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Self-reliant Learning in Technical Education and Vocational Training (TEVT)

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Technical Education and Vocational Training
(TEVT)**

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Hermann Koch

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1 Introduction

The demand for self-reliant learning in general is uncontested in the whole world. This is becoming more and more valid for the technical training. The ability to be a self-reliant learner plays an important role in the work processes and continuing professional development in developed countries. In South East Asia there are many newspaper articles and TV features concerning this matter nowadays particularly in economically advanced countries such as Singapore and Malaysia. They stress the importance of the ability to be a self-reliant learner in technical training for economic growth and competitiveness on the world market. Concrete requirements for fostering self-reliant learning abilities are formulated within the 8th Malaysian Plan. In the aforementioned Plan, it is stated that in order to achieve the objectives of Mission 2020 the TEVT (Technical Education and Vocational Training) will be geared to produce multi-skilled knowledge workforce “that is versatile, willing to learn continuously and can acquire, apply and create knowledge particularly in modern technologies”. The way to impart these abilities is designated trainee centred teaching approach supported by self-reliant learning.

This manual is to show and to explain to teachers and instructors how they can implement trainee centred teaching in TEVT. It is designed to put the teachers and instructors into a position to understand their students’/trainees’ learning processes and to understand their learning and work activities in detail in order to plan and deliver an appropriate teaching process. It is essential at this point to clarify the concept of “learning and work activities” in that all such single activities integrate learning processes and work processes and NOT two separate specialized activities. To do this, the manual gives the support as listed in Figure 1.

Manual’s support

The manual gives

- **explanations on the nature of learning and action and their association,**
- **explanations on the connection between learning and working,**
- **tools for better understanding self-reliant learning and work activities,**
- **tools for designing learning and work assignments for self-reliant learning**
- **examples of learning and work assignments for different performance levels,**

Figure 1: Manual’s support

The manual has six chapters.

First chapter

The introduction.

Second chapter

Justifies the importance of fostering self-reliant learning in TEVT. Readers who are already convinced that self-reliant learning has to be the emphasis in their teaching should nevertheless read the arguments given here. The authors are confident that each reader will find at least one important justification that they have not read before. The reading of chapter two can be very helpful if the teacher or instructor is looking for arguments to answer questions from his/her trainees, such as: “Why do we have to learn in this way (self-reliant)? Does our teacher not have the responsibility to explain all the questions that we ask? Why are we supposed to find information by our-selves?” and similar questions.

Third chapter

Clarifies the role of self-reliant learning, trainee centred teaching and learning and work assignments within a comprehensive didactic approach for TEVT. This chapter demonstrates that providing this manual is just one necessary step regarding the further education required to meet the demands of today’s rapidly changing technology, new national quality requirements and challenges of international economic competition.

The notion of “Didactic” used in the manual is much broader than that usually adopted in English speaking countries. This broad view is very important for TEVT and that’s why it is explained in detail in chapter three.

Fourth chapter

Explains the trainee centred teaching process. “Trainee centred teaching” means that the teaching is centred on the individual trainee as well as the trainee team. Characteristics for such a teaching process are given here as guidelines and tips as well as examples for assignments that can be used for implementing trainee centred teaching.

Fifth chapter

Presents tools and guidelines for designing learning and work assignments. The reader learns how teachers and instructors can look for appropriate assignments, formulate them in an understandable way and design assessment sheets, guide questions and tips for self-reliant learning. This chapter also provides guidelines and tips about what to do to accompany the self-reliant learning process and emphasizes one very important aspect of self-reliant learning – the self-reliant monitoring and evaluation of the actual steps. Teachers and instructors are pushed to change their attitudes about assessing their students/trainees. A selection of assignments from technical training and general studies and their integration completes the descriptions in chapter five.

Sixth chapter

Completes the manual with questions often asked by teachers on the strengths and limitations of self-reliant learning and appropriate answers given by the authors.

Prime rule of the Manual:

Please start by introducing self-reliant learning in your teaching process.

There may be hindrances or constraints – anyhow, please start and think of the saying:

**“It’s better to light a small candle than to lament about the darkness”
(Konfuzius)**

Figure 2: Prime rule of the Manual

2 Justification for self-reliant learning

2.1 Self-reliant learning is a natural way of learning

Wherever experts today talk about learning processes, you can hear the term “self-reliant learning”. It seems to be a very successful new way of learning to cope with all of the problems we presently have to face – problems with the rapid increase of knowledge, rapid change of technology, loss of stable employment, uncertainty in all areas of society.

The meaning of “self-reliant learning”

Self-reliant learning is going to be explained in greater detail later on in this manual. We only want to outline it at this stage:

Self-reliant learning can appear in different forms. It can be just learning by heart (in order to acquire rules or formulas, vocabulary etc.) or it is learning by solving more or less complex practical or theoretical problems. Learners are very active, they perform actions and they take over responsibility for their action.

The opposite of self-reliant learning is reliant learning. People who learn reliantly are reliant on knowledge portions given by a teacher, on demonstrations done by a teacher, on the supervision of their activities by a teacher, on assessments of their learning results done by a teacher. They don’t ask a lot, they watch, they listen and they imitate what their teacher does.

Look at children in a natural environment: How do they learn? When we observe our children playing in the sand at the beach or anywhere else – how they design sand castles, streets and a lot of other things, how they play with other children and organize their play activities, how they ask us questions all day long, how they want to find their own ways of solving their problems – we can realise what “self-reliant learning” means. This is the natural way of learning. Children are always active, always in motion. They conquer the world through play – with their actions. Our children learn during their activities and from the results.

And when they have to go to school – what a shock! The pupils have to sit still and have to follow, have to listen and to watch. There is someone in front of the class telling and explaining something that is – as he/she thinks – interesting for the pupils. At school our whole world is broken down into different subjects. One teacher conveys his/her knowledge about “his/her” subject to the pupils and he/she often doesn’t refer to the subjects of the other teachers. Teachers live in their single subject world and teachers of other subjects are aliens. It is very difficult for most of the pupils to build an association between what they have learnt in different subjects.

At training centres the learning is more practice-related but again instructors tend to break down the whole working world of an occupation into a lot of different subjects. Traditional training tends to target the conveyance of firmly defined skills. The traditional instructor “owns” the knowledge and conveys it to the students. He/she is bringing the content and the answers of problems into the training room with him/her.

If there are young people who are willing to follow and to hear what the teacher or instructor presents, they will learn something as well in the traditional teaching process. But whether they do it depends on their education level, on the learning atmosphere at home and within the

society, on the rules of the society (e. g. obey the teacher), the experience of the young people, their habits and attitudes.

More and more the younger generation of the more developed countries doesn't simply obey and respect representatives of the older generation. They respect performance, intelligence and cleverness – but not from the start. That is valid for all adults including the teachers and instructors.

Our younger generation is used to getting information that they need, not only from their parents, teachers and instructors, they also ask their friends in their peer group and they “ask” electronic media more and more and they are quite capable of dealing with these – often much more so than adults – their teacher included. This situation is combined with an enormous growth of their self-consciousness resulting in much more independent action.

2.2 Strong association between human action and learning

The pedagogical demand for self-reliant learning has a long tradition. In Europe it reaches back at least to the 17th century and the famous educator **Comenius**. One will find in his book “Magna didactica” many statements like the following: “With forging you can become a black-smith”. He wrote about the importance of doing within the teaching and learning process. Learning by doing had been his motto. (This motto for education has been forgotten more and more during the last few centuries.)

Recently psychologists have discovered that learning and doing, particularly the actions of human beings, form an integrated whole. Human action has been in the focus of their research work in the last thirty years and they have developed the so-called “Action regulation theory”. Action regulation theory is a psychological theory of human action, concerned with modelling the ways in which people set goals in their mind, break them down into sub-goals and create a rough plan in their mind before starting to bring it about through coherent action steps. In other words, the relation between thinking and doing is at the centre of this theory. This means, that any practical action begins in the mind. Correct action means correct thinking first. Acting means in this context that a man has to set a goal for an activity. Activities without a goal are not called actions. Figure 3 shows the connection between action, action structure and action competency and explains the correlation between acting and learning.

As shown in Figure 3, human action starts with setting a goal and breaking it down into a sequence of sub-goals – designing an action structure or plan. This plan has a rough structure and there are different options for the sequence of sub-goals. The acting person applies the plan in their mind – engaging in prospective thinking. They look for helpful knowledge, guidelines, experience in their action competence (“action - store” see Fig. 3) and inform themselves in external information sources. Then they use appropriate competencies and information for making a decision: Which could be the right plan?

Within the planning and decision making phase the person learns to mentally gather information and from external information sources. They learn which competencies are useful for planning in a specific situation.

The plan is carried out in practice after the decision is made that the plan is appropriate. The students follow the plan and compare the interim results with the planned sub-goals. Comparing results clarifies whether or not it is necessary to change individual activity steps or the whole plan.

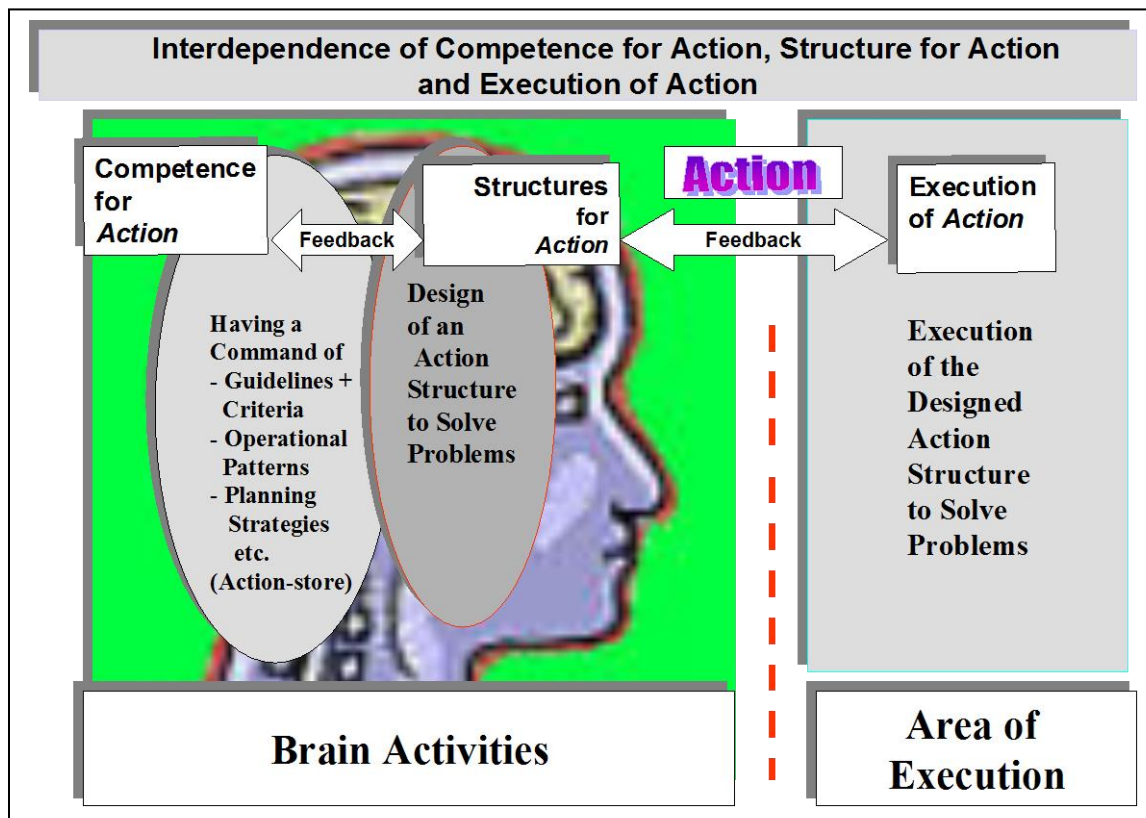


Figure 3: Interdependence of competence for action, structure for action and execution of action

Within the execution phase the person learns to monitor his or her activities and memorize successful activity steps (skills) and appropriate knowledge, this strengthens the volition to achieve the set goal.

At the end of the action process the students compare the results with the plan in a final assessment: Has everything been considered? What should I change next time? Should I extend my search for information? What kinds of knowledge and skills have been especially helpful?

A successful plan and knowledge necessary for carrying it out will be stored in the mind (action competence).

The procedure explained above is called a “complete action”. A person learns self-reliance during this kind of action. Complete action and its results establish action competence in our mind in an optimal way. Table 1 gives an overview of the components of an action competence.

Table 1: Overview of components of an action competence

Components of action competence	
Knowledge	Volition
general knowledge	to achieve aims
special knowledge	to be responsible
guidelines (how to communicate; how to plan etc.)	to act independently
operation patterns (skills)	...
...	
Ability	Feeling
carrying out operations	feel progress

“Knowledge” and “ability” are other expressions for technical competence, the ability to learn, or “learning competence” and methodical competence as well as human and social competence (see Fig. 4 below). Action competence comprises more than these – the volition and feelings are as important as the other components. In complete action actors learn to strengthen their volition, they become acquainted with acts of willpower. They are rewarded with positive feelings after successful activities and they learn to cope with negative feelings after failures.

2.3 Enormous change in industry, trade and service requires a new kind of learning in TEVT

Self-reliant learning as a natural way of learning is described under the first paragraphs of this chapter. Further down it will be explained that self-reliant learning is a demand of our present and future world of work.

Today’s world is a world of change and uncertainty. Long-time values are changing or disappearing, long-time social systems and rules are changing or disappearing, long-time ways of manufacturing and producing are changing. Skilled workers trained for a certain occupation loose their job and can’t find a new one in their field. They have to acquire new skills and knowledge for a new – often a completely different – area of work.

If we look back to the world of work of our parents, we notice that they worked for a long period of time in a single company and all of their life in the occupation that they had learnt. In the past, occupations, companies as well as entire manufacturing/production fields existed for long periods of time. But today as a result of the globalisation of trade and competition and the rapid change of technology this is no longer the case. It is not unusual that a particular business has been established in a region and is very successful for about 10 years and then within a few weeks it disappears. Big companies merge and outsource and close entire departments. Work processes within the same company are changing completely and the remaining workforce has to adjust and to become acquainted with.

Pedagogical conclusions for combining learning and action

→ The superior way to learn is to perform a self-designed action. Such learning is self-reliant learning in its optimal form.

→ The action chosen for your students' learning processes have to be from a field of subjects in which the learners are interested and motivated in setting their own goals.

→ Teaching has to support the processes of

- setting goals (self-planning),
- comparing planned and achieved results (independent decision-making and self-monitoring),
- final assessment/ evaluation with regard to the acting/learning results (self-evaluating, self-assessment) and
- continuously informing oneself.

→ Teaching has to take into account that only complete action has optimal learning results.

→ Action is instigated by problems. The problems have different levels. At the first or lowest level they require seeking steps towards a given goal; at the second level they require finding and formulating a goal in a given framework of possibilities; at the third or highest

Figure 4: Summary – Pedagogical conclusions

The two phenomena, extremely rapid pace of technological change (Fig. 5) and the steadily increasing complexity at the workplace (Fig. 6) have cut short the “longevity” of competencies needed for the workforce to be in charge of work processes.

In order to explain the effect of the process of change on the established knowledge in a particular field of technology the concept of the “half life” (or half life period) of radiating material has been borrowed from nuclear physics. The half-life of radiating material states how much time will pass until half of the isotopes have lost their radiation. Correspondingly the half-life of knowledge states how much time will pass until half of the knowledge, which is needed to be in command of a particular area of technology has become outdated and therefore useless. While the knowledge with which our children graduate from school still has an estimated half-life of 20 years, this timespan is for the field of computer technology down to just one year. Or in other words: after one year 50% of the knowledge, which is needed today to be in command of computer technology, has become outdated.

The complexity of work situations in industry is steeply increasing. If for example the total number of pages of all repair manuals, which do exist for a particular model of car, is counted, it becomes evident that the nineties have witnessed a dramatic increase in the volume of these repair manuals. It reflects the exorbitant increase in the complexity of car repair when it took 202 pages to describe the necessary repairs of the Opel 1.2 litre in 1933 and it takes

13.866 pages to understand all potential repair of the Opel Omega B in 1998 (see Chart 1). Still it is the car mechanic to whom we entrust the repair, in 1933 as well as in 1998.

What is the impact of this pace of change and boundless complexity at the workplaces on the design of training programmes? For sure traditional training concepts cannot cope with this new situation at the workplace.

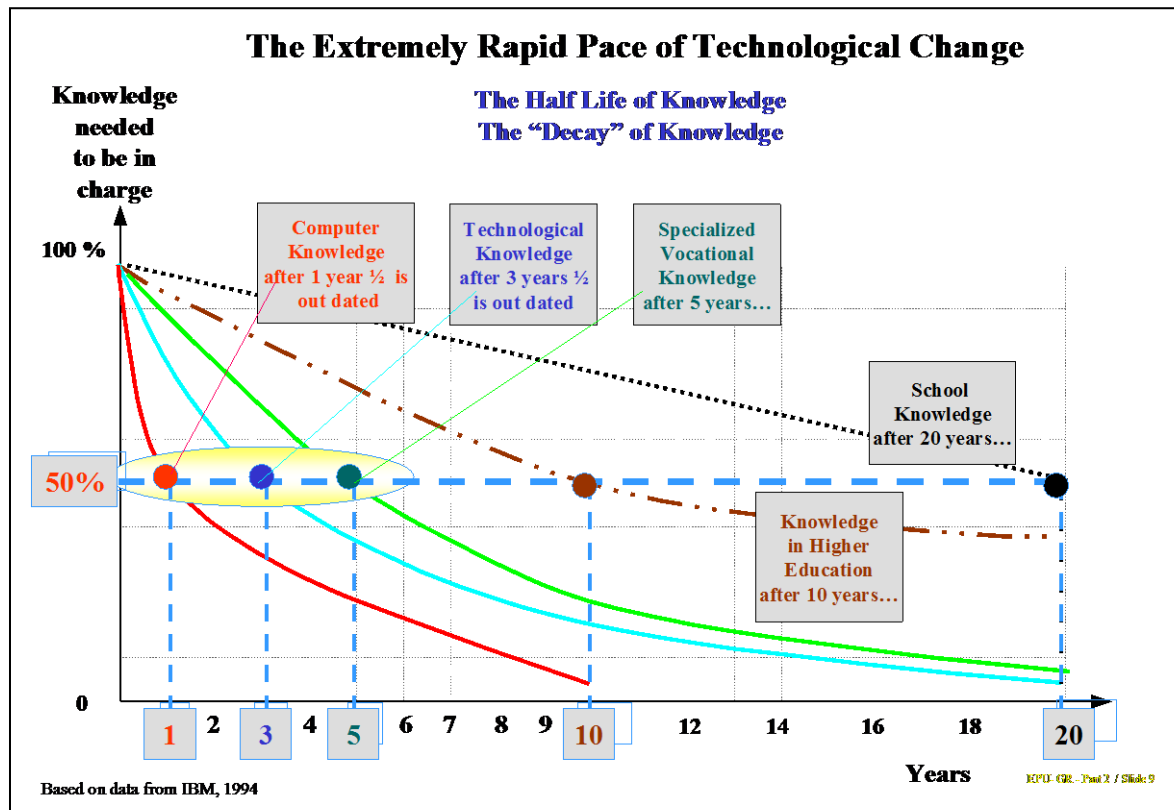


Figure 5: The extremely rapid pace of technological change

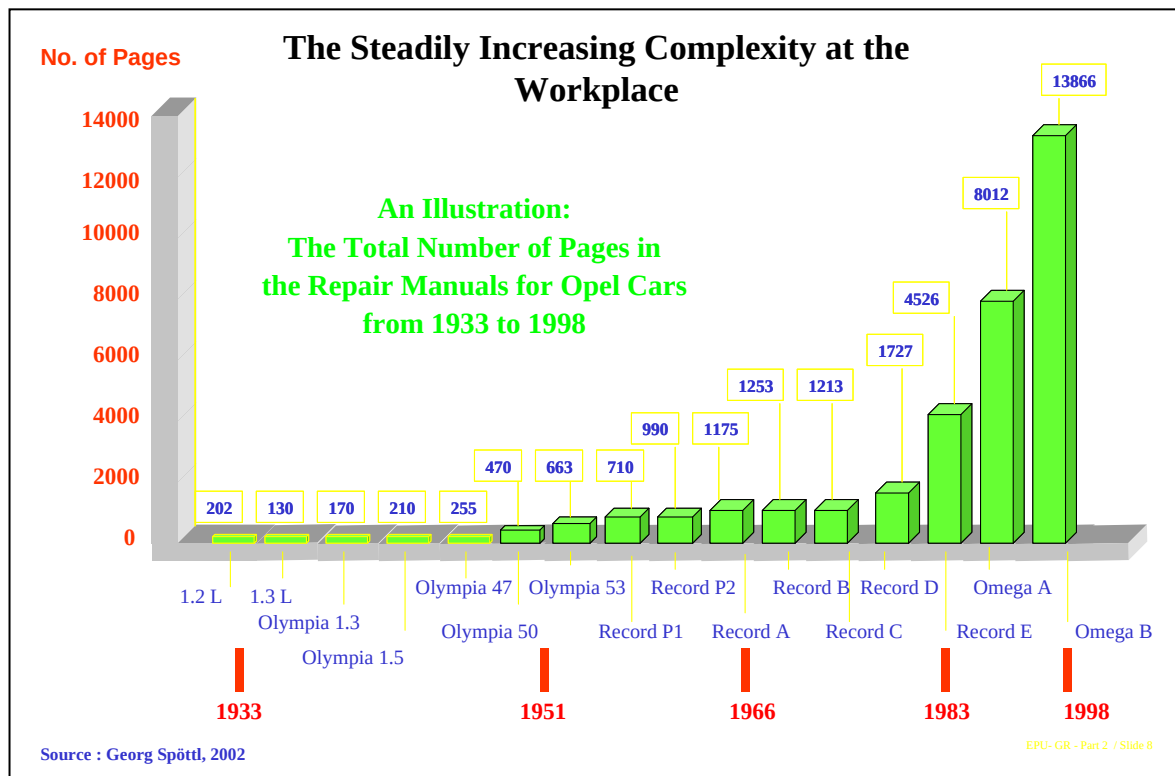


Figure 6: The steadily increasing complexity at the workplace

In fact, people in jobs have to learn continuously in the same way as people who are applying for new jobs. They have to enlarge and enrich their knowledge and they have to acquire new knowledge and they often have to do it without the help of a teacher – they are left to their own devices in many cases. That’s why we have to prepare all workers/employees – not just our younger generation – for the challenges of today’s industrial world so that they are able and willing to learn continuously, that they are able to acquire competencies independently, particularly at their workplace, and to learn with their colleagues. It is one of our main duties to teach our trainees “How to learn”, to prepare them for the ongoing self-reliant learning process.

Another justification has to do with the demands of state-of-the-art production/manufacturing. It is necessary that the leader in a national or an international market (most national markets are actually international due to globalisation)

- is producing/manufacturing/assembling according to the demands of the customer as quickly as possible and with high quality of the products,
- has got a response to all customer requirements,
- can offer a certain number of specific products,
- can offer a variety of versions in a large scale production (e.g. VW offers 2000 different “Passat” cars),
- can provide the customer with “just in time delivery”(SMEs have to deliver big companies the demanded products just in time i.e. when they need it in their manufacturing/assembling line),
- can achieve a zero error production/manufacturing/assembling.

Large hierarchies in companies with a lot of management and planning levels above the level of worker can't accomplish the above mentioned objectives. The information flow is too long and awkward and a lot gets lost along the way. The planning procedure takes too much time and therefore the special just-in-time demands of the customers can't be met. Old fashioned supervision has a negative impact as well. If workers are supervised in all of their activities, then they start relying on the supervisor and not on their own judgement and abilities. If workers, who are used to being supervised, lose supervision for a certain time, they make a lot of mistakes and production quality is low. Besides producing/manufacturing/assembling highly complex products can't be supervised properly at all times and managers have to rely on self-monitoring and self-evaluation by their workforce.

The hierarchy in big enterprises and SMEs has to become smaller and the workforce must be able to react flexibly to new demands in a learn and work setting. The workers have to be able to take part in the planning process, in decisions related to the work process and the applied technology and the workers have to be able to monitor and evaluate their own work to ensure high quality products from themselves and by their teams. The ability of the workforce to work as a team, mutual monitoring and common responsibility are becoming more and more important. In other words: the workers have to become "K-workers" ("knowledge-worker", see Fig. 7, below).

The final justification has to do with the steadily increasing responsibility of workers within the production process as well as somehow also with humanity. The human being at the worker level can become a plaything of all the forces within the characterised process of change, with no opportunity for an active role when he can only react to the demands. As explained above, workers in highly developed industries have a different role in the company today than in the past. The modern worker is responsible for delivering high quality and better service at reasonable prices. They play an important role in the process-oriented work-organisation – from the initial customer order and the planning process to the final quality control and the delivery of the product to the customer.

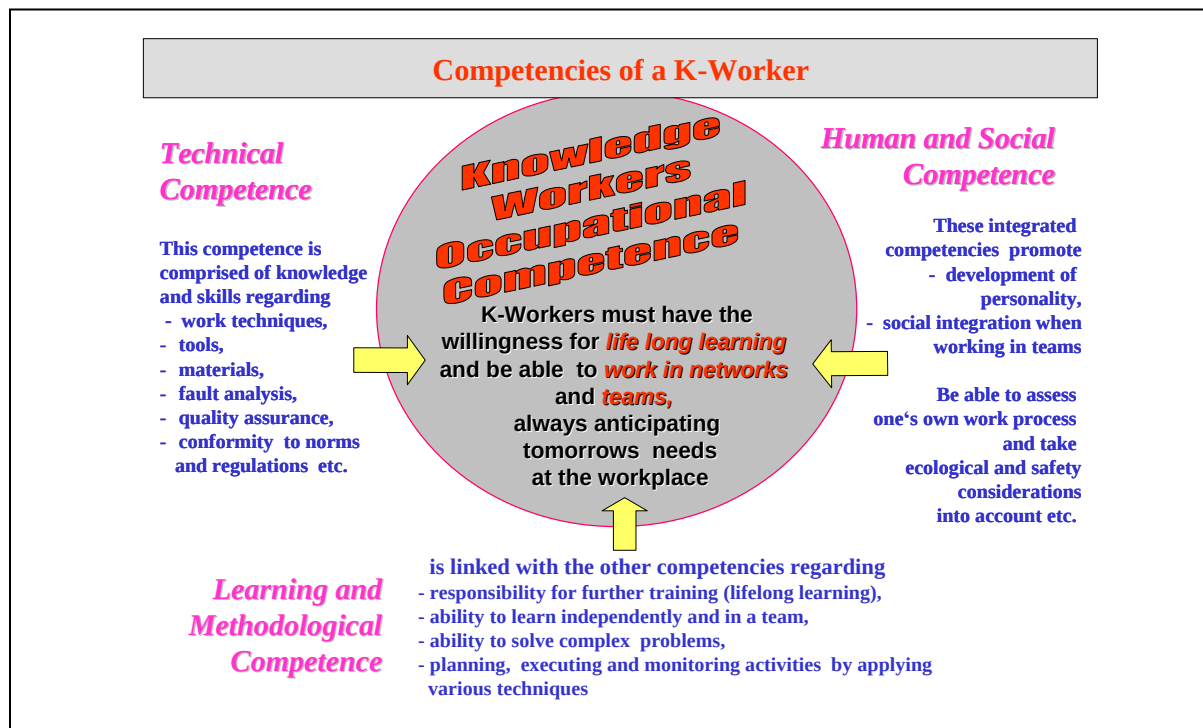


Figure 7: Competencies of a K-worker

Today workers have more responsibility within the work process. Their tasks comprise planning and monitoring responsibility and they are becoming more and more complex at the same time. Associated with their extended role within the companies k-workers have to take care that the work process and the technology is designed in a manner which enables them to fulfil their new role. For this they need the competency to judge and assess the work process and the related technologies critically. Workers have to ask and to answer the questions:

“Why is the work structured like this and why is it used in this form at my workplace?”,

“Why is work organised in precisely this way at my workplace?” and

“Could the job be done otherwise? Which alternatives are there?”

Establishing a culture of self-reliant learning in TEVT is supposed to include this. Learners should be encouraged to seek answers to these questions within the framework of their learn and work processes.

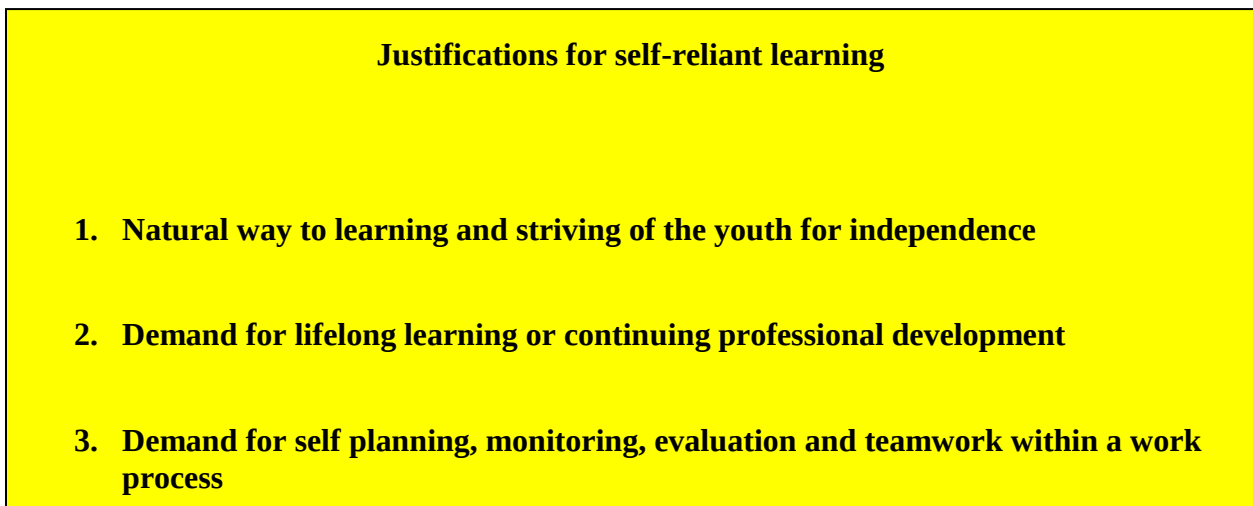


Figure 8: Summary – Justifications for self-reliant learning

3 A new didactic approach for TEVT

3.1 Introduction to the new didactic approach

The notion of “Didactic” used in this manual is much broader than that usually used in English speaking countries. This broader view – as used in Central Europe – is explained at the beginning of this chapter. Figure 9 exhibits the components of this broader notion of didactics. It is concerned with the

- methods of teaching and learning and their mutual association,
- objectives of teaching and learning and their relationship,
- subjects being imparted and acquired (often they are not the same!),
- learning environments and their design and organisation.

Additionally, didactics is concerned with the interdependence of these four elements.

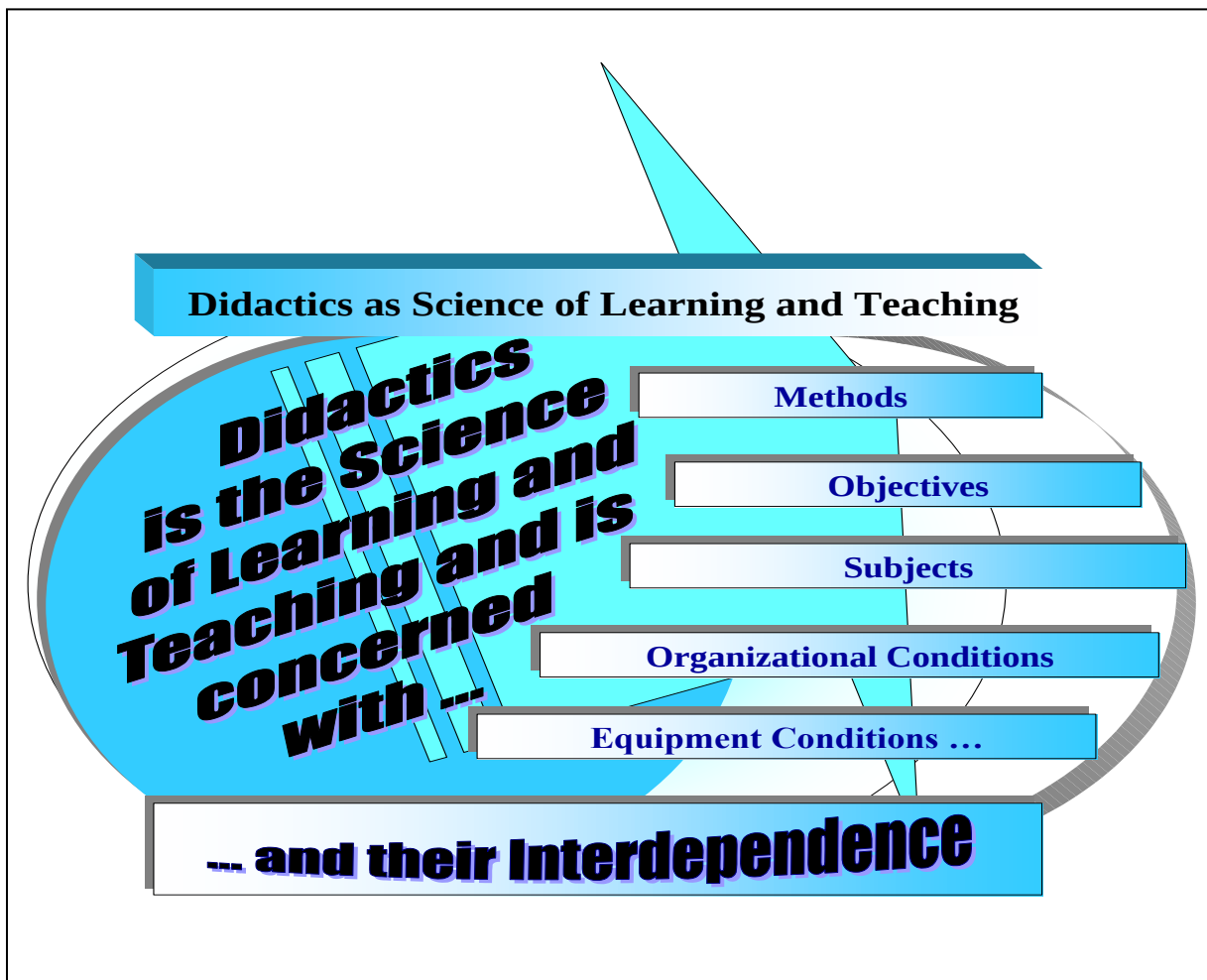


Figure 9: Didactics as the blueprint for learning and teaching

For TEVT the components which didactics is concerned with are related to the work process. TEVT for individuals who have to cope with the demands of modern workplaces and life long learning must be mainly related to the work process and not, as is still common, to a technical discipline. The logic of technical disciplines is the logic of engineers – not of workers. It is the state of the art work process which has to be the main resource for the formulation of the objectives and subjects for learning and teaching. It also is the most appropriate environment for training and it determines learning methods such as self-reliant learning, team and project learning. The notion of the work process as the decisive factor for designing TEVT is basic to the didactic approach shown in Fig. 10.

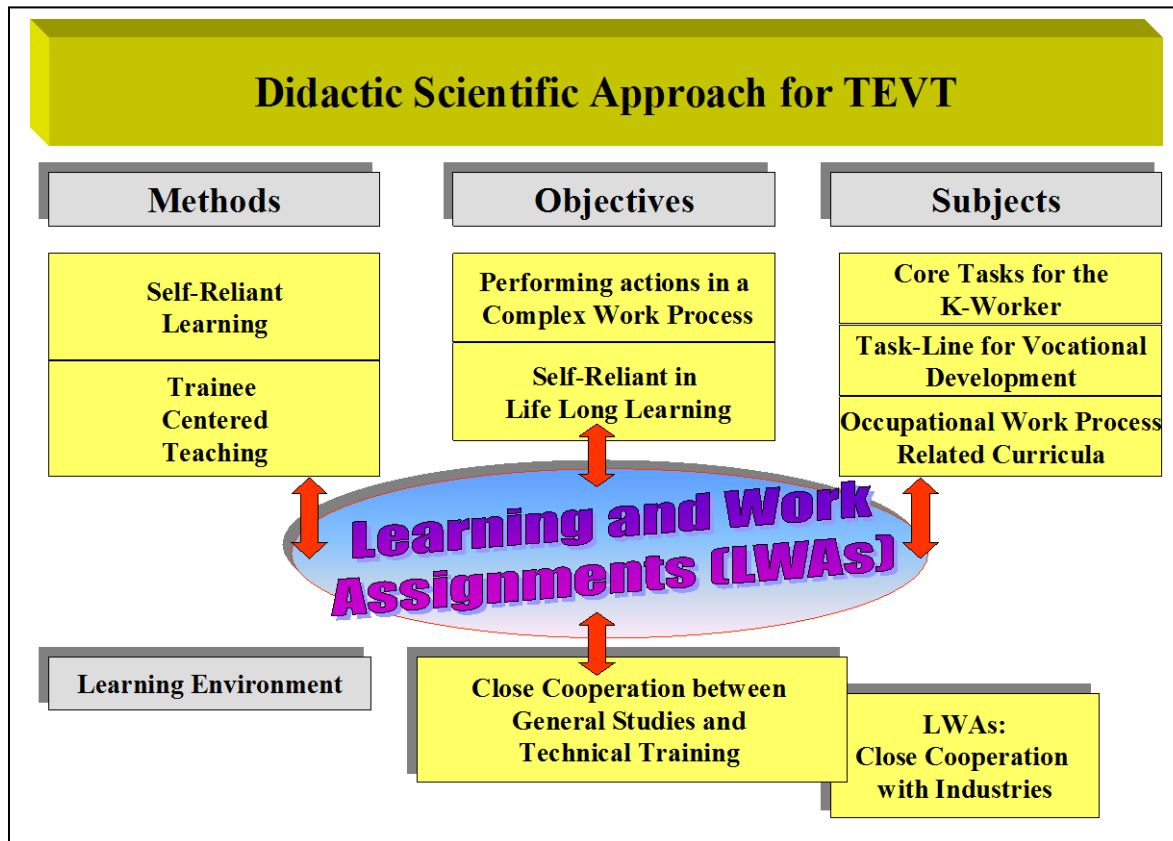


Figure 10 : A new didactic approach for TEVT

We can find in this figure learn and work assignments as a core element surrounded by the methods, objectives, subjects and reference to the learning environment. This constellation is explained in more detail in the next paragraphs.

Objectives of learning in TEVT

Objectives have to be deduced from the work process. As mentioned above, the modern work process can be described as a complete sequence of action. Figure 11 shows the didactic structure and in reference to it steps of the work process structure underlying it. All of the occupational competencies for a K-workers given in Fig. 7, above, are justified by the actions in complex work processes.

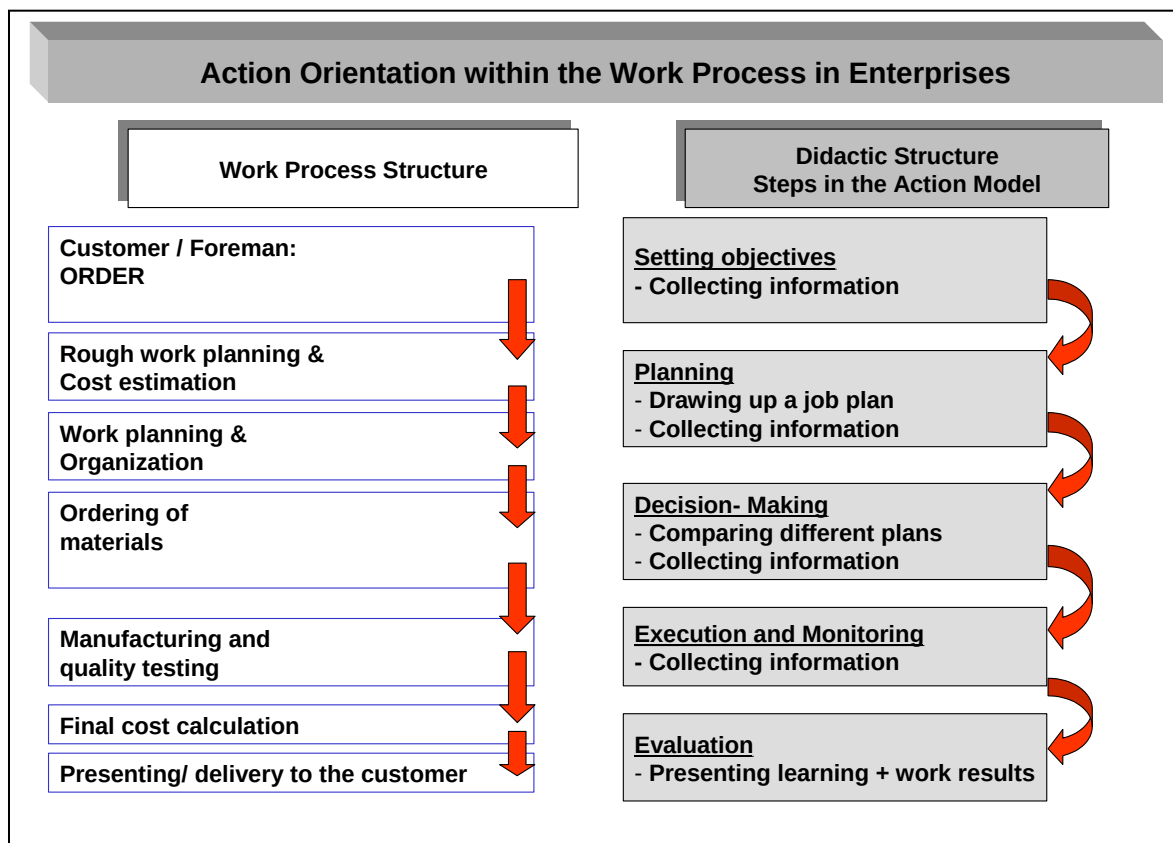


Figure 11: Action orientation originating from the work process in enterprises

Apart from the technical competencies the work process requires the ability of working in teams, common planning, decision making, monitoring and evaluating (communication skills, mutual responsibility). The action is often triggered by problems and requires self-reliant gathering of information. Self-reliance in lifelong learning is made possible by learning during while performing complex work processes successfully and efficiently.

New contents for TEVT

Appropriate contents for TEVT can be determined by the analysis of complex state of the art work processes. Teachers and instructors can do this very easily by going to enterprises concerned with production, assembling, maintaining, servicing etc. in reference to the occupational subjects that they teach. To do this, teachers and instructors must look in these enterprises for work assignments that

- have contents related to their given curricula,
- require planning, decision making, monitoring and evaluation (complete action sequence),
- require aspects of teamwork (e.g. team planning),

This method of identifying appropriate contents is only the first step in implementing a new TEVT based on demands of the actual work processes, because it is based on the given old-fashioned curricula. Here one can find a detailed description of skills deducted from work tasks and duties and knowledge content deducted from technical science. The contents described in the old curricula are often obsolete by the time they are printed due to the rapid change of technology.

The new didactic approach for TEVT demands a new kind of curriculum. This does not mean that teachers and instructors can't start practising the approach before having new appropriate curricula. They can already do it properly following the module about the aspect of "methods" within the approach – about self-reliant learning. In fact the implementation of this new approach for TEVT is a long-term process. It starts with a changing of the role of teachers, instructors and trainees within TEVT, with changing of their habits and attitudes. This process of change leads to demands and pressure for changes in the curricula and the environment of learning and teaching.

Two modules exist describing an appropriate change of curricula and another module is planned by us for "planning and organising learning at work places in enterprises". The contents of both will be outlined within the next paragraphs before we introduce the core element of the approach: the learn and work assignments.

Designing occupational work process related curricula for TEVT

Occupational work process related curricula could be designed based on the results of workshops with skilled workers and experts from the field. In two-day workshops workers from several state of the art enterprises who have broad based experience and are highly skilled will be asked for core tasks of their work process in experts from the field contribute their insights regarding expected technology development (Fig. 12).

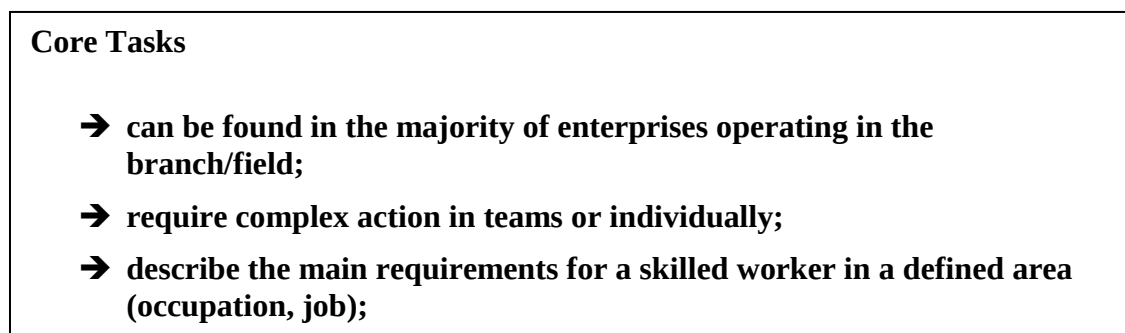


Figure 12: Core tasks revealed by expert skilled workers and further differentiated by experts from the field

There are core tasks that provide an overview of the job/occupation and core tasks that provide a deeper understanding of the conditions and requirements of the job/occupation. The workers describe the tasks roughly, suggest a list of core tasks (15 – 20 tasks) for vocational development and this list has to be approved by experts for TEVT. Finally the workers describe each core task in a detailed manner. Categories for this description are

- contents of work (e.g. inspection of functional reliability and quality of the single parts ...),
- tools (e.g. technical drawings, parts lists, sketches, machine tools, measurement equipment ...),
- methods/procedures (e.g. reading and producing technical documents, manual production methods, testing and inspecting the finished components ...),
- organisation of work (e.g. third-party contractors/ internal reporting order, group work, centralised/decentralised labour management ...),

- requirements to be met by work performed (e.g. executing customer order in accordance with technical documents/models, following safety regulations, use of shop capacities, environmental protection regulations ...).

The core task list and the description of the tasks, as explained above, form the new occupational work process related curriculum.

Defining the environment for work process related TEVT

The learning environment for work process related TEVT has to be as similar as possible to the real world of work, ideally identical with it. Trainees want to learn competencies for an occupation; they want to get practical training and experience rather than going to school as they have done before. The closer the training is related to the actual modern work process the more opportunities exist for the trainees to acquire up to date technical and social competence. To do this, teachers for general studies and instructors for technical training have to work closely together in teams in order to plan and organise a learning process, which makes it possible to acquire general and reference knowledge during practical work. Learning by performing practical work is the key. Learning within the enterprises has to be enhanced. Teachers for general studies and instructors for technical training should together plan and organise efficient learning in actual workplaces more and more.

Learn and work assignments as the core elements of TEVT

Learn and work assignments are the core elements in the didactic approach for TEVT. They contain aspects from all work-related elements and express their interdependence. Learn and work assignments are assignments for the trainees designed by their teachers and instructors. They are closely related to assignments for workers at the work place or they are even real assignments from a specific work place. These assignments are adapted for the learning process with additional questions formulated to guide the problem solving process, hints about possible sources of information, orders for individual or teamwork, sheets for self-assessment, orders for evaluation and presentation etc.. The process of completing the learn and work assignments is a combination of physical action and thinking, decision making etc. Trainees acquire knowledge and skills while solving the assignment as self-reliantly as possible (the advanced trainees more so than the beginners). The practical and theoretical activities of the trainees are the focus of teacher/instructor activities. They consider: “How should the work and learn assignments be designed to ensure the trainees learn and work effectively?”; “When do I have to be an adviser and when do the trainees have to learn by themselves?”. The contents for designing learn and work assignments are determined by the teachers/instructors as explained above. Learn and work assignments combine and integrate the learning and working environments. For example trainees produce real work pieces, design circuits that can be found in the company’s technology or plan their work on the actual company shop-floor.

The core elements of this approach, the learn and work assignments, are going to be explained in more detail in the following chapters.

3.2 Self-reliant learning and trainee centred teaching within the didactic approach

The self-reliant learning process for solving learn and work assignments follows the steps of the appropriate work process as well as the sequence of steps of the complete action and the teaching process is focused on these steps. The teacher/instructor is no longer the master who

gives all of the information, shows everything that has to be done and explains everything. He is no longer the great supervisor who monitors all the trainees' activities and assesses all the time. He concentrates on trainees' self-reliant learning while they perform the action. He is not the old fashioned master; he is an advisor and a coach for the trainees learning activities of the trainees. That's what "trainee centred teaching" is about

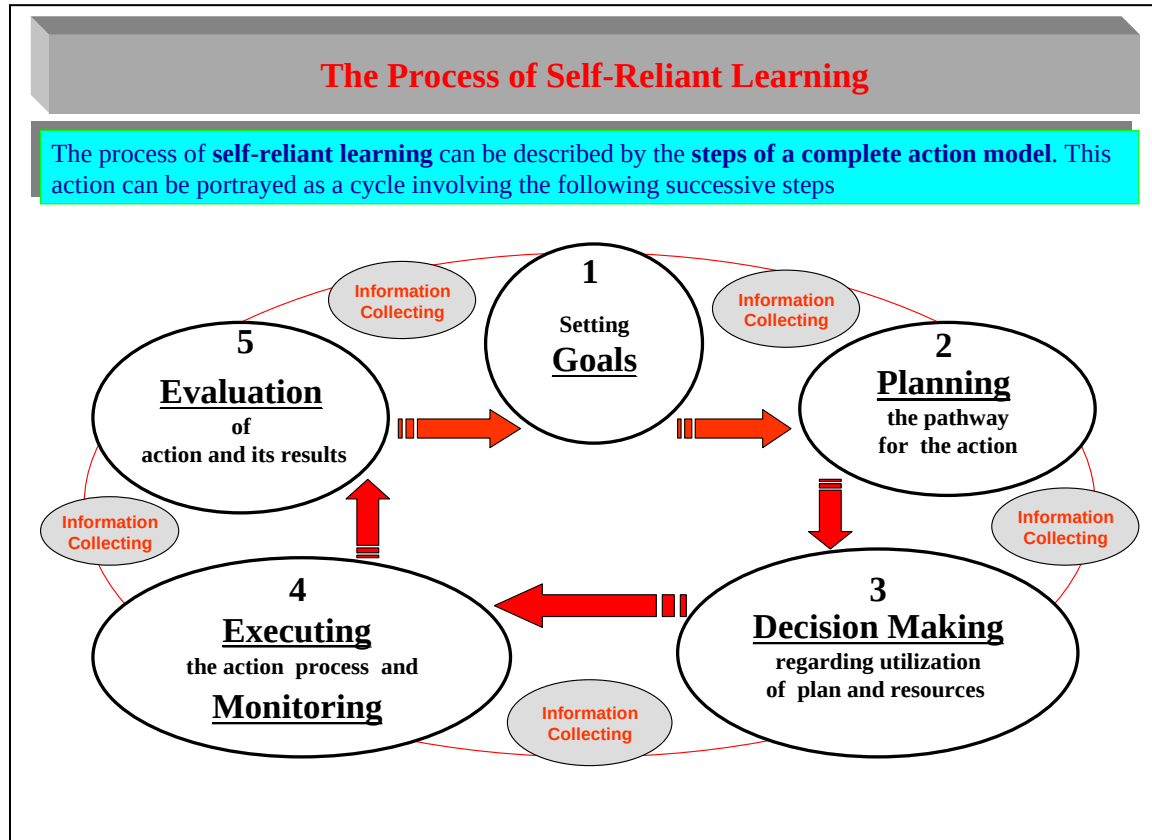


Figure 13: Cycle of self-reliant learning and working

Figure 13 shows the steps of learning and working as a cycle with the following successive learning and working phases:

1 Setting goals

Trainees have to reach a given goal (according to the assignment) on their own or they have even to come up with a goal by themselves. Coming up with their own goal in a learn and work assignment is related, for example, to developing their own version of a product, changing a given design in accordance with material available, developing technology for assembling or improving given tools, setting a time for assembling something etc. The teacher/instructor sets a scope for the activities, material and time, gives hints to help the trainees find their own goal (If the goal is given, the teacher/instructor has to motivate the trainees to take it on as their own.).

2 Planning

Trainees plan the steps in a team or individually. They work on several variations of the plan. The teacher/instructor gives hints and makes them aware of information sources. Other teachers (e.g. general studies) can give lectures on certain subjects and special assignments for acquiring appropriate knowledge.

3 Decision-making

Trainees decide to pursue one of their plans and present the decision to the teacher/instructor and their colleagues. The teacher/instructor reveals mistakes and inaccuracies within the plan and gives advice regarding changes to be made.

4 Execution and monitoring

Trainees follow their work plan and monitor their activities and the results. To do this they fill in monitoring sheets given by the teacher/instructor. Other teachers (e.g. in general studies) provide trainees with information appropriate to the execution and monitoring process. Teachers/instructors should intervene only if a dangerous situation occurs during the use of machines, if trainees don't follow health and safety regulations or if an appropriate result is jeopardised or if they are going to fall seriously short of the set goal.

5 Evaluation

Trainees initially evaluate their entire approach for completing the assignment by themselves. They use a given assessment sheet designed by the teacher/instructor or by trainees themselves in cooperation with the teacher/instructor. This evaluation is double-checked by the teacher/instructor. Trainees also prepare a presentation of their learning and working activity and its results. Teachers for general studies support this by preparing lectures and special assignments.

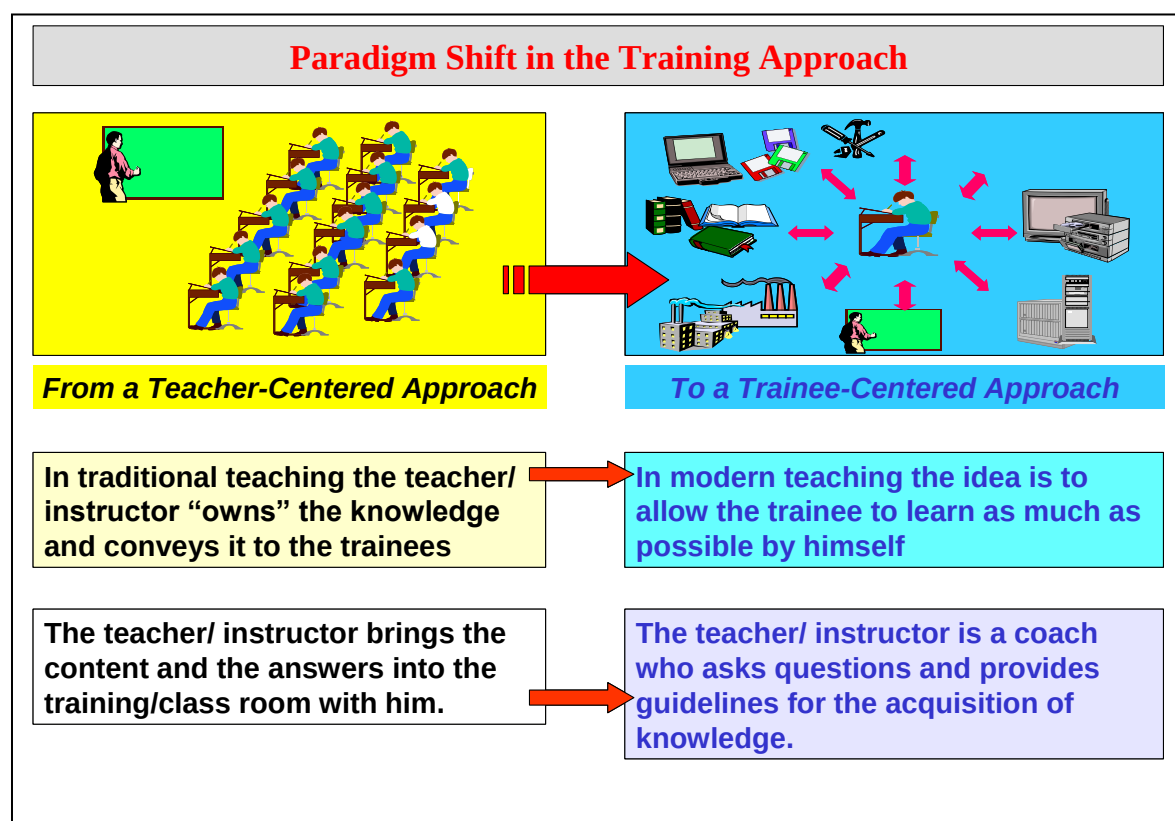


Figure 14: Summary – Paradigm shift for the training approach

4 Learning and work assignments and trainee centred teaching

4.1 Characteristics of trainee centred teaching

We characterised the new role of teachers and instructors in trainee-centred teaching as the role of a coach and advisor in the previous chapter. This role will now be explained in more detail by comparing it with the old role.

The old role of the instructor is very accurately characterised by the so called four stages method:

1st Stage (explaining/listening)

The instructor sets the goal of the training unit. He/she outlines the skills and knowledge to be accomplished after finishing the unit. The importance of the skills and knowledge that have to be acquired, is emphasized i.e. their importance for future learning process for the work process of a skilled worker (motivation). They review with the trainees the skills and knowledge that they have already acquired and point out how they are related to the targeted skills and knowledge and they give an introductory lecture on the new contents that have to be acquired.

2nd Stage (demonstrating/watching)

The instructor names the individual steps of the task that have to be carried out and he demonstrates each step while naming it. The trainees are asked to follow attentively. More information is given during the demonstration. In the case of complex skills the trainees are requested to write down the named steps and the given information.

3rd Stage (correcting/imitating)

The trainees repeat what they have learnt and the instructor corrects the repetition by the trainees carefully. The trainees imitate the action of the instructor as closely as they can. They explain what they do and speak aloud the names of the steps. Monitoring is the main activity of the instructor in this phase.

4th Stage (evaluation/practicing)

The trainees apply the acquired skills and knowledge to different work situations. The instructor evaluates the results: He describes the level of the skills, states the progress of the learning process and explains improvements that are necessary. The instructor assesses the performance level of the trainees.

These four stages are appropriate for acquiring simple skills but unfortunately instructors also use the same methodology for the acquisition of complex skills. They often introduce complex practical tasks with lectures that take hours. Trainees have to listen to a lot of theory before starting with practical exercises. “They need basic knowledge, before getting some practice”, the instructors explain their strategy. That is true for basic knowledge necessary for carrying out the first steps in completing practical assignments. But “basic knowledge” is understood by instructors very often as a lot of theory. They present complex theories needed for future stages in their training and it seems that they forget the weakness of the human mind. We can only keep in mind what we need immediately or something that leaves a strong

impression. Furthermore, the instructors themselves are also unable to keep new information in mind that they need next week for a practical activity that they have never done before. Furtheron the instructors wonder that trainees ask a lot of questions referring to contents that were already covered in the introduction (but which they do not remember). It is much more successful and time-efficient if instructors and teachers give a short introduction on a subject and let the trainees act self-reliantly after that. Trainees can look for information (knowledge) by themselves and from time to time teachers/instructors can support the self-reliant completion of an assignment with brief lectures that go deeper and into more detail on the subject.

Trainee-centred teaching requires active learners. Learners who are given an assignment for self-reliant learning pass through all of the activities presented in the table below (Table 2).

Later in this chapter and in the next it will be described how the assignments, assessment sheets, guiding questions and hints have to be designed. Additional general remarks on the new role will follow.

The teacher/instructor must challenge the learners to find their own way of doing things, their own solutions for given assignments. Teachers and instructors steer the learning process from the background, they intervene only if the practical exercise and work results are jeopardized or if trainees have problems, which they can't solve by themselves (e.g. conflicts in their team). Normally they offer hints to support self-reliant searching for information, to rechecking the plan, to progressing more carefully in self-reliant learning. New-role-teachers and instructors (i.e. those using the trainee centred teaching approach) accept students' own methods of solving problems even though they might not be the most effective or efficient. It's the method of progressing in a self-reliant way which counts. Trainees will find the disadvantages of a chosen way by themselves during the learning and working processes or within their final assessment.

Assessment during the activities for completing a certain assignment and at its end should be done by trainees themselves before teachers/instructors do their assessment. Self-monitoring, evaluation and related assessment are core components of self-reliant learning. Fostering theirs development is a primary objective of trainee- centred teaching. Self-monitoring, self-evaluation and self-assessment produce highly efficient results. The learners have a much stronger imprint and more comprehensive memory of the experience and knowledge gained during the course of these activities because they were required to reflect about the benefit of knowledge and skills used, comparing alternatives and the use of different knowledge and skills, estimating the usefulness of prerequisites. Assessing themselves strengthens their position within the learning process and leads to more self-consciousness. (See chapter 5 for more information and details on self-assessment and chapter 6 for answers to your questions regarding self-assessment).

It is very hard for teachers and instructors to withhold it if they are asked by trainees for information, yet, the trainees have to find it themselves. We often observe that trainees ask their teacher/instructor for information even though they actually know it – and the teacher/instructor answers. It is much more appropriate to stimulate the self-reliant learning of the trainees in such situations than to answer the questions.

Table 2: Comparison of teacher centred teaching and trainee-centred teaching

Teacher/instructor-centred teaching (Old-Role-Teacher/instructor)		Trainee-centred teaching (New-Role- Teacher/instructor)	
Teacher/instructor is teaching by	Trainee is learning by	Teacher/instructor is teaching by	Trainee is learning by
Explaining	Listening	Designing learn and work assignments and guide questions and hints Discussing information results	Self-reliant informing Presenting information results
Demonstrating how to do	Watching and imitating	Designing learn and work assignments and guide questions and hints Discussing plans	Self-reliant planning Presenting planning results
Supervising and monitoring	Following instructions	Designing learn and work assignments and guiding questions and hints Giving advice and hints	Self-reliant monitoring Self-reliant implementing
Evaluating	Listening and accepting	Designing learn and work assignments and assessment sheets Discussing the results and final assessment	Self-reliant assessing Presenting results of all activities

Self-reliant learning means: the trainees are given as much as possible opportunity for their own thinking in the course of the process of completing learn and work assignments. Teachers/instructors have to support their thinking and not to interfere with this process. They should always ask themselves the following questions:

- Could I have involved the trainees more in the preliminary planning of the assignment?
- Have I placed too little trust in the trainees?
- Have I relieved the trainees from too many responsibilities?
- Have I failed to provide the necessary help?
- Have my directives and instructions always been clear enough?
- Have I been too overbearing with my knowledge and skills?
- Have I monitored and evaluated too many things myself and made it difficult for the trainees to exercise their own judgment?

The following figure summarizes guidelines for the teacher/instructor as a coach and adviser.

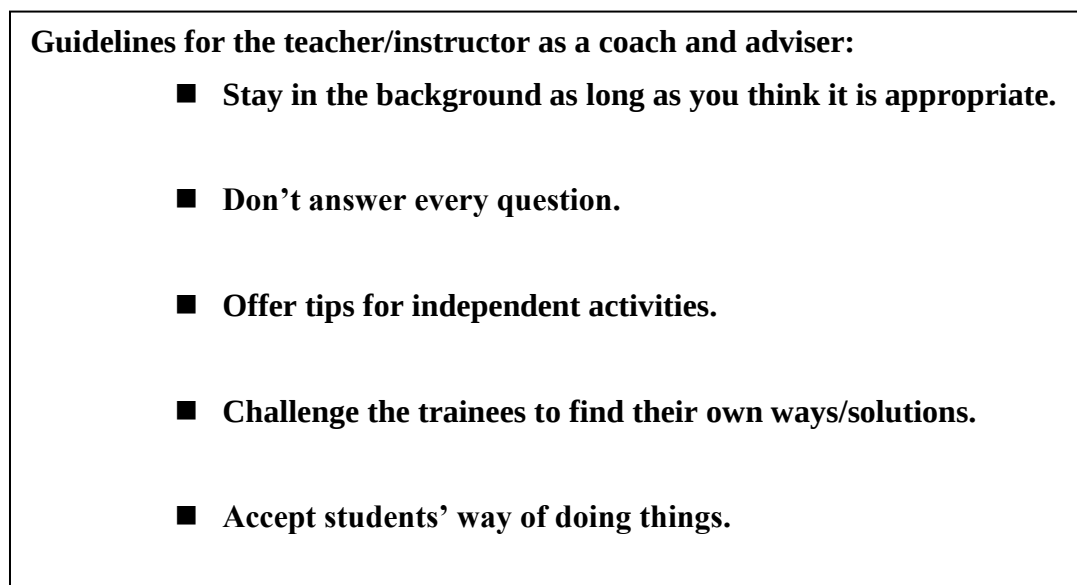


Figure 15: Guidelines for the teacher/instructor as coach and adviser

Emphasizing the new role doesn't mean that teaching by explaining and demonstrating is obsolete, that lectures of the instructor or teacher are not necessary any longer. NO – THESE "OLD METHODS" ARE STILL VERY IMPORTANT TEACHING METHODS. BUT THEY HAVE TO BE INTEGRATED INTO TEACHING PROCESS WHICH IS PREDOMINANTLY TRAINEE-CENTRED.

Characteristics of trainee-centred teaching

- 1. Teacher/instructor is coach and adviser to the learning process.**
- 2. Well formulated assignments (problems, tasks) for the learners are the emphasis of the teaching/training process.**
- 3. Teacher/instructor supports learners' activities for finding their own ways, asking questions themselves, monitoring and evaluating their activities themselves and assessing their own performance level.**

Figure 16: Summary – Characteristics of trainee-centred teaching

4.2 Fostering teamwork in trainee-centred teaching

The fostering of teamwork is necessary during learn and work assignments as part of the new didactic approach. Teamwork is an important part of learn and work activities from the beginning until the completion of any vocational training. Team learning and working follows the same steps of complete action as shown in Fig. 13:

Setting goals

A team discusses a problem and members can contribute with suggestions for sub goals that have to be achieved to find a solution to the problem. The sub goals have to be agreed upon by the team members.

Planning and decision making

The approach used to reach the agreed goals is planned in a brainstorming session monitored by a member of the team. A decision for a concrete plan and appropriate resources is made by the team after brainstorming and formulating possible courses of action based on careful information collection.

Execution and monitoring

The execution of the agreed upon plan can be done individually or in co-operation. For example it is possible that each member of the team assembles the same commonly planned product or each member assembles a component of a complex product. Monitoring can be done by a member of the team or shared amongst team members.

Evaluation

The member of the team charged with monitoring has to evaluate his leadership after finishing the assignment and the team has to evaluate the teamwork as a whole. These two evaluations are the first part of a comprehensive presentation on the learn and work processes for completing the given assignment. The team has to prepare the presentation and as many members of the team as possible have to present.

The composition of the team depends on the intention of the teacher/instructor. It is often appropriate to let the trainees have their choice of the composition of a team particularly for the introduction of teamwork in the learning process. But if there are constraints such as conflicts between trainees, low performance levels that have to be taken into account, independent relations between trainees etc. then the teacher/instructor has to decide on the composition. Trainees will not be able to choose team-membership later on as skilled workers on the job – this should be kept in mind by the teacher/instructor if they are thinking about organising teamwork.

Efficient teamwork does not function from the start. A basic understanding (guidelines and explanations) of learning and working in teams is needed. This understanding has to be conveyed by the teacher/instructor before the initial teamwork begins (see Fig. 17).

Guidelines for communication in teams

➤ **Listen actively**

Active listeners show their concentration and interest to the “speaker” by their reaction (facial expression, body language, appropriate questions). Through active listening it is more likely to avoid misunderstandings. The effects of the speech become more focussed and the ensuing discussion is more effective.

➤ **Take the floor in turns**

This is the most basic of the rules for oral communication. It is not possible to concentrate and listen actively to more than one speaker at a time.

➤ **Be careful with judgements during the speech of a group member**

Judgements regarding statements of members of the group are important within the group work process – but later. First of all we have to try to understand what the group member wants to say. If you have a different view of the subject, discuss it later.

➤ **Give priority to the factors that create disturbances**

Precedence must be given to the elimination of any factors that are creating disturbances in order to prevent destructive behaviour by individual participants. Inappropriate situations must be detected immediately and their threat to become problematic has to be expressed. The person who has caused them must be invited to clear his/her position. If one doesn't take the matter up, behaviours of this kind might jeopardise the team work and – at times – even make it impossible to perform a common project.

➤ **Discuss in writing**

Each member of the team can see what has been discussed. If the results of the discussion are written on a blackboard or pin board, or on a flip chart etc. In this way all the contributions of the discussion can be preserved. In order to initiate an open discussion among all of the participants without interference by the moderator, it is recommended that the participants write down what they would like to say with a felt-tip pen on a card to be pinned on the wallboard, so that it can be seen by all.

The written statements are then a basis for ongoing or future discussions and finally for the minutes/report on the meeting.

Figure 17: Guidelines for communication in teams

If the teamwork is carried out with a member of the team, appointed by the teacher/instructor as moderators in the goal setting phase or the planning and decision making phase, they have to be provided with useful guidelines as well. Such guidelines are given in Fig. 18.

Moderation of a group work process

- Determine the time for each contribution of a group discussion

Do not allow more than three minutes for each speech. All members of the discussion have to speak briefly.

- Everybody has to be a helper

Everybody lends everybody else a hand for all group activities: e. g. writing on the flip chart, writing pin cards etc.

- Use set phrases for starting up the discussion

Such phrases are:

Targeting at problems

- Have you thought about ...?

Clarifying

- There is one thing I'm not quite clear about, ... Would you mind explaining a little further?
- I don't think I follow you, ... Could you clarify what you mean.
- If I said that ... would you agree with that?
- Is it your opinion, that ...?

Figure 18: Guidelines a member of the team charged with the task of being the moderator

Assessment of first teamwork experiences

Trainees, the moderator and team members, have to report on their experience in the teamwork process with reference to the given guidelines after each of the first three teamwork

assignments in a vocational training course in order to remember the guidelines. The report includes specific mention of the five guidelines for communication in teams. First the team members, then other teams and finally the teacher/instructor reviews problems or guidelines that were forgotten or not properly applied.

Assessment of advanced teamwork experience

At the end of a complex assignment, two presentations are carried out: a presentation by the moderator and a presentation by the team (moderator included).

The moderator has to answer the following questions at the beginning of the overall presentation:

- Have I placed too much or too little trust in the team members?
- Have I done my best to encourage my team members to get personally involved in thinking and acting in the course of planning, executing and evaluating?
- Have I relieved the team members of too many responsibilities?
- Have I failed to provide the necessary help?
- Have my directives and instructions always been clear enough?
- Have I been too overbearing with my knowledge and skills?
- Have I monitored and evaluated too many things myself and stopped my team from doing it themselves?

The entire team has to present the results of the practical exercises and work activities after finishing the complex assignment. The first part of the presentation is a report on the process of the learn and work activities and the second part is a description of the results, their quality, benefits, usage etc.

Teams have to discuss the question catalogue given in Fig. 19 to prepare the report on the process of the learning and work activities.

Question catalogue for final assessment

Success of the training activity

What have we learned? How did we learn it?

Product or service requirements

Which product or service requirements were complied with– which were not?

Which requirements could not be agreed upon by the team members? Why not?

Designing opportunities, processing methods, alternative solutions

Why did we choose a certain solution instead of a different one and what advantages/disadvantages does the adopted solution have?

Which interests, needs and objectives were taken into account or neglected, especially in selecting the various solutions?

Collaboration

How effective was the collaboration within the team, between the teams and with the instructor/teacher?

Performance

What did we do well during the performance of the assignment? What could we have done better?

Which aspect of our work did we find satisfactory and which not?

Is there anything we were not able to accomplish? Why?

Figure 19: Question catalogue for final assessment of the completed assignment

Additionally, trainees can fill in an assessment sheet that can be designed as shown in Fig. 20. The team assessment can be double-checked by the instructor/teacher with this table. The completed table can be used as a slide during the final presentation.

Item	Team	Instructor/teacher
Proper planning and layout	1 2 3 4 5	1 2 3 4 5
Decision Making	1 2 3 4 5	1 2 3 4 5
Conflict resolution	1 2 3 4 5	1 2 3 4 5
Safety Precautions	1 2 3 4 5	1 2 3 4 5
Tools used correctly	1 2 3 4 5	1 2 3 4 5
Machines used correctly	1 2 3 4 5	1 2 3 4 5
Minimized wastage	1 2 3 4 5	1 2 3 4 5
Cleanliness	1 2 3 4 5	1 2 3 4 5

Figure 20: An assessment sheet example for teamwork performance

Principles of teamwork for the trainee-centred teaching approach

- 1. The composition of the team depends on the intention of the teacher.**
- 2. Teamwork has to follow the cycle of self-reliant learning as well.**
- 3. Trainees have to follow the guidelines for appropriate communication**

Figure 21: Summary – Principles of teamwork for the trainee-centred teaching approach

4.3 Assignments on three levels of learning and working

Trainee-centred teaching is the basis for self-reliant learning. Efficient self-reliant learning is only possible if the teaching process is trainee-centred. A core element of this teaching process are the learn and work assignments. These assignments require different levels of performance. We distinguish between three levels as shown in Fig. 22. Learners have to climb three stages in order to become self-reliant in their learning process with reference to assignments and in addition to this, teachers/instructors have to teach increasingly as moderator, coach and adviser.

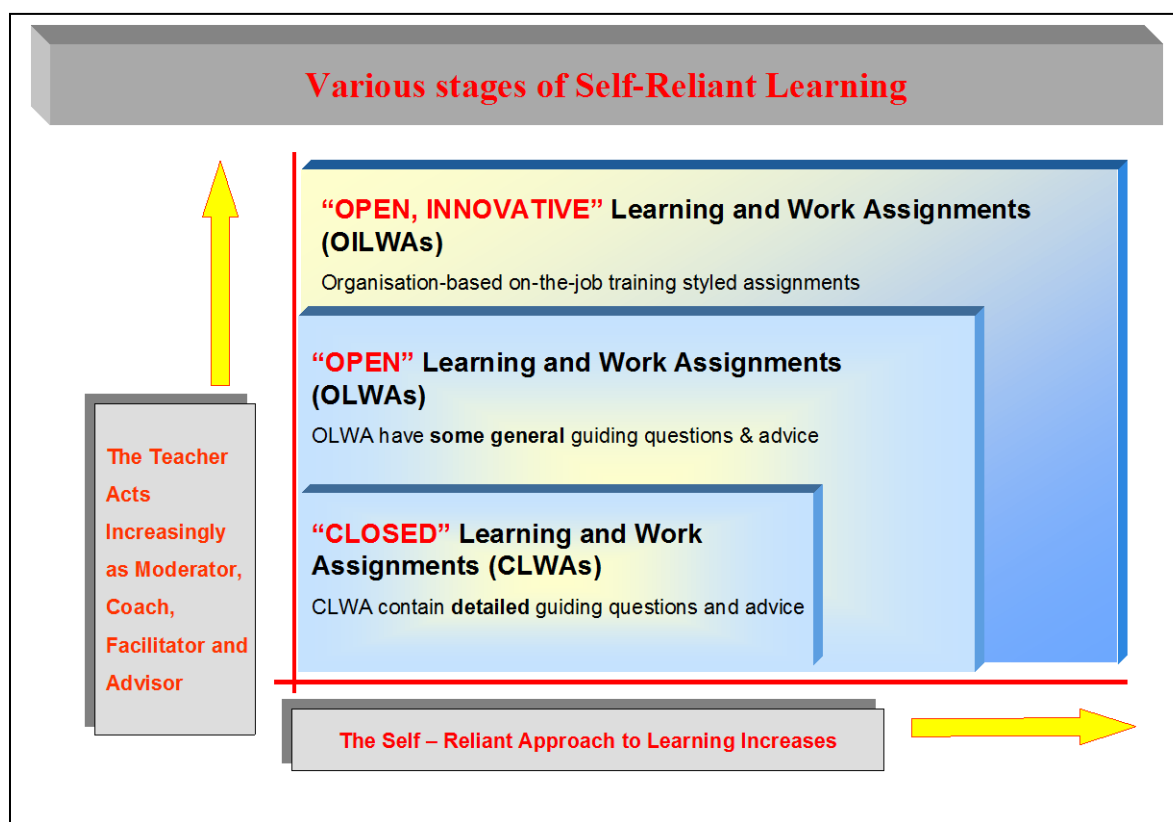


Figure 22: Various stages of self-reliant learning

"Closed" assignments

These assignments require that the learner carries out the complete action for a given goal (set by the teacher/instructor). Students learn particularly how to plan steps for accomplishing given goals acting entirely on their own or in teams, how to decide on an appropriate approach/method, how to monitor their activities and how to evaluate the course of action and its result. To accomplish this they learn how to look for and get appropriate information independently, and how to gain information in a finely tuned cooperative process. In addition to this they can acquire the required knowledge, skills and attitudes for working in a specific field.

The teacher or instructor can foster the acquisition of specific knowledge, skills, and guidelines for communication and cooperation with well formulated aids for self-reliant learning, such as guiding questions, orders, advice and assessment sheets.

An example of a “closed” assignment combined with guiding questions, orders, hints and assessment sheets is given below. How to develop assignments and related aids for self-reliant learning is going to be explained in the next chapter.

“Open” assignments

These tasks require that the learners carry out a complete action including the finding and formulation of a goal in a given framework. The framework determines the scope for designing the goal (e. g. a number of alternatives, size of a product, timetable for manufacturing, available material). With this the learners are more motivated and they act with more commitment and responsibility for THEIR product. Students also learn how to plan steps for accomplishing goals acting entirely on their own or in teams, how to monitor their activities and how to evaluate the course of action and its result. They learn how to look for and get appropriate information independently, and how to gain information in a finely tuned cooperative process. In addition they can acquire knowledge, skills and attitudes for working in a specific field.

The teacher or instructor fosters acquisition of specific knowledge, skills and guidelines for communication and cooperation in this stage of self-reliant learning with more general and fewer formulated aids. The latter depends on the performance level of the students and their progress in self-reliant learning. An example of an “open” assignment is given below.

“Open, innovative” assignments

“Open, innovative” assignments are exceptionally “open” as assignments. Every thing what has been written on “open” assignments above is also true for “open, innovative” assignments other than the fact that the framework for the goal is wider and that the trainees have to establish decision-making and evaluation criteria by themselves. These assignments are related to the organisation of work. They are supposed to enable learners to participate actively in the organisation of work. “Open, innovative” assignments must be designed in a manner that encourages trainees to ask themselves questions such as:

“Why is the technique which is applied structured like this and why does the whole enterprise or the department use it in this form?”,

“Why is work organised in precisely this way at this work place?” and

“Could the job be done in a different way? What alternatives are there?”.

The principal characteristic of these assignments is that the learners are asked to discover and use the instruments associated with work organization to accomplish the tasks, to seek alternative, innovative solutions, often through a teamwork approach, to evaluate the various proposals and, therefore, to become capable of making well-founded choices.

Teachers and instructors design the assignment and aids for the planning process. The use of independent problem solving processes by the team of trainees teams for such complex tasks requires a teacher/instructor as coach. They have to coach the trainee who moderates discussions on the challenges of the assignment following a discussion scheme and they have to coach the trainee-moderated workshop for establishing decision-making and evaluation criteria. Coaching means here that the main activities have to be done by trainees and their team-leader. The teacher or instructor intervenes only if the team-leader has serious problems in the moderation process, if it is necessary to provide trainees with information or if trainees

forget important decision-making/evaluation criteria. (For more detailed information see chapter 5)

4.4 Examples for assignments

Assignment 1 (“closed”)

Assignment

Design and fabricate a simple reducer gear system to reduce the rate of revolutions in the motor indicated.

The reducer gear system has the following specifications:

- The gear ratio is 2:1.
- The driver and the driven gears have the same direction of rotation.
- The size of the gearbox housing is 200 mm x 150 mm x 50 mm.
- The spindle diameter is 20 mm.

Duration: 7 hours

Learning and work organization: team of three trainees

Semester: 2

Aids for learning and working

Planning and decision-making

1. Design the gear system according to the specifications given.
2. Consult your mathematics teacher and carry out all the calculations.
3. Draw a clearly labeled diagram (including dimensions and units).
4. Present your design to other teams and the instructor.
5. List all of the methods used for producing gears. Look in your records and the reference book.

6. Plan your work with a detailed selection of tools and description of work steps. Include duration for each step. Do this planning in a moderated team discussion.
7. Present the work plan to your instructor.

Assignment 1 (“closed”)

Fill in the given assessment sheet (see page 3) while learning from and working on the assignment.

Execution and presentation of the result:

1. Set up the index head on the milling machine table.
2. Mill the gears.
3. Don't forget safety precautions!
4. List the various items of measurement testing equipment.

5. Measure the gear dimensions.
6. Assemble the gears in the housing fixture.
7. Check to see that the gear system functions.
8. Write an assignment report and prepare a presentation in collaboration with your English teacher.
9. Present your results:
 - a. Experiences from the learning and working of your team (Consider the assessment sheet.)
 - b. Functionality and quality of the result which you have achieved (Consider the assessment sheet.)

You have been allocated about 15 minutes for your presentation.

Assignment 1 (“closed”)

Assessment sheet

Please assess the learning and work process within your team. Use the comments “It is accurate” (+), “It is partially accurate” (0) or “It isn’t accurate” (-). You are to assess first and then your teacher/instructor assesses.

Calculation	Team	Teacher/instructor
Calculation related to the specification given		
Correct formula applied		

Drawing	Team	Teacher/instructor
Drawing according to the specifications given		
Drawing according to the standards		

Work planning	Team	Teacher/instructor
All of the criteria have been considered		
Logical steps to the work		
Sufficient planning		
All members involved		

Execution of work	Team	Teacher/instructor
Health and safety precautions were ensured		
Correct selection of tools		
Proper machine handling		
All members participated		

Quality of work	Team	Teacher/instructor
Product in accordance with the design		
System works according to the ratio given		
Driver and driven gears rotate in same direction		

Presentation	Team	Teacher/instructor
Documentation well prepared		
Results well presented		

.....

Signature team leader

.....

Signature teacher/instructor

Assignment

Construct an interface for an elevator in a 5 story hospital. Consider the operation theatre is on the 5th floor and the emergency room on the 2nd floor.

Duration: 10 days

Learning and work organization: team of three trainees

Semester: 4

Aids for learning and work

The following questions and advice will guide you in completing this assignment.

1. Why do we need an interface?

2. Find out possible components for an interface.

Advice:

- *Plan your work with relevant components.*
- *Consider the emergency cases.*
- *Consider the location of operation theatre and emergency room.*

3. Construct the interface.

Advice:

Construct the circuit on the circuit board. Present your work to the instructor.

4. Test to see if the interface works.

5. Write a detailed report in collaboration with your English teacher.

6. Present your results:

Assignment 2 (“open”)

Assessment sheet

Please monitor the quality of your work during the work process. Use Comments such as “it is accurate”, “partially accurate”, “it isn’t accurate”, “could be better”, “three (items of five) are not accurate” etc.

1.) Software

Subject of monitoring	Comments by the team	Comments by the teacher/instructor
Planning and designing of the flowchart a) All the main functions of the elevator have been considered b) All the special conditions have been considered c) Accuracy of the plan		
Execution of work a) Cooperative problem solving among team members b) Usage of correct codes for programming		

2.) Hardware in general

Subject of monitoring	Comments by the team	Comments by the teacher/instructor
Layout of the circuit a) Components are well arranged b) Number of components needed is minimized		
Safety a) Any bare wires? b) Any shorts or crossed wires?		

Assignment 2 (“open”)

3.) Interface

Subject of monitoring	Remarks by the team	Remarks by the teacher/instructor
Debugging All of the errors have been corrected		
Functionality Elevator works properly when the interface is connected		

Assignment

Drive shafts of motor vehicles have to be removed in the car maintenance workshop. Workers use different devices to facilitate their work. Analyze the devices used by workers in several workshops and design and assemble an optimal (from your and the workers’ point of view) device for removing the rear drive shaft of motor vehicles.

Duration: 12 days

Learning and work organization: team of four trainees

Semester: 4

Aids for learning and work

The following questions and advice will guide you in completing this assignment.

Informing/analyzing

1. Visit several workshops and analyze the work of removing rear drive shaft of motor vehicles.
2. Ask workers what would facilitate this work.
3. Study several devices given. Use the internet as well.

Planning and decision-making

1. Develop alternative solutions in your team.
2. Discuss decision-making criteria and devise the most appropriate (workers’ needs, safety precautions) solution.
3. Establish a plan and timetable for the main steps that have to be done.
4. Establish the monitoring and evaluation criteria in a workshop moderated by the team leader.
5. Create technical drawings in collaboration with the teacher of this subject.
6. Present your drawings and your plan/timetable to the other teams and your instructor.

Execution

1. Monitoring criteria should be taken into account at all stages of the planned work process.

Evaluation

1. Write an assignment report and prepare a presentation in collaboration with your English teacher.
2. Present your results:
 - Experience from the learning and working of your team
 - The functionality and quality of the device and the consideration of workers' demands
 - You have been allocated about 30 minutes for your presentation.

5 Designing assignments for self-reliant learning and working

5.1 General explanations on designing closed and open assignments

We have developed guidelines for designing learn and work assignments that teachers and/or instructors can work with individually or in teams. Teachers/instructors can start by using the guidelines after having chosen a work assignment as the basis for the designing process. To do this teachers/instructors have to

- ➔ look for a work assignment within the practice field of their trainees occupation (in companies),
- ➔ compare the demands of the assignment with the demands of the curriculum. If the demands are met, they have to
 - 1. consider where and how it is possible for the students to perform the assignment and to
 - 2. consider whether it is necessary to change the assignment (not much) to adjust it to the circumstances of the self-reliant learning process (given machines, tools in the workshop, accomplishments of trainees, means for learning etc.). (See chapter 3 paragraph 3.1 as well)

A learn and work assignment consists of the actual assignment and corresponding guiding questions, orders, advice and assessment sheets.

The actual assignment

The actual assignment relates to a job task or even to a work activity in an enterprise. It must be described briefly but clearly, if possible it has to include customers' needs (appearance, colour, material, strength, price etc.) and also to specify regulations and environmental requirements. The actual assignment has to consider the available time for the performance of the task as well as information on the type of collaboration (teamwork, partnership, individual) requested.

The actual assignment is formulated at the top of the assignment sheet.

The corresponding guiding questions, orders, advice

Corresponding guiding questions, orders and advice can be designed by using the table as shown in Table 3. The appropriate usage of this table is explained in three steps:

- a) Establishing the table as a designing tool
- b) Filling in the first three columns
- c) Formulating guiding questions, orders and advice for self-reliant learning

Table 3: Table for designing learn and work assignments

Activity carried out to complete the assignment	Learning objectives	Information source	Guiding questions and hints

A team of teachers/instructors or an individual has to follow the following guidelines:

a) Set up a pin board and divide the work surface into four columns (the fourth column wider than the others)

Using a pin board to draft guiding questions, orders and advice, for an assignment that requires self-reliant learning and working has the advantage of allowing all members of the teacher/instructor team to see the current status of the discussion at all times and to change the position of items easily. If the team is a small one, standard self-adhesive sticky notes can be used instead of the traditional pin board.

If no pin board is available, a flip-chart sheet turned on its side can be attached to the wall or laid out on a work table.

b) Write the titles at the top of the columns (see the table above) and fill in the first three columns

In the first, second and third column all activities, learning objectives and information sources that were agreed upon by the team before drafting the guiding questions, orders and advice have to be listed.

The steps that have to be done by a skilled worker in order to complete the assignment have to be written down in the first column, taking into account that the worker has to do the five steps of a complete action as well.

The teachers/instructors have to think of their trainees after writing down these steps and to go to the second column. Considering the stage of the learning process and the performance level of the trainees, teachers/instructors must ask themselves: “What do I intend to teach them?”; “Which goals should they achieve with their learning and work activities?”. The wording of the aims has to be as detailed as possible. Goals like “teamwork” are inappropriate. The goals have to incorporate the desired characteristics of teamwork (e. g. “taking part in a moderated team discussion for planning the action that has to be performed”).

Teachers/instructors ask themselves and colleagues of other teams for information sources in order to fill in the third column: “Which information sources are available for the self-reliant learning and work process and which have to be provided?”

c) Formulate the guiding questions, orders and advice.

When devising all the guiding questions, orders and advice, it is important that teachers/instructors put themselves into the trainee's position, into the trainee's mindset, and go through all the mental processes which should/could take place, in advance. They have to answer the questions:

- ➔ Which action context should the new information be assigned to? Which system of knowledge do the trainees apply to integrate the new information?
- ➔ How can the guiding questions/orders/advice induce the trainees to think in advance before making decisions or performing actions?
- ➔ How can the trainees be guided towards obtaining the knowledge for the execution of the assignment? What do they have to do to acquire the knowledge?
- ➔ How can the trainees be induced to monitor themselves? How can the monitoring take place during the performance of the assignment?

The guiding questions/orders/advice should always be clear and unambiguous, but not too easy. The teacher/instructor should assume that the trainees want to learn something new and the questions should help them to understand the problems presented by the assignment. It is pointless to set questions which only require the trainees to copy what is stated in their reference material.

Guiding questions/orders can also ask for acquired knowledge or information which was sought by the trainees (See assignment 1 and 2 chapter 4). The trainees are requested to write the knowledge on a certain subject into a blank on the assignment sheet. Such items give the trainees the chance to check the quality of their gained knowledge and give the teacher/instructor feedback on the learning stage by taking a brief look at the assignment sheet.

But guiding questions/orders should not be confused with examination questions: they are not supposed to test knowledge but instead ensure that the trainees know or have found out all they need to know in order to deal with the assignment professionally.

Guiding questions or orders may include terms which are unfamiliar to the trainees. Additional questions or explanations should be set to help the trainees find out what these new terms mean.

The formulation of guiding questions, orders and advice must be related to a certain step of the action, which was formulated in the first column as shown in Table 4. It is crucial that the teachers/instructors who have formulated the items refer to the corresponding action step and the previously determined objectives when making up the guiding questions. Teachers/instructors can only continue formulation of guiding questions, orders and advice after a careful comparison between those written in column 4 and the corresponding items in column 1 and 2.

The completed table is not the assignment sheet. Only the items of column 4 are used to design an assignment sheet, as shown in the examples of this manual!

The assessment sheets

As explained in chapter 2 it is very important to monitor and evaluate every stage of an action in order to gain action competence (human and social, learning and methodical, technical competence). To do this the learn and work assignments must provide the trainees with appropriate aids. Guiding questions and orders can support this, as shown in assignment 1 and 2 and specified in the paragraph above. Assessment sheets are another possibility. The most important function of these sheets is to provide the opportunity for the trainees to judge and assess their activities (individual or team) and the results of their learning and work processes.

A variety of assessment sheets currently exist and are in use in training practice. One can distinguish two main groups: One group refers to the concrete work activity and its result and the other to the characteristics of the learning and work process. Representative examples are given in Figures 23 and 24.

Assessment sheets for self-reliant learning and work processes are given primarily for the trainees to foster their competencies. They are also given for an assessment by the teacher/instructor, ***but this is the lowest priority for their usage***. The latter have the task of double-checking what the trainees have assessed, to give them feedback on their ability to assess themselves. Assessment sheets for self-reliant learning and working have to be designed for the trainees and NOT for the assessment by the teachers/instructors. Teachers/instructors assess the progress of their trainees' self-reliant learning, which also includes their progress in self-reliant assessing. (See chapter 6 questions 7-10)

Table 4 : Example of a learn and work assignment designing table

Assignment: Manufacture an ENGRAVING TOOL according to the drawing that is attached. Use the appropriate raw material available. The time to complete the assignment is 3 days.			
Activity carried out to do the assignment	Learning objectives	Information sources	Guiding questions and hints
(1) - Evaluation of drawing - Selection of appropriate raw material available - Work planning	- Trainees are able to select appropriate raw material available - Trainees get first experience with modification of drawings - Trainees have accomplished developing a parts list in accordance with a drawing - Trainees get first experience with team planning of work - They are able to apply technology related mathematics and physics - They have been acquainted with decision making and presenting a work plan result - They have basic drilling machine knowledge	- Drawing - Reference book - Training manuals - Metal work textbook - Manual of arithmetic rules	- Evaluate the drawing and compare with the raw material available on the shop-floor! - Is it necessary to modify the drawing? Make a proposal! - What kind of steel is recommended? Use the metal reference book! - Minimize the wastage! - What is the weight of your planned engraving tool? - Plan the work by detailed selection and description of work steps! Do that in teams of five trainees! - Decide on an appropriate technology. - Present your work planning results to the trainer. - Describe the five most important attributes of the drilling machine used - Determine the drilling speed! - ...
(2) - Deciding on an appropriate technology	- They get first experience with drilling machine technology - ...		
(3) - Filing the grip of the engraving tool - Drilling the hole - Finishing the grip - Manufacturing the needle - Uniting the grip and the needle - ...		- Drilling machine manual - ...	

Assessment sheet

Please assess the learning and work process in your team. Use the comments “it is accurate”(+), “it is partially accurate”(0) and “it isn’t accurate”(-) . You are to assess first and then your instructor/teacher assesses.

Planning of work (gathering information and planning)	trainees	instructor/ teacher
All of the information has been considered.		
Logical steps to the work.		
Plan is suitably detailed.		
The planned steps have been carried out by the team.		

Execution of work (decision-making and execution)	trainees	instructor/ teacher
All members of the team have worked together.		
The wastage has been minimized.		
Health and safety was ensured at all times.		
The consciousness for the environment was strongly developed.		
All of the planned tools have been used.		
All of the machines have been used properly.		

Quality of work (monitoring and evaluation)	trainees	instructor/ teacher
The quality of the product is in accordance with the standards.		

Figure 23: Assessment sheet related to the learning and work action performed

Assessment sheet

QUALITY

Please monitor the quality of your work during the work process.

1. Work-piece “holding device”

Subject of monitoring	Deviation from the target (mm)	Points 0,0mm= 10P 0,1mm= 8P 0,2mm= 6P 0,3mm= 4P >0,4mm= 0P	Assessment by the instructor
right angle			
groove			
hole			

2. Work-piece “swivel arm”

Subject of monitoring	Deviation from the target (mm)	Points 0-1mm= 10P 2-3mm= 8P 4 mm= 6P 5 mm= 4P >5mm= 0P	Assessment by the instructor
bend			
length			

3. Work-piece ...

Subject of monitoring	Deviation from the target (mm)	Points	Assessment by the instructor
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Figure 24: Assessment sheet related to the product manufactured

Rules for designing learn and work assignments

- 1. Formulate the assignments for the trainees as well as work assignments for the working places. Don't forget special requirements, the amount of time required and type of collaboration.**
- 2. Write down the steps that have to be done by a skilled worker in order to complete the assignment in the first column. Consider that the worker has to do the six steps of a complete action as well.**
- 3. After writing down these steps, think of your trainees and go to the second column.**
 - Consider the stage of the learning process and the performance level of your trainees.
 - What do you intend to teach them?
 - Which goals should they achieve with their learning and work activities?
 - The wording of the aims has to be as detailed as possible. Don't use goals like "teamwork"! You have to formulate goals, which incorporate the desired characteristics of teamwork.
- 4. You and your colleagues provide information sources in order to fill in the third column.**
- 5. The fourth column contains the guiding questions and advice for your trainees. Make sure that the answers to these questions are a guide for the trainees and an opportunity for you to check the information that they have found and whether or not they are at the right track. The**

Figure 25: Summary – Rules for designing learn and work assignments

5.2 Taking into account the integration of technical training and general studies

A variety of characteristics of learn and work assignments have been stated so far. Here we want to focus on another. Trainees have entered TEVT after leaving school in order to learn all of the requirements for a job or occupation. They want to become acquainted with the world of work, with the challenges of their occupation that they have to meet after finishing the TEVT process. But they get to know, for example in a polytechnic, teachers for general education who may teach with or without a relation to the work process. Trainees again become confronted with general knowledge that has little association to the world which they have to act in. They often do not know what the knowledge provided by the teacher is useful for. And the teacher – they lament the poor motivation of the trainees in their classes.

Learn and work assignments are a means to overcome the problems mentioned above. As shown in assignments 1, 2 and 3 these assignments can integrate elements of general studies. Teachers are assigned to collaborate with the trainees in solving problems such as preparing and carrying out a moderated group discussion, writing reports, planning construction, designing manufacturing items, preparing presentations and so on.

Teachers for general studies and instructors for technical training have to collaborate closely in designing such “integrated learn and work assignments”. They can use a table for designing learn and work assignments similar to that shown in paragraph 5.1. A similar table is given in Table 5.

Table 5: Table for designing “integrated learn and work assignments”

Activity carried out to complete the assignment	Learning objectives	Information sources/ Collaboration with general studies teacher	Guiding questions and advice

Another “integrated assignment” is given in assignment 4. The elements of general studies are emphasized with a frame.

Assignment

Design and manufacture a metal DURIAN opener. It must be easy to handle, very efficient and durable.

Duration: 8 hours practical work and 6 hours general studies

Learning and work organization: team of three trainees

Semester: 3

Aids for learning and work

1. Observe the process of opening DURIAN and report observations in your team. Compare the provided opening devices and discuss advantages and disadvantages in your team.

Prepare a report on your team discussions so far and on your suggestions for improvement in collaboration with your English teacher.

2. Design your own DURIAN opener and provide detailed technical drawings. Consult

Check the durability of your design in collaboration with your physics teacher.

3. Design an assessment sheet for assessing deviation from the physical dimensions given in your detailed technical drawings during the course of performing the practical part of the assignment. Use the example given.

Assignment 4 (“open”)

Assessment sheet

Please assess the learning and work process in your team. You are to assess first and then your instructor assesses.

Please note 1 is the lowest and 5 the highest rating.

Team planning	Trainees	Instructor
Brainstorming	1 2 3 4 5	1 2 3 4 5
Information gathering	1 2 3 4 5	1 2 3 4 5
Members' communication	1 2 3 4 5	1 2 3 4 5

Team decision-making	Trainee	Instructor
Product spec. design	1 2 3 4 5	1 2 3 4 5
Dealing with resources	1 2 3 4 5	1 2 3 4 5
Task allocation	1 2 3 4 5	1 2 3 4 5

Innovation	Trainee	Instructor
Attractiveness	1 2 3 4 5	1 2 3 4 5
User friendliness	1 2 3 4 5	1 2 3 4 5
Durability	1 2 3 4 5	1 2 3 4 5

Signatures (students)

Signature (instructor)

Assignments for self-reliant learning are actually possible for problems with a limited relation to the work process as well. They can be designed similarly to learn and work assignments. But the steps of complete action have to be considered here in relation to learning activities in the first column of the designing table. Assignment 5 is an example for such a problem that had been analysed using the method given in this chapter, as shown in Table 6.

Assignment 5

Assignment

You are required to write a letter of job application in English. Use the available resources in the library to help you construct the letter. You have to present the letter and how you developed it in the next class.

Duration: 4 hours

Learning and work organization: individually

Semester: 4

Learning aids

1. Where can you find the job advertisements?
2. The advertisement should reflect your educational background and interests.
Use reference book.
3. Is there one standard / acceptable format? Decide on the format.

Why is outlining important? Write down at least three items.

.....

.....

.....

.....

Table 6: Designing guiding questions and advice for a general studies assignment (English)

Assignment technical English: You are required to write a letter of job application in English. Use the available resources in the library to help you construct the letter. You have to present the letter and how you developed it in the next class.			
Activity carried out to do the assignment	Learning objectives	Information sources	Guiding questions and hints
(1) Analyzing sources	Trainees are able to find appropriate sources	Newspaper, internet	Where to find the job advertisements?
(2) Selecting appropriate positions	Trainees are able to identify requirements and specifications of a job	Reference book	The advertisement should reflect your educational background and interests. Use reference book.
(3) Writing a job application letter	Trainees are able to identify an appropriate format for an application letter Trainees are able to plan a written piece by utilizing the outlining process Trainees are able to produce a grammatically correct application letter	Reference book	Is there one standard / acceptable format? Decide on the format. Why is outlining important? Check your grammar. Use your reference book.
(4) Monitoring the action			Carry out a mutual check with your neighbour after checking it yourself.

5.3 Designing open innovative assignments

Open innovative assignments have to be performed at a higher stage of self-reliant learning. Trainees have learned to carry out closed and open assignments by setting their own goals, self-planning, making their own decisions-, self-monitoring, self-evaluation and independent gathering of information. They have learned to perform appropriate learn and work assignments individually and in teams. All of this enables them to deal with open, innovative assignments. The specific characteristics of such assignments are the following:

- Trainees have to contact companies, have to get to know companies' departments and their workforce in the course of performing these assignments.
- Trainees learn and work in a company, training centre (e. g. practical department of polytechnics) and in a classroom.
- Trainees do not get guidelines, orders or advice as detailed as in closed, and open assignments.
- Trainees establish decision-making and evaluation criteria by themselves.

(The first characteristic mentioned above does not mean that closed and open assignments cannot be performed in companies during the course of a vocational training program. Assignments that are performed completely at work places in companies will be described in another manual as they require a completely different design.)

Table 7 shows the variety of learning opportunities in open innovative learn and work assignments with reference to components of action competence.

Table 7: Learning opportunities of open, innovative assignments

Technical competency	Learning competency	Methodological competency	Social Competency
• Exercise self control • Assure quality • Select procedures and/or tools or respectively re-sources • Apply rules and procedures • Adapt flexibly to new situations • Apply rules and procedures • Conform to standards and regulations	• Differentiate between important and unimportant things • Transfer knowledge and methods • Be motivated to learn • Transfer skills already learnt to new problems • Apply learning techniques	• Select work procedures • Work in a goal orientated manner • Determine time frames for the carrying out of tasks • Find and evaluate alternatives • Change plans flexibly where necessary • Draw conclusions	• Share responsibility • Recognise problems and contribute to their solution • Tolerate different points of view • Actively take part in team work • Proceed in a manner based on the division of labour

The open innovative learn and work assignments are integrated assignments in the truest sense. They combine practical training, work and general studies. General knowledge can be acquired during the course of planning, decision-making, recording the experience and results of the learning and work process and particularly within the process of preparing the extensive final presentation (see assignment 6).

Assignment 6 (“open, innovative”)

Assignment

In the warehouse of the energy supply enterprise, cables of different thickness frequently have to be cut to a required length. A cable length cutting machine is already available for this purpose. An additional cable-cutting unit is required in another warehouse section, as it is too complicated to move the existing machine any distance. The new unit is to be designed and constructed to be similar to the existing one. An on-site inspection is necessary to be able to evaluate the function and the area of operation of the “cable cutting unit” properly.

Suggestions for improvements to the design, the manufacturing procedures, the selection of materials etc. is welcome.

The project has to be done in small groups of four participants, who independently plan, execute, control and evaluate the tasks. Included in this is exact documentation of the work, as well as co-operation between the individual groups.

The evaluation criteria must be determined at the beginning of the project. 90 hours of practical and theoretical training and work are given for the completion of all tasks.

Duration: 90 hours (general studies and technical training)

Learning and work organization: team of four trainees

Semester: 6

Steps to do:

Setting goals

The project begins with a visit to the existing “cable length cutting device” at the power station. The practical possibilities and learning opportunities of a modified machine are debated by trainees, representatives of the power station, instructors and teachers and then the project selection is approved. Following this, tasks set by the instructors and teachers are handed out and next procedures discussed.

The cable length cutting equipment is structured into five assembly groups. A work group is established for each assembly group by the trainees. The learners largely organise the formation of the groups themselves. Five groups of four trainees are established.

Planning

The work groups gather information about their assembly pieces and organise the data required for further processing.

The work groups plan their procedures themselves. The planning takes place in the training centre (polytechnics) and in the classroom.

The time schedules co-ordinated with the presentation date are discussed together.

A guideline for the shaping of the documentation will be worked out.

Steps to do:

Executing

The work groups make suggestions for improvement and prepare manufacturing drawings. They can also make use of the “Geddy” CAD program which they will get an introduction to (IT teacher).

Parallel to this, manufacturing will begin in the training centre.

The manufacturing documentation is completed within general studies lessons.

A list of criteria for testing social and environmental compatibility is worked out.

This list is filled out with reference to the “cable cutting device” and evaluated.

Monitoring

The individual assembly units are assembled in the company (power station). The final inspection of the manufactured assembly components is carried out by the trainees themselves in collaboration with company representatives following assembly.

Presentation and evaluation

The total documentation is completed. Data processing programs can be utilized by the trainees here too.

The work groups develop transparencies to illustrate the presentation.

The course of the presentation is agreed upon by the groups.

The trainees present the process of the learning and work project in a plenary session consisting of trainers, teachers, as well as representatives of the enterprise. Two trainees provide a general overview of the course of the learn and work project. Group speakers present the results of the individual work groups.

In order to make a well-founded choice between the various options, and ultimately decide on the implementation of one or the other, it is necessary that the trainees establish precise decision-making and assessment criteria for open, innovative learn and work assignments. These criteria may be drawn from the requirements of the various “parties” concerned (e.g. customer, worker, standardization rules, requirements associated with environmental and social feasibility). They are related to the product to be provided and obviously affected by the conditions at work or learning environments (machinery, tools, materials etc.). Questions as given in Figure 26 might be helpful for establishing decision-making criteria.

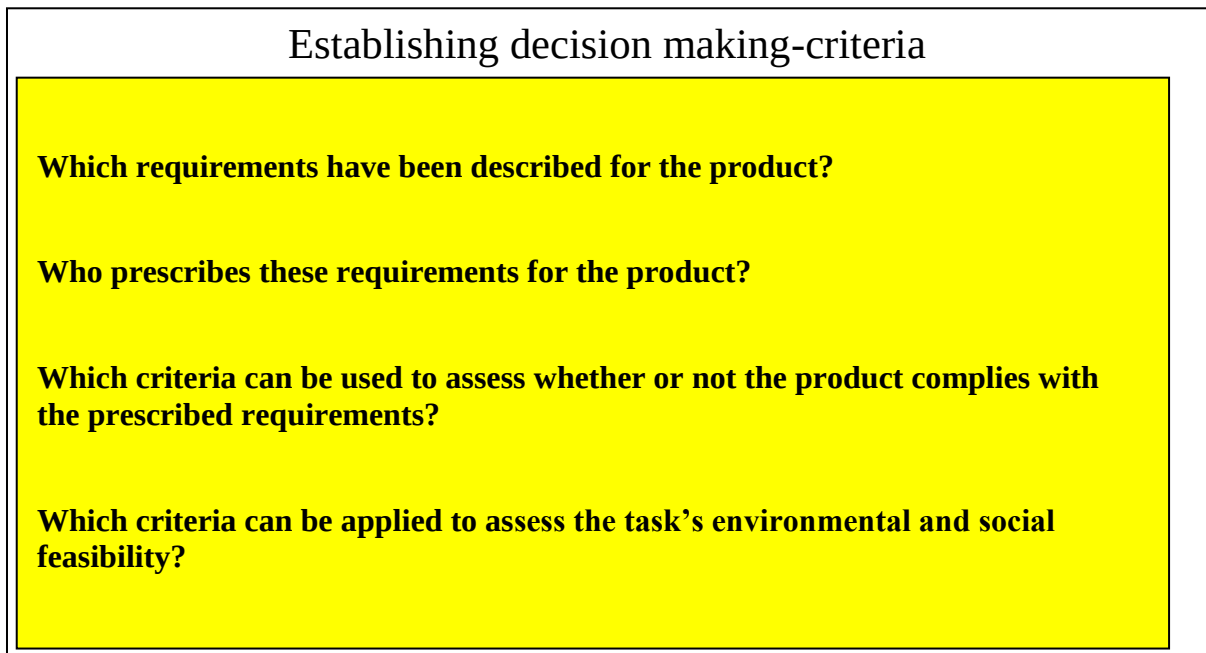


Figure 26: Questions for establishing decision-making criteria by trainees

Furthermore the trainees may establish the basic criteria according to which their own work may be assessed, such as

- compliance with the requirements prescribed for the product,
- the quality of the planning and collaboration,
- the individual’s contribution to the overall performance,
- the implementation of improvement proposals,
- a yardstick for technical performance.

All of these aspects have to be pondered before execution of the task. After execution trainees have to present their performances. In doing this the following questions should be taken into account:

- ➔ What have we learned? How did we learn it?
- ➔ Which product requirements were complied with and which not?

Which requirements could not be agreed upon by us (the trainees)? Why not?

- ➔ Why did we choose a particular solution instead of another and which advantages/disadvantages did the adopted solution bring?
- ➔ How effective was the collaboration within the team, between the teams and with instructors and teachers?
- ➔ What did we do well in performing the assignment? What could we have done better?
Which aspects of our learning and working did we find satisfactory and which not?
Is there anything we were unable to accomplish? Why not?
- ➔ What special problems emerged during learning and working? How were they solved?
- ➔ What have we learned from our mistakes?
- ➔ What should be changed in future open, innovative learn and work assignments?

6 Ten questions from teachers/instructors and answers from the authors

Questions for teachers and instructors occurred in discussions of workshops on self-reliant learning and appropriate answers are the subject of the last chapter. The authors have gained a lot of experience in seminars on the subject of this manual. They conducted about one hundred seminars on self-reliant learning with teachers and instructors in a number of countries. The questions and problems have been consistent if discussions about strengths and limitations of self-reliant learning and trainee-centred teaching were carried out. They are summarised in Figure 27 and briefly discussed by the authors afterwards.

Statements and questions for teachers and trainers

- 1. If self-reliant learning has been put into effect, are all of the other teaching methods obsolete?**
- 2. Trainees need basic knowledge and skills before starting with forms of independent learning. When – at which stage of the training course – is self-reliant learning appropriate?**
- 3. Trainees (or their parents) pay for the training course. They demand that the teachers/instructors teach them. They expect teachers/instructors to convey knowledge. What should I do, if trainees refuse it to look for information by themselves?**
- 4. The self-reliant learning approach is a challenge and an advantage for trainees with a high performance level – what about trainees with a low performance level?**
- 5. Teamwork, self-planning, self-evaluation take a lot of time – from where do I get this time? My curriculum is already overloaded.**
- 6. If trainees perform a complex assignment, they have to learn independently for a long period of time. How can I make sure that they are on the right track in doing the assignment?**
- 7. What should I do, if some trainees on a learning team don't take part in the learning and work activities in an appropriate manner?**
- 8. How can I assess teamwork?**

Figure 27: Statements and questions for teachers and trainers

If self-reliant learning has been put into effect, are all of the other teaching methods obsolete?

First of all, self-reliant learning is not a method, neither a learning method nor a teaching method. It is an approach to learning; a culture of learning, just as trainee centred teaching is a culture of teaching. Learners have a different role in such learning and teaching processes from that in the usual learning and teaching processes as do teachers/instructors. This difference in role has to be acknowledged – and that is not easy for either of them – learners as well as teachers/instructors.

All of the teaching and learning methods that we know, such as team learning, partner learning, individual learning, inductive and reductive learning, problem solving, learning by heart or teacher lecture, demonstration, teacher experiment, four stages method etc. are appropriate methods in self-reliant learning or trainee centred teaching. But all of them have to submit to the culture of self-reliant learning and trainee centred teaching, to submit to the idea of a very active learner who is supported by a teacher/instructor who acts as a moderator, adviser and coach.

Trainees need basic knowledge and skills before starting with forms of independent learning. When – at which stage of the training course – is self-reliant learning appropriate?

Self-reliant learning has to be performed from the very first day of the training course – but on a level that depends on the prerequisites of the learners and their performance level. Certainly highly developed forms of self-reliant learning need preparation. Teachers/instructors will give more support in the form of lectures, demonstration and simulation at the beginning of an ongoing process of self-reliant learning. The support is reduced as time goes on. But the overall process must be a process of performing complete action. It makes no sense to start vocational training with the old fashioned school learning procedure and to start the processes of performing learn and work assignments through self-reliant learning after six or twelve months.

Trainees (or their parents) pay for the training course. They demand that the teachers/instructors teach them. They expect teachers/instructors to convey knowledge. What should I do, if trainees refuse it to look for information by themselves?

This is a serious problem. Parents and trainees have only got to know the old role of a teacher/instructor and they expect this again. Often one can find assessment sheets for teachers' and instructors' lessons at schools and training centres which ask whether the teacher/instructor provides the learners with everything that they need and whether the teacher/instructor is always on hand if learners have questions. Such assessment sheets need to be revised.

It is absolutely necessary that teachers and instructors convince their trainees of the importance of self-reliant learning for their occupational career and their role in society. Learning and work assignments have to be introduced with stress on the necessity of self-reliant learning as well.

The self-reliant learning approach is a challenge and an advantage for trainees with a high performance level – what about trainees with a low performance level?

It is true that trainees with a high performance level get the opportunity to use all of their strengths in a self-reliant learning /trainee centred teaching process. The other trainees are not left out or ignored, though. Trainee centred teaching with learning and work assignments offers more opportunities for the teachers and instructors to work individually. They can give their attention to trainees with lower performance levels while trainees with higher performance levels learn and work independently during the performance of the learning and work assignments. Trainees with low performance levels are enabled to carry out all of the steps of the complete actions and to achieve the goal of the assignment by themselves with the appropriate support of the teacher/instructor. And this in turn leads to action competencies and to encouragement for further learning. Those trainees with lower performance levels have had a lot of discouragement at school because of a teaching process that was directed at the average learner. The teacher went on teaching if most of the class had finished the task. Slower learners were interrupted in their learning action and this led to a deficit in their action competence, in their knowledge, skills and last but not least in their volition to learn.

Teamwork, self-planning, self-evaluation take a lot of time – from where do I get this time? My curriculum is already overloaded.

This question is associated with the statement of teachers/instructors: “I have to achieve the goal of my classes/training units.” That depicts the old role of teachers and trainers. Do they have to achieve their goals? NO – The trainees have to achieve THEIR goals and THEIR goals are often not the same as the goals of the teacher/instructor. The efficiency of the teaching process is not measurable through the achievement of the teacher’s goals for the class. The question is whether or not the trainee has achieved the goals of TEVT! This is more and more often NOT possible with old fashioned learning and teaching. Teachers and instructors have to think about which contents of their current curricula are absolutely necessary and which they could cut out.

If trainees perform a complex assignment, they have to learn independently for a long period of time. How can I make sure that they are on the right track in doing the assignment?

Teachers/instructors have a lot of opportunities to check the state of learning and working processes, the quality of the acquired knowledge and skills without detailed common assessments (Which would often disturb the complete action and its impact for establishing action competence.). Well designed learn and work assignments contain questions for acquired knowledge and orders to write it down in appropriate blanks, so that the teacher/instructor can check it at a glance. They contain advice on how to prepare presentations or short lectures after the planning phase or for the evaluation, where the teacher/instructor is told in detail what the trainees have learned. In this way teachers/instructors are always informed about whether or not trainees are on the right track.

What should I do if some trainees on a learning team don't take part in the learning and work activities in an appropriate manner?

It is not uncommon that trainees try to hide behind their colleagues. If a hint given by the teacher/instructor is not successful in changing this behaviour, it should be discussed during the evaluation of an assessment sheet for the quality of teamwork or during the discussion of a presentation. Often it is helpful to ask those trainees to prepare themselves for the presentation carefully and to play an important role within it. It should be a last resort to form a special team of those students.

How can I assess teamwork?

Teamwork can be assessed verbally or with grades or points. If grades are used by teachers/instructors and different performance of trainees are taken into account, they could give, for example a team of three trainees after finishing the assignment, a grade of 8 and the team has to decide which grade for each of the members is appropriate (2,2,4 or 3,3,2 or 4,3,1 etc.). The trainees in a team take over responsibility for their performance in this way. Such an appraisal of a contribution within a teamwork process needs highly developed social competencies and is only possible at an advanced stage of self-reliant learning.

Often trainees need an individual assessment of their contribution for the team result given by the teachers/instructors and so they have to use the presentation to assess a single trainee or they may assess the trainee by asking questions and through observation during the execution of the task.

Is an assessment by the teacher/instructor unnecessary in self-reliant learning processes?

First of all, assessments by teachers/instructors are not obsolete in self-reliant learning processes. But the excessive quantity often used is obsolete. It seems to be that teachers/instructors are in love with assessments. Actually trainees have to learn to assess their own skill level, their own accomplishments and knowledge, their (team) work process and its result by themselves in self-reliant learning processes. Teachers/instructors are supposed to foster this and this cannot be done with our old fashioned assessment system which is not able to give feedback about progress in establishing competencies.

A note regarding our grading system

Conventional grading systems measure learning speed rather than learning ability. That might be useful for interim examinations after a course or a few units but not during the course of a self-reliant learning process or a complete action.

Grades are abstractions. A “five” in English judges abilities, which are quite different from those judged by a “five” in maths.

The grade itself and the yardstick on which it is based provide little information on either the nature of a performance shortfall or how to overcome it.

If there are too many good and very good grades, the appraisal criteria have to be made more stringent and the assignments more difficult. The converse applies to a situation with too many poor or very poor grades. Grades thereby become an arbitrary consequence of the average performance within the class or group.

Our final examinations do not account for self-reliant learning in teams. How can I motivate the trainees for this kind of learning?

The threat of interim or final examinations should not be used to motivate trainees, especially not in a trainee-centred teaching process. Here the motivation has to come from the assignments and the particular approach to solving them. Thus our conventional examinations are a big problem. They examine knowledge and skills in isolation and not in relation to the work being done. They do not take competencies into account in an appropriate manner. We should use the approach of learn and work assignments and their relationship to work processes to design new and appropriate interim and final examinations for TEVT.