes quite difficult. Normally, we calculated relations between context and test scores threefold, checking if the group taking part in both actions is representative for the whole group of test takers as well as for the group of questionnaire respondents. Fortunately, this mostly was the case. If there are significant differences between the group analysed and the larger group of test takers/questionnaire respondents in this report, this is explicitly marked.

COMET-China project saw a similar distribution, the risk group there being 70%.

Overall, competence levels as well as total test scores are unrelated to the age and sex of participants.

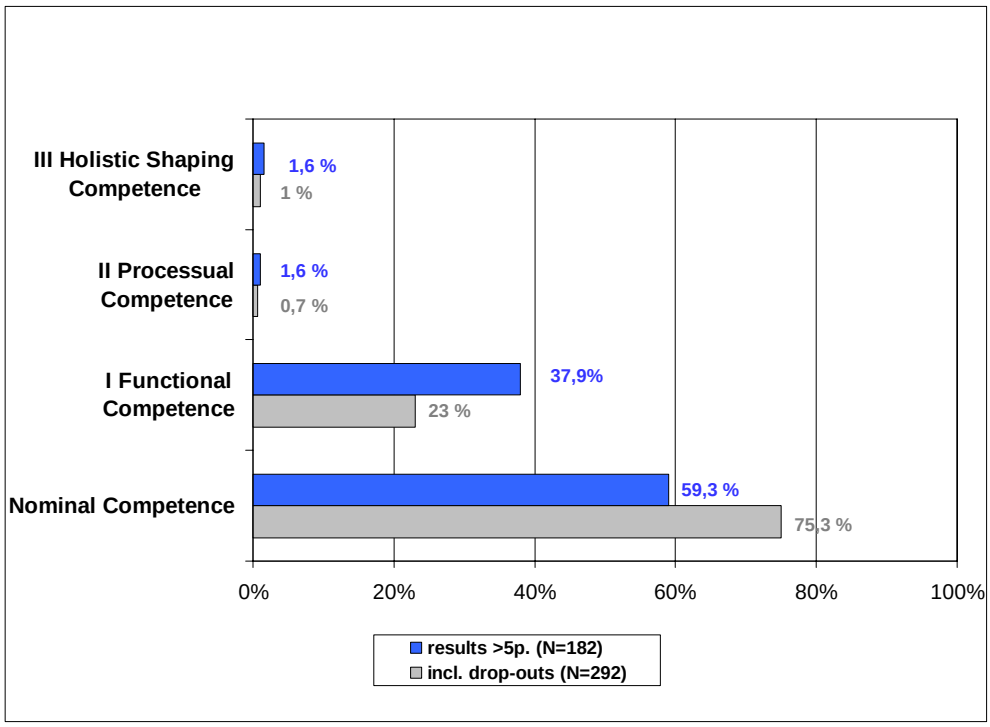

Fig. 15: Competence levels of all test takers and of total scores >5

In an international comparison with China (scholars of Chinese VET schools) and German apprentices (electronic technicians – crafts, Bremen), South African learners reach a significantly higher competence level than the Chinese (fig. 16). Even though the proportion of risk group apprentices (achieving only nominal competence) is very high (59,3%), this share is still lower than that of the Chinese reference group (70%). Such high proportions of risk-group apprentices are an indicator for a predictive probability that - in this context - also a huge number of them will not be able to achieve the required competence level of a skilled worker according to international standards.

However, for this comparison it has to be considered, that among the South African (as well as the Chinese) test persons there was a huge number of „drop out"-candidates, i.e. test persons, who did not get to terms with their test tasks and could therefore not be considered for the evaluation. If these drop-outs would be added to the risk group of apprentices, the dispersion of competence levels would change considerably (fig. 15).

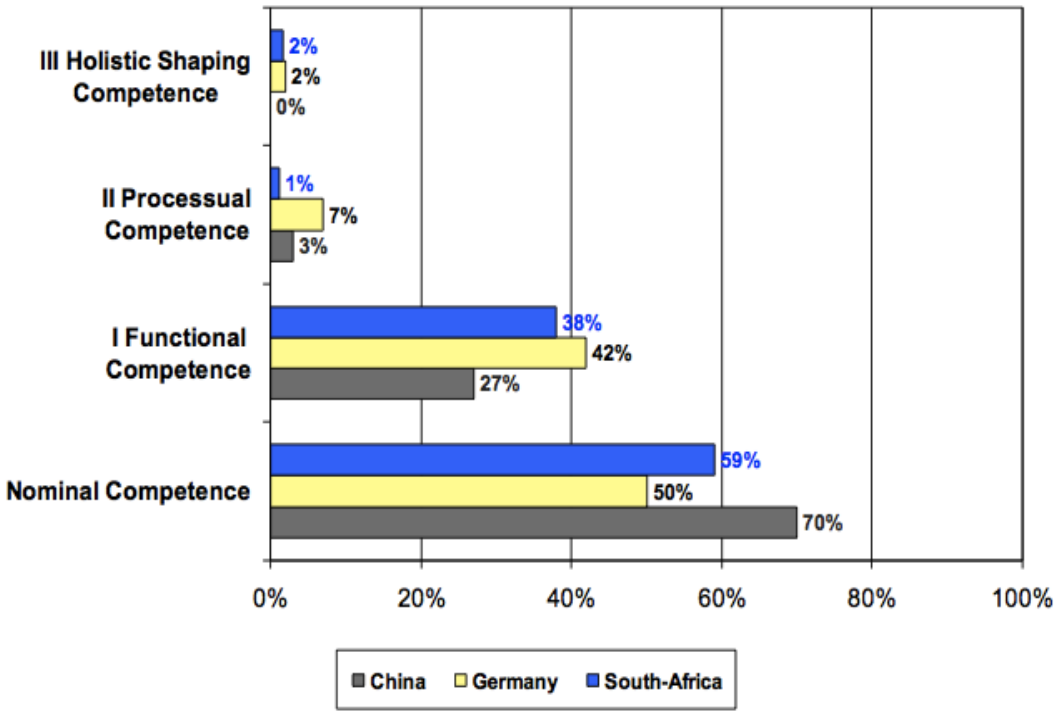

Fig. 16: Competence levels in China, Germany, and South Africa

This result is not due to test motivation. The test takers were highly motivated and an overwhelming majority found the task interesting and useful (fig. 17–19). For almost 70%, the test task was closely related to their occupation, too (fig. 20).

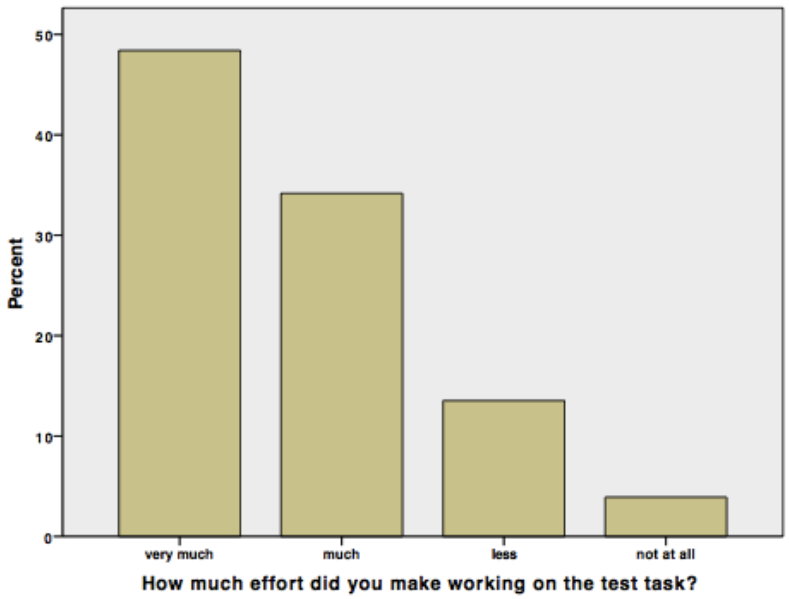

Fig. 17: Responses to 'How much effort die you make working on the test task?'; N=281

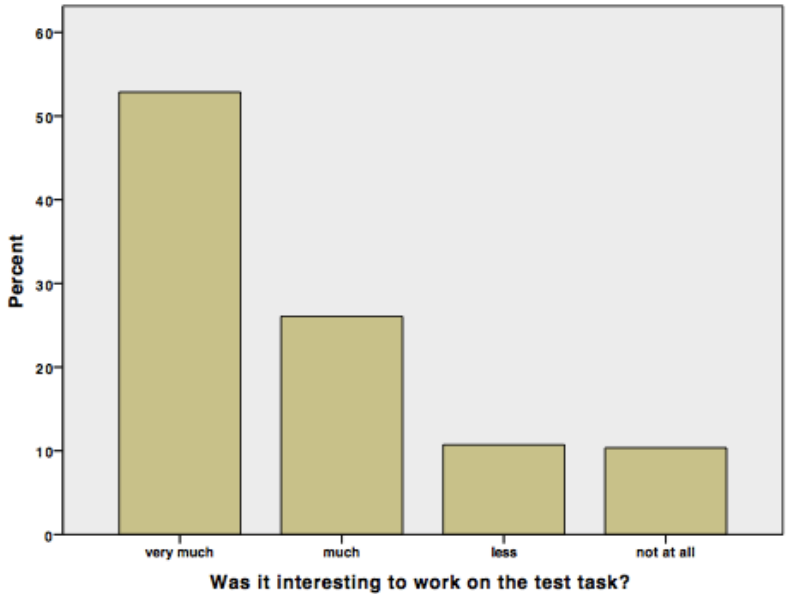

Fig. 18: Responses to 'Was it interesting to work on the test task?'; N=280

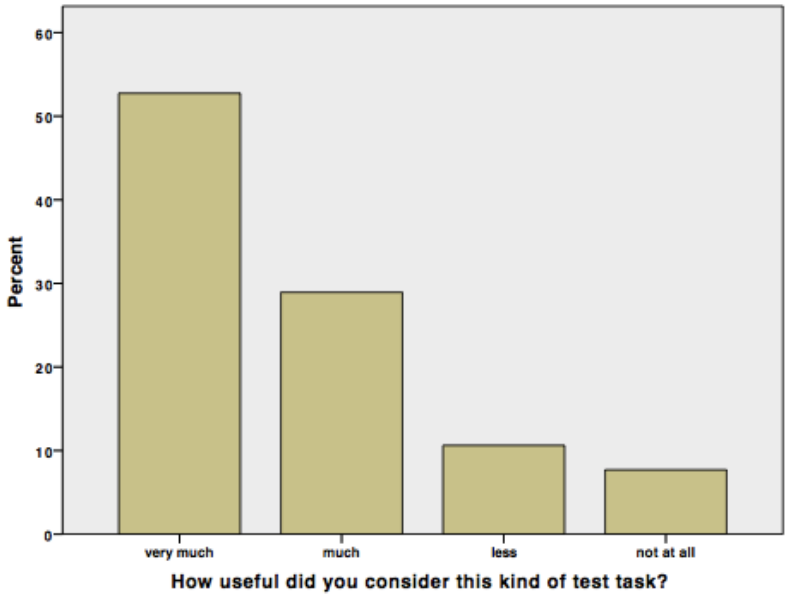

Fig. 19: Responses to 'How useful did you consider this kind this kind of test task?'; N=273

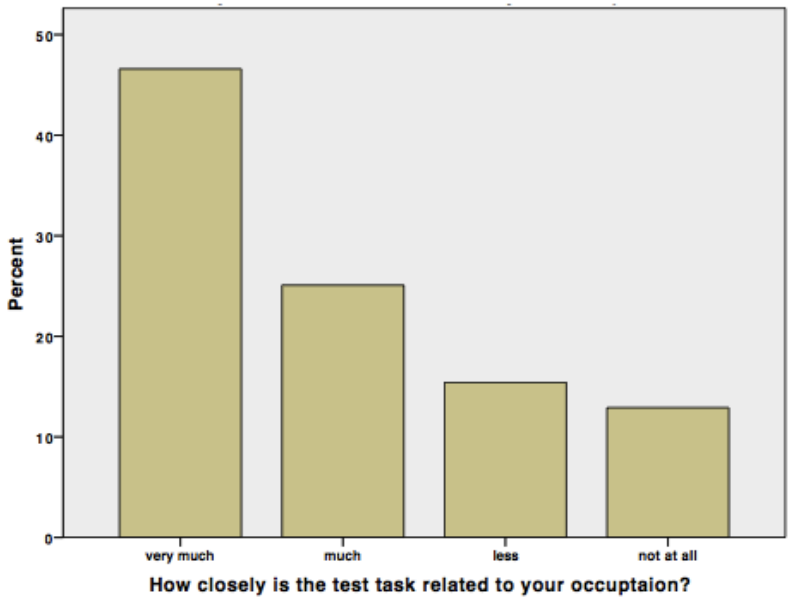

Fig.20: Responses to 'How closely is the test task related to your occupation?'; N=279

Not only the South African learners' test motivation was extremely high; they show a lot of commitment to their training in general, as well. On all items regarding organisational and occupational commitment, South African learners score very high. This commitment is a strong resource to engage in learning in order to become an expert in one's field.

Regarding organisational commitment, two items (fig. 21 and 22) represents the learners' continuance commitment to their training company, while figure 23 relates to a general emotional attachment. Acceptance for all these statements is extremely high, even higher than for Chinese 3rd year students and much higher than for German apprentices.

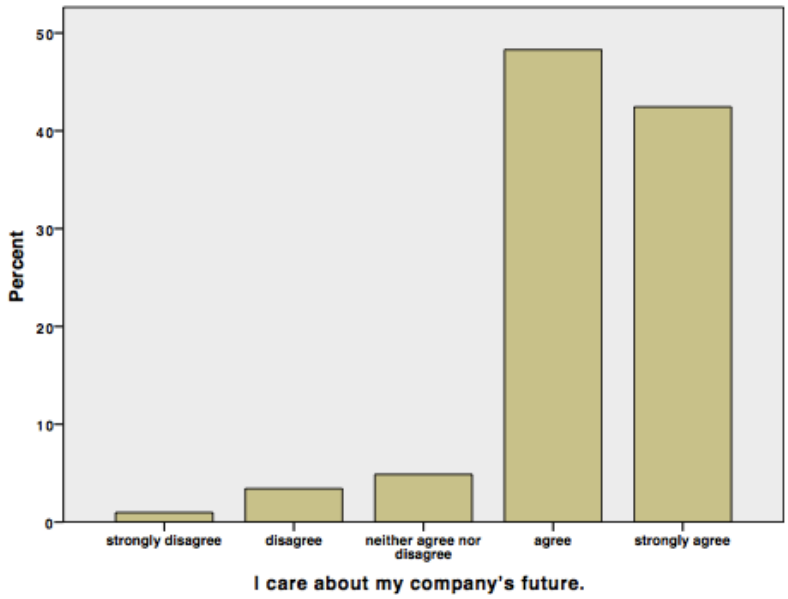

Fig. 21: Responses to 'I care about my company's future'; N=205, mean=4.28

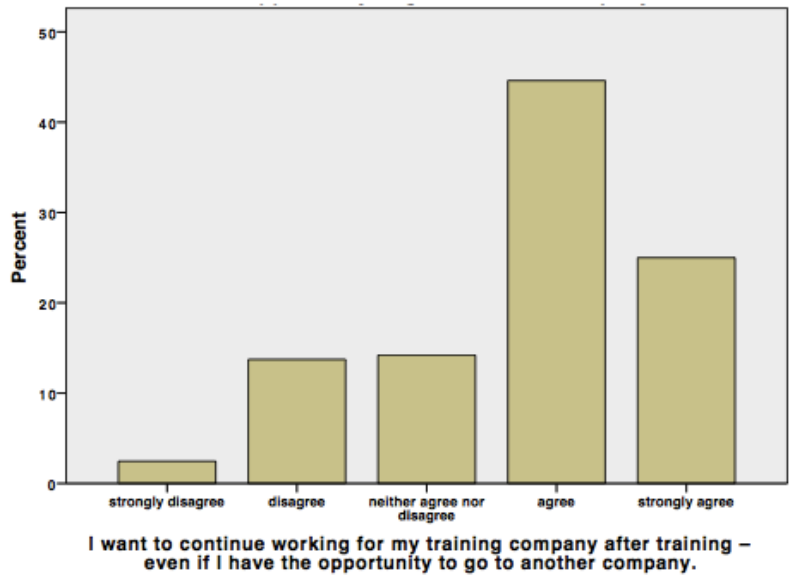

Fig. 22: Responses to 'I want to continue working for my training company after training - even if I have the opportunity to go to another company'; N=204, mean=3.76

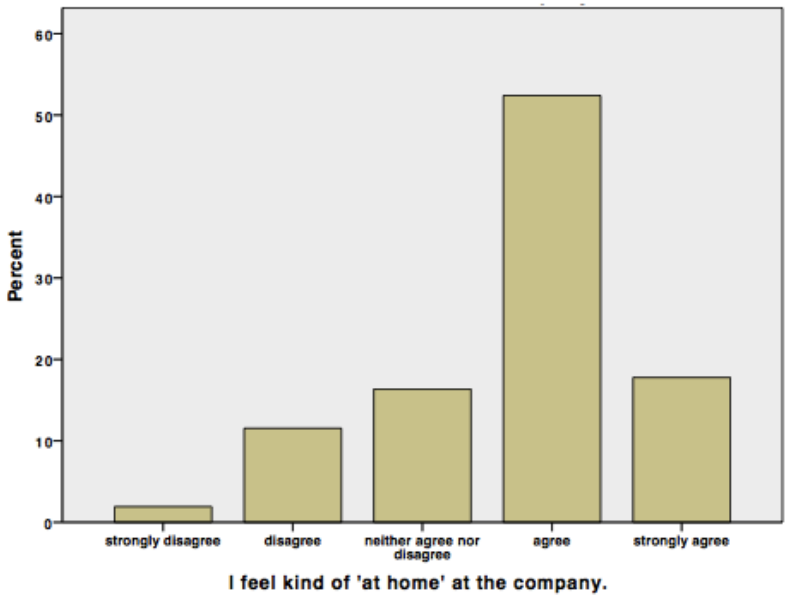

Fig. 23: Responses to 'I feel kind of 'home' at the company'; N=208, mean=3.73

Figures 24 and 25 relate to the learners' motivation in developing a vocational identity. Interest in acquiring work process knowledge (fig. 24) is very high, as is striving for quality (fig. 25). Again, values are higher than in China and Germany.

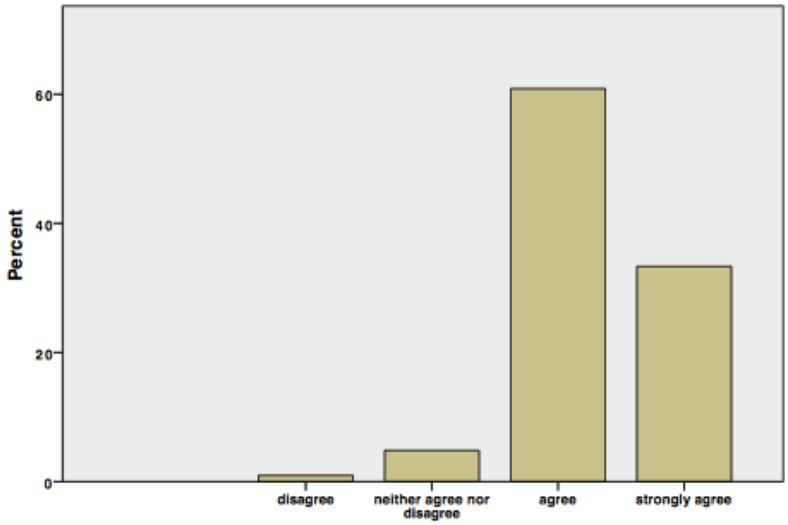

Fig. 24: Responses to 'I am interested in how my work contributes to the company's overall work flow'; N=207, mean=4.27

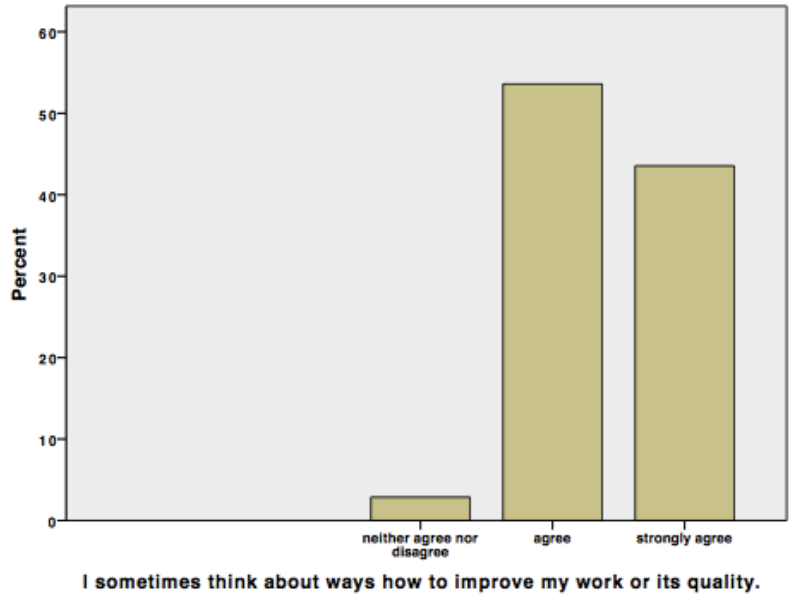

Fig. 25: N=209, mean=4.41

Regarding occupational commitment, one indicator is the intention to continue in the chosen career (fig. 26). Here as well, figures for South African learners are even higher than for German apprentices. And much higher than for Chinese learners of whose almost the half considers a change in their vocational career.

Fig. 26: Responses to 'I want to continue working in my profession after training'; N=211, mean=4.43

One reason for this contradiction between high motivation and relatively poor results may be the difficulty of the test tasks. All COMET tasks are aimed at the same point of development from novice to expert - tasks that a learner should be able to carry out after at least two years of training.

But the occupational field electro technology comprises occupations of a relatively high standard of difficulty, as the results of an ongoing survey on the test tasks show (tab. 15).

Occupations	Test tasks standard of difficulty
Electricians	8,7
Industrial mechanics	7,8
Car-mechatronics	6,9

Tab. 15: The occupations' electrician, industrial mechanic, and car mechatronic's tasks standard of difficulty, measured in units from 1 to 10

An empirical analysis of different occupations' standard of difficulty showed, that the practitioners' estimation on different standards of difficulty is largely correct. Thus, test tasks in the field of electro technology show a high standard of difficulty (7 on a scale from 1 to 10). In comparison, the industrial mechanic, although showing a relatively high standard, too, is easier to acquire. The car mechatronic's tasks standard of difficulty is rated as 5.1. Of all three professions analysed in the COMET research network, this is the lowest standard of difficulty.

One may follow the hypothesis, that in South Africa, too, learners in the professions of metal and car technology will show a higher competence profile than electro technicians.

5.3 Risk group lower at in-company training

The part of learners that stay on the level of only nominal competence - the 'risk group' - is significantly lower where learners are trained within a company. Reflected work experience is one factor to acquire occupational competence. For the pilot study COMET South Africa, this result is backed by an analysis of the context questionnaire too. Learners at colleges and training centres do not distinguish between motivation related to organisation and occupation and development of vocational identity.

In general, there is no significant difference between the different training institutions in terms of competence level or overall total score (see appendix II for detailed results).

Still, one difference is the relatively lower portion of learners at the level of only nominal competence. For the PISA studies, the group of learners at nominal competence is considered the 'risk group' (see the competence models in chapter 3). For this group, according to PISA, it may be difficult to successfully complete vocational education. Thus, getting learners above this level becomes an important task for vocational education.

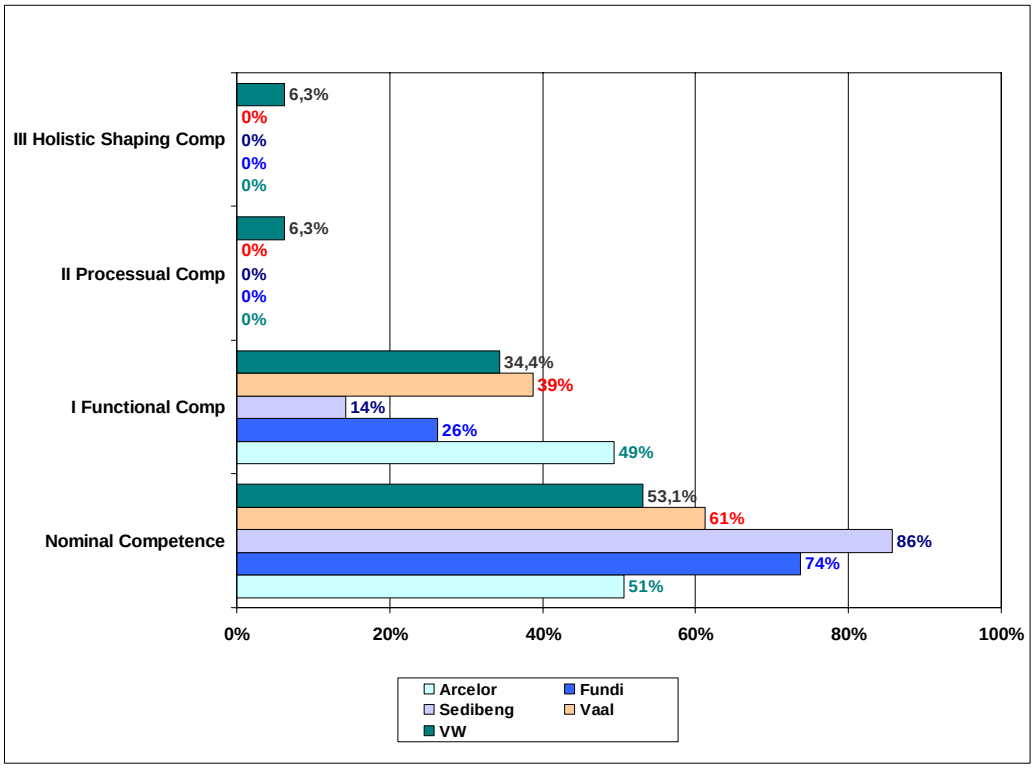

Fig. 27: Competence levels according to training institution

In general, COMET studies found that reflected work experience is one of the most important triggers for competence development. This pilot study only gives limited insights in the actual learning processes at college, training centre or company. And at first glance, the context of learning processes seems to be quite beneficial according to the learners.

Figures 28 and 29 show how the learners perceive an important aspect of the company's learning climate: mutual support as well as giving help and feed-back to learners. Both answers are clearly positive, the perceived learning climate being comparable to German companies (for fig. 29: even better) and much better than at Chinese companies.

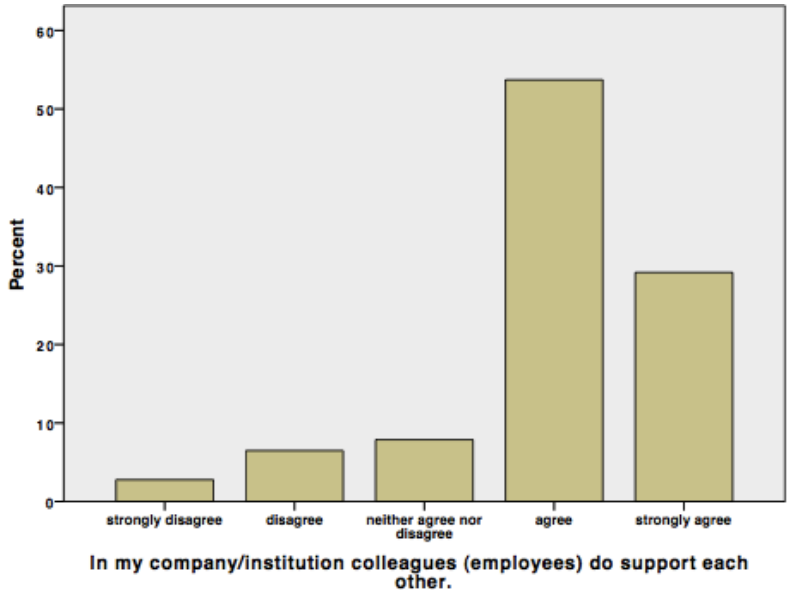

Fig. 28: Responses to 'in my company/institution, colleagues (employees) do support each other'; N=217, mean=3.98

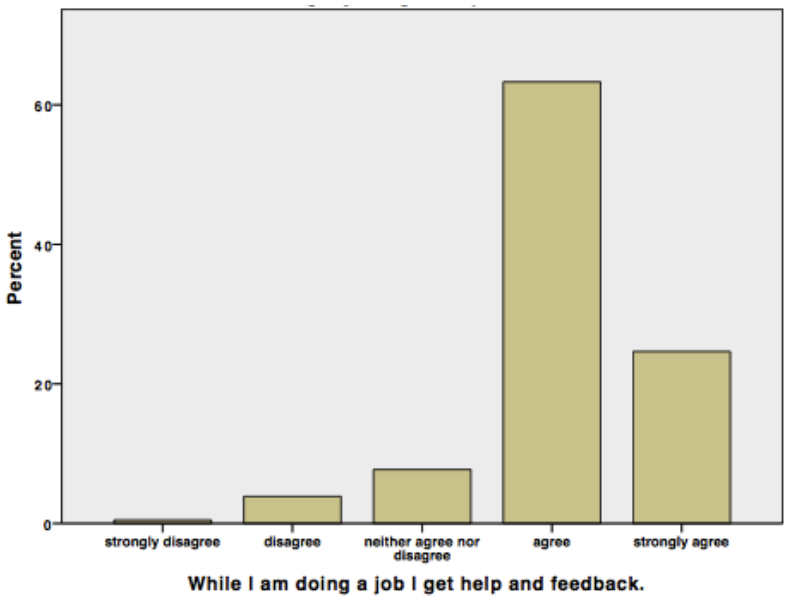

Fig. 29: Responses to 'while I am doing a job, I get help and feedback'; N=207, mean=4.08

Figure 30 is exemplary for the variety of work tasks at the company. As with all other items of this group, the learners perceive this variety as rather high, again quite close to the German pattern and much more pronounced than in China.

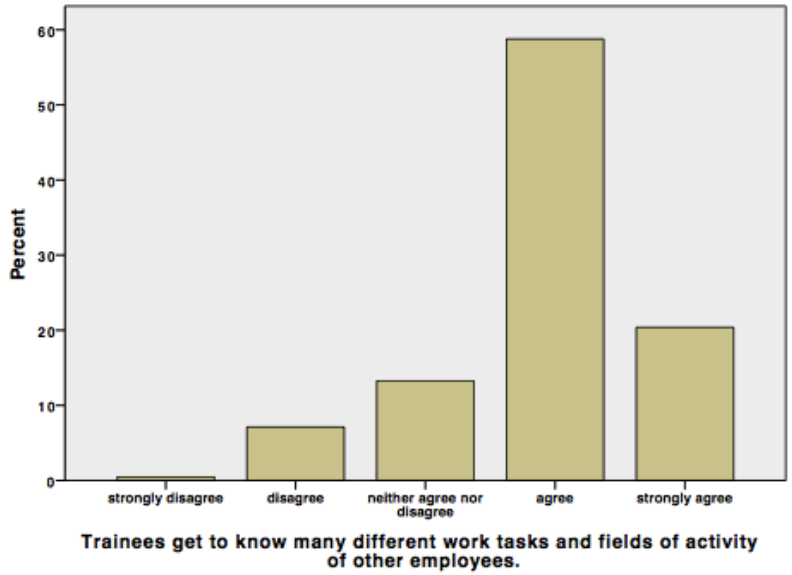

Fig. 30: Responses to 'trainees get to know many different work tasks and fields of activity of other employees'; N=211, mean=3.91

Regarding vocational school (a more detailed analyses see below) the learners agree that the company offers better learning opportunities. This figure is even higher than in China or Germany (fig. 31). Still, for the learners the vocational school plays an important role as well. Fig. 32 shows the learners' high estimation of the content acquired at school for their occupation. Again, this figure is higher than for Germany or China.

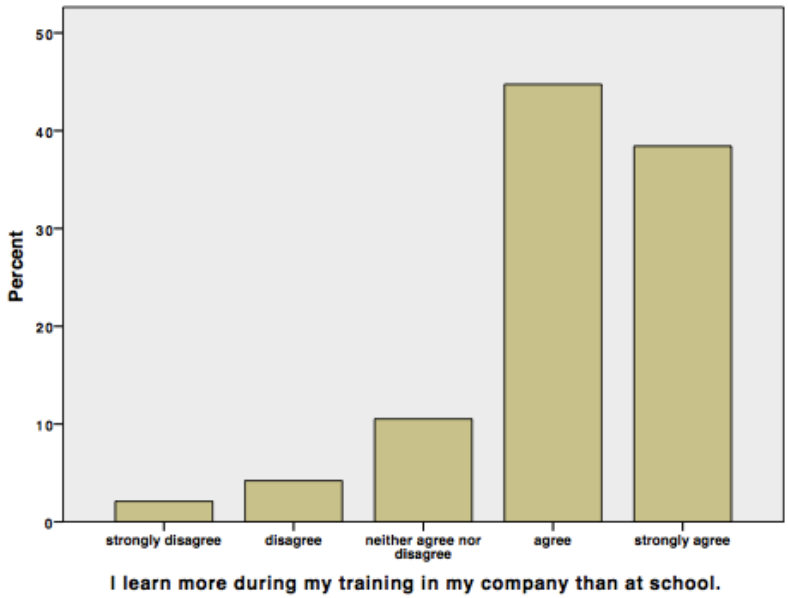

Fig. 31: Responses to 'I learn more during my training in my company than at school'; N=190, mean=4.13

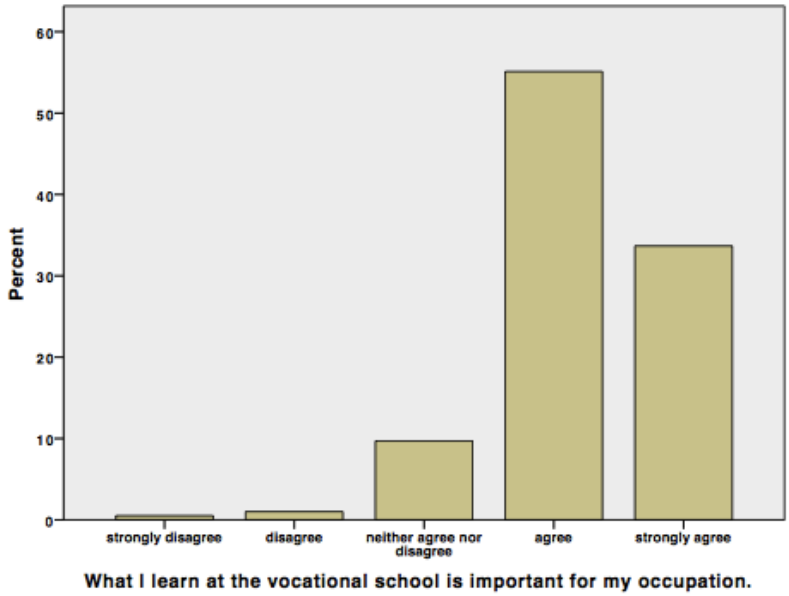

Fig. 32: Responses to 'what I learn at the vocational school is important for my occupation'; N=196, mean=4.2

Still, this is not the whole picture.

The analysis of context data had two restrictions. First, the relatively small group filling in the context questionnaire as well as taking the test task makes it difficult to relate context to test score. Secondly, patterns are difficult to detect because of the surprisingly 'high' scores of the context questions: for the majority of students, the context of learning at company as well as at school is pronouncedly positive, they are highly committed to their company as well as their profession, and develop a vocational identity.

In the light of the test results, one explanation for these answers would be that the learners are proud of themselves being able to learn and become a professional. This high estimation of what they are doing partially hinders an analysis of own and structural weaknesses.

This makes it almost impossible to find any meaningful patterns (e.g. forms of commitment or specificities of in-company learning according to sex, age, year of training or training institution) by descriptive depiction or correlations. Especially, the scales for commitment and vocational identity did not proof to have enough discriminative power against each other. So, along the lines of the pretest described in chapter 5.1, exploratory factor analyses were carried out (main components, varimax rotation) in order to see some reasons for this uniformity of answers. As it turned out, there are differences between learners from training centres and colleges (which were underrepresented at the pretest), and the learners from VW and Arcelor.

Figure 33 and 34 show the relation of the items on occupational and organisational commitment. For the training companies, it was possible to extract up to four different factors out of the twelve items - a clear sign for the two scales becoming blurred, i.e. for the learners at training centres and colleges, organisational and occupational commitment are almost undistinguishable. If one

extracts only two factors (fig. 33), only two items regarding occupational commitment are clearly separated from the others. The rest form a homogenous pattern.

For the learners at ArcelorMittal and Volkswagen (fig. 34), it was at least possible to extract two factors. Still, those factors did not replicate the original scales.

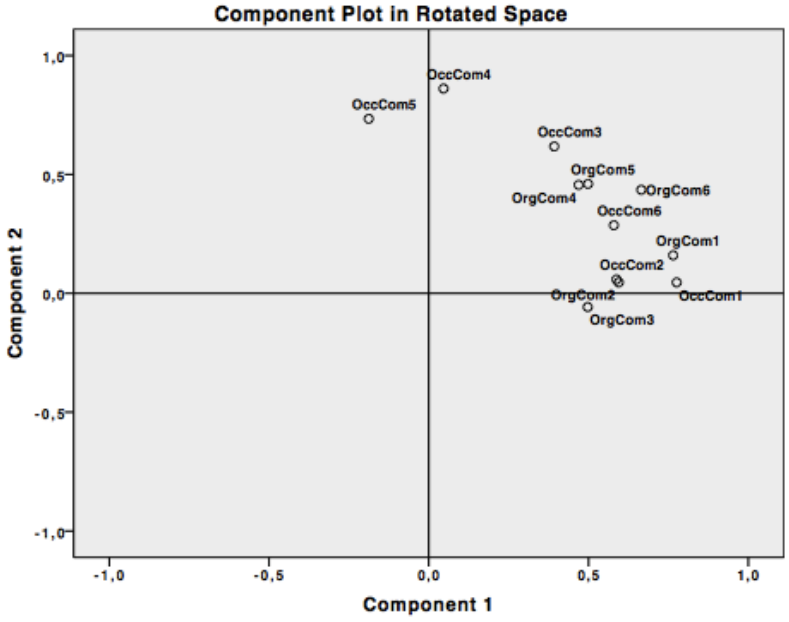

Fig. 33: Organisational and occupational commitment at training centres

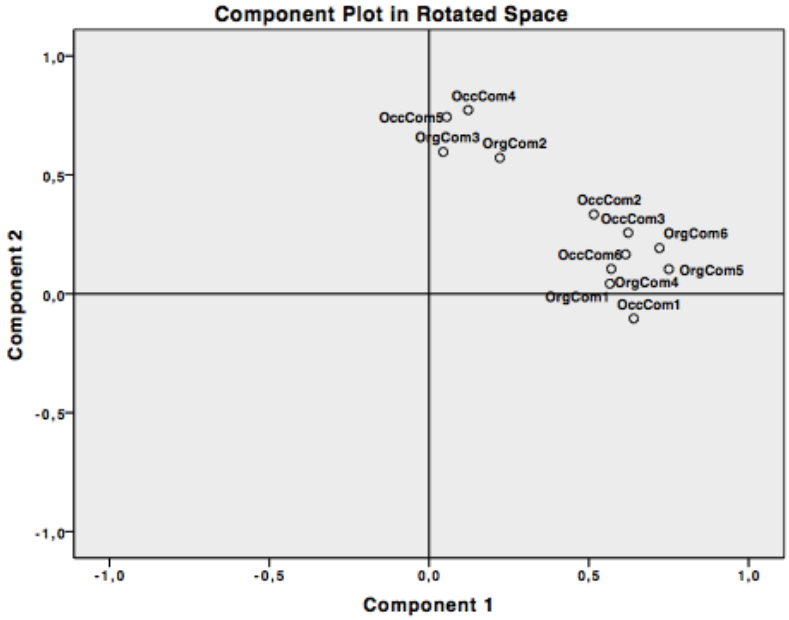

Fig. 34: Organisational and occupational commitment at Arcelor and VW

Regarding the relation of occupational commitment and vocational identity, the pattern is similar. The data of the learners at colleges and training centres allowed to extract up to 4 factors. The

two-factor solution (fig. 35) again shows only two items separated from the others. Here, too, the learners almost did not differentiate between commitment to an occupation and the prerequisites to develop vocational identity.

For the learners at ArcelorMittal and Volkswagen (fig. 36), the image is slightly different. The two factors that were extractable form a continuum, but the items for vocational identity and occupational commitment are clearly concentrated on this continuums different ends. This means, although being related, for the learners these two dimensions are separated.

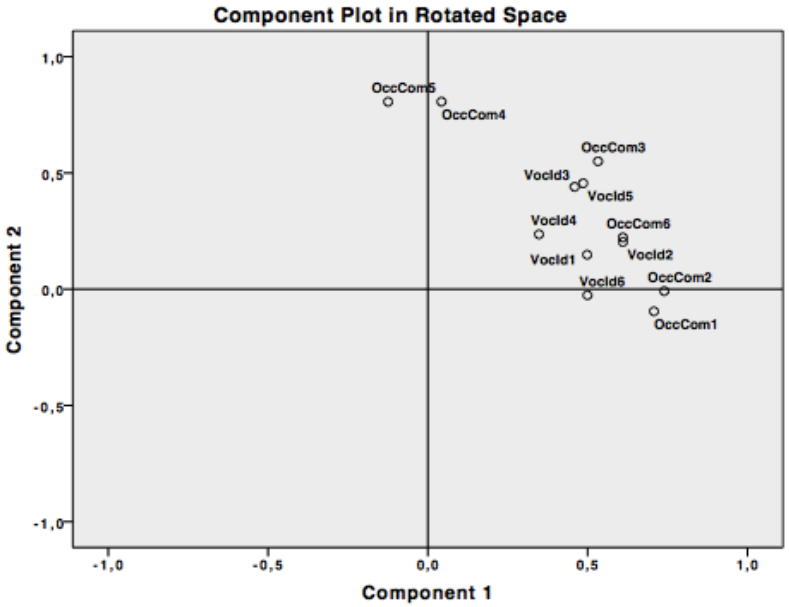

Fig. 35: Occupational commitment and vocational identity at training centres

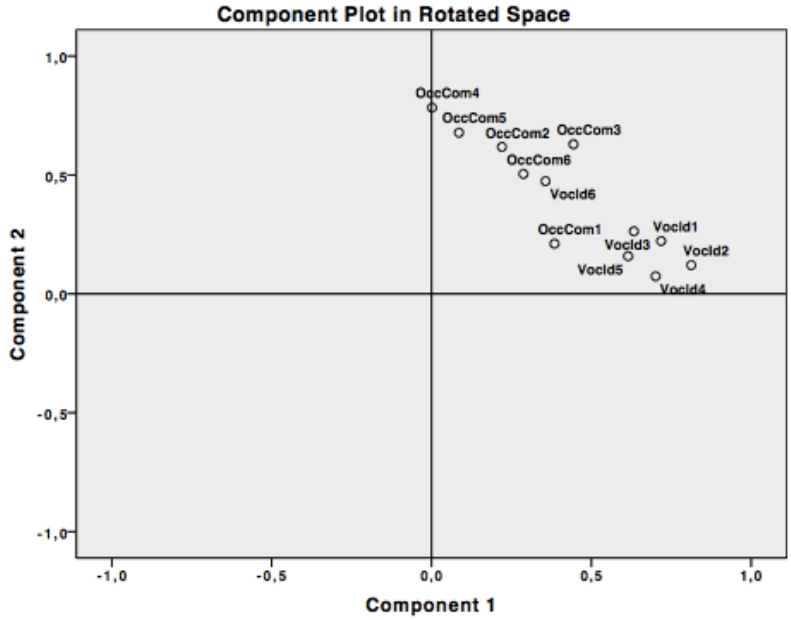

Fig. 36: Occupational commitment and vocational identity at Arcelor and VW

Finally, the scales for organisational commitment and vocational identity were compared. Although the constructs these scales ask for are clearly separated, the same pattern emerged. The training centres and colleges' solutions allowed for extraction of three factors. When extracting two no meaningful pattern showed up (fig. 37).

At Arcelor and VW, however, the two-factor solution did indeed reproduce the scales; for the learners, organisational commitment and vocational identity are two different things (fig. 38).

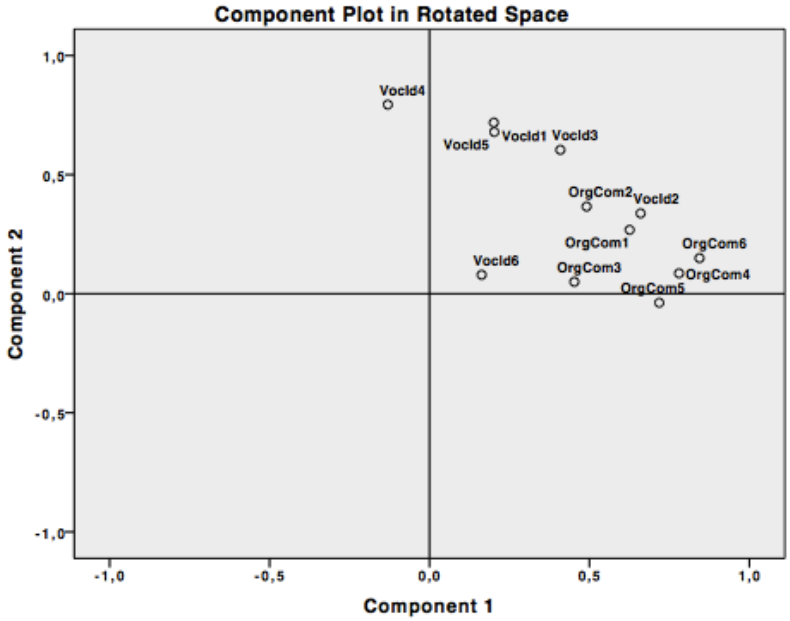

Fig. 37: Organisational commitment and vocational identity at training centres

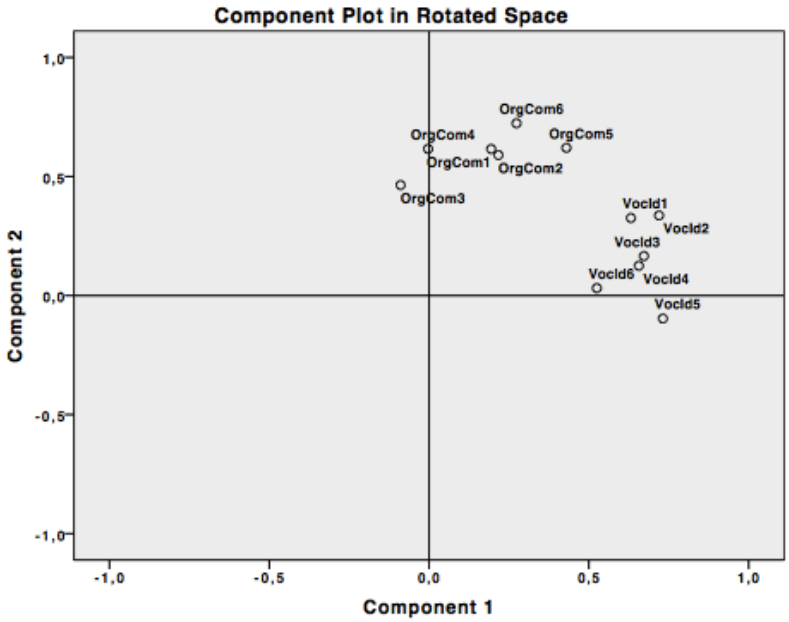

Fig. 38: Organisational commitment and vocational identity at Arcelor and VW

All in all, this means:

The learners' general high commitment and their generally high estimation of training context can blur their ability to differentiate between different matters. For the learners at ArcelorMittal and VW, occupational commitment, organisational commitment, and vocational identity are different things, although they score high at all of them. For the learners at training centres and colleges, all things related to individual commitment become one. So, a high common factor - general motivation - should be accountable for this pattern. In the light of test scores, the high perceptions of training organisation at company and school may even seem unrealistic and caused by high motivation.

In terms of the data's statistical analysis, this means that for the context data one has to mostly rely on exemplary single items that cannot be distinguished according to the individual learners' background (notably, there is no significant difference in answering to the items between learners at college/training centre and learners at VW or ArcelorMittal).

In terms of vocational education, it may be an important step in the learners' development from novice to expert to exchange an overall high motivation for a professional point of view and become able to differentiate between company and profession as well as acquiring a colder view on the training context.

5.4 Stagnation of competence development during the course of training

There is no significant difference between the competence levels of apprentices of the first, second and third year of training. During the course of an apprenticeship of three years, more knowledge is acquired, but this gain of knowledge can only be considered as horizontal expenditure or increase of knowledge. A rise in competence level is not achieved (stagnation in competence development).

As a general pattern, one expects a development of professional competence during training. In the case of the South African test takers, this did not happen. Results of 1st (here, only Fundi provided participants), 2nd, and 3rd year learners do not differ significantly (fig. 39).

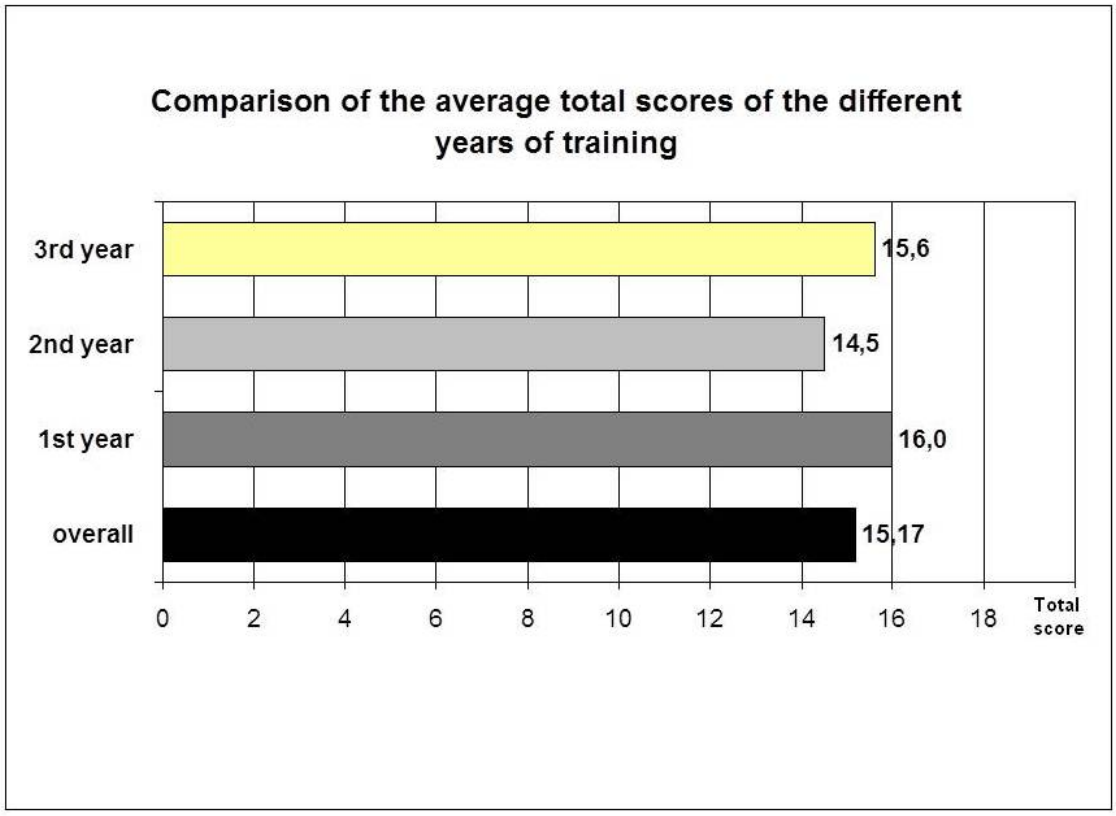

Fig. 39: Stagnation in competence development

If one looks closer at the 2nd and 3rd year learners (the group the COMET tasks aim at), one sees more test takers being able to score a good result at the third year. Still, the large group of learners staying at a low level of competence renders this difference invisible in terms of deviations of the means (fig. 40). So, only a minority of learners seems to undergo a development of competences in between the second and third year of training (see chapter 6). To analyse the course of competence development more deeply, a longitudinal study could be called for.

At first sight, this test result seems surprising, since in any kind of dual vocational education and training, one can expect, that competence would increase during the course of training.

This surprising phenomenon can be ascribed to a highly modularised form of vocational education. Each time, a new module is introduced, a learner (no matter what year of training he or she is in) has again the status of a “beginner”. What was done in previous modules looses its relevance.

Holistic shaping competence versus fragmented competence

Vocational or professional competence is based on the ability to solve problems in a holistic manner.

The South African National Skills Development Handbook 2010/2011 states for an Occupational Learning System (OLS):

> *"It is then that we realise that although we have reached an advanced level of specialisation in a particular field of knowledge, it is the ability to holistically combine and apply all the relevant fields of knowledge that really results in effective solutions. […]. So while there is obviously a rift between discipline based learning and work based learning, what is not so obvious is that there are rifts even within the various subfields of each of these approaches" (p. 237).*

This pioneering central theme of the OLS has been transmitted by the COMET competence model and a corresponding didactic concept but not in a highly modularised form of content structures which was the basis for learning and teaching methods for the test persons who took part in the first COMET test in South Africa, where traditional curriculum and assessment structures are opposite to *competence-based, holistic learning concepts.*

This is backed by the distributions of scores according to the competence criteria in between the Chinese, German, and South African learners. As fig. 40 shows, K1 (functionality) is a clearly stronger aspect in South African solutions than in China or Germany. K6 and K7, though, - social acceptability and environmental compatibility - are less considered.

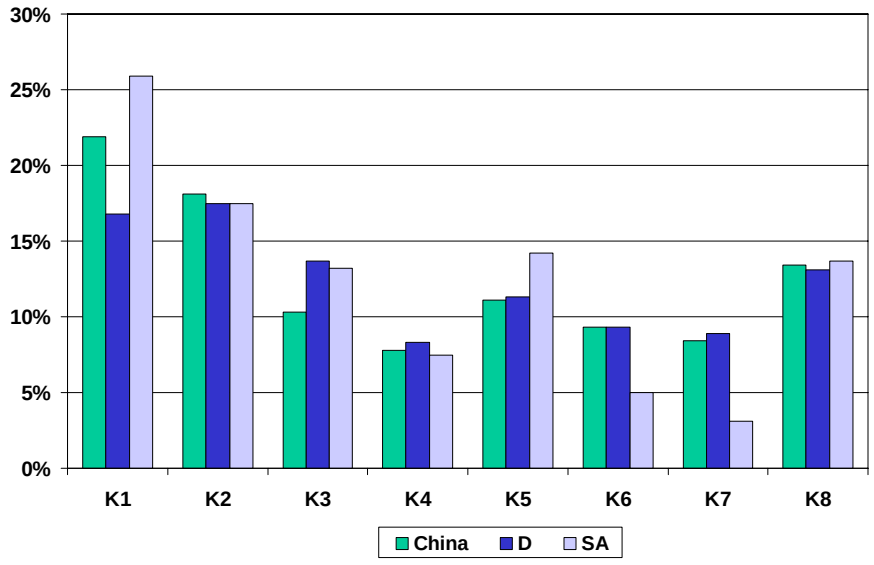

Fig. 40: Relative importance of competence criteria in China, Germany, and South Africa, in percent; K1-K8=100% for each group

A closer look at the vocational curricula is therefore indispensable. It has to be examined, if and to which extent the modules are based one on the other (i.e. following a developmental logic form novice to expert), since the test results suggest that the test persons have followed a rather horizontal module structure (fig. 41).

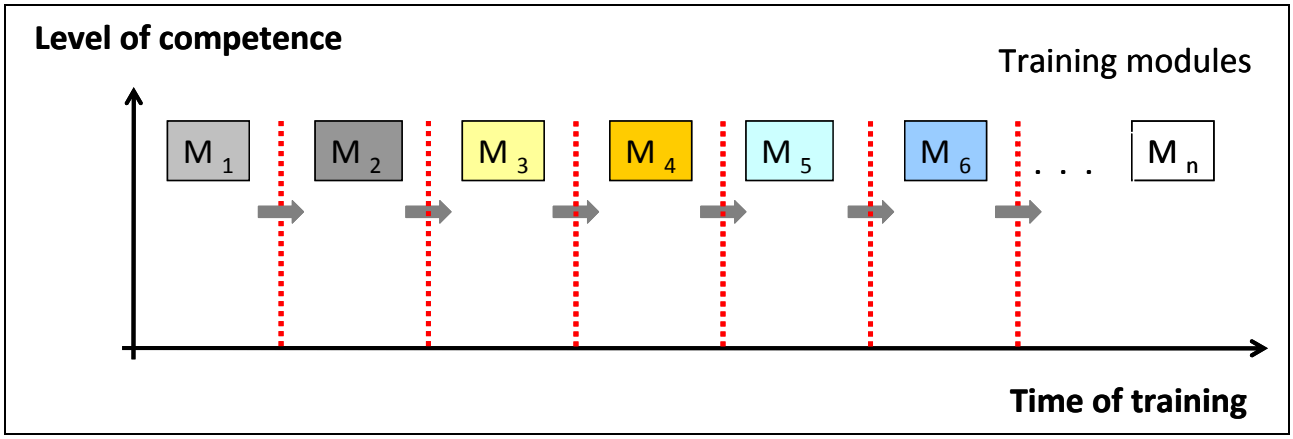

Fig. 41: Horizontal shape of modules in TVET

The instruction is focused on the curriculum's task structure. By breaking up work the context of work and its flows (developmental tasks/learning areas), a structure of abstract units of qualification emerges. The work process knowledge necessary to acquire occupational *Handlungskompetenz* and *Gestaltungskompetenz* (know that, know how, know why) dissolves into theoretical knowledge, skills, and work experience.

So, the specificity of professional work process knowledge disintegrates. The concept of skilled workers' holistic qualification is not met. The learners' mostly do not become confronted with the companies' work tasks, that are always complex and have to be solved according to the concept of holistic problem solving. Work tasks have the quality of developmental tasks which is dissolving if developmental tasks are split up into a structure of small units.

It is an essential fact that a curriculum conductive to competence development has to follow a structure of developmental learning tasks based on a concept of learning areas (fig. 42).

The problem of introducing modularised or unitized curriculums has among others been examined and criticised in an ILO working paper, according to which "unitization is a more radical departure from traditional approaches to the curriculum; it refers to the break up of qualifications (…) and is concerned with assessments rather than teaching" (Young, 2005).

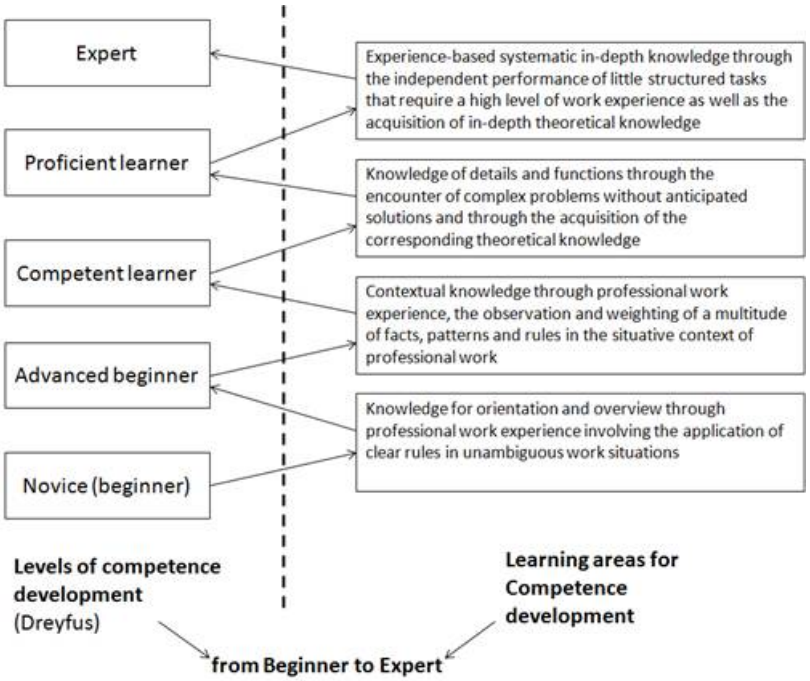

Fig. 42: Vocational competence development from novice to expert

The "National Skills Development Handbook 2010/2011" also mentions this concept. The central meaning of such "developmental occupational tasks" is pointed out as follows:

> *"What are the developmental tasks? A process of identifying the developmental steps required to achieve each occupational tasks identified in the occupational profile" (p. 324).*

But as for a transfer of developmental tasks into a curriculum, it has to be understood that the established practice differs considerably from a model of modern curricula, where modular task structures are replaced with learning areas and action-oriented instruction.

Assessments

The established praxis is based on an "atomised" vocational course of instruction. Such form of teaching split-up into a vast number of items has not proved to be a suitable basis for the acquisition of context knowledge. Moreover, vocational or professional competences can neither be conveyed nor assessed on such basis.

Business processes

Among others, learning in a context of real business processes is an essential quality criterion for dual vocational education and training and the acquisition of professional action competence.

Only if apprentices are exposed to real work situations, i.e. only if they learn how their jobs are contributing to overall work processes and what influence this has on a customer (internal or external), they can develop context knowledge, quality awareness and consciousness. If they work and learn according to very split-up modules, if they cannot learn in and contribute to real business processes, a central pre-condition for successful vocational training won't be given.

Around 25% of the test persons have achieved the first of three competence level „functional competence“. As this test result is not reliant on test groups according to the different training centres or participating companies, this is an indicator for the assumption that the underlying vocational curricula and assessment concepts have a great and formative influence on training quality and success. Such training concept does not open up the opportunity for apprentices to develop a holistic organisational and vocational concept of work. In a very narrow sense, this model of a training course fosters the acquisition of single skills or dexterities that - in sum - do not lead to professional (action) competence.

5.5 Work and school

Students are quite satisfied with the vocational schools in general, and especially with the teachers. Still, they do not see a contradiction between being highly motivated and skipping classes.

The learners' attitudes towards vocational training at school are quite positive. Lessons are interesting (fig. 43), and the teachers are highly estimated (fig. 44–47). Teachers even have a good knowledge of the work in-company.

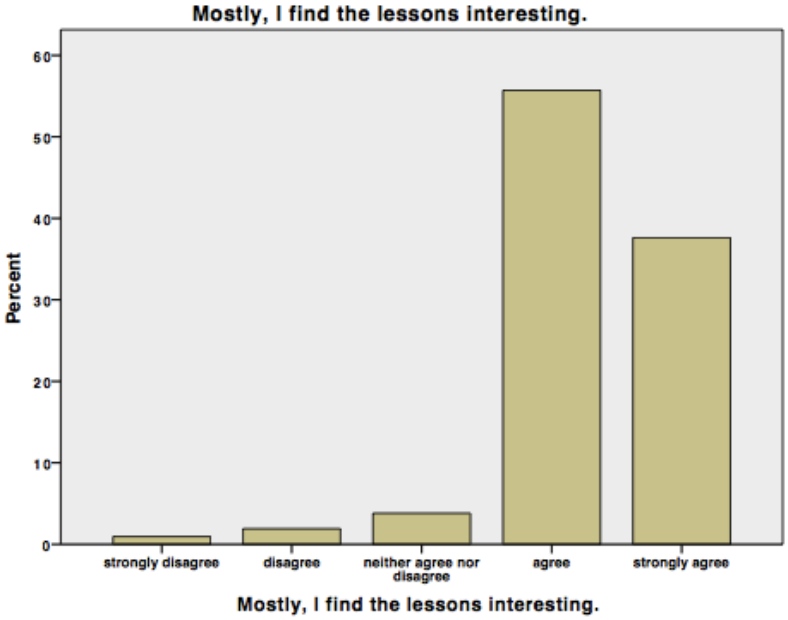

Fig. 43: Responses on 'Mostly, I find the lessons at school interesting'; overall, N= 2.04, mean = 4.27

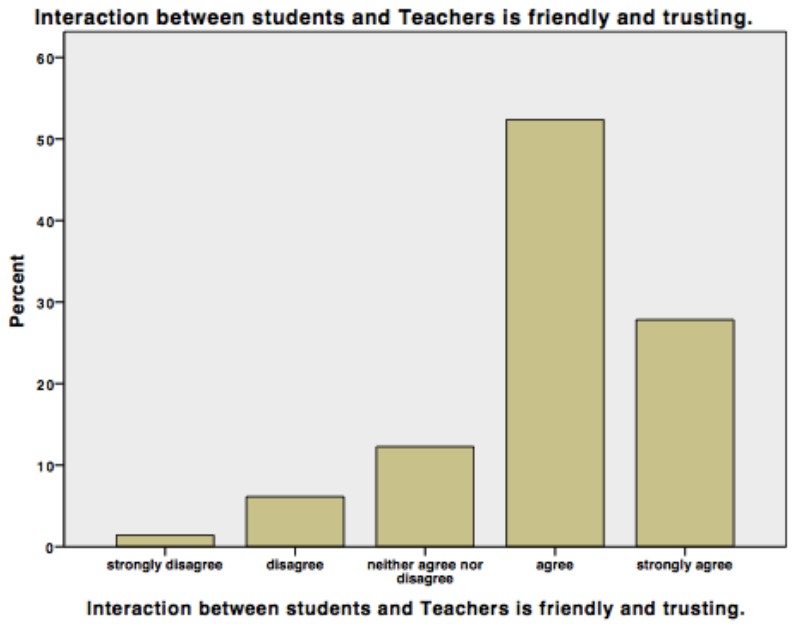

Fig. 44: Responses on 'Interaction between students and teachers is friendly and trusting'; N= 212, mean = 3.99

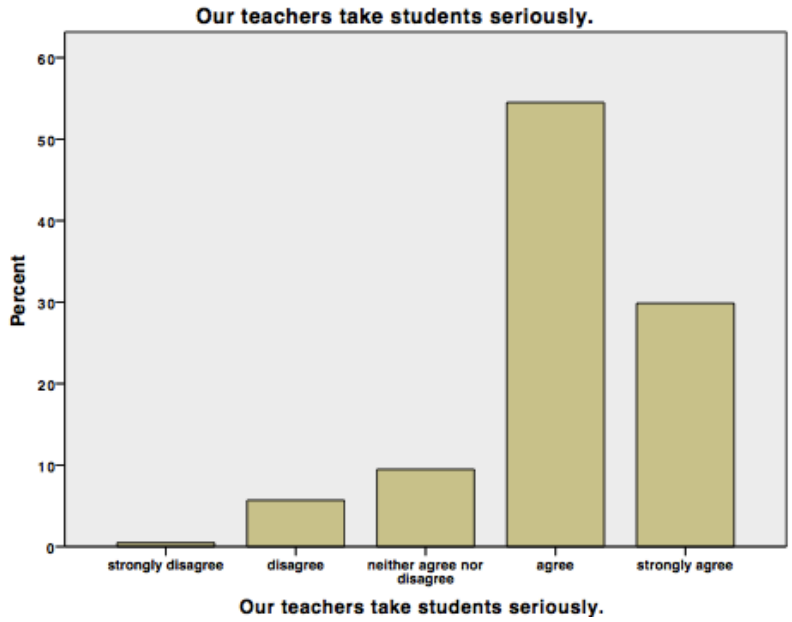

Fig. 45: Responses on 'Our teachers take students seriously'; overall, N= 211, mean = 4.08

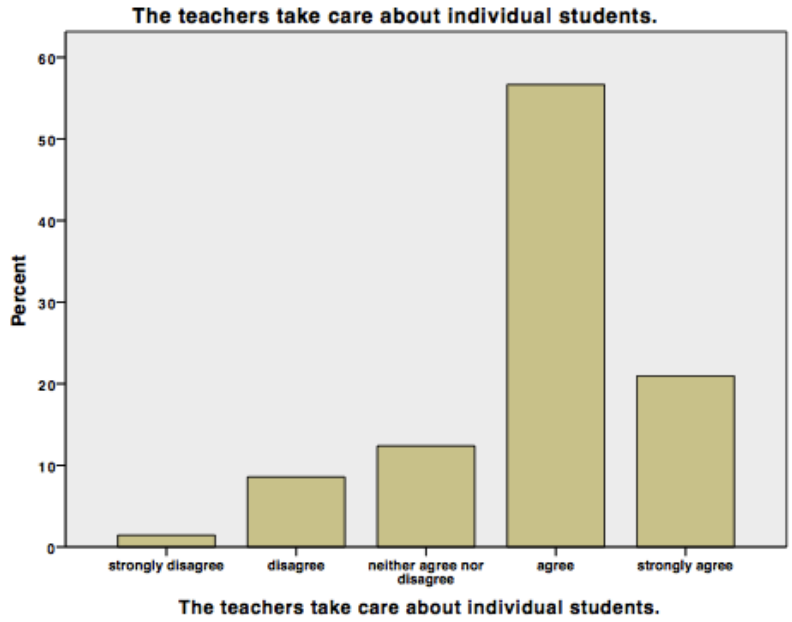

Fig. 46: Responses on 'The teachers take care about individual students'; overall, N= 210, mean = 3.87

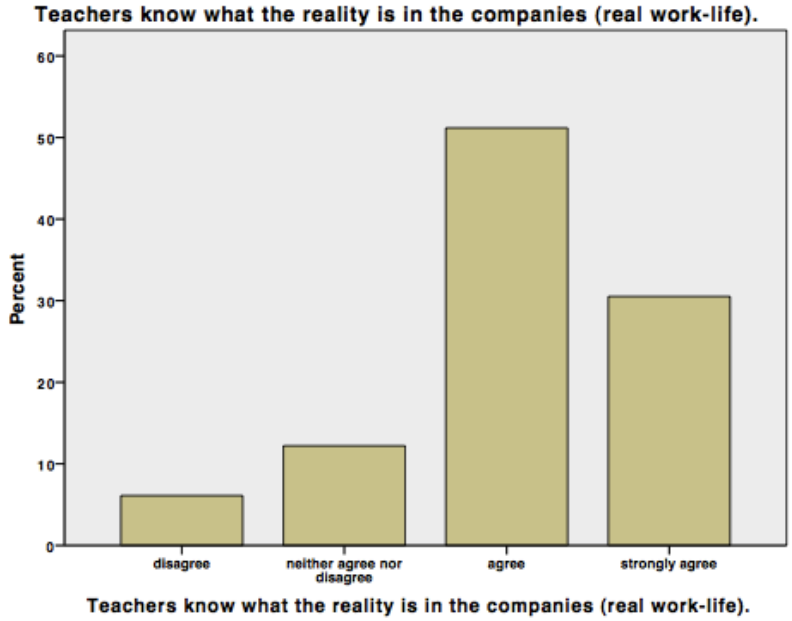

Fig. 47: Responses on 'Teachers know what the reality is in the companies (real work-life)'; overall, N= 213, mean = 4.06

Regarding the mutual recognition between schools and companies, the learners perceive the situation positive as well: the company is satisfied with the learning at school (fig. 48) as is the school with the learning at company (fig. 49).

Fig. 48: Responses on 'The company is satisfied with the training at school'; overall, N= 193, mean = 3.71

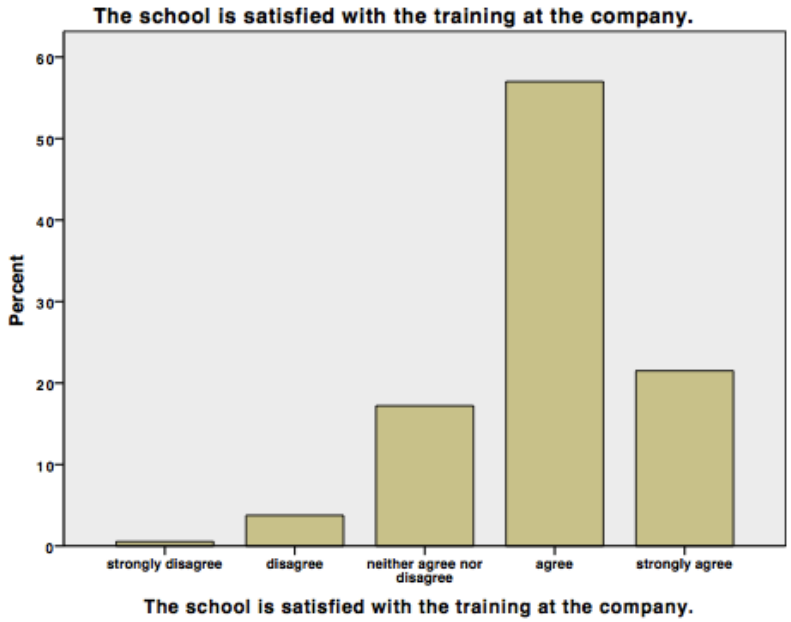

Fig. 49: Responses on 'The school is satisfied with the training at the company'; overall, N= 186, mean = 3.95

In this positive picture, there is no difference of the perceptions of learners at college/training centre or at companies. These two groups differ only at one point: their peers' attendance rates. 40% of learners at college/training centre agree that schoolmates often skip school (fig. 50). Of the learners at company, another 25% agree to this statement.

If the figure given by the students is correct, than the students' satisfaction with their school may become another meaning. If one appreciates school while at the same time not attaining it, and

still has the impression to be highly motivated in all aspects of vocational education, it may be that the perception of what is necessary to become an expert is not exact.

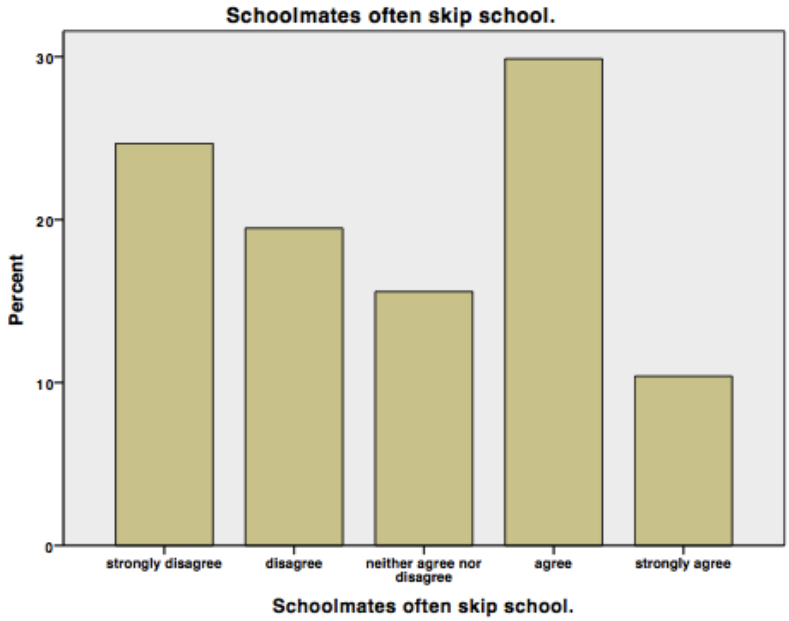

Fig. 50: Responses on 'Schoolmates often skip school'; Training centres, N= 77, mean = 2.82

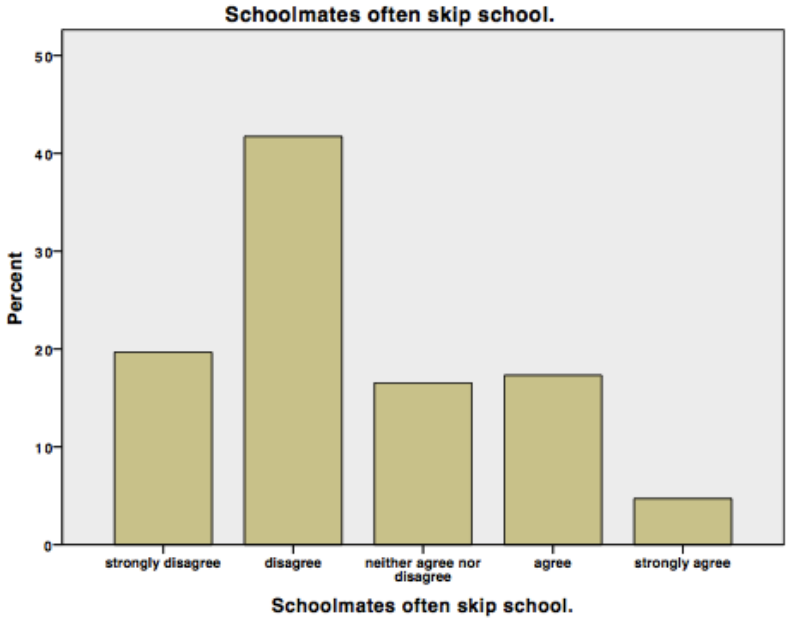

Fig. 51: Responses on 'Schoolmates often skip school'; Arcelor/VW, N= 127, mean = 2.26

5.6 The best results

The learners that gained the best results show more fully developed competence profiles. Additionally, better test takers have a more realistic attitude towards work and learning.

Five learners achieve the second or third level of competence. Taking into account the conditions of training, this is a remarkable achievement. In general, their competence profiles are more fully developed than the average test takers - the variance between the different categories is lower. Appendix II describes the competence profiles of the test takers according to the overall score they reached.

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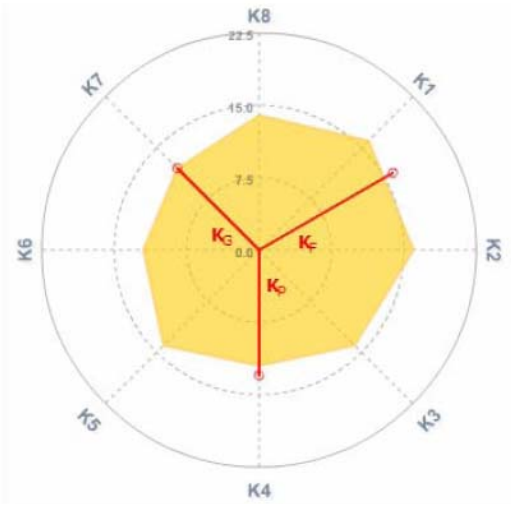
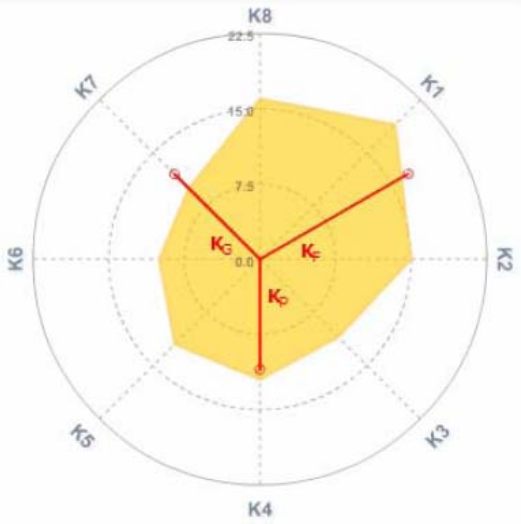
<tr><td> 
</td><td> 
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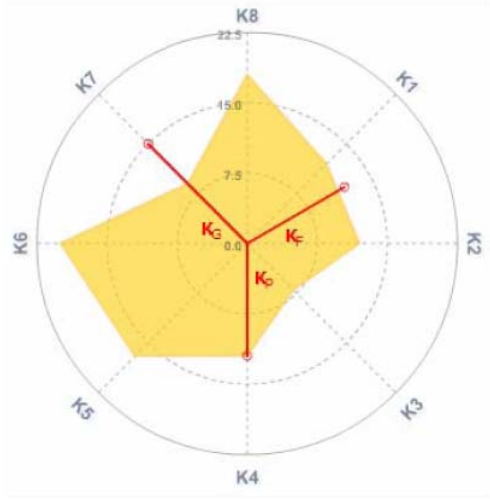
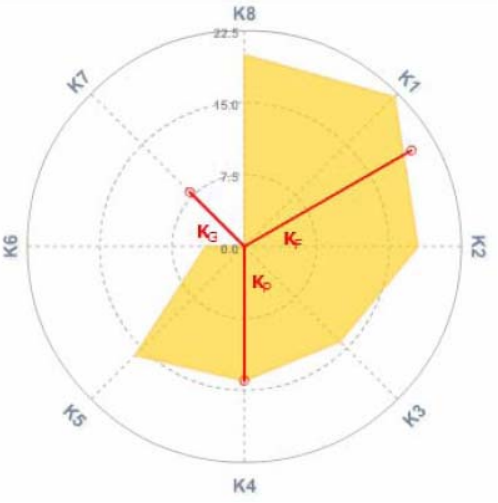
<tr><td> 
</td><td> 
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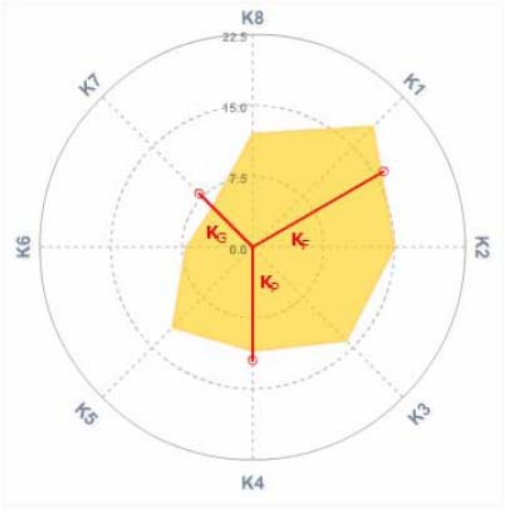
NH (02-004): Level KG; Total score 39,7	*NL (06-037):Level KP; Total score: 42,7*
	
WD (06-049): Level KP; Total score 38,4	

Fig. 52: The 5 best test takers' competence profiles. COMET South Africa 2011

The radar charts show the high degree of accuracy possible in measuring competence profiles. For teachers and trainers, the radar charts contain important information on the different learners' strengths and weaknesses and show, where to assist them. The learners NH (06-004), TV (06-045), and AD (06-003) achieve the highest level of competence already in their second year of training. The competence profile clearly shows, what competencies still have to be assisted: to solve occupational tasks as well in a way that:

K7: they comply the respective environmental standards

K3: they not only meet functional requirements but as well the client's expectation according to usability.

The example AD (06-003) shows the competence profile of a 3rd year learner's that achieved a very high total score as well as the level of holistic shaping competence (KG). Differently to NH, he shows a quite homogenous competence profile. He clearly shows the capacity to holistically solve occupational work tasks while considering all aspects of the solution.

The third example TV (06-005) shows a learner as well achieving a very high total score and the third (highest) level of competence. The competence profile shows some homogeneity of dimensions, but still reveals some weaknesses in the capacity to solve occupational tasks in relation to practice while considering the company's work environment and the client's interests. This is demonstrated by somewhat lower scores in the dimensions K3 to K7.

WD (06-049) shows a profile characteristic to *processual competence*. The third level of competence's categories (K6, K7, K8) are rather weak. In contrast, the learner shows high scores for all (!) parts of functional and processual competence. NL's (06-037) profile is quite peculiar.

Amongst all learners, he shows the highest scores regarding

- functional competence (20) as well as
- processual competence (14,7).

Additionally, he demonstrates a remarkable degree of creativity. His solution shows some weaknesses in the dimensions of social acceptability and environmental compatibility.

Unfortunately, none of the five best test takers did provide any context data. So, a larger analysis was carried out.

As the group of test takers filling in the context questionnaire is rather limited, we decided to include all learners with a score equal or more than 16.5 points, which is a bit more than 25%. This way, 17 learners could be analysed in terms of different training or individual context. Surprisingly, only 5 items were found, where the high-performers judged differently than the rest (fig 53–57). All those items are related to commitment (53, 54) or vocational identity (55–57). But, in *all* of them the high-scoring group judged significantly *lower* than the rest, even in item 80 that should be clearly related to a learners professional competence!

A possible explanation would link this finding with the pattern described in the previous parts:

the main part of learners is motivated, content, and proud to learn their profession. This may lead to an unrealistic estimation of their own capacities as well as of the quality of their training. The 'top10' are more realistic about their capacities and have a more professional view on training company and occupation.

One challenge for South African VET will be to make good use out of this resource of motivation and professional pride - and enable these learners to reach a higher level of competence.

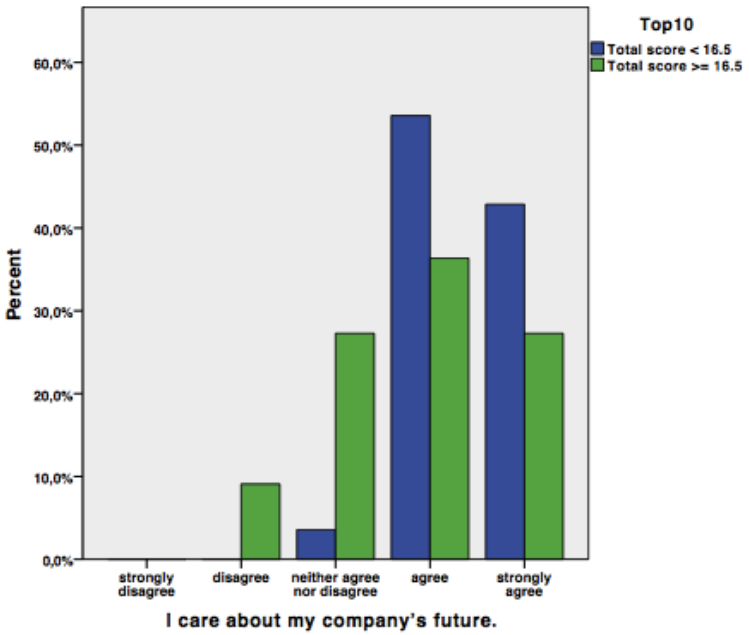


Fig. 53: Responses to 'I care about my company's future'

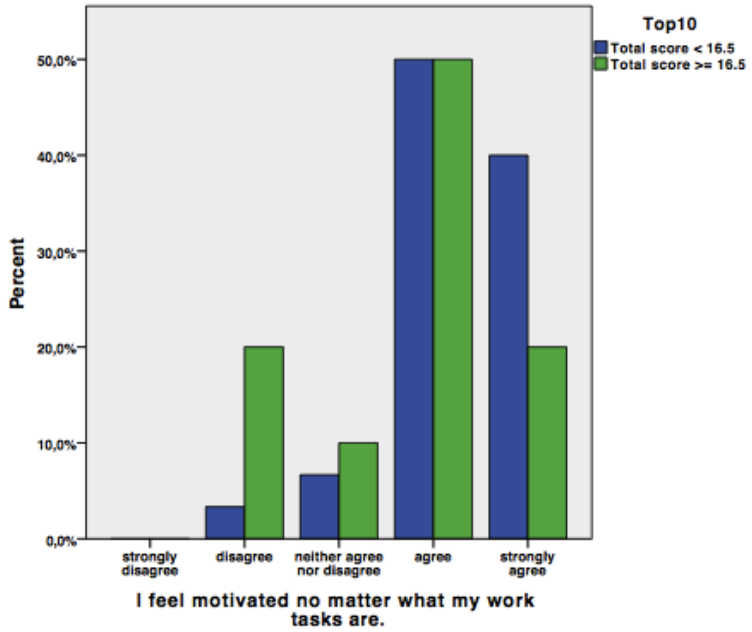


Fig. 54: Responses to 'I feel motivated, no matter what my work tasks are'

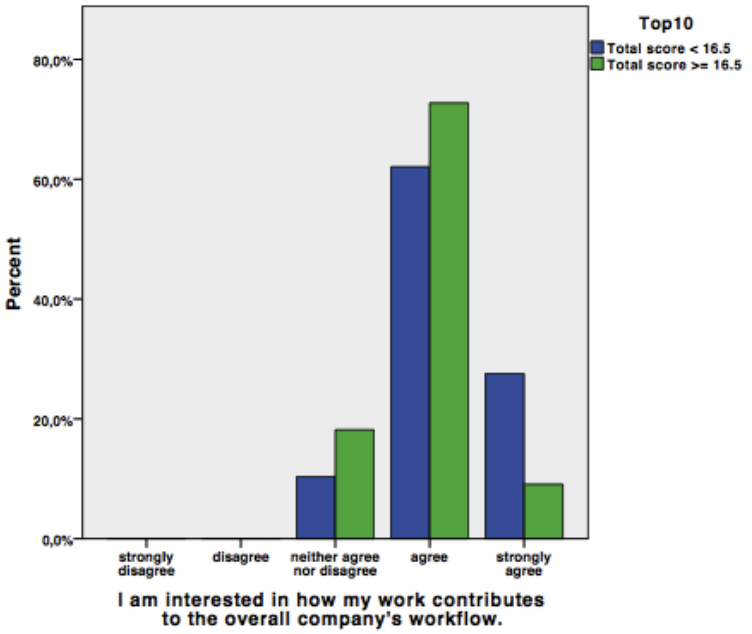


Fig. 55: Responses to 'I am interested in how my work contributes to the overall company's workflow'

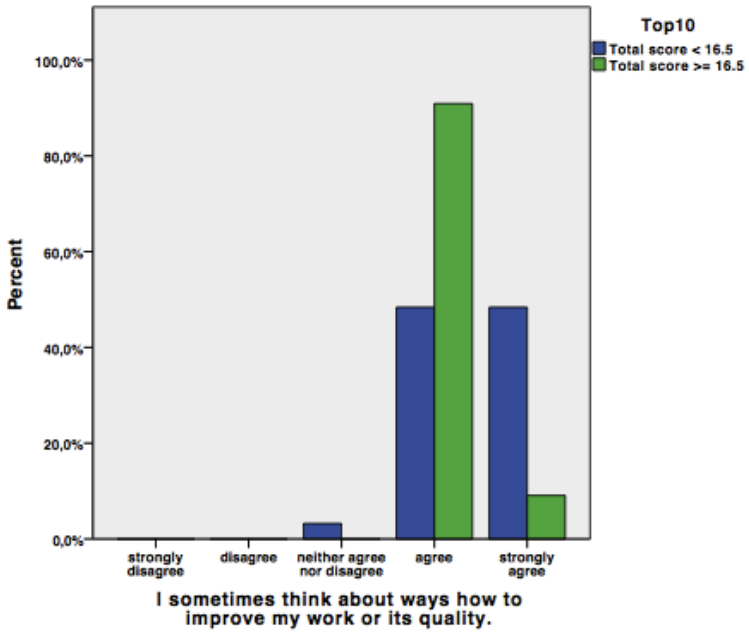


Fig. 56: Responses to 'I sometimes think about ways how to improve my work or its quality'

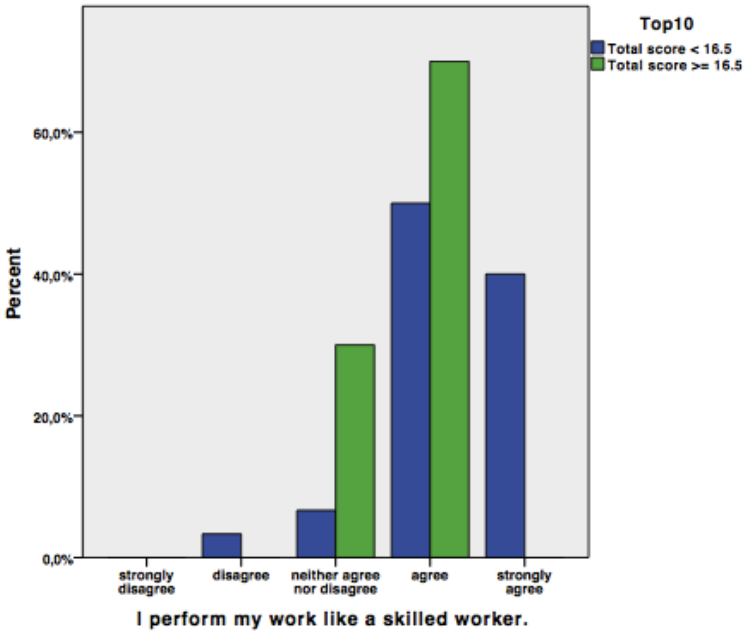


Fig. 57: Responses to 'I perform my work like a skilled worker'

6 QRC: Studies on costs, benefits and quality of in-company training

6.1 Apprenticeship as a pillar of a competitive economy

Dual technical and vocational education and training can only develop its full power as a contributing factor for economic growth and as well as an essential component of the educational system as such if its core element, namely in-company training as its practical part is both rentable and of good quality.

On the other hand, the question whether to train apprentices or to employ trained personnel is for any employer dependent on the decision, as to which alternative could be the most efficient way to secure/meet a company's demand of well-trained staff. Only a few companies manage to set up a precise cost-benefit calculation for the training provided within their own company and it is a matter of fact, that cost issues are often over-estimated. This lack of precise information and transparency was one of the main arguments to set up a measurement instrument, especially designed for use by companies/company managers to measure

- costs
- benefits and
- quality

of in-company training based on a self-evaluation method. This specific evaluation tool QRC has first been established by I:BB within the frame of an EU project and has been successfully introduced in various regions and branches since 2005. For the South African context, the method has been modified and adopted to country specific conditions before it has been applied in a first pilot test in 2011/12. Last corrections have been made in the first quarter of 2012 and applied in three QRC workshops in March 2012 in Johannesburg and Cape Town. At present "QRC" is online at www.rsa.qek-tool.de and ready to be officially launched by the merSETA as a service component available on its own webpage.

Apart from the project aim to provide a "VET controlling system" for companies which should be easy to handle, it is intended to receive in a medium term perspective a solid data base on an anonymous level for some further comparative analysis in different economic branches and regions. Another motivation for this project is the creation of a consultancy instrument, which can now be used by various VET advisory bodies.

The pilot project is not only based upon a tested and verified evaluation method, but also on the aggregated data of hundreds of other users as an important benchmark contribution. It is this benchmark research result that counts for the central theme of innovation strategies – individually (on a company level) and as an overall strategy on macro level.

6.2 Profitability or: cost-effectiveness of in-company training

On average, benefits gained by in-company training of apprentices are exceeding its costs and training as the practical part of technical and vocational educational and training can be organised as a self-financing system.

For example, Swiss companies, obtain a net return of 400 Mio CHF on average per year, although the personnel costs of apprentices are relatively high in Switzerland (SCHWERI et al, 2003). This monetary benefit is related to apprenticeships with duration of 3-4 years. Similar results have been gained by German QRC project studies that suggest an average net benefit of € 1323,00 per apprentice.

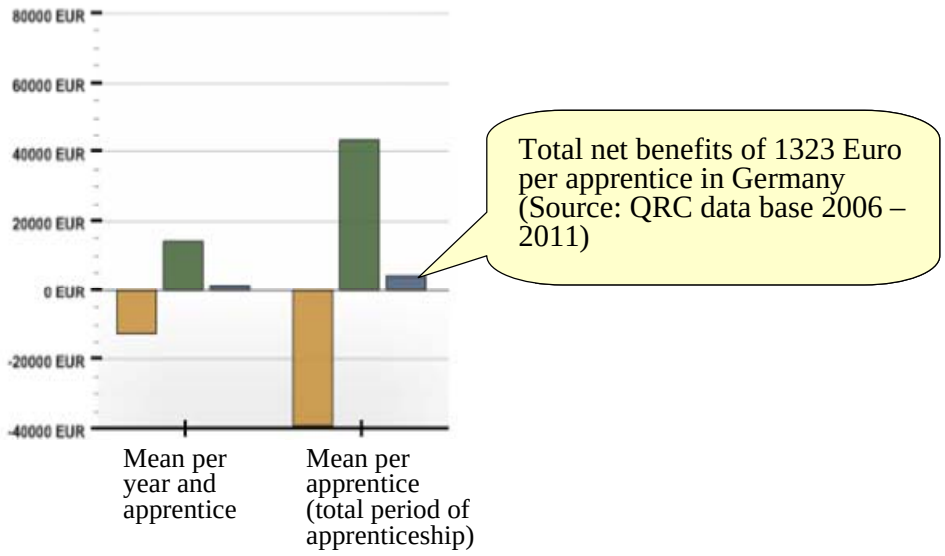


Fig. 58: Average benefits in a QRC benchmark project

Up until know and based on the current pre-test and pilot cases of the QRC project in South Africa, it is too early to publish average costs or average benefits of in-company training offered by South African companies. With a total of less than 35 individual test cases it is not possible to derive a general average value, which would reflect the prevailing situation correctly.

6.3 Presentation of the results with QRC

The QRC tool uses three different questionnaires, the first of which relates to company details, such as number of employees, company size, etc. In a second block all relevant data for the calculation of costs and benefits has to be entered. The third questionnaire is dedicated to the quality assessment of in-company training provided in a referring vocation.

Results of an individual evaluation with QRC are presented directly after the user has finished data entry, including benchmark result with regard to other QRC users. Such benchmarks are always dynamic, i. e. such results vary according to the number of users and total data entry into the QRC database. An individual analysis is illustrated by some following figures and tables:

- QUALITY-EFFICIENCY MATRIX (QEM): offers a summary of all results (cost-benefit and quality analysis in one chart.
- BAR DIAGRAMS and TABLES: presentation and calculation of costs and benefits in Rands
- QUALITY DIAGRAM: showing all quality aspects and their development throughout the total training period in a “spider-web-graphic”.

Case study: company case 1

The following case (case 1) shows a South African company training electricians. This course of apprenticeship starts with low returns and low quality. Throughout the course of apprenticeship, both profits and quality rise and in the third year, the full potential of in-company training is tapped. Overall result of apprenticeship are very good in the third year, nevertheless the company does not manage to receive net benefits in total, and in-company training remains expensive, while quality is good.

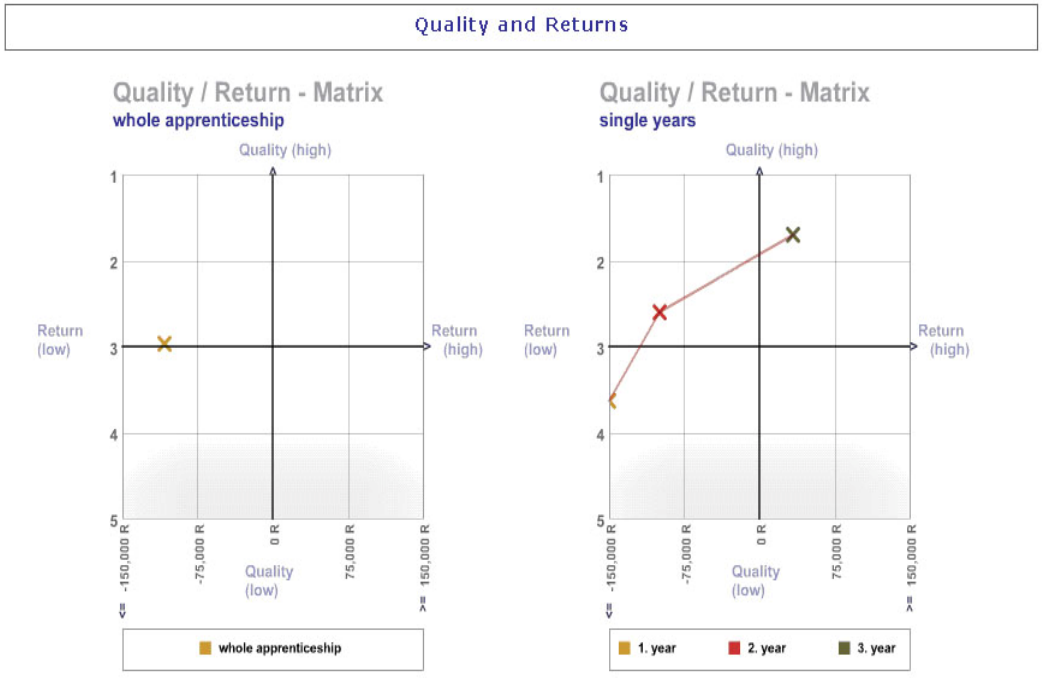
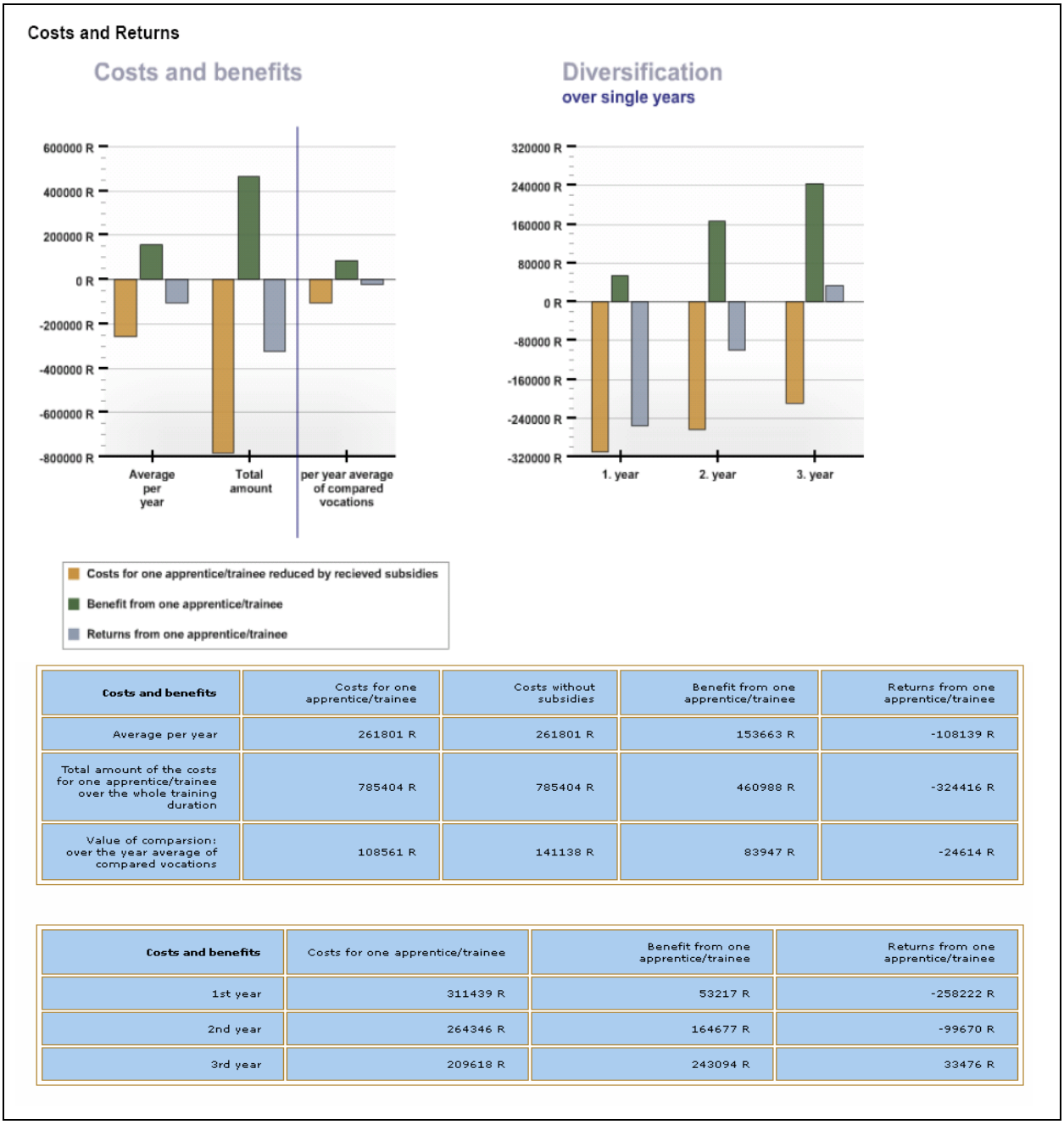


Fig. 59: Quality and cost-effectiveness in training electricians (company case 1)

Whether and to what extent in-company training in a company is profitable is shown in bar diagrams where results are available as a yearly figure, but also as an average per year and a total sum representing the entire period of apprenticeship. Moreover, the benchmark of average results from compared vocations (companies in the same branch offering same courses of in-company training) is given here. The orange bar represents the costs, the green one the benefits from one apprentice in an examined vocation. The blue bar is a summarised result: either net costs or net benefits. All figures relating to the cost-benefit section are as well recorded in a table indicating real Rand values (see table below).



Costs and benefits	Costs for one apprentice/trainee	Costs without subsidies	Benefit from one apprentice/trainee	Returns from one apprentice/trainee
Average per year	261801 R	261801 R	153663 R	-108139 R
Total amount of the costs for one apprentice/trainee over the whole training duration	785404 R	785404 R	460988 R	-324416 R
Value of comparsion: over the year average of compared vocations	108561 R	141138 R	83947 R	-24614 R

Costs and benefits	Costs for one apprentice/trainee	Benefit from one apprentice/trainee	Returns from one apprentice/trainee
1st year	311439 R	53217 R	-258222 R
2nd year	264346 R	164677 R	-99670 R
3rd year	209618 R	243094 R	33476 R

Fig. 60: Costs and benefits of training electricians (Company Case 1)

All in all, this company is a good case for a course of training that is of a high and rising quality levels. The company does not receive any grants or subsidies for offering training opportunities. While in-company training is not profitable during the first and second year of training, in the 3rd year the real work contribution of apprentices come into play and are remarkably high so to exceed as well the training costs during this year. In this example, it can easily be seen, that high quality of training is an investment that pays off in the long run.

Since the benefits are derived from the information about the productive contributions of apprentices, it is necessary to have a closer look at the diversification of times and locations of apprenticeship. In company X, almost 65% of the training takes place in the workplace. This training is more on a skilled workers' level, thus at relatively high quality levels (see QRC analysis of company case 1 below).

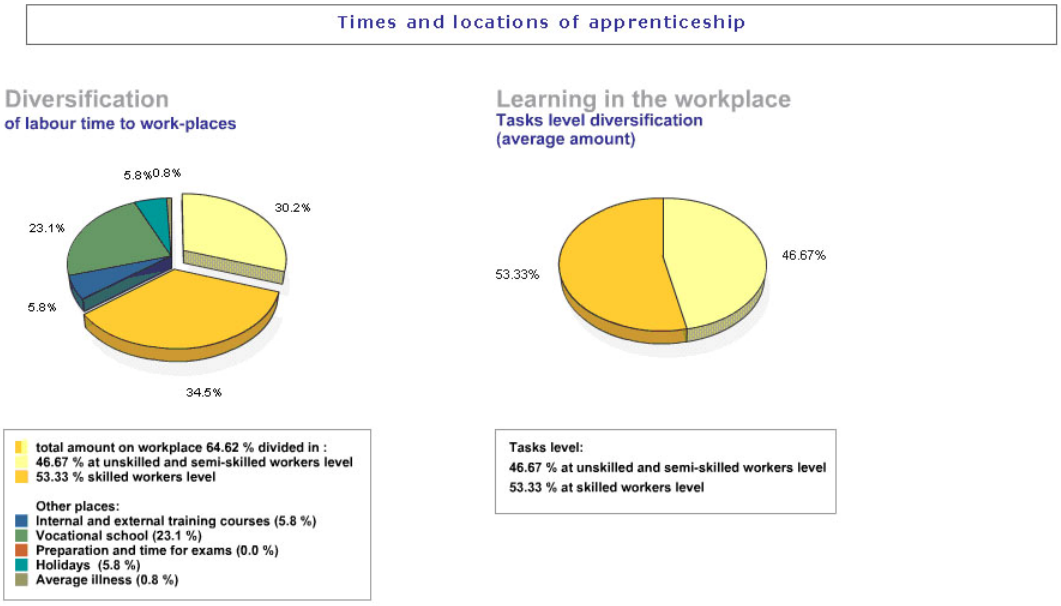


Fig. 61: Times and locations of apprenticeship in Company case 1

In the case of company 1, the share of workplace based learning is almost 65% (yellow shares in the left pie chart) over the complete apprenticeship period. Out of these 65%, the proportion of work at a skilled workers level is 53,33% (darker yellow share in the right pie diagram) and 46,7% at an unskilled workers' level (lighter yellow share in the right pie diagram). The higher the proportion of an apprentice' contribution to real work processes at a skilled workers' level, the higher will turn the profitability. If apprentices are only working at unskilled or semi-skilled level, this would lead to a situation where the scope of in-company training is not maxed out, neither in terms of training quality nor in terms of real money values (profitability).

Case study: company case 2

In this second case a company has net losses with in-company training during the whole apprenticeship period. Quality increases throughout the 4 years of training and reaches a high level at the end of apprenticeship in this vocation. Even with subsidies the cost-benefit situation remains rather weak. The overall result should therefore be subject to further examinations in order to seek for ways to improve the balance sheet.

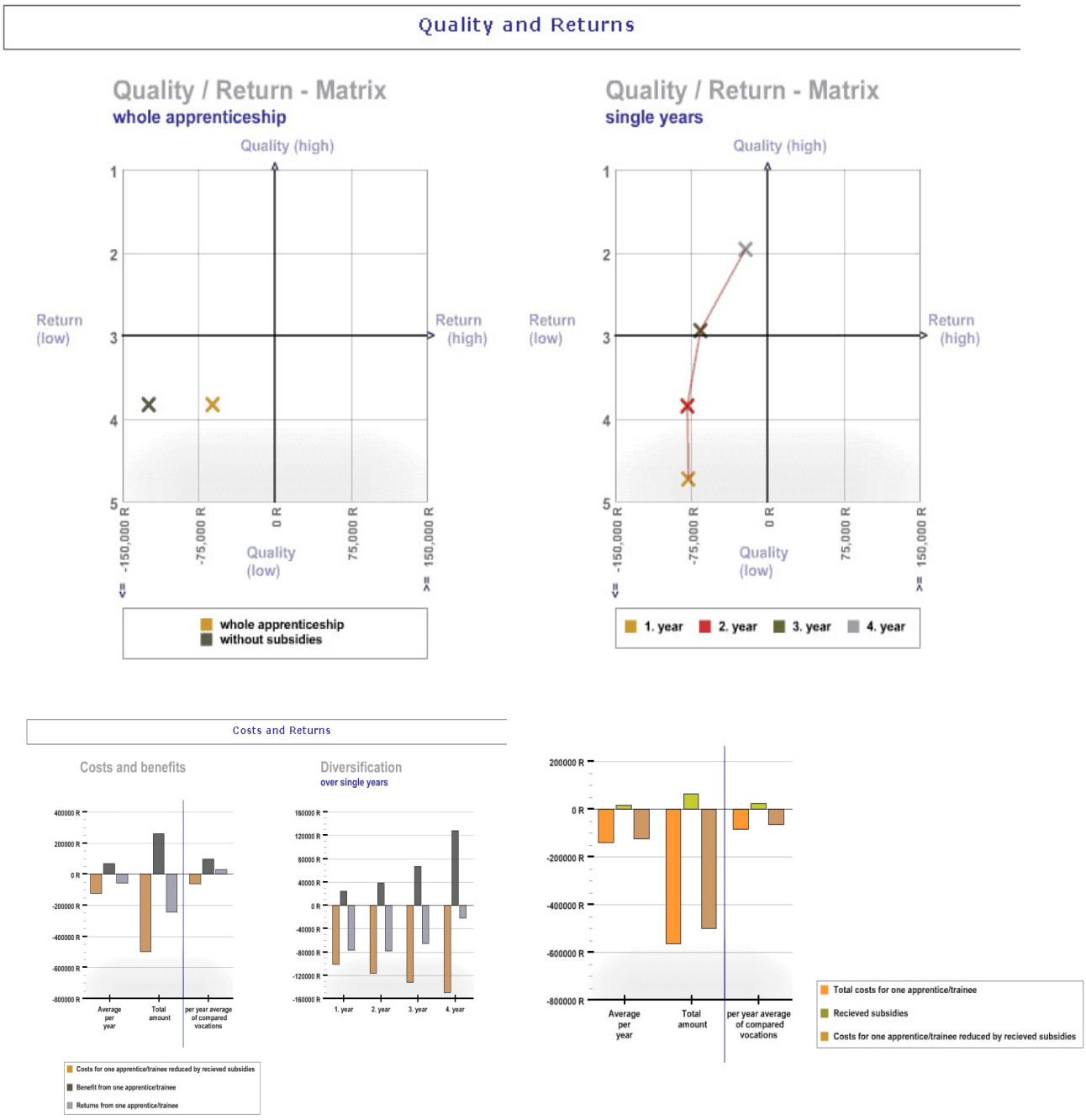


Fig. 62: QRC Bar diagrams of company case2: Costs and benefits of in-company training, considering as well the share of subsidies

If one now looks at the distribution of times and locations of apprenticeship in company case 2, one can easily find that – compared to company 1 – this apprenticeship takes place to a lesser extent in the workplace. A high proportion of training is located in vocational schools (36%). Only 44% of the entire time of apprenticeship is dedicated to workplace learning, but here, the share of work at an unskilled workers' level (55%) exceeds the level of work tasks at a skilled level (45%). One reason for a relatively week cost-benefit ratio lays here.

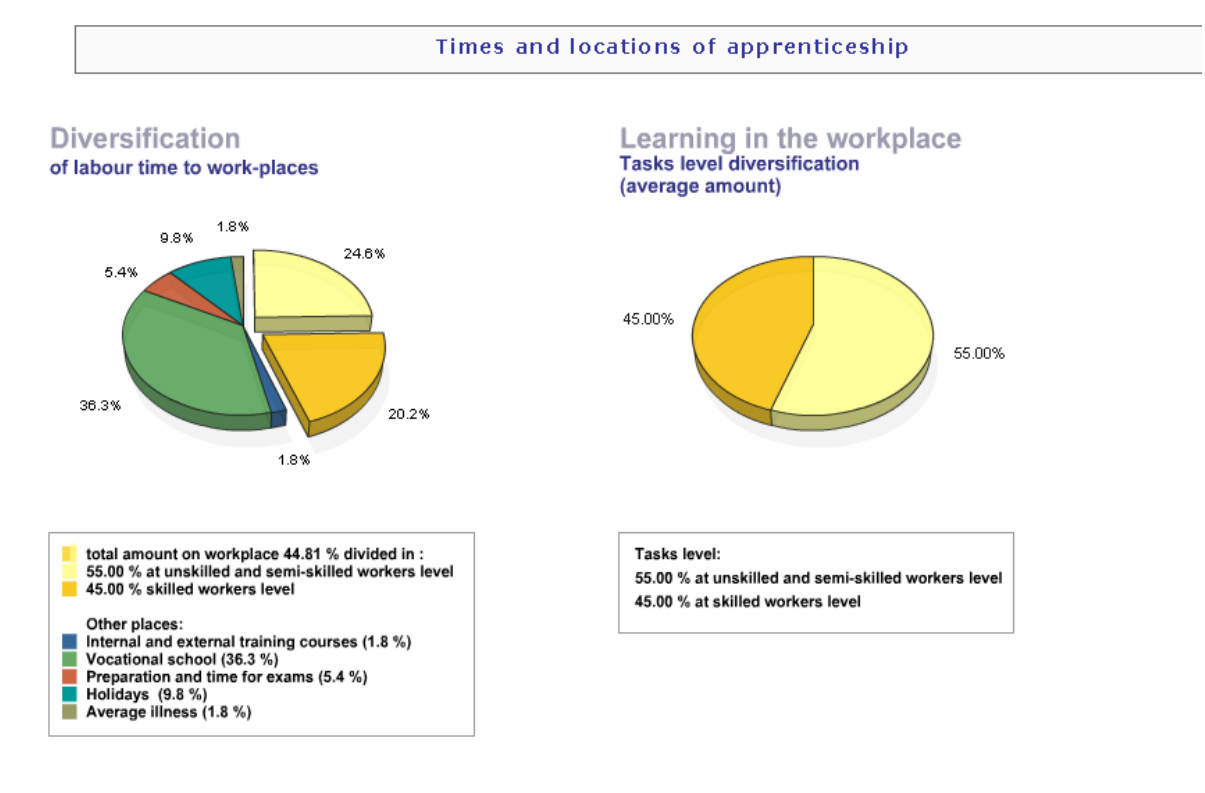


Fig. 63: Pie Charts about times and locations of apprenticeship in company case 2

The feedback for quality issue which was subject of the third questionnaire of the QRC tool is shown by so-called spider web graphics. The index QA is an overall indicator for the company's training quality in an examined apprenticeship. This index is transmitted into school marks (A=very good, D=poor).

The quality diagram represents 4 input and 2 output factors of apprenticeship quality

(1)	Reflective learning in the workplace	Input Criteria
(2)	Professional level of training	
(3)	Autonomous/independent learning	
(4)	Learning in business processes	
(5)	Professional competence and	Output Criteria
(6)	Vocational commitment	

Two different charts are given to QRC users in a final analysis. One to compare the performance of their own company with the performance of a companies in the same economic branch or companies offering apprenticeship in the same vocations - and another chart to visualise the development of training quality over the 2, 3 or 4 years of apprenticeship.

Going back to the cases of company 1 and company 2, different performances in training quality can be recognised, with QRC.

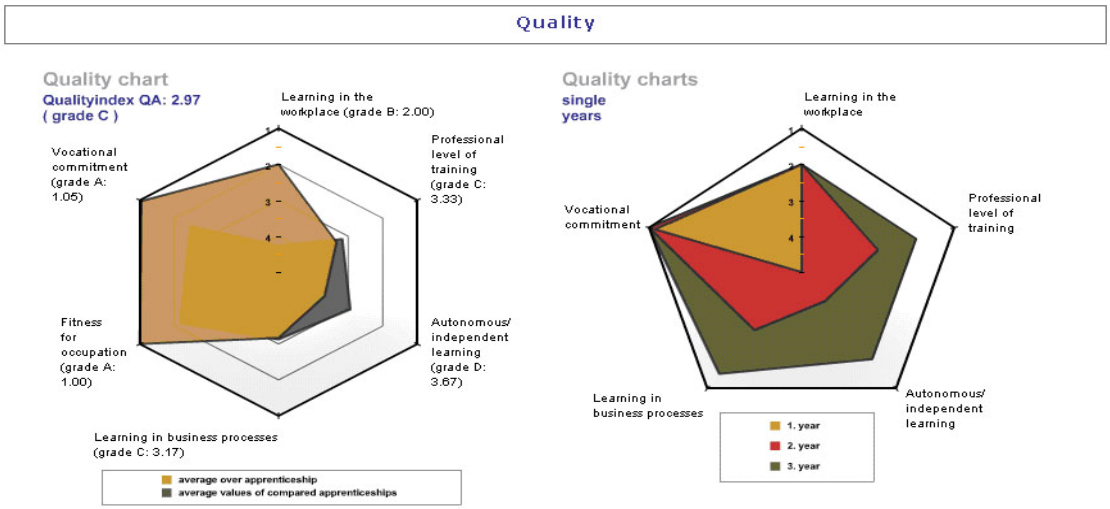


Fig. 64: Quality results in "spider-web" graphs: company case 1

The chart on the right side shows the comparison of the average quality results in company 1 compared to same apprenticeship in the same profession in other companies. In this case, the yellow area is the performance of company 1 which is better than the average performance of the benchmark values. Each of the edges of the spider web represents a highest possible result for one of the quality criteria. Company 1 is well performing in terms of the two output criteria: fitness for job and vocational commitment. Other areas remain underdeveloped, notably the criteria of autonomous/independent learning.

On the other hand – and apart from these average values – this company shows a very positive development in all quality issues, if one looks at the right spider web graph that shows the performance and development over the 3 years of apprenticeship. In this respect, this case is almost an ideal example for successful development. Nevertheless, improvement could be made in some quality aspects during the first year of training.

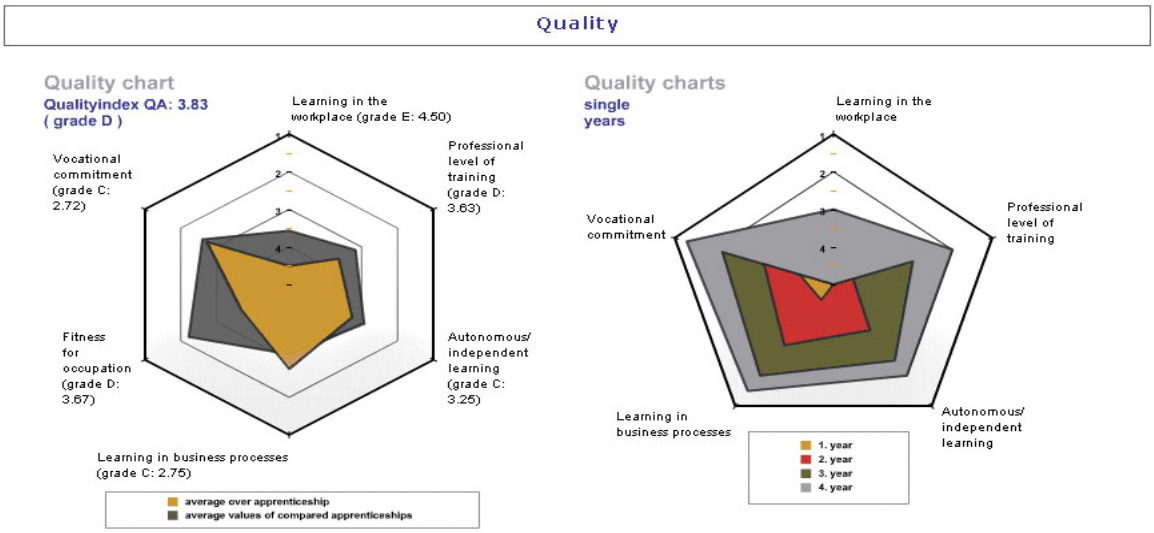


Fig. 65: Quality results in "spider-web" graphs: company case 2

The results of company 2 look a bit different. First of all, one can notice, that on average, other companies offering training in a same profession, perform better in almost every aspect. Reflected workplace learning is underdeveloped and only increases in the fourth year of training. Even though this company also delivers an example for a good development in most of the quality aspects, the overall index cannot be better than a grade D.

6.4 Cost-benefit / quality paradox

Contrary to the calculus of educational economics, where a higher investment in the educational system suggests a higher quality of education, the experiences regarding the practical part of technical and vocational education and training show that a high quality of in-company training can as well lead to better cost-benefit ratios, i.e. to superior cost-effectiveness. This is to the benefit of all parties concerned: apprentices, companies and – of course – also to the economy as a whole.

One can summarise QRC cases in a four field matrix and derive four different natures of In-company training. Fig. 66 shows the performance of 250 companies offering in-company training. Quality (from high to low) is represented on the vertical axis. The horizontal axis summarises the cost-effectiveness (from low to high). All points in the right field on the top thus represent company cases where both, quality and cost-effectiveness of in-company training are high. These cases can be considered as innovative. Best practice cases like this have also been found within the course of the first pre-test of QRC in South Africa (see example of a company training boilermakers in fig. 67, where in-company training is of high quality and produces net benefits without any subsidies.)

Results in all other fields, namely II, III and IV, are sub-optimal. Company results in the field II

represent high cost training, but nevertheless a training of apprentices at high quality. If companies end up with a result in field III, there is a lack of training quality but cost-efficiency is achieved. Such cases can often be found in companies, where apprentices are used as low-cost labour but where training does not lead to autonomous and high qualified professionals. A result in area IV would mean negative quality results as well as negative cost-benefit ratios.

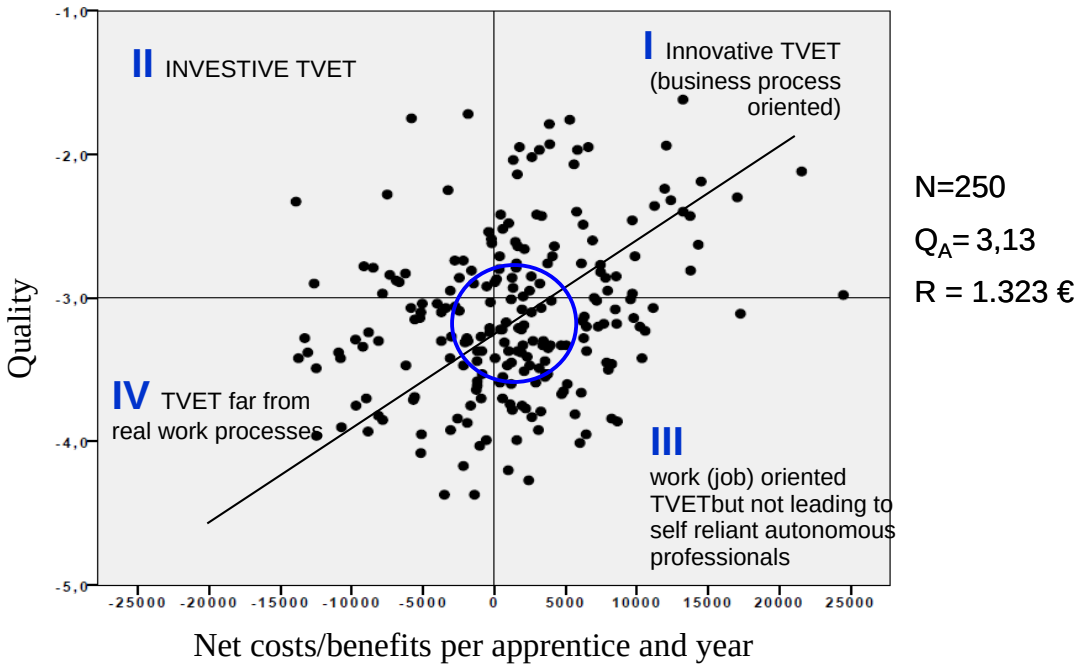


Fig. 66: Costs, benefits and quality of in-company training in Germany. Results of a QRC analysis based on 250 company cases

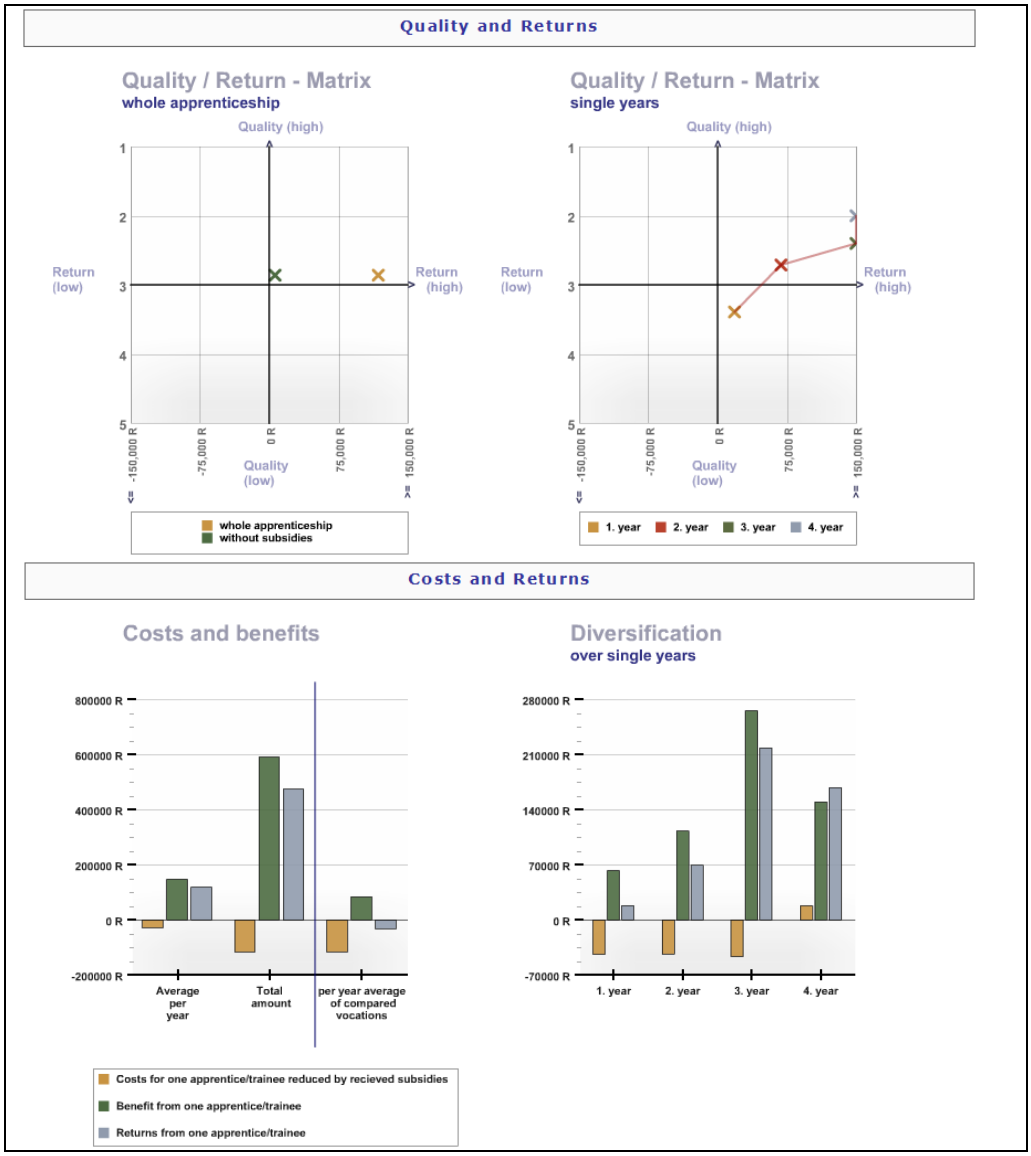
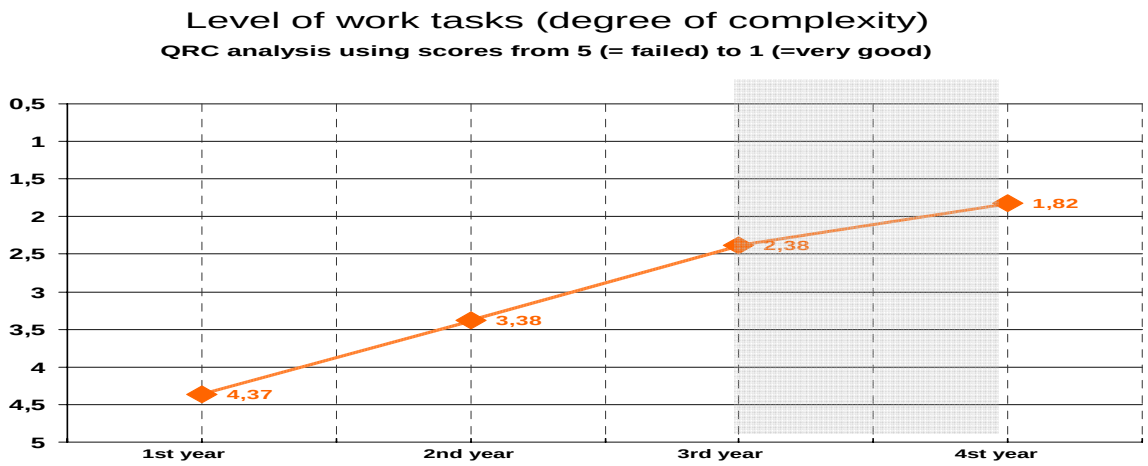
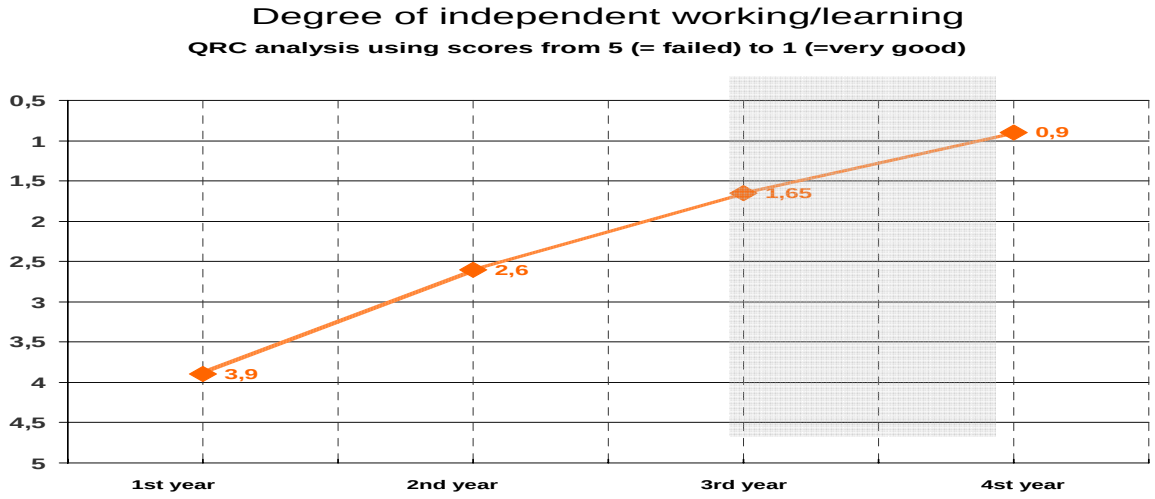


Fig. 67: Individual company test result QRC South Africa: Vocation"boilermaker

Even though the number of current case studies with the South African QRC tool is too small (40 cases in total) to derive representative results, some common elements relevant to all available company cases are already interesting to be noted. The following graphs relate to quality aspects of in-company training in companies who took part in the QRC pilot test:





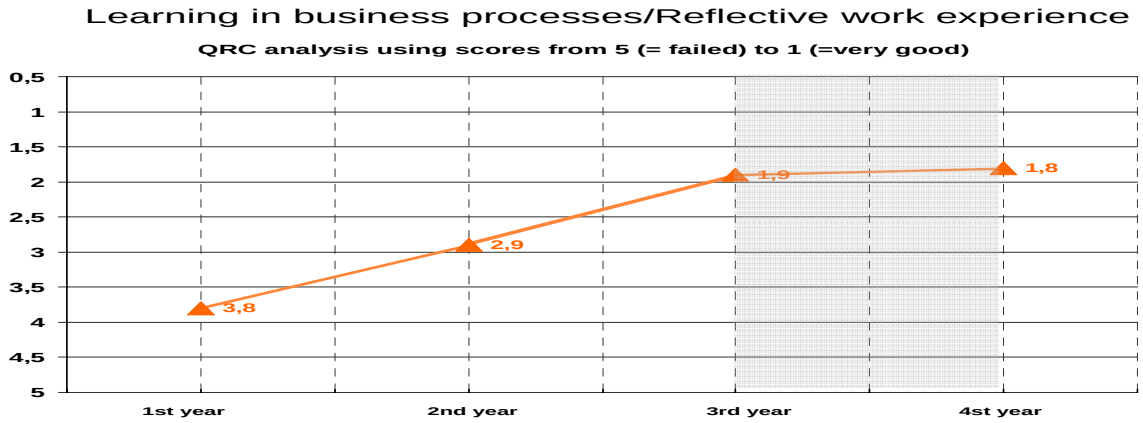


Fig. 68a-c: Analysis of 3 quality aspects of in-company training in South African Companies (QRC pre-test data 2011/2012)

It is striking that in non of these quality aspects the full quality potential of in-company training is met in the first and second year of training. On the other hand a high level of training quality can be achieved by a model training that is based on learning in real and productive work assignments that challenge and stimulate professional competence development.

The establishment of work-process oriented learning methods enabling a reflective work experience within the in-company part of training can be recognized as a central initiative to move up TVET quality and should be subject of further projects to raise TVET quality in South Africa.

Outlook and future considerations

During the course of the next project phase, further South African QRC cases will be entered into the QRC database, which will allow for further and deeper examination.

The QRC project as an integrated part of the services merSETA can offer to its member companies will not only be to the benefit of individual users. Above all, the merSETA will be in a position to offer consulting activities based on QRC analysis.

QRC is anticipated to benefit the South African Skills development system in various ways. First of all, employers will be able to explore the possibilities of improving productivity of apprentices. It will be likely to understand the training costs related to candidates entering an apprenticeship with different pre-apprenticeship qualifications and to relate general cost benefit results to the quality of training provided.

In the long run, Further Education Training (FET) Colleges might also benefit from the information gathered by the QRC database; their curricula can be benchmarked against those of private training providers. Moreover, QRC data can assist private training provider in setting training fees according to market related rates and to interpret the possibilities of tailoring curriculum offerings for specific employer needs. Decentralised Trade Testing Centres will be able to link test pass rates to QRC data and share this information with apprentice training stakeholders.

A second project phase will require

- An official launch of the QRC tool
- Intensive tuition of a QRC project manager
- Regular training of multipliers (VET facilitators, responsible for in-company training), possibly within the frame of other project activities.
- On the basis of at least 75 individual company cases, results and findings will be summarised and recorded in a profound project report, focussing on
    - TVET quality in South African companies
    - Costs and benefits of in-company training
    - Correlations between costs, benefits and quality of apprenticeship

- Comparison of results out of different economic branches and benchmarks regarding different professions/vocations
- Identification of best practice cases
- Conclusions and recommendations

Creating transparency / Learning lessons of best practice

The disclosure of best practise cases will lead to an improvement of the "image" of apprenticeship. By publishing and demonstrating good examples, other companies might benefit from these experiences. Innovations in apprenticeship will be easier obtained, if the ways to innovation are "visible" and realistic. Publishing cases of best practise will have a positive impact on trainers as well as trainees. With the help QRC cases of best practise are easy to indentify. Cases of high profitability and with a high cost benefit ratio will be examined and – provided that company owners or responsible managers and trainers will agree – their example will be documented. I:BB/merSETA will publish a brochure of best practice and invite the companies to present their methods within the frame of VET conferences/workshops. A broader audience can be reached informing the media. The examples of best practise can also be published on relevant homepages.

7. Conclusions and recommendations

7.1 Conclusions

7.1.1 Modern apprenticeship

South African apprentices can well achieve competence levels explicitly higher than in COMET the pilot test carried out in October 2011, if dual vocational education and training is organised and modernised in accordance with international standards. The South African TVET system has the relevant potentials/resources.

Rationale:

Vision *of* (NSDS III):

> *"A skilled and capable workforce that shares in, and contributes to the benefits and opportunities of economic expansion and an inclusive growth path" (p. 3).*

7.1.2 High quality TVET

A well structured TVET system where curricula are based on learning areas is a pre-condition for building a workforce with ability to holistic problem solving. An appropriate approach is COMET competence model with its central idea of vocational education and training: Empowering apprentices in a manner to actively participate in and further to shape the world of work in social, economic and ecologic responsibility.

Rationale:

The Mission of (NSDS III):

> *"To increase access to high quality and relevant education and training and skills development opportunities, including workplace learning and experience, to enable effective participation in the economy and society by all South Africans and reduce inequalities" (p. 3).*

and OSL:

> *"…it is the ability to* ***holistically*** *combine and apply all the relevant fields of knowledge that really results in effective solutions" (NSDS-Handbook 2010/2011, p. 237).*

In the prevailing and established forms of teaching/leaning and in the curricula these central ideas and concepts have not been implemented jet. In order to put them into practise and establish a successful TVET architecture it can be relayed on findings of international comparative studies in modern TVET research.

7.1.3 Quality assurance

Implementation of new methods of assessment and competence diagnostic as a central element to assure TVET quality based on the COMET assessment concept.

Rationale:

According to NSDS III:

> *"The intention of NSDS III is to make sure that the energy and resources of education and training stakeholders are focused on ensuring that these challenges are addressed, and that **measurable impact** is achieved over the coming five year period" (p. 4).*

An outcome-oriented assessment system concomitant to the course of training is based on test and evaluation tasks that are applicable for a measurement of professional shaping and action competence. An introduction of such assessment methods would lead to a considerable reduction of the existing assessment activities. An assessment structure according to relevant learning areas will not require more than three (a maximum of five) tests in one year of training. This assessment concept directly corresponds with a modern vocational didactic, i.e. with the concept of developmental learning and practical work tasks according to the COMET competence model.

7.1.4 Reflective work-experience

According to the present results of the first COMET test in South Africa, the weakness of the established VET structure is due to the fact that the core element of TVET, which is **reflected work experience,** is not bailed out as much as it needs. Therefore it is suggested to replace the modular training concept in training workshops with the concept of learning in qualifying work processes.

Rationale:

> *"NSDS III seeks to encourage and actively support the integration of workplace training with theoretical learning, and to facilitate the journey individuals make from school, college or university, or even from periods of unemployment, to sustained employment and in-work progression" (p. 3).*
>
> *"The desperate plight of so many of the longer term unemployed who lack basic numeracy and literacy, do not possess entry-level skills, and do not have the work experience and work-based training needed to enable them to seek and obtain work" (p. 4).*

and NSDS III (4.5):

> *"Encouraging better use of workplace-based skills development".*

The results of the COMET test regarding the deficits of vocational and work-related competence are based on a lack of reflected work experience. These assumptions are confirmed by some first findings resulting from a pre-test experience with the online-tool QRC.

In general, weaknesses regarding the quality of in-company training are linked to the following factors:

1. The share of learning in real business processes is too low
2. The level of work tasks (degree of diversity) is low
3. Work process orientation is low

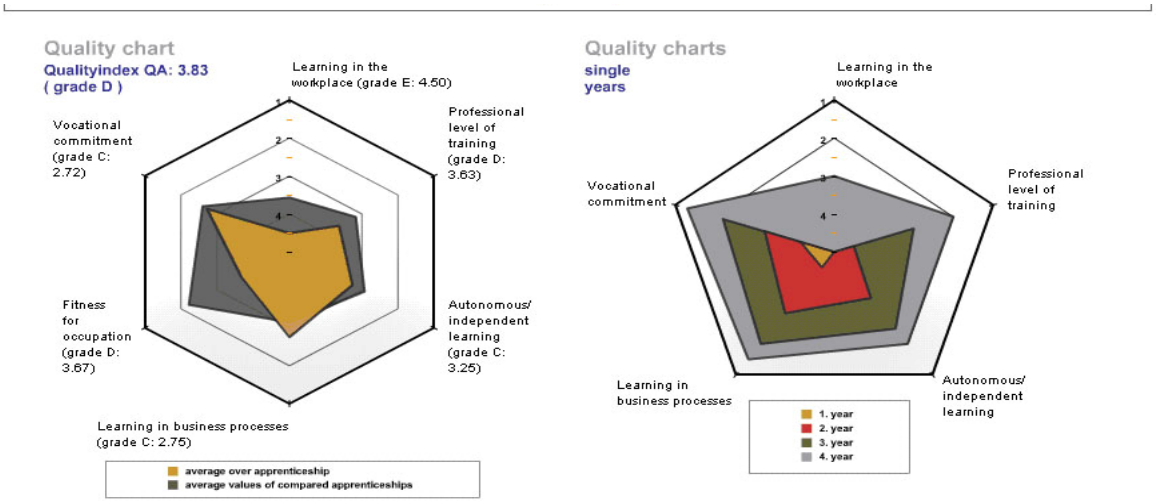


Fig. 69: Example of a quality chart with QRC

Such deficits find their expression in a low competence level of apprentices. But if the potentials of learning in qualifying work processes are maxed out, it will be possible to

- reach higher competence levels and to
- lower the costs of training

7.1.5 Dual organisation of vocational learning

A dual organisation of vocational education is a prerequisite for VET quality and thus for the achievement of higher competence levels.

Reason:
According to NSDS III:

> *"…integration of workplace training with theoretical learning" (p. 3).*
>
> *"Workplace learning should be an integral part of all vocational programmes. Establishing effective partnerships between education and training systems and employers to provide for workplace training would ensure that skills have real labour market relevance and that young people gain an early appreciation of and exposure to the world of work. A particular focus of NSDS III is on artisans" (p. 12).*

Findings from international comparative TVET research are proving that the success of dual vocational education and training is predominantly based on the organisation of dual VET. Therefore it needs an integrated Curriculum considering developmental vocational tasks in line with the concept of a development from novice to expert. Such tasks can be identified by "Commitees of expert practice (CEPs)" according to the method of "Expert Worker Workshop".

Following the Novice-Expert-Concept these tasks have to described and assigned to **vocational learning areas** (not to modules!). In an integrated curriculum, these learning areas have to be attributed to both learning locations (VET schools and also companies) in a complementary way.

NSDS III:

> *"Setting standards for quality artisan training" (p. 12).*
>
> *4.3.1.1: "…the curriculum is revised to ensure that it provides a sound foundational basis for building labour market relevant skills" (p. 17).*

7.1.6 Curriculum development

The test results suggest a continued and extended implementation of integrated outcome-based curricula according to the concept of learning areas and based on modern occupational profiles. This requires

1. **The qualification of curriculum development specialists for business (real work) oriented curriculum design.**
2. **The establishment of domain specific qualification and curriculum research as a common task of universities and SETA-based VET research.**

NSDS III (4.1): Establishing a credible institutional mechanism for skills planning

> *"It is important to recognize the changing nature of work […], within which South African enterprises are operating. […]. This requires the development of research capacity, particularly research related to building new knowledge linked to sector and national industrial plans" (p. 13).*

This requires: NSDS 4.2.4:

> *"Relevant research and development and innovation capacity is developed and innovative research projects established" (p. 14).*

Moreover, the recommendations of the INAP Commission "Architecture Apprenticeship" can serve as a foundation for the development of a sound qualification and curriculum research. (INAP Commission "Architecture Apprenticeship", 2012)

7.1.7 Training of and (advanced) continued training of teachers/trainers

Teachers and trainers (internal training officers) who took part in the South African COMET project 2011 have shown an enormous interest and commitment regarding the implementation of modern VET research tools and regarding a modernisation of vocational education and training

The following topics should be part of a continuous training programme of these and other VET teachers and trainers:

- **Designing modern occupational profiles**
- **Designing integrated and work process related occupational curricula**
- **Implementation of an assessment/diagnostic system based on the COMET-model.**
- **Shaping occupational learning projects**
  - in the enterprises
  - in vocational colleges
- **Managing training partnerships between companies**
- **Upgrading informal apprenticeships.**

NSDS III:

> *"Programmes that contribute towards the revitalisation of vocational education and training, including the competence of lecturers and trainers to provide work-relevant education and training, and promote occupationally directed research and innovation" (p. 6).*

A key role will play the introduction of master study courses for vocational pedagogics according to the Hangzhou-Declaration (2004) (see appendix III).

As an immediate measure, setting up an internet-based COMET platform for learning tasks in co-operation with the German COMET project in Hesse (Ministry of culture) should be envisaged. A similar platform exists in Hesse since three year know and has – among others contributed to a successful dissemination of the COMET learning and assessment concept in the vocational field "electro technology".

For the performance, upkeeping/maintenance, regional and trans-regional working groups of VET teachers and trainers would be fundamental.

7.1.8 Modernisation of assessment practice

At the end of any dual vocational education and training course, there should be an examination to assess professional maturity (*Berufsfähigkeit*)
This examination should include:

- **A practical assessment to examine the apprentice' competence to solve a complex work task connected to real work orders. This examination should take place within the training (employing) company.**
- **A theoretical assessment to examine the apprentice' work process knowledge based on a national assessment model according to the principles of the COMET assessment system.**

Rationale:

According to NSDS III (4.2):

> *"A particular focus of NSDS III is on artisans. To facilitate the realisation of the above objectives with regard to the development of artisans, the DHET has established the National Artisan Moderating Body (NAMB) whose main statutory functions will include the following:*
>
> *Setting standards for quality artisan training*
>
> *Monitoring the performance of and moderating accredited artisan trade test centres*
>
> *Developing, maintaining and applying a national databank of instruments for assessment and moderation of artisan trade tests*
>
> *Developing and maintaining a national database of registered artisan trade assessors and moderators*
>
> *Recommending certification of artisans to the QCTO" (p. 12).*

Practical assessments have to be linked to standards defined for a vocation. Practical knowledge can be assessed in the context of real work orders. This is why any assessment of practical knowledge cannot be subject to abstract tests apart from a given context.

According to international experiences the conduction and monitoring of practical assessments can be dedicated to local assessment commissions. It has to be added that a practical assessment can as well omitted (or most widely) if an assessment related to a regular evaluation according to the learning area concept has been introduced.

A final theoretical examination can be reduced to the contents of the leaning areas of the final year of training. Test tasks should be elaborated according to the COMET assessment concept. This requires a regular training of raters in order to qualify them and to assure a high degree of inter-rater reliability.

7.2 Recommendations

7.2.1 Short term reform projects

A: COMET Project

Performance of a longitudinal examination (large scale competence diagnostics) with two test dates:

- April 2013
- April 2014

In the vocations:

- electro technician
- industrial mechanic
- car mechatronic

The preparation phase includes

- selection of test groups of around 300 – 600 apprentices/students per test group
- implementation of the learning form “learning tasks” according to international COMET standards
- introduction of the COMET Assessment System

Rationale:

The pilot COMET project in 2011/12 has shown that vocational competence, vocational and occupational commitment of apprentices can and students can be measured very precisely and test instruments have proved valid. The test results show – with a high degree of exactness the strength and the weaknesses of the South African TVET praxis. From these results it can be learned how the quality of apprentice teaching and training can be rised.

Quality assurance in technical and vocational education and training needs an examination method according to international standards, which also allows for international comparisons.

B: Introduction of project oriented learning forms

Based on the COMET competence model, project oriented learning shall be introduced in the following vocations

- electronic technician
- industrial mechanic
- car mechatronic

and in close cooperation with the international COMET consortium. The beginning of this measure is May 2012.

Rationale:

One of the central disadvantages of the established TVET praxis in South Africa is its content fragmentation. On this basis, apprentices have difficulties to develop of a relational understanding of complex work tasks.

> *"A variation of the turf war theory is that there is a fundamental rift between the actual practitioners of discipline based learning (primarily in the Dept Education), and work-based learning (primarily in the Dept Labour), and that in fact this kind of rift is visible all over the world in approaches to learning and knowledge.*
> *Different terms are used to describe this rift, including:*
>
> - *Academic vs Practical*
> - *Theoretical vs Experiential*
> - *Teaching vs Learning*
> - *Inputs vs Outputs*
> - *Institution vs Workplace*
> - *Discipline vs Occupation*
>
> *It is in fact a feature of modern society, that increasing levels of specialisation across all fields is resulting in a fragmentation of knowledge from the perspective of "knowledge consumers" (students, business, workers, governments). The need for integration and connection between these silos of specialised knowledge becomes very apparent, when we try and apply knowledge to solve human problems. It is then, that we realise, that although we have reached an advanced level of specialisation in a particular field of knowledge, it is the ability to holistically combine and apply all the relevant fields of knowledge that really results in effective solutions. And most specialists only want to stay with the familiar environment of the field of their specialisation, seeking deeper levels of "truth" deeper within their field. Few specialists have the breadth of vision and courage to find links between their domain and other domains" (NSD, p. 236, 237).*

The COMET Competence model is based on the concept of holistic problem solving of work tasks.

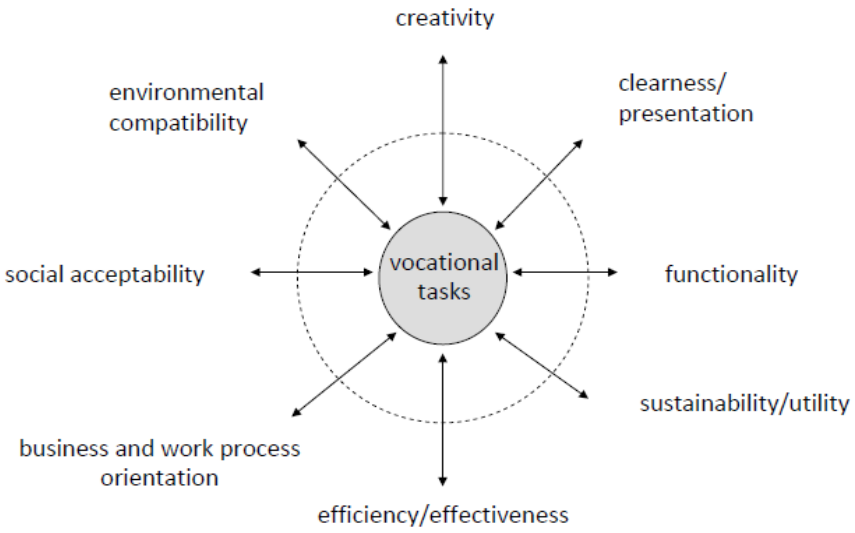


Fig. 70: Criteria for the complete (holistic) solution of professional tasks

In this particular project stream the effectiveness of project oriented learning shall be examined. In an agreement with other COMET projects it shall be assured and guaranteed, that works of

those “learning tasks projects” which have already been successfully implemented, can as well be used and shared by other partners of the international COMET network. This especially relates to the development of test and learning tasks in the relevant vocations.

C: Project oriented assessments

In the vocations

- electronic technician
- industrial mechanic
- car mechatronic

the COMET rating and assessment scheme shall be tested. The COMET rating and measurement model will serve as a basis.

Rationale:

Assessment procedures play a major role in TVET quality. One can consider assessment practice as the “secret” or “hidden” curriculum. This is the reason why it is necessary to examine competence development of apprentices as well by using test tasks according to the COMET competence model and according to the current project findings.

It will then be possible to test, in how far the learners are able to solve problems on the basis of their knowledge and as well in a holistic problem solving approach. This assessment concept strengthens the qualification of young professionals which will be in a position to realise the central idea of a “learning enterprise” with participative organisational structures.

The COMET assessment scheme ameliorates feedback structures of vocational learning and is thus a major determinant for vocational competence development.

7.2.2 Recommendations in an intermediate term perspective

The results of the COMET pilot test and of the QRC case studies support the hypothesis that the weaknesses of South African TVET practice (input- and output related) which have been measured with both evaluation methods, QRC and COMET might be a result of

- a very fragmented and strongly hierarchised TVET structure
- a curriculum practice that is contradictory to the central aims of vocational education that should lead to vocational competence and the ability of solving vocational tasks in a holistic way.

This hypothesis has to be empirically examined in a subsequent 24-month project phase II which will start in 2012. If the hypothesis is confirmed, this would lead recommend a comprehensive TVET reform

- in the field of developing occupational profiles and
- in curriculum development

According to the latest INAP Memorandum on the Structure, Organisation and Management of Dual Vocational Education (working paper of the INAP Architecture Apprenticeship commission, see Appendix III):

> "Putting the concept of open dynamic occupational profiles into reality shall make it possible
> - to establish profiles that are stable in content and over time,
> - to raise public awareness of these occupations,
> - to achieve a high level of flexibility, stability and transparency on occupation-specific labour markets,
> - to limit the number of training occupations to about 200–300 internationally established non-academic occupations.
>
> The stability of occupational profiles is the prerequisite for restoring their relevance in public debates, in the choice of careers and the development of professional identity of trainees, which had been lost due to the continuous reinvention of job titles in enterprises with a task-oriented work organisation. International and national classification systems that were developed for labour statistics are not suitable for vocational education. Job profiles or "employment occupations" are highly specialised descriptions of work. They are by no means adequate as a basis for organisation of vocational education. The same is true of modular certification systems, which are now represented in many national and international qualifications frameworks." (p. 6)

International experiences have as well shown, that a reform in technical and vocational education and training must be accompanied by the establishment of university study courses in vocational pedagogies for VET teachers, internal training officers, TVET experts at Master level.

The groundwork for such measures has been negotiated within the frame of a UNESCO project and has been published in the Declaration of Hangzhou in 2004 (appendix).

University TVET master courses will as well secure the necessary infrastructure for Graduate programmes (PhD Courses) and thus the needed basis for further TVET research. If South Africa further develops / builds up its own TVET research institutions, an innovative TVET system based on the interaction of TVET policy, practice and research can be realised.

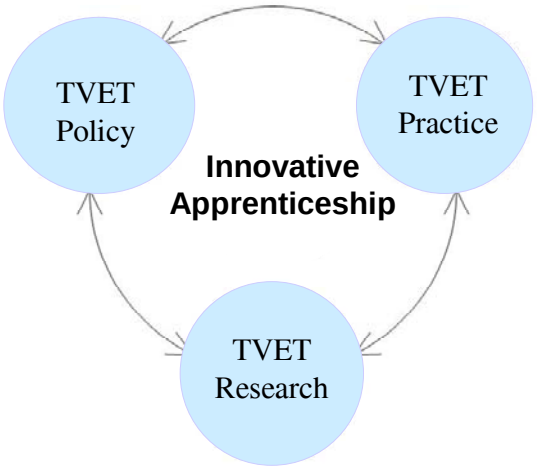


Fig. 71: Circle of innovative apprenticeship

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Appendix I Competence according to training institutions

Split down according to training institutions, the numbers for competence level according to training institution are too small to show significant differences in terms of competence level (tab. 16).

		Level of Competence				Total
Training institution		0	1	2	3	
Arcelor	Number	39	38	0	0	77
	% according to Training_institution	50,6%	49,4%	,0%	,0%	100,0%
Eastcape M.C.	Number	1	0	0	1	2
	% according to Training_institution	50,0%	,0%	,0%	50,0%	100,0%
Fundi	Number	14	5	0	0	19
	% according to Training_institution	73,7%	26,3%	,0%	,0%	100,0%
Sedibeng	Number	18	3	0	0	21
	% according to Training_institution	85,7%	14,3%	,0%	,0%	100,0%
Vaal	Number	19	12	0	0	31
	% according to Training_institution	61,3%	38,7%	,0%	,0%	100,0%
VW	Number	17	11	2	2	32
	% according to Training_institution	53,1%	34,4%	6,3%	6,3%	100,0%
Total	Number	108	69	2	3	182
	% according to Training_institution	59,3%	37,9%	1,1%	1,6%	100,0%

Table 16:Competence levels according to training institution

If the general pattern of roughly 60% of test takers staying on nominal level, 38% achieving functional competence, and 3% a higher level is broken, this is not significant according to the small numbers of test takers in some of the participating organisations.

Fig. 17 visualises the distribution of competence levels according to training institution. Though overall not significant, one may notice that the rate of learners only reaching the level of nominal competence - the risk group - is less for the learners at Arcelor and VW compared to those at the training centres and colleges. Sadly, the number of participants providing information about their prior schooling is too low to decide weather this may be due to training arrangements or to recruitment practices.

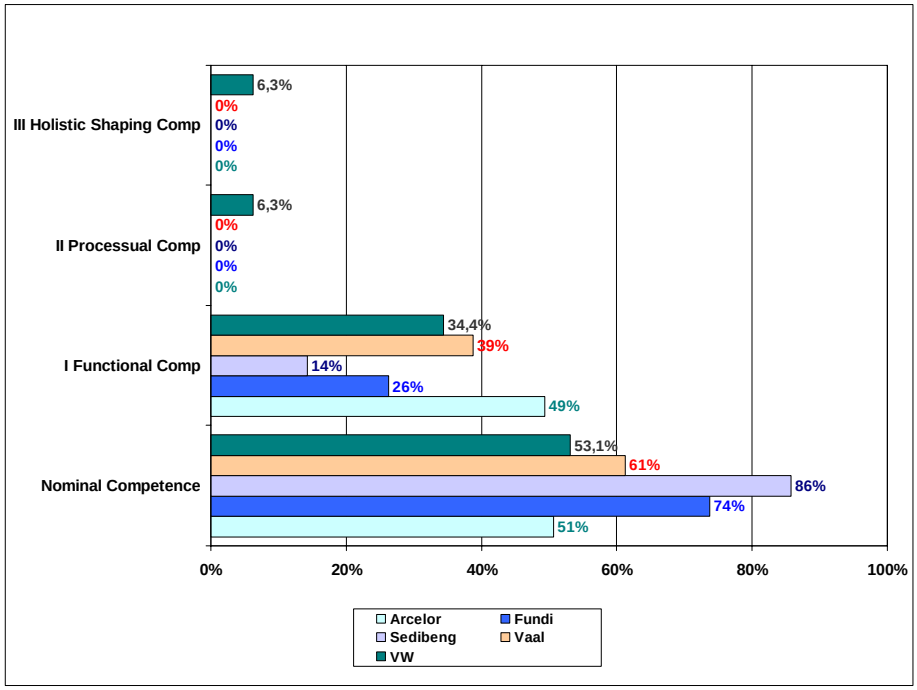


Fig. 17: Competence levels according to training institution

For all training institutions, we calculated (apart of the individual feedback) the distributions of competence levels for all participants as well as for those scoring more than 5 points (as this is the threshold used in COMET projects for deciding wether participants were able to make sense out of the task). Furthermore, for both groups competence profiles were calculated (radar charts). Is has to be noted, though, that especially for colleges and training centres the numbers of participants is relatively low. So, any closer analysis e.g. according to values of specific competence criteria has some margin of error and may be up to chance.

Arcelor Mittal shows 71% of test takers only reaching the level of nominal competence. Still, this is a comparatively good value regarding other training institutions that compensates for not having learners at the levels of processual or holistic shaping competence. For students scoring more than 5 points, the rate of those only reaching nominal competence is the lowest amongst all training institutions (fig. 18).

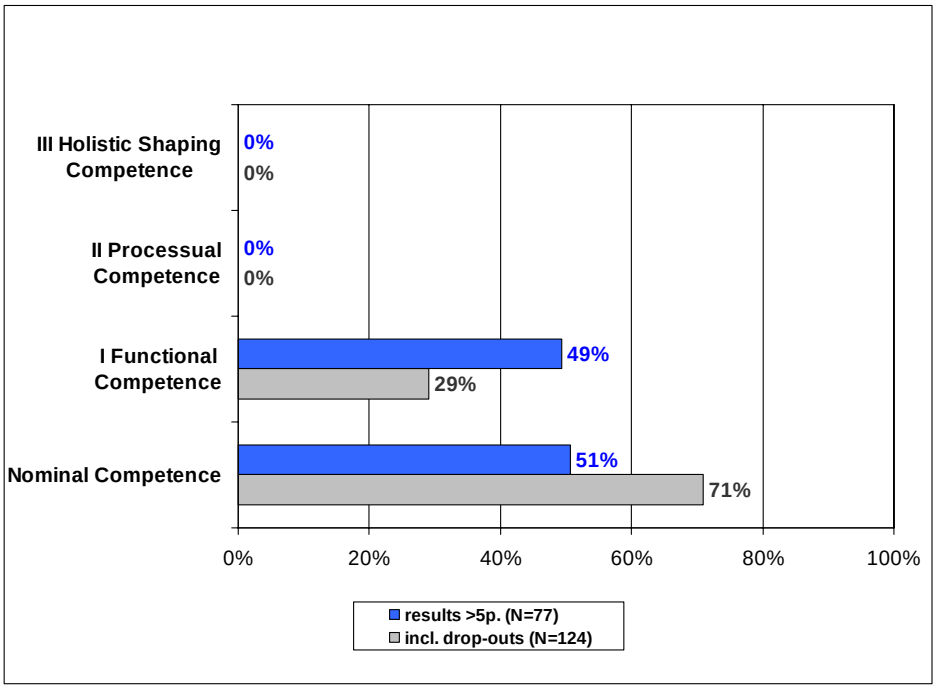


Fig. 18: Average distribution of competence levels at ArcelorMittal South Africa

Figures 19a and 19b show the distribution of competence criteria and dimensions. For all learners as well as for those scoring more than 5 points, the solutions' aspects K4 and K7 (efficiency/effectiveness and environmental responsibility) are relatively underdeveloped.

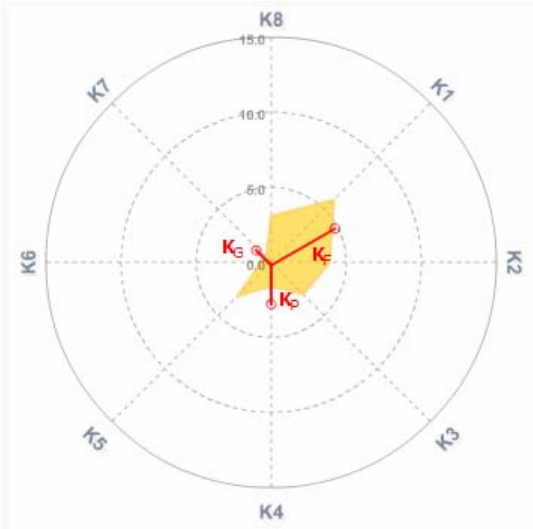


Fig. 19a Average competence profile at Arcelor Mittal 124, total score mean = 9

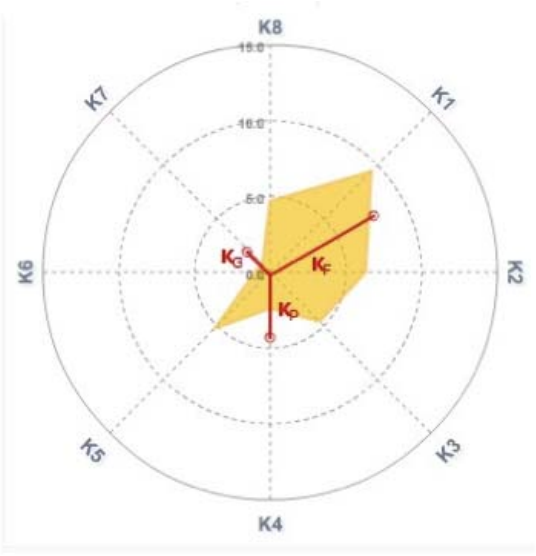


Fig. 19b: Average competence profile at N= Arcelor Mittal total score > 5. N= 77, total score mean = 14,15

At *Eastcape Midland Colleage*, only four learners took part in the test. Thus, no reliable conclusions can be drawn. Still, it seems remarkable that one of the test takers reached the highest level of competence whereas the other three are part of the risk group (fig 20, 21). The radar chart shows a lack of environmental compatibility (as at almost all training institutions), but a relatively high degree of the solutions' social acceptability and creativity.

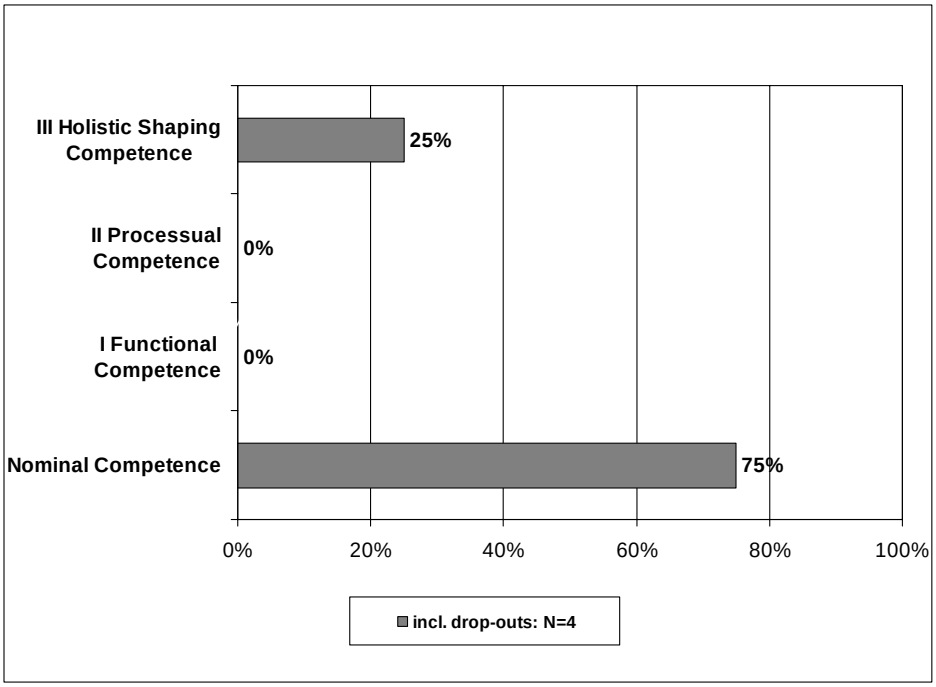


Fig. 20: Average distribution of competence levels at Eastcape. N=4

Fig. 21: Average competence profile at Eastcape Midland Colleage. N= 4, total score mean = 14.3

Fundi Training Centre shows a relatively high group of nominal competence, with no test takers reaching processual or holistic shaping competence (fig. 22). The competence profile is slightly

more homogenous, K4 and K7 not being as much underdeveloped as in some other training institutions (fig. 23a–b).

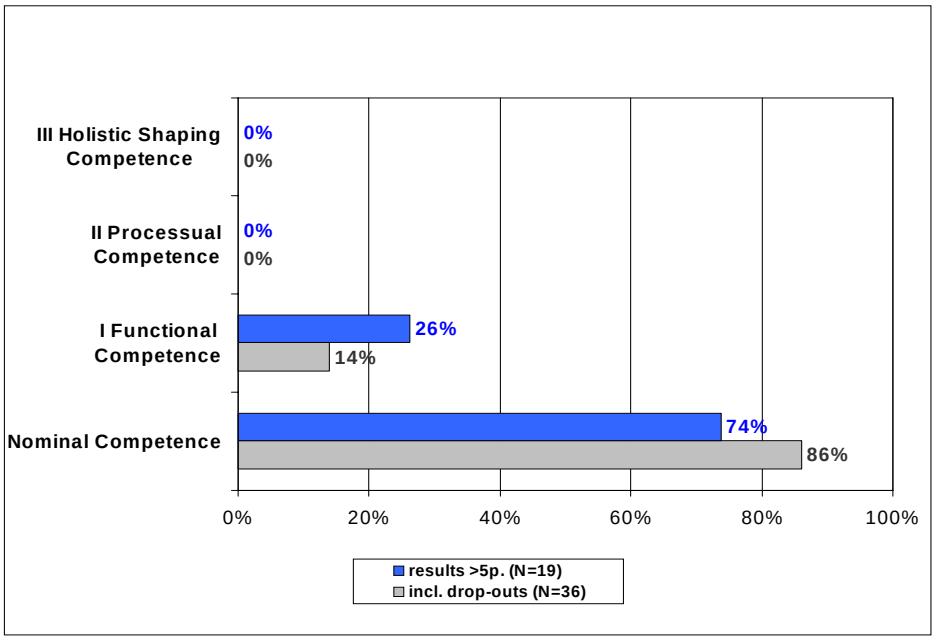


Fig. 22: Average distribution of competence levels at Fundi Training Centre

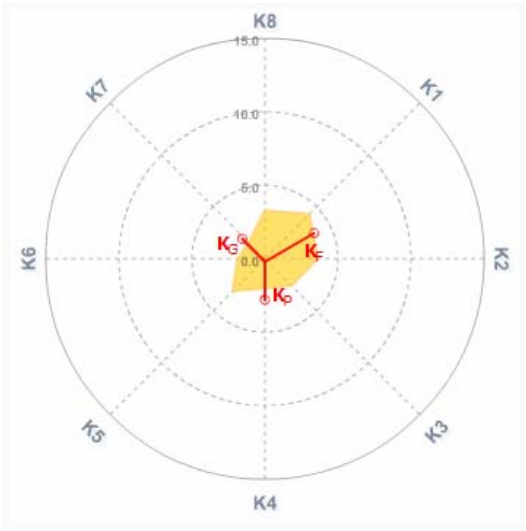


Fig. 23a: Average competence profile at Fundi Training Centre. N= 36, total score mean = 8.8

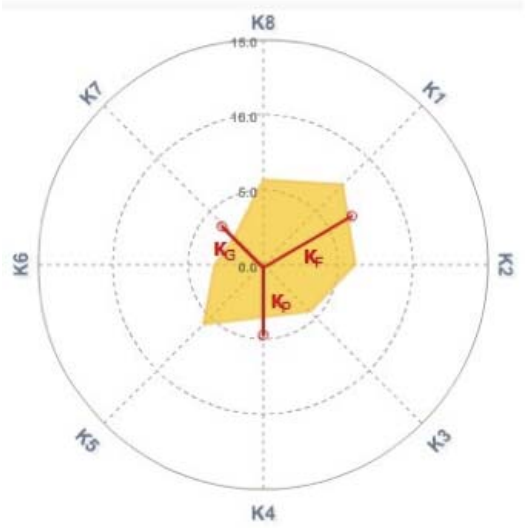


Fig. 23b: Average competence profile at Fundi Training Centre, total score >5. N= 19, total score mean = 15.3

At *Sedibeng College*, the number of learners belonging to the risk group is relatively high, both overall as in the group of learners scoring more than 5 points (fig. 24). The average competence profile looks relatively homogenous despite the low scores for K4 and K7 that are typical for the whole group of test takers (fig. 25a–b).

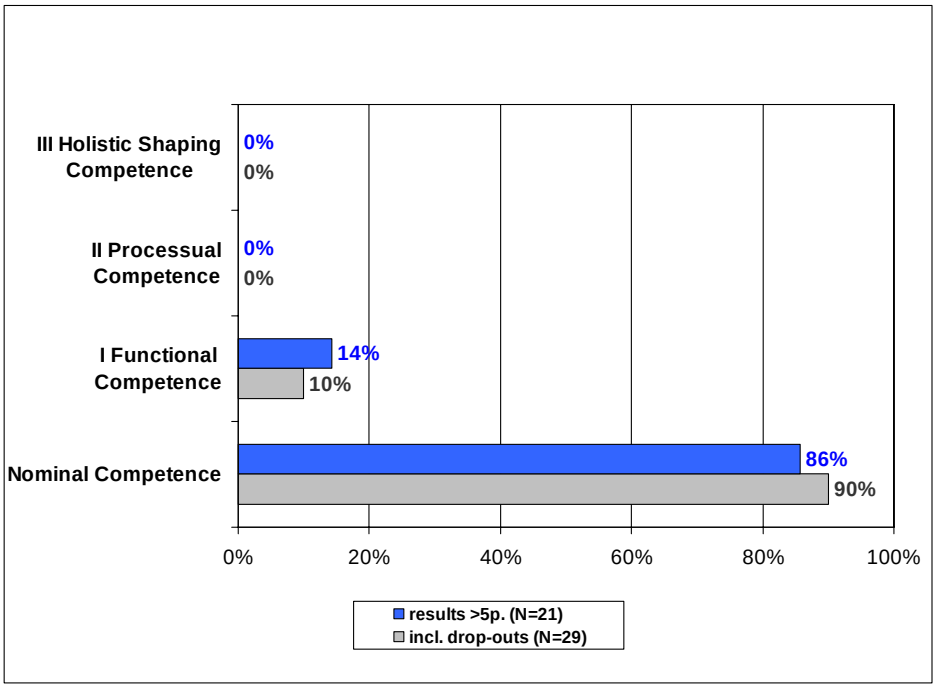


Fig. 24: Average distribution of competence levels at Sedibeng

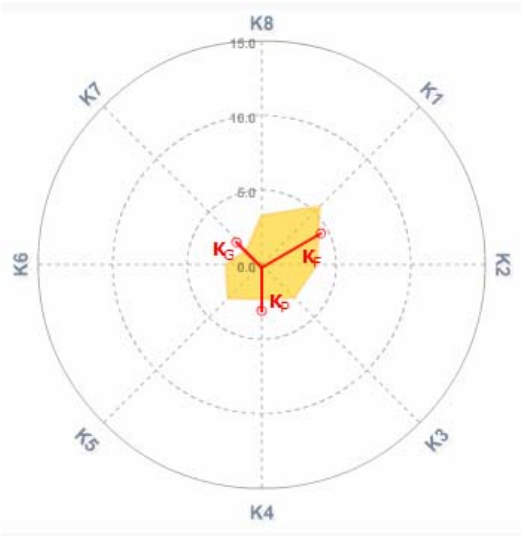


Fig. 23a: Average competence profile at Sedibeng. N= 29, total score mean = 9.8

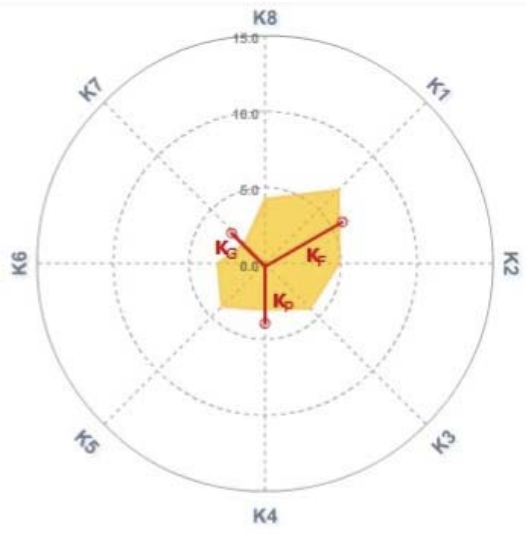


Fig. 28: Average competence profile at Sedibeng, total score >5. N= 21, total score mean = 12.7

Vaal university shows average results, the risk group being slightly lower than overall, but not having students reaching the levels of processual or holistic shaping competence (fig. 29, 30). The radar charts show a pronounced weakness at the criteria K4 and K7, the solutions' efficiency and environmental compatibility (fig. 31, 32).

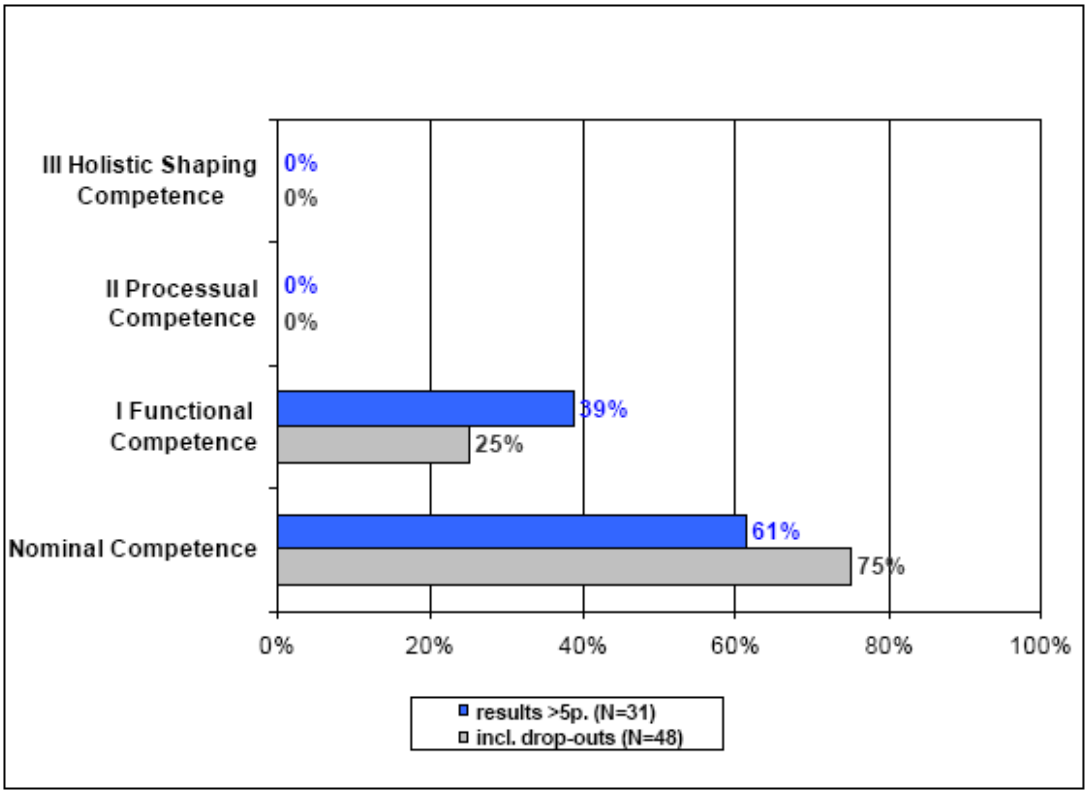


Fig. 29: Average distribution of competence levels at Vaal University

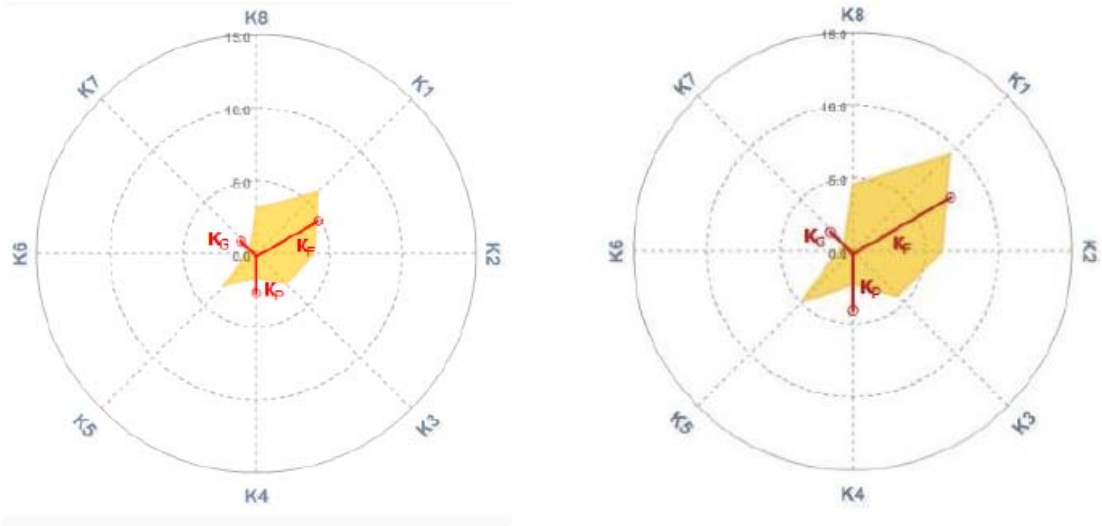


Fig. 31: Average competence profile at Vaal University. N= 48, total score mean = 8.9

Fig. 32: Average competence profile at Vaal University. total score >5. N= 31, total score mean = 13.71

At *Volkswagen*, the risk group as well as the group of learners reaching the level of functional competence are slightly lower than average, the number of learners reaching processual or holistic shaping competence slightly higher (fig. 33, 34). The competence profile shows a high focus on the solutions' functionality, giving less relevance to efficiency and environmental compatibility (fig. 35, 36).

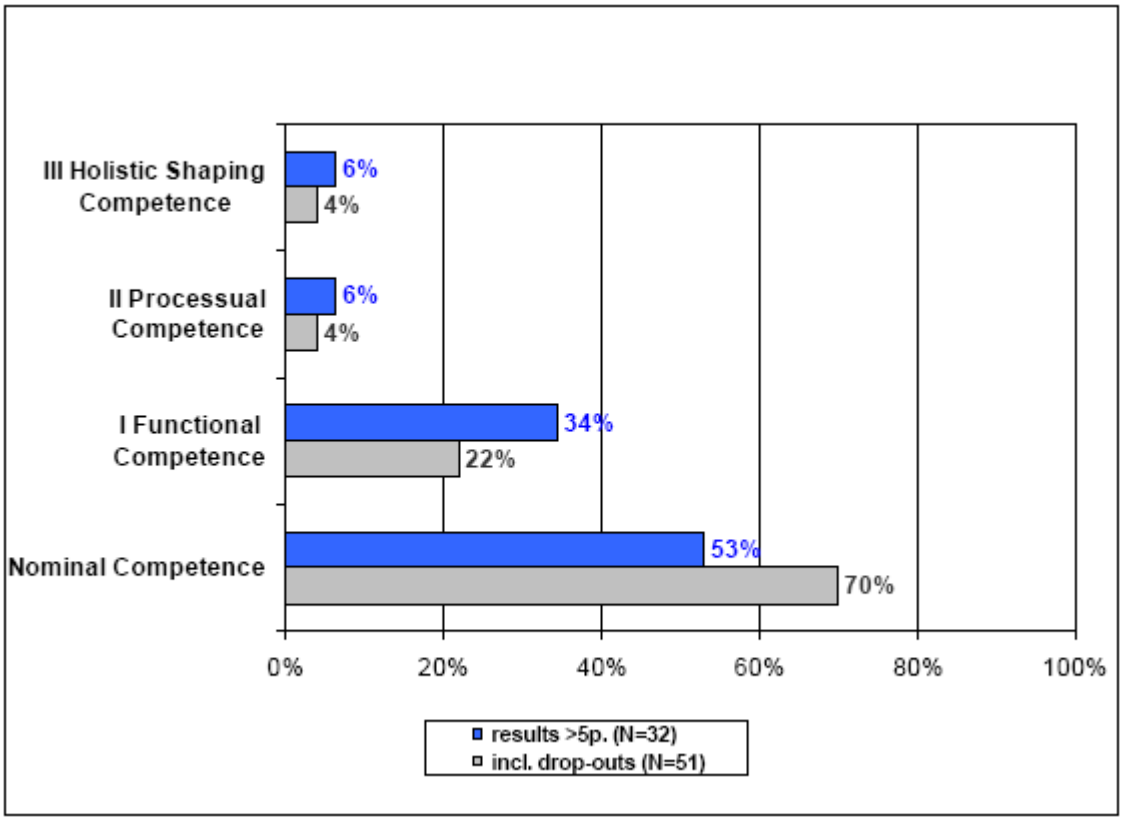


Fig. 33: Average distribution of competence levels at VW

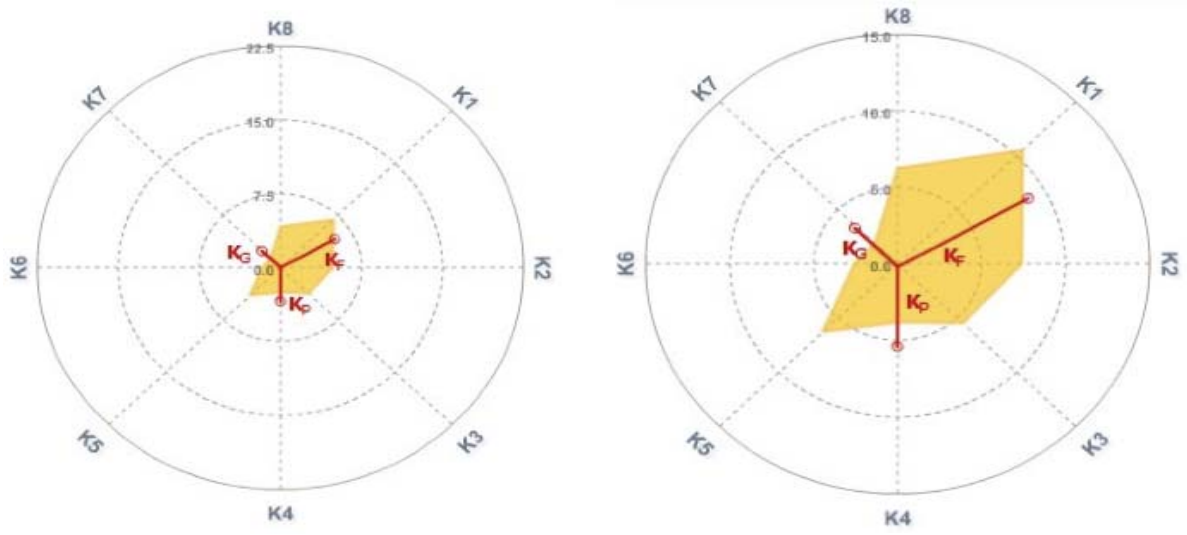


Fig. 35: Average competence profile at VW. N= 51, total score mean = 11.6

Fig. 36: Average competence profile at VW, total score >5. N= 32, total score mean = 17.8

To summarise, the test scores do not differ extremely in between training institutions. Although there are differences in competence levels (fig. 17) as well as in the average total score (fig. 37), the number of participants is too small to show significant differences. As the percentile bands (explanation in chapter 4) demonstrate, the different institutions' mean scores are just inside the various confidence intervalls (fig. 38). The percentile bands show, additionally, the group of ‘low scorers’ being stronger at Sedibeng as well as more than 10% positive outliers at VW which are responsible for the far-reaching band.

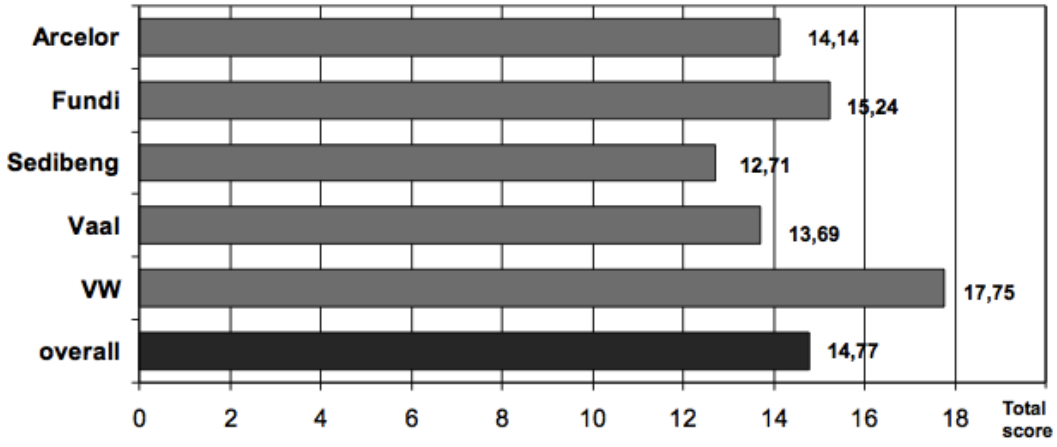


Fig. 37: Average total score according to training institution

Appendix II Competence Profiles according to different results

Analysing typical characteristics of competence profiles, it is important to try to distinguish between peculiarities that are are only inherent in strong or weak profiles and those that are characteristic regardless of the test takers' level of competence. According to total scores, the participants were split into ten groups, each representing a decile of the whole population. For each group, a competence profile was calculated (as often some of the participants had the same score, it was necessary to split into uneven groups). Fig. 41 shows the highest decile, representing the ten percent highest scoring test takers. Here, the competence profile is much more homogenous than in average, only K4 (efficiency) being slightly underdeveloped. These learners are regarding all the different aspects of complex work tasks.

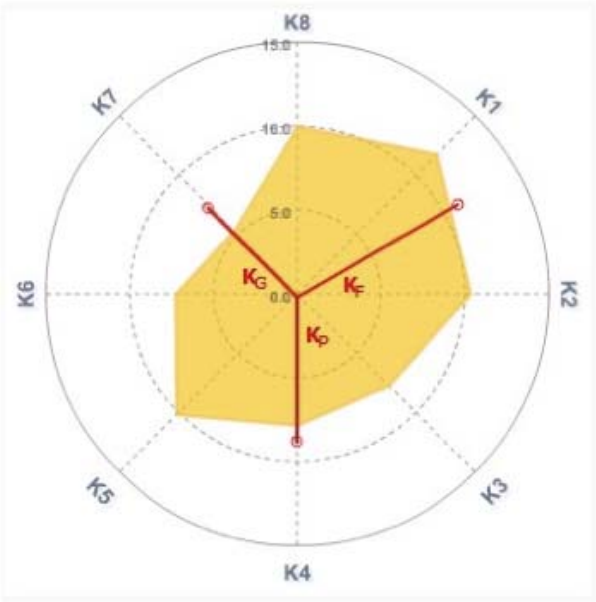


Fig. 41: Competence profile of the 10th decile (top 10%) N= 16, total score >16,5, total score mean = 27.19

Figure 42 represents almost 20% of the test takers (the 8th and 9th decile), as 33 participants scored 16.5 points. This competence profile is remarkably different to fig. 41, showing pronounced weaknesses at K4 and K7, while having strengths in the solutions' functionality (K1) and work and business process orientation (K5).

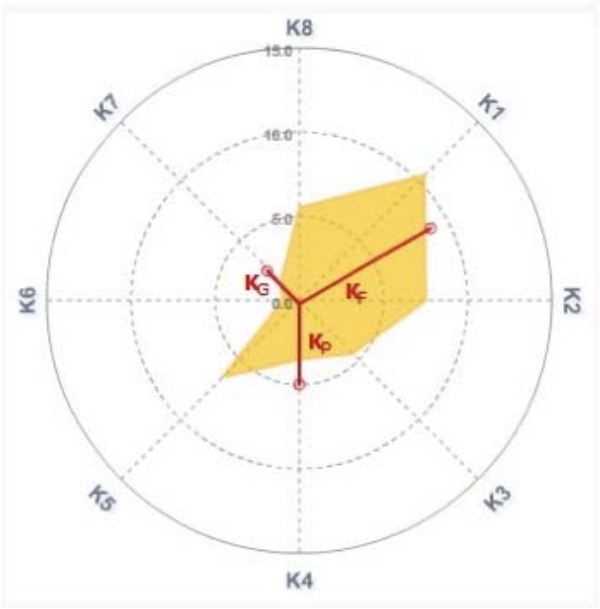


Fig. 42: Competence profile of the 8th and 9th decile N= 33, total score = 16.5, total score mean = 16.5

The 7th decile's overall score is quite close to the 8th and 9th. Their scores only differentiate for K4 and K7, that are even weaker accentuated than in fig. 42 (fig. 43).

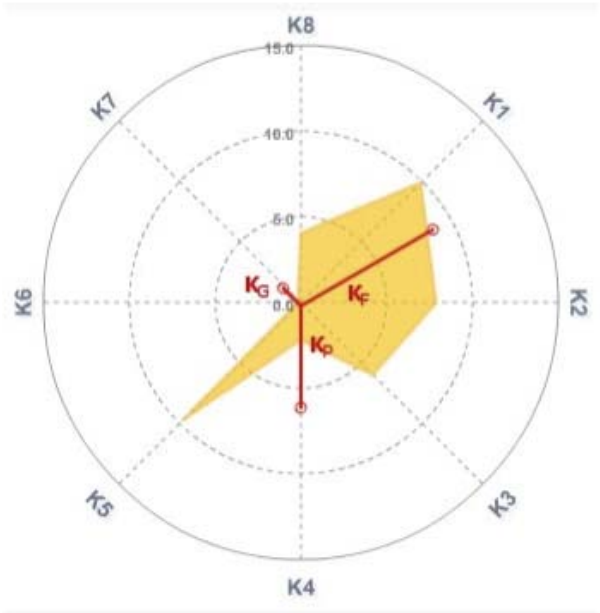


Fig. 43: Competence profile of the 7th decile N= 17, total score = 16.3, total score mean = 16.3

The sixth decile, too, contains participants that scored almost as high as the 7th-9th decile. In difference to those, here K5 is not as strongly pronounced (fig. 44).

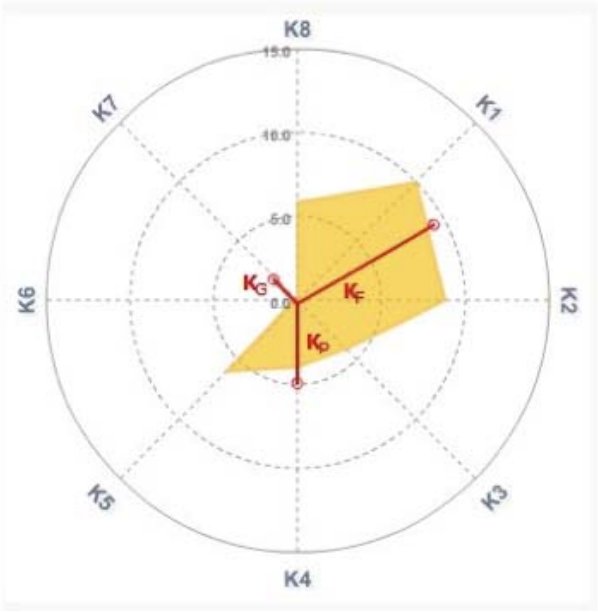


Fig. 44: Competence profile of the 6th decile N= 17, total score 15.51 - 16.2, total score mean = 16.19

The 5th decile scores one full point lower than the 6th. The competence profile generally shows lower values, only K1 - the solutions' functionality - being at a relatively high level (fig. 45).

Fig. 45: Competence profile of the 5th decile N= 22, total score 13.01 - 15.5, total score mean = 15.15

The break between the 4th decile and the upper half of test takers is quite pronounced, this decile on average scoring roughly two and a half point lower than the 5th. Competence on all levels is rather weak (fig. 46). Together with deciles two and three that score similarly overall (fig. 47-48), here the test takers mostly rely on the solutions' functional dimension. The first decile (fig. 49) shows generally weak values at all criteria.

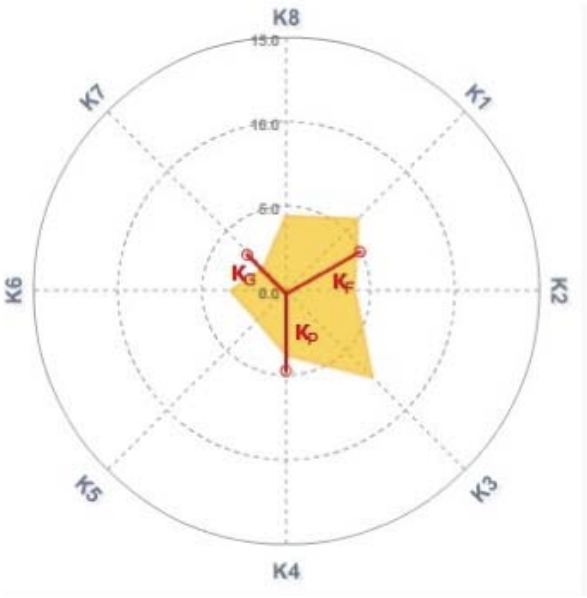


Fig. 46: Competence profile of the 4th decile N= 19, total score 11.31 - 13, total score mean = 12.88

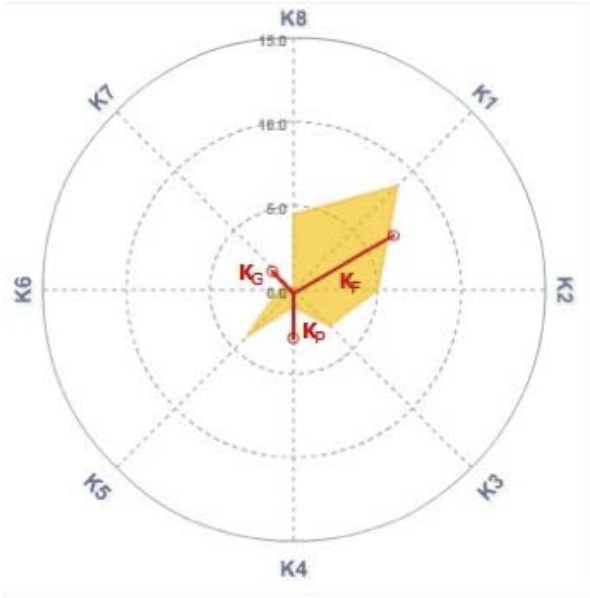


Fig. 47: Competence profile of the 3rd decile N= 18, total score 10.51 - 11.3, total score mean = 11.07

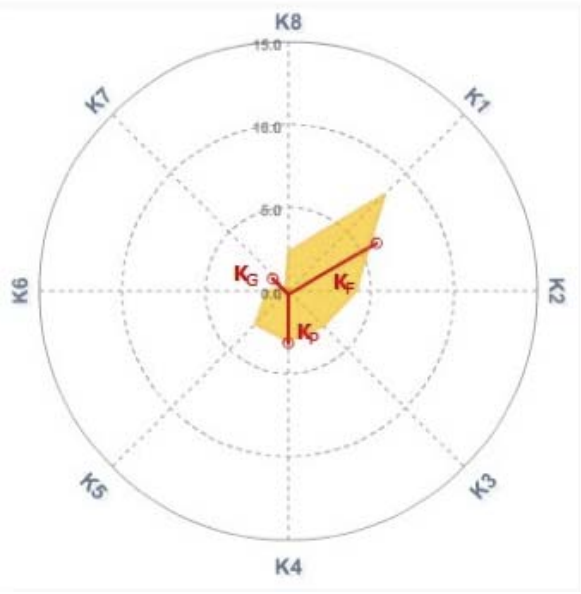


Fig. 48: Competence profile of the 2nd decile N= 21, total score 9.71 - 10.5, total score mean = 10.41

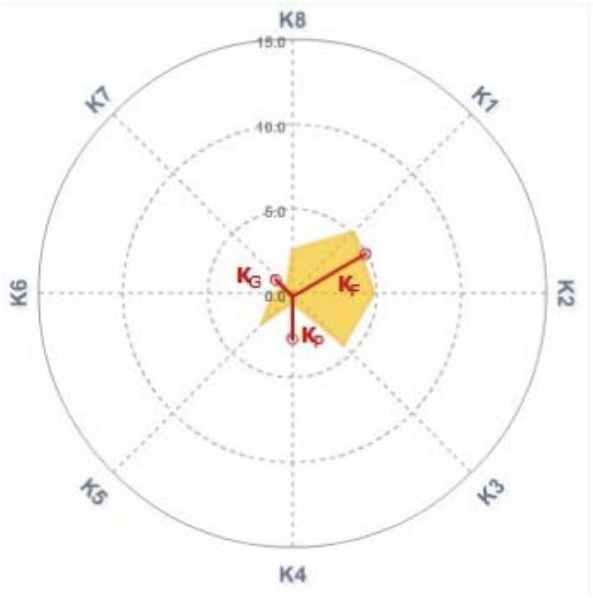
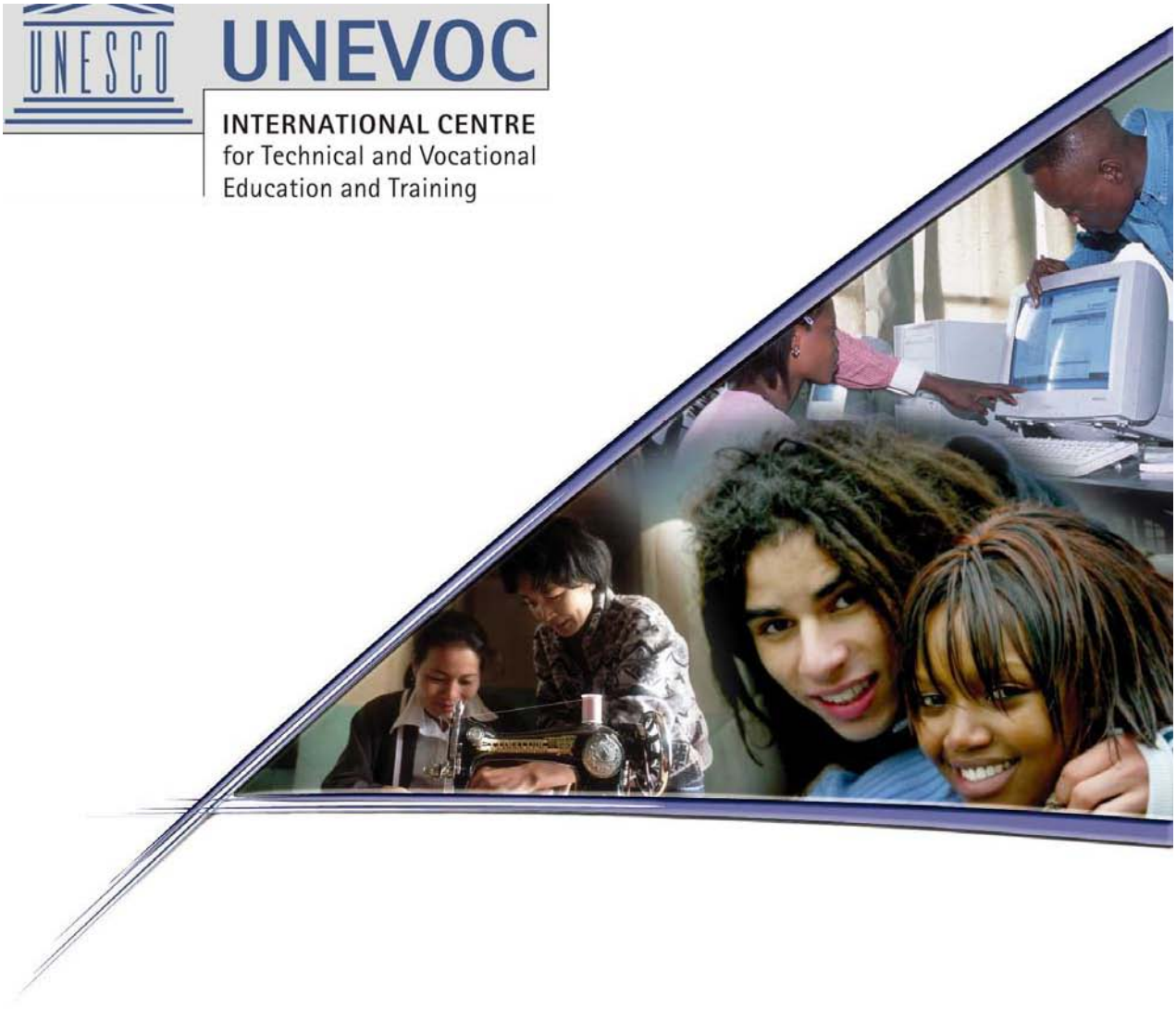


Fig. 49: Competence profile of the 1st decile N= 23, total score 5 - 9.7, total score mean = 8.9

Appendix III Hangzhou declaration

UNESCO UNEVOC
INTERNATIONAL CENTRE
for Technical and Vocational
Education and Training



UNESCO International Meeting on Innovation and Excellence in TVET Teacher/Trainer Education

Jointly organised by UNESCO-UNEVOC and UNESCO Office Beijing ir
partnership with the Chinese National Commission for UNESCO and th
Chinese Ministry of Education.

Hangzhou, China
8 – 10 November 2004
Documentation from the meeting.

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Final report of the meeting.

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March 2005

Report prepared by Karina Veal, Joachim Dittrich & Pekka Kämäräinen
Further information on TVET Teacher Education available on websites of United TVET network on innovation and professional development www.unip-net.org and UNESCO-UNEVOC www.unevoc.unesco.org

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Introduction

At the very centre of quality technical and vocational education and training lies an effective interaction between teacher/trainer and learners. Indeed, an overall improvement in vocational skills for employability and citizenship can only be realised if there is an improvement in the quality, effectiveness and relevance of teaching. Many, both in the developed and developing worlds, are increasing the emphasis they place on improving the capacity of technical and vocational education and training (TVET) systems, in recognition of the important role TVET plays in equipping individuals with relevant skills and knowledge. TVET can also better enable individuals to participate in social, economic and technological innovation processes. Therefore, embedding TVET into regional and national innovation structures is of crucial importance to the economic performance and social development of countries. Having a pool of skilled and knowledgeable people within the TVET industry is as important to the TVET industry as it is to the industries TVET serves.

The UNESCO Office Beijing and the UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training in Bonn (Germany), in partnership with the Chinese National Commission for UNESCO and the Chinese Ministry of Education organised the international meeting to develop strategies to increase innovation and excellence in TVET teacher education. The meeting was held in the Radisson Plaza Hotel, Hangzhou, capital of Zheijing Province, Peoples Republic of China, from 8 - 10 November 2004. Sixty-eight experts participated, from twenty-five countries, with a broad based representation from developing countries within the Asian region.

Whilst there have been many international meetings of TVET experts, and many international meetings of teacher training experts, the meeting in Hangzhou was the very first time that an international group of colleagues have come together specifically to address a range of issues pertaining to TVET teacher/trainer education. The meeting gave considerable time to discussing ways of improving the quality of TVET professionals through advanced study. Specifically, the meeting considered the idea of a masters-level programme in TVET. The meeting agreed with the value of the framework developed by a consortium of European academics as the basis for further investigation as an international curriculum framework for a masters degree in TVET teacher education and research. The meeting also agreed on the value of, and the formation of, a new international association in TVET able to progress the masters programme and other ideas. Proposals for both initiatives are included towards the end of this report. Finally, participants endorsed their Hangzhou Declaration, the text of which can be found as a foreword to this report.

the relative importance of the European cooperation project Europrof that created a trans-national ‘invisible college’ to discuss the foundations of education of new TVET professionals. Mr Kämäräinen drew attention to the different strands of the follow-up project Euroframe (the plan for trans-national inter-university network in the field of TVET and the analyses on patterns to promote *continuing professional development* of TVET professionals) as efforts to consolidate and/or articulate the common grounds of the ‘invisible college’. Mr Kämäräinen also discussed the impact of attempts to cross the barriers between educational expertise (for vocational teachers) and work-related expertise (for HRD-specialists). He emphasised the importance of connective learning arenas for TVET-related educational innovations and for organisational innovations in working life. Finally he drew attention to the conceptual diversity of views regarding the interpretation of pedagogic and/or professional expertise in TVET. He made a distinction between three basic approaches: pedagogy applied

to TVET, vocational pedagogies as subject-didactic annexes to subject-disciplines and pedagogic of TVET, and knowledge development on vocational areas of specialisation and on related pedagogic know-how.

Mr Rupert Maclean was the third speaker of this session. He opened up the debate on a possibility to set up a new professional community to support the follow-up of the conference. Rather than tie this issue very strongly to the specifics of any particular model of organisation he presented a broad range of options how international associations can address issues that are important for educational researchers, practitioners and policy developers. In this context he referred to the possible support that can be provided by UNEVOC centres. After these explorations he left open possible conclusions to be drawn in the debates in the working groups.

Views from the field

Professor Johanna Lasonen, holder of the UNESCO Chair in Intercultural Education at University of Jyväskylä, Finland, chaired *Views from the Field*. Held over two consecutive sessions, the presentations gave participants the opportunity to hear brief presentations from TVET teacher training experts in ten countries, who were each asked to address the following two questions: a) how are TVET teachers currently trained and b) what are the strengths and weaknesses of the current approach?

Malaysia: Professor Jailani Yunos, Kolej Universiti Teknologi Tun Hussein Onn, Jahore

Malaysia's vision 2020 aims at a sustainable and high quality economic development that includes prospects for advanced production and building up high potential knowledge at the intermediate level of qualification. Knowledge workers, being highly skilled individuals who also have hands-on experience are expected to play an important role in modernising production and in innovation. In order to educate and train such high potential workers, TVET needs upgrading both at the institutional level and at the TVET teaching level. The country is recognising the need for several thousand new, highly skilled TVET teachers during the next years and is currently focusing on building up capacity for TVET teacher and trainer education.

Chile: Ms Ana María Rosende, Centro de Formación Téchnica Duoc UC, Santiago

TVET training in Chile remains insufficient to meet the needs of industry and the needs and aspirations of individuals. There are still many teachers who lack formal training in education or pedagogical aspects and who do not develop sufficient employability competencies in technical areas. The government is aware of the need to increase specialised training for vocational teachers. This is being implemented within two main teacher-training institutions: Chile Califica (Vocational and Continuous Education Programme) and Duoc UC Technical and Professional Institute. Ms Rosende reported that Duoc UC has a strong and innovative approach but needs significant expansion to meet the needs of the country.

Indonesia: Dr Masriam Bukit, Technical Education Development Centre, Bandung

There is strong involvement of the private sector in TVET training in Indonesia. It is estimated that four-fifths of the TVET schools are privately run, with only one-fifth government run. There is a particular problem with unqualified, or low qualified, teachers in the privately run schools. Significant resources are going into in-service training centres for TVET teachers, in regional cities throughout Indonesia. Dr Bukit reported that these programmes themselves need improvement and expansion, and do not replace the need for significant upgrading and increase in pre-service TVET teacher training.

China: Professor David Lim, Vocational Training Council, Hong Kong

A number of vocational training providers offer programmes in Hong Kong; institutes, training centres and centres for students with special educational needs. In all, there are around 150,000 students (35,000 FTE) and over 2,000 full time teachers. The percentage of teaching staff with formal teaching qualifications, especially in the lower level training centres, does not compare well with that of secondary schools. A number of quality improvement and assurance mechanisms are in place to maintain quality and confidence in the outcomes of vocational training, nonetheless, increasing the percentage of staff with formal teaching qualifications is important. In recent years, considerable attention has been given to reforming a number of aspects of vocational training in Hong Kong. Developing and

implementing approaches to improving the teaching force is a priority for the coming years.

Thailand: Dr Siripan Choonmoom, Vocational Education Commission, Bangkok

In Thailand there is also a strong private sector for TVET training and again a much stronger representation of qualified teachers within the public providers. Most people who wish to pursue a career as a TVET teacher undertake a 2-year study programme. There is also a 4-year bachelor degree in TVET education but only 20 per cent choose that option. With both programmes, students are required to complete one semester of teaching practice in addition to their academic studies. Considerable effort is being paced on improving the quality of TVET teachers in Thailand with standards for professional qualifications, experience and ethics, as well as new professional development programmes to maintain relevance for those already qualified.

Bangladesh: Associate Professor Che Kum Clement, Islamic University of Technology, Dhaka

Whilst Bangladesh faces many challenges in educating and training its population (which has widespread poverty and very low adult literacy levels) there are defined pathways for TVET teachers. There are three TVET teacher training institutes in the country: the Technical Teachers Training College, Dhaka, the Vocational Teachers Training Institute, Bogra and the Islamic University of Technology, Dhaka. However, the teachers (and indeed the skills provision programmes) tend to be swayed towards those with science or engineering backgrounds. To meet the skills development needs of the population, greater emphasis needs to be given to TVET teachers with broader backgrounds and experience. Professor Clement also reported interest in offering post-graduate training options in TVET education to raise and maintain standards.

Cambodia: Mr Bun Phearin, National Technical Training Institute, Phnom Penh

TVET teaching and learning needs in Cambodia are shaped by the particular needs of the country which has, for example, 80 per cent of its population in rural areas involved in agriculture. There are too few government run TVET teacher training options, although the shortfall is to some extent made up by donor-subsidised and NGO programmes in available. Historically, many TVET teachers became qualified abroad – maybe in Viet Nam or in the former Soviet Union – but now the focus is on developing suitable options internally.

India: Professor S.Z. Haider, PSS Central Institute for Vocational Education, Bhopal

Responsibility for formal technical and vocational education in India is shared between a wide number of players. There are three different levels of training (technical industrial arts and crafts schools, higher secondary vocational education and also technician education) and overall planning is undertaken not only by various national bodies but also by different ministries and departments with responsibilities for particular industries. Add to this the relative responsibilities for planning and implementation between central and state governments, plus the inevitable challenges arising from the large population and geographical size of India, and it is clear that TVET provision is highly complex. There are likewise a number of options for pre-service and in-service education for TVET teachers, ranging from pre-service regional colleges of education and universities and in-service training of teachers conducted under the guidance of organisations such as NCERT, the National Council of Educational Research and Training. NCERT is placing some priority on increasing TVET teacher quality with a range of competency based short programmes (2-4 weeks) based on job requirement analysis aimed at raising quality and promoting innovation

Lao PDR: Mr Soulikhamkone Sisoulath, Vocational Education Development Centre, Vientiane

Centres such as the VEDC in Vientiane face a massive challenge over the coming years. TVET teacher training is extremely under-developed in Lao PDR. The collapse of the former eastern bloc struck a big blow to higher education, since many people from Lao had gone outside on scholarships to other communist countries. Mr Sisoulath reported that the government is now committed to offering opportunities internally, both with pre-service and in-service programmes, but that the activities are still embryonic. The first year of the new diploma/degree Lao TVET teacher education programmes was in 2003, with intakes so far not quite reaching 100 students per year. The two biggest constraints are budgetary and also insufficient numbers of experienced staff members to teach in the programmes.

DPR Korea: Dr Chae Ryang Il, Ministry of Education, Pyongyang

The government of the DPR Korea has provided a comprehensive system of education, which includes technical and vocational education and training undertaken either in the universities (technical) or in what is called the informal higher education system (study-while-working system). With this system the colleges relate to the major areas of employment, i.e. factory college, farm college, fisherman's college as well as evening and correspondence courses in general subjects. The government is concerned to raise the level of intellectual attainment in the country and is paying attention to life long education. There are plans to open new informal institutions of higher education, including new factory, farm and fishermen's colleges and increase the training index and scope of the existing vocational institution to better meet the requirements of the economic development in the new century. Improving the role and quality of TVET teachers is a part of this, and is a priority for the future.

Outcomes of group sessions

The three-day meeting was structured to allow for detailed working sessions. Two cycles of parallel working groups were organised during which the participants were divided into two thematic groups.

Group A: Identifying 'good' TVET teachers and trainers

Working group A discussed a number of issues relating to 'good practice' in TVET teaching, whether measured in informal ways or through the establishment of occupational standards. The session was chaired by Dr Veronica Volkoff, and benefited from a previously distributed discussion paper prepared by Professor Peter Gerds, who was also the first speaker. He outlined some of the experiences of countries that have, over recent years, debated the merits of, or commenced a process of developing, occupational standards for teachers. Dr Zhao Zhiqun provided information on a research project undertaken of TVET teachers in China which found, to some extent, a mismatch between the current skills of teachers and the new expectations of community and industry. Dr Norman Lucas followed the issues of vocational standards with direct reference to the situation in the UK.

After these presentations the roundtable discussion of the group focused on the desirability/feasibility of adaptive standards for TVET teachers/trainers. There was no clear consensus on this issue, based on the workshop at this meeting. Some participants thought there was definitely value in commencing a process of defining standards for TVET teachers and trainers; others believed there was value in defining some standards but not attempting any international adoption whilst others believed that only the identification of common core standards would have any utility. All agreed, however, that the use of different tools to improve standards is worthy of national discussion and action.

Group B: Structuring a higher-level degree in TVET

Working group B discussed a proposal for a common curricular framework for Master programmes in VET was chaired by Professor Felix Rauner. The introductory speeches were given by Dr Joachim Dittrich, Professor Zhang Jianrong (Tongji-University, Shanghai) and Mr Pekka Kämäräinen. Firstly, Dr Dittrich gave a brief input of the preparation of the working document and the idea of piloting the approach in preparatory workshop in China in spring 2004. Then Dr Zhang Jianrong presented the master-programme in TVET at his

support the creation of common quality awareness in the context of emergent fields of expertise (i.e. quality workshops and peer reviews). Dr Dittrich analysed the applicability of such models in the current context for discussing TVET-related expertise. He characterised the ongoing debate as an open dialogue that is proceeding towards a relatively open and flexible framework for addressing quality issues. On the basis of this situational assessment he argued for taking a community-based approach on the quality issues. On the basis of these background analyses Professor Clement discussed the possible organisational working concept of a future professional association and its main functions in promoting good quality master-level programmes in TVET to be introduced in diverse global regions.

Looking ahead

Dr Khin Zaw, Yangon Institute of Education, Myanmar, chaired the final session of the meeting. He invited the first speaker of the session, the Rapporteur-General, **Ms Karina Veal**, to take the podium. Ms Veal gave a summation speech encapsulating the main ideas and themes of the three-day meeting.

Professor Felix Rauner, on behalf of the scientific committee, presented a concluding reflection on the underlying issues for organising the conference and the key concerns that led to the choice of the focus. Then he focused primarily on the results of the working groups B and D. He considered it very important that a broad-based international forum expresses its support for the development of master-level programmes in TVET with a focus on vocational fields of specialisation. Furthermore, he considered it essential that this conclusion is supported by a corollary conclusion to promote quality awareness and research culture by setting up a new scientific and professional community.

Professor Shi Weiping, on behalf of a group that had been invited to prepare a draft "Hangzhou declaration", presented the draft. The group consisted of representatives from the main global regions that were represented in the conference. The draft addressed the risks that were related to the development of VET. As a counter-strategy, the document emphasised the need to make transparent the innovative potentials of vocational and professional learning. This is closely linked to the corollary need to upgrade the competences and the academic recognition of VET professionals. Due to the lack of time for in-depth discussion it was proposed that any further suggestions be received after the session, before finalisation and distribution to the participants.

Mr Pekka Kämäräinen presented the organisational conclusions concerning the follow-up. Given the fact that the proposals concerning a new professional association and its field of activity were at an initial stage, it was proposed that a coordination committee should be elected to continue the preparation of the organisational concept and to support 'regional' follow-up measures. In the light of the preparatory work and the experiences with the conference the responsibility to coordinate the work of the committee was given to colleagues at Bremen University, specifically to Professor Felix Rauner (chairman) and to Dr Joachim Dittrich (secretary). Mr Kämäräinen presented a list of the candidates who had volunteered to participate as representatives of their regions or as experts in specific areas of interest.

Description of the masters degree.

The master course is targeted at graduate students in Vocational Education i.e. teachers, trainers, and lecturers.

Issued degree:	Master in Technical and Vocational Education and Training (TVET)
Length of study:	90 to 120 Credits[1] according to national regulations.

The following table shows the 12 vocational disciplines. The lists of topics that are shown in the table are open lists. Also one or the other of the topics might be incorporated into another vocational discipline according to regional or national settings, e.g. catering might be a topic in Leisure, Travel and Tourism or in Agriculture, Food and Nutrition.

The minimum **entry requirements** are degrees or equivalent competences to the Bachelor level.

It is recommended to establish at the offering institution a commission which decides on issues concerning the study course, especially in terms of different career pathways and institutional settings in the different countries and of non-formal learning accreditation.

Vocational discipline	
Business and Administration	Production and distribution of goods Services Marketing, administration, finances, insurance Transportation, logistics, tourism ...
Production and Manufacturing	Manufacturing Mechanical engineering design Supply engineering / environmental engineering Automotive engineering ...
Civil engineering	Construction Wood Surface and coating technology ...
Electrical and Electronic Engineering and Information and Communication Technology	Production systems Building equipment Information and communication technology Media technology ...
Process Engineering and Energy	Applied sciences Energy conversion …
Health Care and Social care	Health care Clinical care Personal hygiene Nursing.

[1] One credit is equivalent to a workload of 25 to 30 hours (according to the Bologna definition)

Vocational discipline	
Education and Culture	Child and youth care nursing education Adult education Special needs target groups Music and dance

	Leisure, Travel and Tourism	Travel Sports Tourist services Catering and hospitality ...
	Agriculture, Food and Nutrition	Agriculture Food production Domestic economy ...
	Media and Information	Printing Electronic-advertising Electronic-customer-service Sales promotion
	Textile and Design	Clothing production Fashion Interior design Art and craft
	Mining and Natural Resources	Mining Oil and natural gas ...

Frame Curriculum
Studies of Education, TVET and Vocational Disciplines: 39 credits

Three of the modules have to be concluded with a written assignment which will be assessed according to defined criteria. One out of the Modules 2, 3 or 4 will be realised in project form and concluded with a project report. In each unit the student either has to write and present a paper or to take part in a written assessment.

Foundation studies

		credits
Module 1	**Foundations, theories and structures of education, TVET and HRD**	**12**
M1-01	Foundations and theories of education, TVET and HRD	3
M1-02	Institutional and technical pre-requisites of TVET and HRD	3
M1-03	TVET and HRD in a historical and cross-cultural perspective	3
M1-04	Learning in work-processes and working in learning-processes	3

Module 2	**Shaping TVET connected to the vocational discipline**	**9**
M2-01	Development and evaluation of vocational curricula, media and learning environments	3
M2-02	TVET in theory and practice: Foundations of vocational teaching and learning, innovation, development and organisation of learning-processes	3
M2-03	Human development, learning and education in the framework of initial education and lifelong learning within its societal context	3

Advanced Studies

		credits
Module 3	**Teaching and learning in exemplary fields of practice**	**9**
M3-01	Application of methods and techniques of educational and vocational research and development	3
M3-02	Teaching, coaching and moderation of learning in career education and work-force development. Assessment and analysis of individual learning styles	3
M3-03	Development and application of media and learning environments	3

Module 4	**Management und evaluation of TVET and workforce development**	**9**
M4-01	Evaluation, measurement and exploration of educational supply and demands	3
M4-02	HRD and organisational development in TVET and workforce development	3
M4-03	Planning and development of programmes and courses - Methods of exploring work-process-knowledge	3

Studies of the vocational discipline and its didactics: 18 credits

Foundation studies

		credits
Module 5	**Vocational Discipline I**	**6**
M5-01	Introduction to the vocational discipline, history of the vocational field, standards and qualifications	3
M5-02	Occupational analysis and Curriculum development	3

Advanced studies

		credits
Module 6	**Vocational Didactics in the Discipline I**	**12**
M6-01	Hands on planning, realisation and assessment of a teaching unit in the occupational discipline, application of discipline specific methods, media, and practical sessions.	9
M6-02	Learning in work-processes, occupational and work process studies and curriculum development	3

Further studies: 36 credits

		credits
Module 7:	**Area of specialization in vocational discipline (working with specific research and development methodologies related**	**18**

Formation of an international association of TVET professionals

The participants agree that there is an urgent need for the development of the international scientific community of TEVT scientists and professionals. Such process needs an International Association of TVET Professionals in order to improve quality of TVET and to facilitate professionalisation of TVET at the international level.

The participants suggest, that the course of action, which started in Hangzhou be continued on the way to establish the international scientific community in TVET. The support for this initiative, which was offered by UNESCO-UNEVOC during the conference, was greatly appreciated.

To proceed, the scientific committee, whose mandate ended with the Hangzhou meeting, is re-established and extended. The members were elected during the closing session. They represent regions from all over the world and both developing and developed countries.

Elected committee

Chair: Prof. Dr. Felix Rauner
Secretary: Dr. Joachim Dittrich

Members with regional responsibilities:

East Asia: Prof. Shi Weiping, Dr. Zhao Zhiqun, Dr. Zhang Jianrong

*Central Asia:*Dr. M. Mohammad Haghpanahi, Prof. Syed Zargham Haider

*South-East Asia, Pacific:*Prof. David Lim, Dr. Masriam Bukit, Prof. Dr. Jailani Bin MD Yunos

Other developing countries: Prof. Dr. Che Kum Clement, Ms. Naing Yee Mar, Dr. L. Efison Munjanganja

Americas: Prof. Richard L. Lynch, Ms. Ana María Rosende

Europe: Mr. Pekka Kämäräinen, Mr. Norman Lucas

Members with thematic responsibilities:

Quality: Mr. Leung Manwey Joseph

Appendix IV: Concept and timetable of the rating seminar

COMET Rater Training Venues: merSETA Headquarter, Johannesburg. 26 - 27 October 2011		
COMET: Measuring Vocational Competence in South Africa. Rater training after the first COMET test		
PROGRAMME Wednesday, Oct. 26th, 2011		
09h00	Welcome and introduction	merSETA/Helen Brown
09h15	Presentation The COMET approach Short repetition of August seminar	Lars Heinemann/ Ursel Hauschildt
09h45	Presentation of COMET rating scale and items	Lars Heinemann/ Ursel Hauschildt
10h15	Presentation of test task 1 (skylight control), its solution space and sample solutions	Lars Heinemann/ Ursel Hauschildt
10h45	Participants are divided into two groups Within each group each rater rates individually Rating as a group (each group defines a moderator) Group discussions if ratings of individual ratings differ too much	All participants
12h45 / 13h00	Lunch	
13h45	Presentations of individual ratings and group ratings Discussion about difficulties and results Analysis of significant deviations	Plenary
14h15	Presentation of test task 2 (signals), its solution space and sample solutions	Lars Heinemann/ Ursel Hauschildt
14h45	Participants are again divided into two groups individual group rating (same procedure as before)	All participants

16h45	Presentations of individual ratings and group ratings Discussion about difficulties and results Analysis of significant deviations	Plenary
17h30	End of seminar day 1	
PROGRAMME Thursday, Oct. 27th, 2011		
8h30	Presentation of test task 3 (drying space paint shop), its solution space and sample solutions	Lars Heinemann/ Ursel Hauschildt
09h00	Rating in two groups (as before)	All participants
10h30	Presentations of results, discussion and analysis	Plenary
11h00	Presentation of test task 4 (signals), its solution space and sample solutions	Lars Heinemann/ Ursel Hauschildt
11h30	Rating in two groups (as before)	All participants
13h00	Lunch	
13h45	Presentations of results, discussion and analysis	Plenary
14h14	Summary/ Further planning / Timetable	Helen Brown/ Zolile Zungu
14h30	End of Seminar	