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NordYrk 2019

Arcada – University of Applied Sciences, Finland

Vocational Education & Training at a Cross-road

Challenges from labour market demands and industrial revolution 4.0

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Outline

-Employability and contextual factors

-Main features of our time – The qualifications needed

-Challenges for curriculum design and vocational didactics

-Industrial revolution 4.0

-Challenges for Swedish industry

-Implications of the advent of the 4th industrial revolution

-Role of teacher/instructor, teacher training & research

-Concluding remarks

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EMPLOYABILITY AND CONTEXTUAL FACTORS

Moreno Herrera, L. (2016). Yrkesutbildningsutmaningar i nya tider – vilken väg ska vi ta? [Vocational education and training in new times – what is the best way forward?]. *Nordic Journal of Vocational Education & Training*, vol. 2/6, pp. 66- 83

SFIVET

CALL FOR PAPERS

The end of VET as we know it?

Skills development in times of technical and social change

6th Congress on Research
in Vocational Education and Training

Swiss Federal Institute for
Vocational Education and Training (SFIVET)
Bern/Zollikofen, Switzerland

4 – 6 March 2019

Employability
Labour market (Macro) VET institutions (meso) & Learning process (micro)

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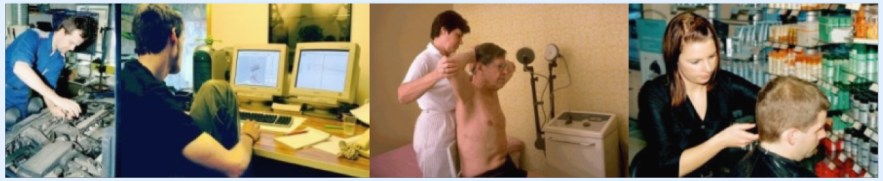
Towards a holistic approach to employability

Context dependence & markets demands

General education & VET

EMPLOYABILITY & SOCIAL COHESION



Didactics/learning process

Teacher/Instructor, teacher education, Research

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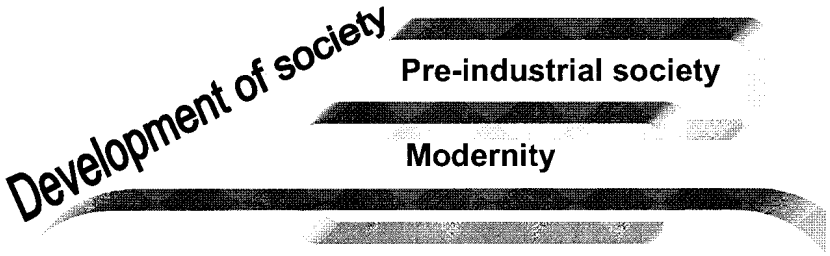
Employability – components and tensions

- Certification, qualifications & competences
- EQF and NQF – realities and work market dynamics
- Value learning outcomes acquired in non-formal settings. Validation

MAIN FEATURES OF OUR TIME QUALIFICATIONS NEEDED

Contextualizing factors



Postmodernity

- Change from good producing to service economy; change in occupational slopes
- Quality of life measure by services and amenities
- Flexible management
- Flexible employment
- Increasing development of information & communication technology (ICT); standardization
- Decentralization
- Growth of female participation in labour forces
- Globalization
- Environmental concern

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New qualification needs in relation to the restructuring of working life

Qualifications	Restructuring aspects in working life
Knowledge	
Theoretical knowledge	Work as a problem solving process
Technical knowledge	Introduction of ICT
Practical, tacit knowledge	Increased uncertainty, risk situations caused by technical integration
Skills	
Professional skills (multiskilling)	Integration of tasks, group work
International skills	Globalization of markets and production
Social skills	Group communication, , different kinds of social interactions
Management skill	Decentralization, flat hierarchies
Normative	
leadership	Coordination, autonomous work teams
creativity, entrepreneurship	Quality, time and innovativeness as key elements in world market
Industrial citizenship	Commitment and enrollment in work process from idea to realization

To be employable

-Knowledge: Theoretical knowledge. Practical knowledge. Vocational, tacit knowledge…

-Skills: Professional skills (multi-skilling), soft skills, from intercultural understanding to intercultural competence.

-Normative: Leadership. Entrepreneurship. Industrial citizenship. Work as a problem solving process.

Needed early start with employability concerns

SvD DEBATT

1 Skolan gynnar inte kreativitet

7 juni Framgångarna för de kreativa näringarna sätter Sverige på kartan: musik, spel, kläddesign, film. Vi måste slå vakt om de seriellt kreativa och den samhällspotential de utgör, skriver innovatören Örjan Strandberg.

3 Skolan bör lyfta fram industrin

31 juli Unga behöver komma närmare industrierna och få ökad kunskap om industrins betydelse. Därför har vi tagit initiativ till Hej Industrin! för de yngre, skriver vd:arna för 13 arbetsgivarorganisationer inom industrin.

CHALLENGES FOR CURRICULUM DESIGN AND VOCATIONAL DIDACTICS

Gessler, M., & Moreno Herrera, L. (2015). Vocational Didactics: Core Assumptions and Approaches from Denmark, Germany, Norway, Spain and Sweden. *International Journal for Research in Vocational Education and Training*, *2*(3), 152-160.

Outcome Orientation

The significance of what has been learned manifests itself in the outcome stage, that is, putting the application into practice.

Important to design learning opportunities, so that the learner can satisfy practical requirements in the work-place, on the one hand, and be able to shape his/her work as well as the work environment, on the other hand.

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Path dependency

National vocational education and training systems pursue different aims and demonstrate different regulatory systems (governance).

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Horizontal Structure

Vocational training do not focus on education in individual subjects (mathematics, etc.), but rather the ability *to act in a vocational domain.*

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Vertical Structure

Occupations have a vertical structure. Example, four levels of requirements:

(1) unskilled or semi-skilled activities;
(2) professionally oriented activities;
(3) complex specialist activities; and
(4) highly complex activities.

Vocational didactics has to take different requirement levels into account.

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Temporal Structure

A vocational didactic has to be aligned with the respective objectives pursued in a particular phase of (work) life: vocational orientation, vocational development and education, and vocational further training and re-orientation.

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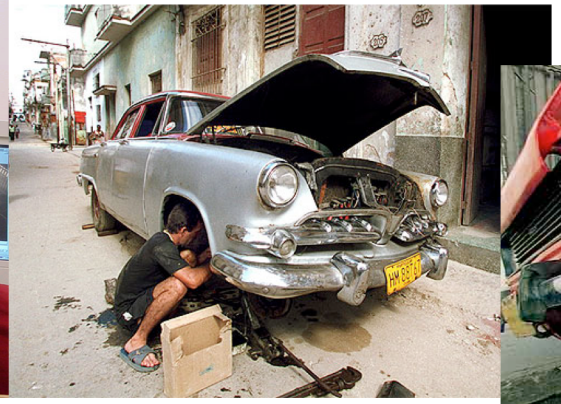
Changing nature of work

Vocational Education and Training is related to the conditions of work. **VET should therefore prepare for the changing conditions and nature of work**



INDUSTRIAL REVOLUTION 4.0

Navigating the next industrial revolution

Revolution	Year	Information
1	1784	Steam, water, mechanical production equipment
2	1870	Division of labour, electricity, mass production
3	1969	Electronics, IT, automated production
4	?	Cyber-physical systems

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Industrial revolution 4.0 – Core aspects

The 4th Industrial revolution involves emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, quantum computing.

Compared with previous industrial revolutions, the Fourth is evolving at an exponential pace and disrupting almost every industry by enhancing the transformation of entire systems of production, management, and governance.

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Four challenges for Swedish Industry

Digitalization – A rapid structural transformation is undergoing in which embedded and connected factories and products are revolutionizing the industry. But many Swedish industrial companies do not follow, and therefore risk being driven out unnecessarily.

Sustainability - Parts of the Swedish industry is not enough resource efficient. Sustainable production and sustainable products can be a Swedish strength in the future, but Swedish industry should move forward their positions.

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Competence - Swedish industry have difficulties in recruiting the skills needed to compete in the world market. The quality and relevance of educations are often too low and the transition from old to new jobs needs to be facilitated.

Innovation Power - Swedish research and innovation environments facing tough competition. In contrast to most comparable competitors, corporate R& D investment as a share of GDP has fallen.
(Project VET 4.0)

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Four focus areas

Industry 4.0 – Companies in the Swedish industrial sector are to be leaders of the digital transformation and in exploiting the potential of digitalization.

Sustainable production - Increased resource efficiency, environmental considerations and more sustainable production are to contribute to the industrial sector's value creation, job creation and competitiveness throughout the entire country.

Raising competence industry - Competence providing system at local, regional and national level shall meet the industry's needs and promote long-term development.

Testbed Sweden - Sweden should be a leader in research areas that contribute to strengthening the industrial production in Sweden.

The challenge for the VET in Sweden is to match these areas!

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Contextual challenges

A great challenge in terms of the supply of skills to the industrial sector

In Sweden, the proportion of the population who have recently gained a scientific or engineering degree is lower than the EU average.

The OECD's PISA survey shows a dramatic decline between 2000 and 2012 in Swedish school pupils' knowledge of mathematics, reading comprehension and science…but we are getting better!

Young people's interest in mathematics and technology is lower than it is in social issues and the teaching is rarely set up to change the situation.

There is low interest in training as a teacher in these subjects.
In the long term, there is a risk of shortages, particularly of those with industrial education at upper-secondary school level, as well as of civil engineers with certain specializations, especially in the field of data, electronics, computer technology and automation.

Increasing specialization means a growing problem in terms of labour market matching efficiency. In a fast-moving society, knowledge and skills quickly become obsolete, which brings the importance of lifelong learning to the fore.

IMPLICATIONS OF THE ADVENT OF THE 4TH INDUSTRIAL REVOLUTION

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Changes of labour market and qualifications

Polarization of the demand of qualifications due to erosion of middle level vocational qualifications caused by digitalization and automation of work processes (Kreinsen, Ittermann, 2017*;* Lee, Pfeiffer, 2017; Spöttl, 2016).

Hybridisation of high-skilled qualifications and VET curricula on the basis of interdisciplinary know-how and transversal competencies (Spöttl, 2016).

Increasing focus of **VET curricula and design of modules best related to the technological work processes** (Spöttl, 2016; Die berufsbildende Schule, 2016).

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Four scenarios of the implications of the Industry 4.0 for the provision of the vocational education and training

The **1st scena**rio claims, that development of the Industry 4.0 does not cause significant changes in the provision of the VET at least in the short period of time.

The **2nd scenario** claims, that the structure of the VET provision will remain unchanged, but the contents (curricula) will have to be adjusted to the requirements posed by the Industry 4.0,

The **3rd scenario** expects combination of existing occupations and qualifications. For example, mechatronics can become rather wide occupation strongly related to other occupations, what requires to shift the curriculum design and provision of VET to the work process-based approach.

The **4th scenario** foresees development of the separate highly specialized qualifications oriented to the requirements and needs of the Industry 4.0.

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Implications for VET curriculum design

Increasing integration of the different work processes resulting into development of complex and wide competences integrating advanced technological know-how, practical skills and attitudes.

Increasing inter-disciplinarity and universality (in terms of application in the different work processes) of knowledge and cognitive competences in the VET curricula.

Increasing flexibility of curriculum design by following dynamically changing skills requirements of work processes.

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Focus on the development of attitudes of responsibility and sensitiveness to the environmental and social issues of technological development and innovations.

Attention to the development of competencies needed for interactive cooperation, knowledge sharing and social solidarity.

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Implications for VET didactics

Application of the work process and problem-based learning methods in the context of operating cyber-physical systems.

Promotion and supporting of independent learning and competence development based on the holistic analysis of the technological and work processes.

Promotion and supporting team learning approaches and methods by involving trainees, experts, knowledge and information systems.

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Implications for the formative competence assessment

Revision and development of the new assessment criteria for the emerging technological and organisational competences.

Preparation of new interactive assessment methods adapted for the assessment of the new competences.

Organization of assessment of competencies in the virtual space by using cybernetic instruments and measures.

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ROLE OF TEACHER/INSTRUCTOR, TEACHER EDUCATION & RESEARCH

How will these changes and implications will change the activities of VET teachers and what new competence needs can emerge?

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Teacher education´s two pillars

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Challenges of Research in VET

The variety of research questions and development tasks at the levels of vocational education and training systems **(macro level)**, the organization and design of vocational training programs and institutions **(meso level)** and the analysis and shaping of education and learning processes **(micro level)** leads to the integration of different scientific disciplines and research traditions. VET research therefore can be organized only in an interdisciplinary way (Rauner & Maclean, 2008, p. 13)

CONCLUDING REMARKS

Pro-activeness and further research concerning challenges of industrial revolution 4.0 for VET

Teacher education for VET- strategically important

Policy learning more viable than policy import

Partnership between stake holders

Hybridisation: horizontal integration of vocational and general education (Helms-Jörgensen)

Reconceptualising skills development in function of employability and social cohesion

Strengthening the 'E' in VET

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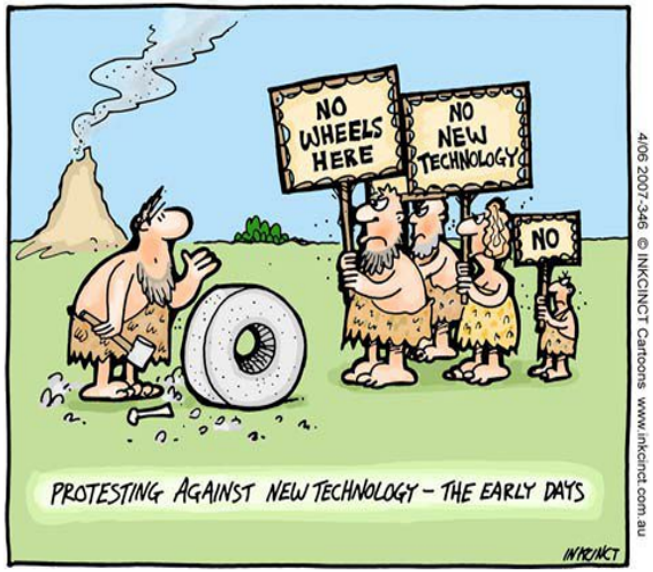
The road ahead

Industry 4.0 Can Spark Growth but not without Skilled Workers

Criticisms & tensions



Thanks!