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Occupational competence needs analysis as a basis for TVET curriculum development

Abstract

Rapid changes occurring in the world of work persistently challenge the actors of technical and vocational education and training (TVET) to update vocational curricula maintaining its relevance to the world of work. TVET teachers are the very actors at the forefront facing the challenge. The ability of teachers to identify the current competences needed by the world of work is of the most important competencies a TVET teacher requires to enable them to make day-to-day improvements of their vocational curricula.

In line with this challenge, the research project entitled "Occupational Competence Need Analysis" attempts to pilot the application of methods to analyse the current situation in the world of work in terms of the core occupational tasks required to perform an occupation. The methods, employed in the research process were (1) occupational sector analysis, (2) expert worker workshop and (3) work process analysis. The most valuable output of the research is the teaching material gained through the documentation of the research and empirical experience the researcher gains while applying the method. The two outputs should be imparted to TVET teacher students in universities and provide a reference for teachers when they work on curriculum development.

In the framework of the RCP-Project, five partner institutions from Asian countries carried out a joint research process involving application of the method. Comparative analysis between the results is intended to deliver rich and wide-ranging information on the method's application in different cultural settings. The results yielded from the research showed, among other things, the virtue of being well-prepared and the understanding of methods applied in the research. Shortcomings of the latter two aspects would result in some deviations from the expected research output.

1 Introduction

1.1 Problem statement

The caveat "change is something constant" can be applied to every sector of human life especially that of education and the world of work. Changes in the world of work in technology and work organization have been extremely rapid over recent decades. The changes have clear implications for education sectors, in particular those of technical and vocational education and training (TVET). The implications reflect the coherent interrelation between technology, work and education.

For the TVET sector the changes require adjustments of learning and teaching material and organization. These adjustments set out to synchronize what is taught in vocational education institutions with what is actually performed at work places. For a broader perspective the competence needs of the labour market have to be matched by those developed within the vocational learning processes.

The TVET system cannot be separated from the world of work, as the main goal of TVET is to develop occupational competencies and enable its graduates to meet the requirements of their future work places. The fulfilment of these goals depends, for instance, on the availability of proper TVET curricula. Appropriateness of curricula in this regard means comply with the competence needs of the world of work as the user of the vocational education outcome.

Synchronizing (matching) training competencies and occupational competencies from the world of work has become a long-term agenda in the TVET systems of many developing countries, and hence do not enjoy highest priority. Often the endeavour to update TVET curricula barely takes into consideration the quality of its output. Instead it seems to be an agenda implemented by request of both internal and external decision-makers with either no or little emphasis on the real needs of employers and industries. This tendency can be traced back to the fact that the TVET curriculum in many developing countries is developed in a centralized system and is therefore overly inflexible (cf. Middleton et al, 1993, 200).

Indeed it is not easy to match curricula and the real occupational needs of industries and their changes. Most TVET stakeholders such as employers, auditors and industry representatives acknowledge the difficulties of keeping up with constantly emerging changes in technological innovations, regulation and the shifts in client demands (Clayton, 2012). However, keeping TVET curricula up-to-date requires continuous effort. If TVET actors cease their efforts, the gap between the two sectors will increase swiftly and curricula will lag behind drastically. Among the actors engaged in and responsible for developing TVET curricula, TVET teachers are at the cutting edge. They have the closest relation with given curricula and deal directly with them in their daily work. They are the forefront stakeholders of TVET responsible for the functioning of a curriculum. They are appointed to operationalize the curricula as a frame instrument to produce the occupational competences of their students.

The central function of TVET teachers in dealing with the curricula has made them the key actors in both the implementation and the development of curricula, which should be striving to continuously keep up-to-date. They should be the first to know what is best for the learners for them to be prepared to enter the world of work. They should also be the first to know what occupational competences are needed by employers and industries.

Consequently, to keep vocational curricula current and relevant to industrial needs vocational teachers and instructors need to be – at the very least – well informed on the methodology of analyzing occupational competence needs directly and empirically in the world of work. However the fact remains that, numerous, if not most vocational teachers – particularly in

developing countries – are not in possession of the methodological competencies for undertaking such analysis.

In addition, TVET teacher educators tend to know little of the workplaces and competence requirements of graduates of technical and vocational education and training (TVET)[1]. Furthermore they do not have the methodologies at hand, for analysing such workplaces and competence requirements. The same is actually true at the national level regarding TVET curriculum development.

However, it is mandatory, that teacher educators have such methodologies at hand and master them:

1. to include the relevant knowledge on requirements at work places in TVET teacher education;
2. to include the teaching of the methodologies in TVET teacher education, so teachers are able to analyze workplaces and competence requirements in their future job;
3. to be able to run research on TVET curriculum development to inform on national TVET curriculum development.
4. to be able to analyse work places or work processes, for the purpose of comparing competence requirements in TVET at the regional and international level, and for the upcoming regional qualification frameworks.

1.2 Organisational background and goals of the research

In the framework of the Regional Cooperation Platform on TVET Teacher Education in Asia (RCP[2]), 5 Institutions from 4 countries teamed up to address the above-mentioned deficiencies via the implementation of a collaborative research and development project. The partner institutions were Universitas Pendidikan Indonesia (UPI – Indonesia University of Education) acting as the lead institution, Universitas Negeri Yogyakarta (UNY – State University Yogjakarta), Indonesia, National University of Technology Education (NUTE), Vietnam, the Chinese-German Institute for Vocational Education (CDIBB) at Tongji University, Shanghai, (China), and Universiti Tun Hussein Onn Malaysia (UTHM).

The collaborative project set out:

1. To collect and select instruments for workplace analysis and occupational competence needs analysis to be taught in teacher education programmes at the universities participating;
2. To be able to prepare relevant learning materials, apply the selected instruments in real-world situations conduct work place analysis and competence needs analysis. The experiences derived from the application of the instruments are expected to contribute to the quality of the learning material and help the project members (all are teacher educators) to impart the acquired knowledge to their student teachers.

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[1] The assumption is based on pre-research findings using the examples of teacher educators in several teacher education institutions in Indonesia.

[2] See www.rcp-platform.com

3. To check, based on the application experiences, whether the selected instruments work satisfactorily in the different cultural and "production cultural" environments of the partners. In case a need for adaptation is detected, the instruments will be amended accordingly to make it possible to adapt.
4. The fourth, a fairly subordinate one, is to compare the results of the instruments' application generated in the different regional and national environments, to demonstrate one of the possible applications of the instruments.

2 Research methodology

2.1 Approach and method of research

The first step was to undertake desktop research to identify existing methods of competence needs analysis. All partners studied the respective methodologies – paper based – before the first workshop was held to discuss, which of the methods should feature in the project. Main criteria for the discussion were whether the methods were compatible with the partners' joint understanding of TVET, whether they gave insight into real-world work settings, and whether they could be implemented without too much organisational and financial effort and be applicable in a vocational school environment as well as suitable for TVET teacher education.

As a common point of reference for the collaborative work, the partners agreed on the concept of "core occupational tasks"[3] as the most appropriate for describing the competences needed by TVET graduates. This concept describing core occupational tasks with the following

- The object of the work
- Tools, methods and organizing of work; and
- Requirements posed on work.[4]

Desktop research showed that competence needs analysis in the majority of cases is performed in the framework of the development of occupational profiles or the related curricula. A small number of different approaches could be identified i.e. the widely applied "Developing a Curriculum" or DACUM (Norton 1997), "functional analysis", for which Mansfeld and Schmidt (2001) provide an application handbook and the ILO Guidelines for the Development of Regional Model Competency Standards (RMCS) (Lewis 2006), and a set of instruments developed over the years by researchers of the University of Bremen and the University of Flensburg[5] in Germany.

The discussions during the first workshop yielded the joint impression, that the functional analysis approach is not very suitable for obtaining insight into the reality of occupational work, as functional analysis largely deals with structuring already available knowledge. The DACUM approach, if not modified, leads to detailed DACUM charts displaying a mosaic of

[3] See e.g. Spoettl 2002, Dittrich 2008,

[4] For a detailed explanation of these categories see Spoettl 2002.

[5] See e.g. Dittrich 2008.

numerous duties and tasks, which will certainly cover a whole occupation, but tends to fragment the holistic picture of an occupation. Thus it destroys the coherence between object of work, tools, methods and organisation, and demands posed on work.

The partners finally decided to use three instruments in the project: occupational sector analysis for providing background information on the occupational, economic and labour market sector, expert workers workshops for identifying the core occupational tasks of an occupation, and work process analysis for obtaining a deep insight into the requirements of occupational work in the workplaces and work-processes directly.

Each of the research partners prepared documentation of his/her field research. The project reports were analysed and discussed in a second project workshop in terms of the project goals.

2.2 Selected instruments

2.2.1 Occupational sector analysis

An occupational sector analysis should always be conducted as a first step of occupational research as its purpose is to provide the necessary background information. Depending on the overall goal of the research, it must be more or less detailed or comprehensive.

The purpose of an occupational sector analysis in our context was

- to get an overview of the occupational sector with its structures and developments, including the types and volume of the business, the number and type of companies, employees, one's own account workers, the significance of the occupational profile in question, remuneration structures, regulations, major actors such as professional, employers, employees associations, etc.,
- to discover, which additional occupational profiles exist in the sector and what their relation is to the occupational profile in question,
- to acquire knowledge on the "state of the art" of work in the sector in terms of recent and future development trends in the organisation of work and business processes, technical developments, socio-economic developments, the legal framework settings and major actors (companies, associations, unions, ...)

This implies that the sector and geographical coverage must be defined according to the study purpose. If we simply wish to look at a certain economic sector, it will be of little use to give detailed information on other sectors, where the occupational profile in question might also be used. Some information on these neighbouring sectors, however, should be given, as they could affect the developments in the sector to be researched. The same applies to geographical coverage. If we deal with just a province or a city, detailed data should be given related to this geographical unit. Information on the national situation does not need to be too detailed, especially as regions exist with distinctly different economic structures.

2.2.2 Expert worker workshop

The expert worker workshop is an instrument for identifying core occupational tasks and describing them comprehensively. The 'expert worker workshops' have the following two main objectives:

- To describe modern skilled labour in terms of core occupational tasks that can be classified according to occupational fields or a specific metier;
- To differentiate between different tasks according to the level of skills they involve.

If a metier/occupation can be described by means of core occupational tasks, then the competences it involves are automatically defined. This implies that workers are able to perform the described occupational task independently.

The documentation of the expert workers workshop is made up of 4 elements, namely a description of the organizational framework of the expert workers workshop, an ordered list of occupational tasks, a more detailed documentation for each occupational task according to a determined scheme, and a documentation of important aspects which have occurred during the workshop.

2.2.3 Work process analysis

The tool of expert workers workshops provides valuable information on the core occupational tasks, which make up an occupation. This information, however, is passed verbally, during the real work processes. The tool enables the TVET researcher, lecturer and teacher to verify the data obtained during the worker workshop directly in the work process performed by the workers, who were previously interviewed.

Occupational task analysis presents an easily approachable means of analysing work for those in the field of technical and vocational education and training. It enables a better understanding of occupational tasks in work and business processes via analysis. Curriculum developers, teachers and lecturers can obtain an impression of the characteristics and requirements of skilled work.

The results of occupational task analysis is help to define and further differentiate the description of the occupational field of activity, the learning and qualification goals and the subject matters for work and study in each occupational task.

The analysis of occupational tasks is also frequently termed "work process analysis", and occurs in the following three phases:

- Preparing for the research
- Carrying out the research
- Evaluating and documenting the research (so the results may be used in the framework of a research project, for teaching or even for curriculum development).

2.3 Occupational profiles selected

As the application of the last two of the three identified instruments requires the researchers have a certain a-priori knowledge of the respective occupational field and as it should be possible to compare the results of the pilot application of the instrument, the partners agreed, to analyse two occupational profiles, based on the professional experiences of the researchers:

- Cabinet making targeted by the researchers from UPI and CDIBB;
- Domestic electrical installation targeted by UNY, NUTE, and UTHM.

3 Findings of the pilot applications

First and foremost, the research project is not intended to develop vocational curricula, but to get the researchers involved in the implementation of the methods of occupational competence need analysis and evaluate the usefulness of the methods. Thus, the result discussed in this chapter does not deal with the outputs of the analysis, which are job profiles of wood construction and domestic electrical installation[6]. Instead, the findings and experiences obtained from the research process itself are focused upon.

The application of the selected methods for the analysis of occupational competence required a set of methodological instruments to be developed as a working aid (these will be made publicly available in the above mentioned comprehensive study report). The tools provide detailed and clear guidelines for the execution of the research but also allow adaptation to the given circumstances and cultural settings of the respective partner countries.

The submitted country reports indicate that some partner institutions made use of this possibility and applied modified approaches. Analysing the resulting differences allows the subject to learn how a modification of the instrument can affect the research results. Due to space limitations only selected findings of the comparative analysis can be explained in this article. Again, the complete analysis results will be made available in the above mentioned comprehensive report. Selected findings are highlighted below, grouped into categories such modifications of the method, organisational issues, differences in results, and miscellaneous observations.

The findings are based on discussions conducted during a second workshop attended by all partners after implementing pilot applications of the instruments, and on an analysis of the country reports delivered after applying the instruments. Facts and findings explained in this chapter do not set out to criticize the way the different research teams applied the methods and what the result looked like. Instead its purpose is to describe experiences of the pilot applications, from which readers can get some insight into the process of competence needs analysis as well as the researchers' learning processes.

[6] A comprehensive study report covering all aspects of the project implementation will be made available on www.rcp-platform.com latest in early 2014.

3.1 Modifications of methods and approaches

One of the obvious cases has been revealed by the research team of Tongji University. has, Due to the worker's limited time the team organized the expert workers workshop in the workers' place of work instead of assembling them in a place outside the workshop required by the default of instruments. The researchers interviewed the workers directly in a work situation. Such research organization has some disadvantages. Workers cannot concentrate on discussing the core occupational tasks as they are engaged in normal work activities simultaneously. Furthermore the interview might be undertaken in the presence of their employer or supervisor, which can inhibit the interviewee.

Another critical practice is demonstrated by the research report from Yogyakarta (UNY). The report reads

*"Before the workshop activities were undertaken, the research team as facilitator, prepared the documents needed in the workshop activities, these included: invitation to expert workers, designing workshop activities, preparing the occupational analysis draft of residential electrical installation, and other administrative activities."(*Project Report of UNY, 3) and *"...Each group discussed the occupational sector that had been guided using professional task instruments the facilitator prepared. The participants gave marks using the symbols (+) or (-) for the different occupational tasks on the prepared instruments. Participants selected teh symbol (+) when the occupational tasks were appropriate for application and the symbol (-) when it cannot be applied."(*ibid, 4)

The two statements indicate that before running the discussion, the invited workers were provided with a draft of occupational analysis by the facilitator. This draft contained a number of work tasks, to be discussed between the workers and the facilitator. In this way the researchers had already provided a fixed framework of thinking and confined the workers 'contribution to accepting or rejecting the researchers' ideas.

Just how hazardous such an approach can be, was shown by the Malaysian researchers' completely independent experience. By providing freedom of expression to the expert workers, the researchers learnt, that the occupational profile of a "wireman", anticipated by the researchers as a proxy for the work area of domestic electrical installation, defined as one of the Malaysian National Occupational Skill Standards (NOSS), barely exists in the everyday reality of the Malaysian world of work. Domestic electrical installation is carried out by small companies, who have much bigger business fields in which each of the workers has to cover a far broader range of occupational tasks.

Another valuable finding was that it is apparently necessary to invest a degree of effort in discussing the concept of core occupational tasks. Even though the instrument gives explanations and examples, there are differing interpretations among the researchers resulting in different qualities of identified core occupational tasks. One research team, for instance, identified abstract categories of tasks instead of real work activities:

"....Each of those occupational tasks is categorized into three tasks, namely: (1) electrical installation for small houses, (2) electrical installation for mid-size houses, and (3) electrical installation for luxury houses. And, each group is divided into five tasks, i.e.

- *Lighting installation.*
- *Cooling installation.*
- *Heating installation.*
- *Motoring installation.*
- *Protecting and security system installation."*

Another research team defined site exploration, planning, installing, checking, calibrating, operating, repairing, and maintaining each as a separate core occupational tasks, while making distinctions regarding different types of appliances.

Both schemes suggest that the structuring was heavily influenced by the researchers, as practitioners tend to structure their field of work in a different way.

3.2 Modifications in the organization of methods application

The success of the work on occupational needs analysis obviously depends a good deal on the way researchers organize the application of the different methods. Hence, it is extremely advisable that researchers do their best to understand and follow the instructions given in the research instruments, to avoid certain pitfalls. In so doing the results will have a high grade of reliability and validity. Nevertheless every research design is limited by various influencing factors and resources, such as time, money, working environment, cultural setting, etc.

The UPI research team was able to bring together a number of expert workers from four different small furniture companies in an expert workers workshop. The number of companies played a role in the richness, depth, and reliability of the information and data collected. However, all the companies were small-sized or home-industry companies from Bandung, which does not really represent the whole picture of the furniture industry in Indonesia in all its complexity. It can, however, represent the situation of the industry in the city of Bandung which is definitely not a furniture production hot spot. During the expert worker workshop and work process analysis the workers were very cooperative and actively engaged and the researchers were satisfied that they had collected all the information required.

The Chinese research team was only able to get access to one single furniture company as most furniture companies were reluctant to be involved in research.

"It has been very difficult finding the expert workers in the wood furniture industry. Initial attempts were unsuccessful. We tried to get in touch with factories/bosses of some small workshops through the furniture shops near university. However, as the owner of the shop does not know us very well (despite the fact that I have bought furniture for over 1000 Yuan at the shop), he could not offer me very strong support."

The very limited number of researched workplaces limits the representativeness of the collected data.

3.3 Active participation of expert workers

In selecting expert workers for invitation, researchers assumed that some aspects needed to be taken into consideration. Among these were the workers' educational background, which could be a modality for them to communicate actively and properly and express their ideas during the workshop. For this reason, before inviting the expert workers, the UPI research team discussed whether it would be advantageous to invite company owners and supervisors to the expert workshops, as they feared communication with the workers would be difficult due to their typically low level of formal education.

Following the guidelines they refrained from this. The workshop experience showed the workers were more than capable of reflecting on their work practice and explaining to the academics, what the essential elements of their work actually are. Obviously, the ability of workshop facilitator to activate the communication ability and willingness of the workers was key in getting the workers to express themselves.

3.4 Differences in research results

3.4.1 Differences in manufacturing culture

Table 1 shows the comparison of core tasks of the occupation “cabinet making”, identified by UPI for Bandung, Indonesia and CDIBB Tongji for Shanghai, China:

Table 1: **Comparison of core occupational task in cabinet making**

	Indonesia	**China**
TASK 1	marketing and promotion	finding out and understanding the requirements of the client
TASK 2	design	drawing and revising blueprint
TASK 3	calculating the cost calculating the cost	making list of materials to be processed
TASK 4	procurement of materials	purchasing materials
TASK 5	furniture shaping	cutting the wood planks/boards, making all the components and units
TASK 6	finishing	painting the surface
TASK 7		assembling
TASK 8		painting, surface treatment
TASK 9		quality control

There was quite a high grade of similarity in the results. Even though the number of the tasks appeared to be different, the underlying structure is similar. Task 5, 6 and 7 in the Chinese

version are actually included in task 5 of the Indonesian version, and the Chinese task 9 is included in the Indonesian task 6.

The detailed descriptions of the occupational tasks, however, display some remarkable differences. In the Chinese case, minimizing material waste and considering production and product health and environmental hazards is emphasised, but in the Indonesian case such issues are hardly mentioned. Differences can also be found regarding legal procedures and requirements, the purchasing power of the clients influencing product quality requirements, the size of the enterprise that influences division of labour settings, and the type of material used which affects core work procedures.

3.4.2 Differences in TVET culture

Comparing the results documented for the occupational profile in domestic electrical installation it is clear the Vietnamese researchers applied the concept of core occupational tasks in the main. The Malaysian researchers, however, possibly due to the restrictions regarding the occupational skills of a "wireman" (see above) delivered a documentation resembling a piecemeal collection of tasks with the appearance of a DACUM chart. Consequently the Malaysian result provides little helpful information on tools, methods and organisation of work or on the demands posed on skilled work by the different stakeholders. In addition, both reports from Indonesia and Malaysia contain little information on the economic and labour market framework conditions and the technological development perspective for this occupational profile. Whether this deficit is down to too little time invested in the occupational sector analysis or to researchers' lacking interest in these important issues is not quite clear.

4 Conclusions and recommendations

The research project was aimed, among other things, at gathering empirical experiences of the application of competence needs analysis instruments. Together with the teaching material, which was developed simultaneously, the experiences are expected to be significant enough for the researchers involved to be able to contribute to the improvement of TVET teacher education. With the material and experiences used to teach teacher student about competence needs analysis approaches, future teachers should be capable to link their curriculum with the current competence needs at related workplaces methodologically.

The analyses of the country reports and experiences and the exchange between researchers during the second project workshop showed that application of the instruments is complex and various aspects must be taken into consideration. One of the key aspects indicates researchers must have a good knowledge and deep understanding of the methodological concept. Deficiencies and deviations from the ideal-typical method will automatically lead to sub-optimal knowledge generation as was clear in the previous chapters.

Given the fact that initially most of the researchers are not familiar with the research instruments, it is necessary to invest more effort and time than was available in the project to develop the researchers' capacities in applying the instruments. We recommend the researchers

remain in touch in the future and continue exchanging experiences when applying the instruments in the framework of TVET teacher education.

Regarding the application of the instruments for scientific research on curriculum development there are additional aspects that have not been discussed in this article, that must be considered. This applies directly to the reliability of research data. Expert workers and their companies must cover the whole spectrum of the businesses for which the occupational profile in question is of interest. Companies of differing size active in all relevant business fields and in a defined geographical region have to be represented, and special attention paid to innovative, future-oriented practices. Only in this way can the research data represent the picture of a prospective occupation which can be generalized in terms of a regional or national scope. The respective selection criteria will vary from case to case according to varying research goals and has to be made transparent and documented in each research report to permit assessment of the research outcome reliability.

References

Clayton, B. (2012). Keeping Current: The Industry Knowledge and Skills of Australian TVET Teacher. In Collaboration in TVET. Proceedings of the 2nd UPI Internal Conference on TVET. Bandung: Faculty of Technology and Vocational Education of Indonesia University of Education, 28-35.

Dittrich, J. (ed.) (2008). Curriculum Design. From professional tasks to the education and training plan. Institut Technik und Bildung, Universität Bremen.

Lewis, A. (2006). Guidelines for Development of Regional Model Competency Standards (RMCS), Regional Skills and Employability Programme in Asia and the Pacific. International Labour Office, Bangkok.

Mansfield, B. & Schmidt, H. (2001). Linking Vocational Education and Training Standards and Employment Requirements – an international handbook. European Training Foundation.

Middleton et al. (1993). Skills for Productivity. Vocational Education and Training in Developing Countries. New York: Oxford University Press.

Norton, R. E. (1997). DACUM Handbook. Second Edition, Leadership Training Series No. 67, Ohio State University, Columbus, Center on Education and Training for Employment.

Pätzold, G. & Rauner, F. (2006). Die empirische Fundierung der Curriculumentwicklung - Annäherung an einen vernachlässigten Forschungszusammenhang. In Qualifikationsfoschung und Curriculumentwicklung. Stuttgart: Franz Steiner Verlag, 7-28.

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