Enhancing collaborative learning skills of engineering graduates – why and how?

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Outline

- My short bio and what is TEK
- Overview of my dissertation
- Why increased need for collaborative learning?
- What is collaborative learning?
- How to enhance collaborative learning in the context of engineering education?
- Summary

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Kati Korhonen-Yrjänheikki

- Most of professional career in expert and management positions related to development of higher education, continuing professional development, foresight and strategy.
- Since 2007 Director of education and employment at the Academic Engineers and Architects in Finland TEK.
- Educational background in industrial management and futures research. PhD at Aalto University School of Science 6/2011.
- Dissertation “Future of the Finnish Engineering Education – A Collaborative Stakeholder Approach” available at www.tek.fi/engineeringfuture.
- LinkedIn http://fi.linkedin.com/pub/kati-korhonen-yrj%C3%A4nheikki/37/45a/274
- Twitter @katifuturist

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- Academic Engineers and Architects in Finland TEK
- A lobbying and services organization for graduate engineers, architects, mathematicians, physicists and IT specialists. 70% of all M.Sc.(Tech.) graduates in Finland belong to TEK.
- Promotes technology for the benefit of individuals, the environment and society
- 73 000 members, among largest trade unions in the Confederation of Unions for Professional and Managerial Staff in Finland AKAVA.
- 40% of members in management position, 60% experts
- 80% work in private sector

TEK's key objectives in educational policy

- To enhance quality of engineering education and to strengthen its funding using several measures.
- To enhance continuing professional development of engineers in all phases of working life.

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Overview of my dissertation

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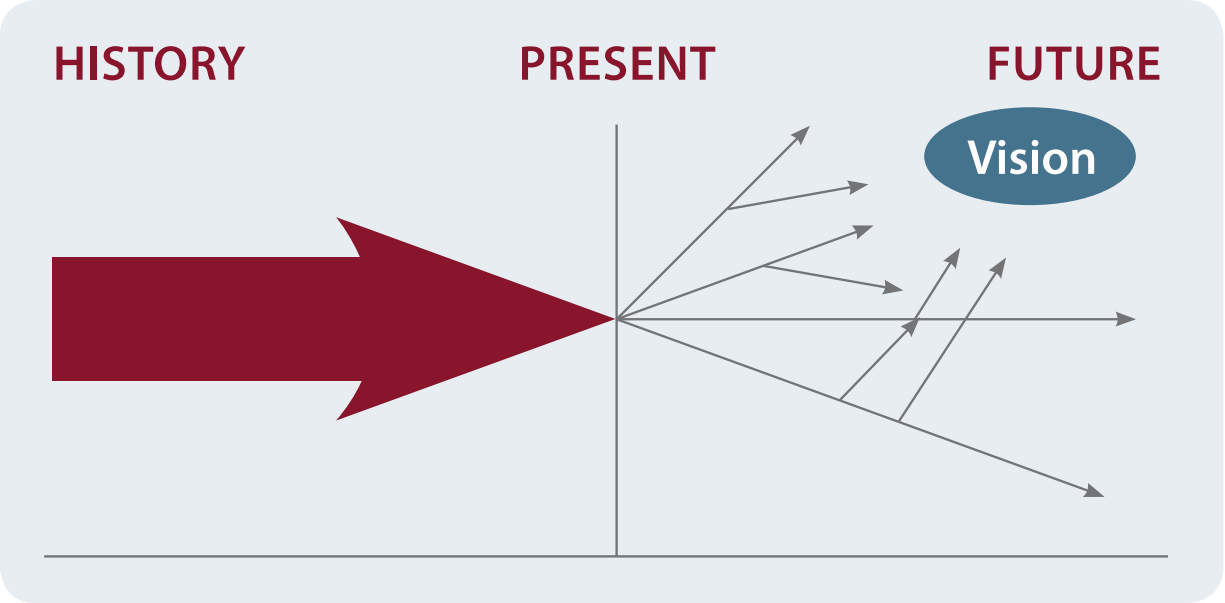
Applied foresight approach



Business environment = driving forces, trends and weak signals in the society

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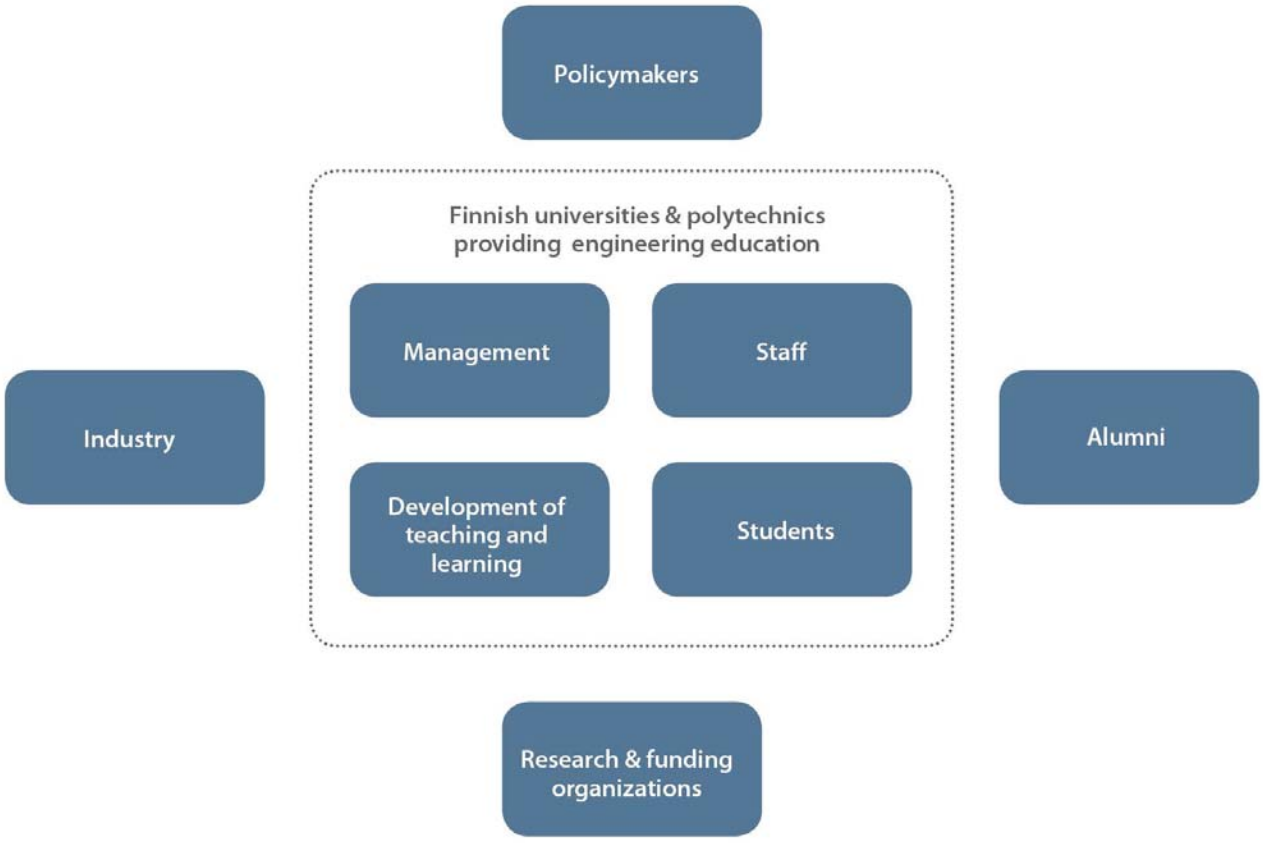
Korhonen-Yrjänheikki, K. 2011.



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Korhonen-Yrjänheikki, K. 2011.

Future of the Finnish Engineering Education – A Collaborative Stakeholder Approach: *Research Questions*

RESEARCH QUESTION 1:

What kind of a framework can be developed for selecting participants for a group communication process of key stakeholders when aiming at capturing future prospects and enhancing development of engineering education nationally, in this case in the context of Finland?

RESEARCH QUESTION 2:

What are the future prospects and development proposals for the Finnish engineering education based on the views of key stakeholders on the past, present and future, as well as literature and statistics describing the long-term development and present?

OVERALL RESEARCH PROBLEM:

How to develop the Finnish engineering education to face the anticipated challenges of the future primarily on the basis of the views of key stakeholders during the three group communication processes of the study?

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Korhonen-Yrjänheikki, K. 2011.

	Argument Delphi	Open Futures Search	Collaboration Group
When	9/2001 - 9/2002	29.-30.11.2006	8/2007 - 9/2009
Objective	study future prospects of the Finnish EE	national strategy for the Finnish EE	national strategy for the Finnish EE
Aimed reasonability	options	primarily options, but also commitment	options and commitment
Applied definition of stakeholders	those with direct economic and/or legal decision-making power on the Finnish EE (applied from Donalson & Preston 1995 as interpreted by Savage 2004)	those with power to affect the performance of the Finnish EE or a stake in the performance of the Finnish EE (applied from Jones 1995)	those with power to affect the performance of the Finnish EE or a stake in the performance of the Finnish EE (applied from Jones 1995)
Number of participants	21	53	28 in core group; about 50 other participants in workshops on teaching & learning in Finnish EE; 20 other in the workshop on structural development
Methodology	Argument Delphi, a variation of Policy Delphi (Kuusi 1999)	Combination of Future Search (Weisbord & Janoff 2000) & Open Space (Owen 2008)	World Cafe (Brown & Isaacs 2005), Open Space (Owen 2008), Dynamic facilitation (Nummi 2007), Idealogue (Nummi 2007), Structured Round (Rees 2005)
Work process	First round interviews, second round questionnaire	One face-to-face work-shop lasting two full days	14 workshops, 4 meetings, 8 preparatory assignments
Role of the researcher	Facilitator	Facilitator	Two-fold role: initiator, planner and manager of the whole process and participant in the group representing TEK (stakeholder group: alumni)

Korhonen-Yrjänheikki, K. 2011.

Engineering graduates need to be developed from technical problemsolvers to collaborative creators capable of defining and creating solutions collaboratively to complex transdisciplinary problems.

The most critical skills shortages are in graduates' abilities and skills related to collaborative learning.

Source: Korhonen-Yrjänheikki, K. 2011.

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Why increased need for collaborative learning?

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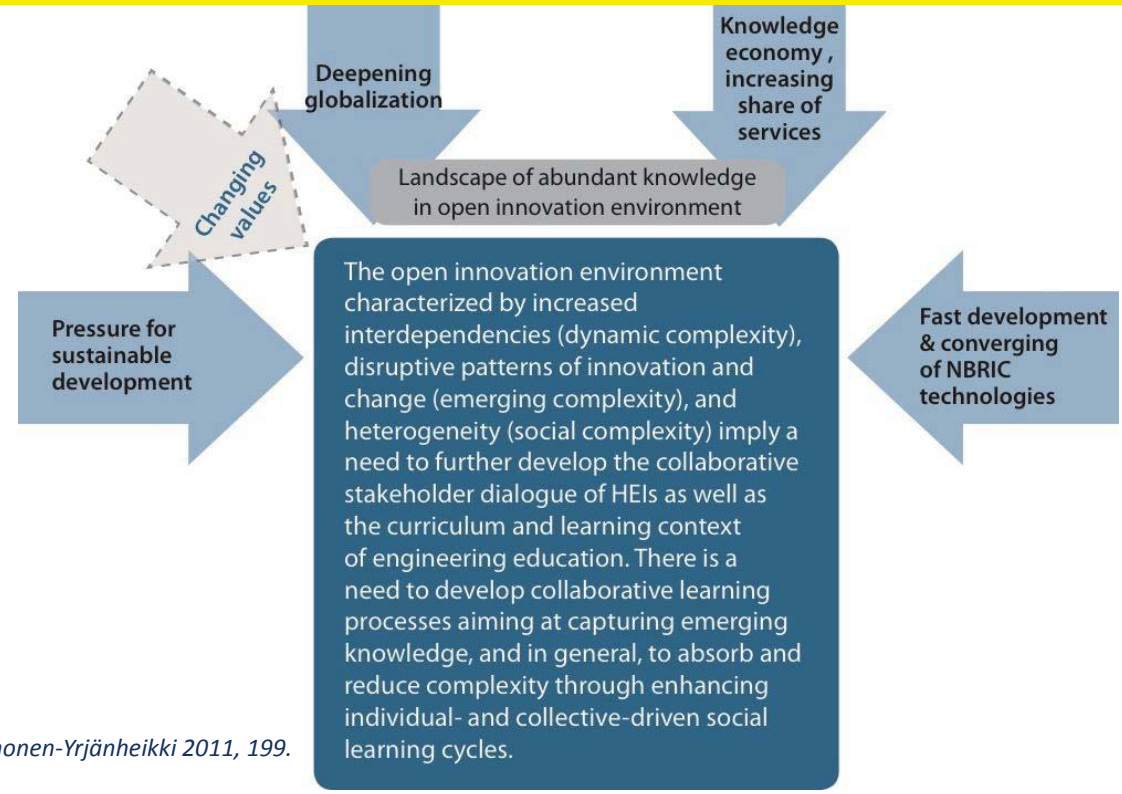
The business environment forces to improve and speed up knowledge creation and application.



Korhonen-Yrjänheikki 2011, 199.

Why increased need for collaborative learning? 1(2)

- Competitiveness of a nation is increasingly dependent on its ability to renew through social innovations that are a result of collaborative learning processes.
- Opening innovation environment increases interaction with various stakeholders.
- Increasing emergent complexity of the society that would require grasping of self-transcending knowledge through collective flow that may be regarded as a result of an optimum collaborative learning process.

Source: Korhonen-Yrjänheikki 2011

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Why increased need for collaborative learning? 2(2)

- Complex transdisciplinary problems like climate change emphasize importance of collaborative learning.
- An increased need for continuing professional development during the engineering career and the socio-cultural aspect of becoming an expert and developing expertise require collaborative learning skills.
- Engineers increasingly work in expert positions requiring teamwork.

Source: Korhonen-Yrjänheikki 2011

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What is collaborative learning?

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What is collaborative learning?

- A set of values, attitudes and abilities needed for collaborative knowledge creation.
- Collaborative learning combines individual and organizational learning.
- Key skills enabling collaborative learning are knowing of oneself, self-respect, reflection skills, communication skills in heterogenous contexts, deep listening skills, ability to share one's knowledge and skills and systems understanding.
- The values and attitudes characterizing the individual and organization are **trust**, commitment, openness, love (oneself and others), courage, benefit of oneself cannot be separated from the benefit of others, appreciatiion of deep listening, acceptance of uncertainty.

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How to enhance collaborative learning in the context of engineering education?

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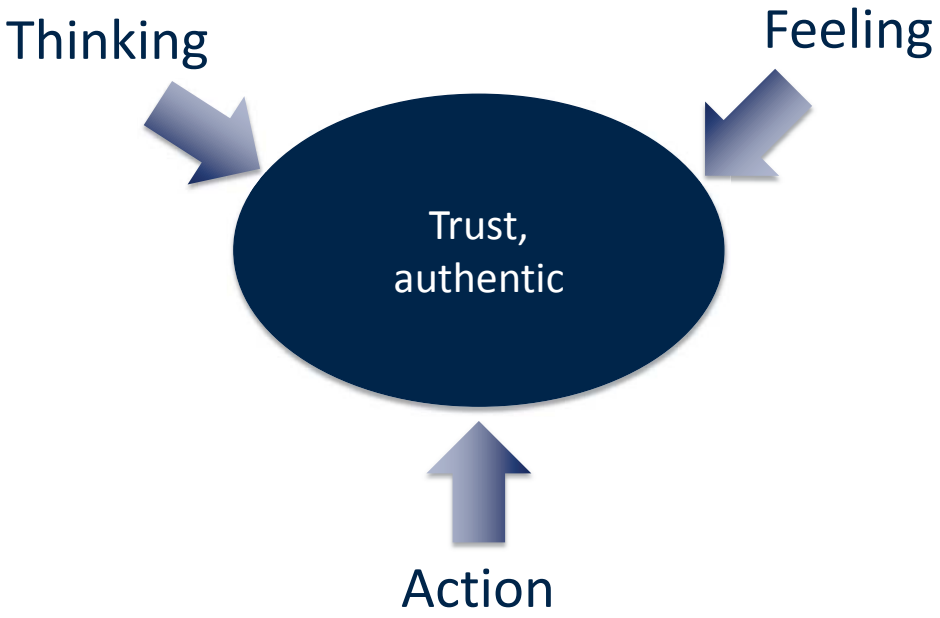

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FIELD STRUCTURE OF ATTENTION	MICRO: INDIVIDUAL ATTENTION	MESO: CONVERSATION & LANGUAGING	MACRO: INSTITUTIONAL STRUCTURE	MUNDO: GOVERNANCE MECHANISM
1. I-IN-ME	Downloading	Downloading	Centralized	Hierarchy
2. IN-IN-IT	*OPEN MIND: OPENING AND SUSPENSION, COPING WITH DYNAMIC COMPLEXITY*			
	Seeing	Debate	Decentralized	Market
3. I-IN-YOU	*OPEN HEART: DEEP DIVE AND REDIRECTION, COPING WITH BEHAVIORAL COMPLEXITY*			
	Sensing	Dialogue	Networked	Dialogue
4. I-IN-NOW	*OPEN WILL: LETTING GO AND LETTING COME, COPING WITH EMERGING COMPLEXITY*			
	Presencing	Presencing	Innovation ecosystem	Collective presence

Source: Summarized from Scharmer 2009 (Korhonen-Yrjänheikki 2011, 56)

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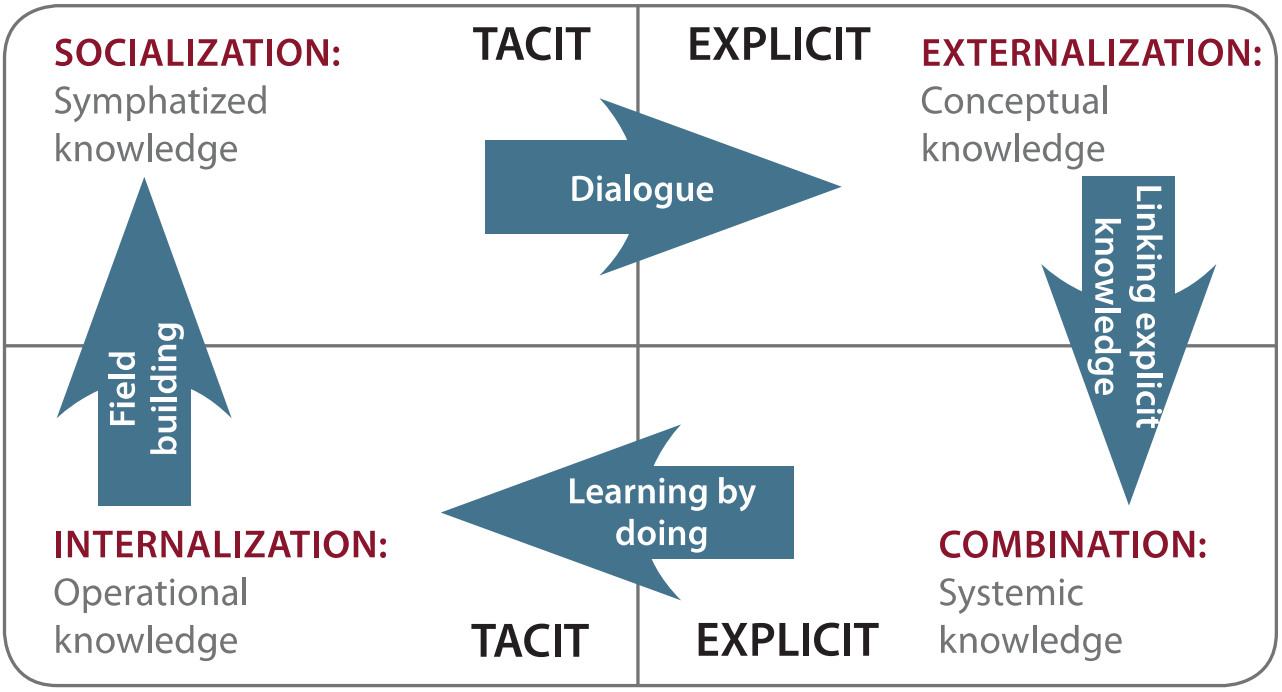

Source: Summarized from Nonaka & Takeuchi 1995 (Korhonen-Yrjänheikki 2011, 49)

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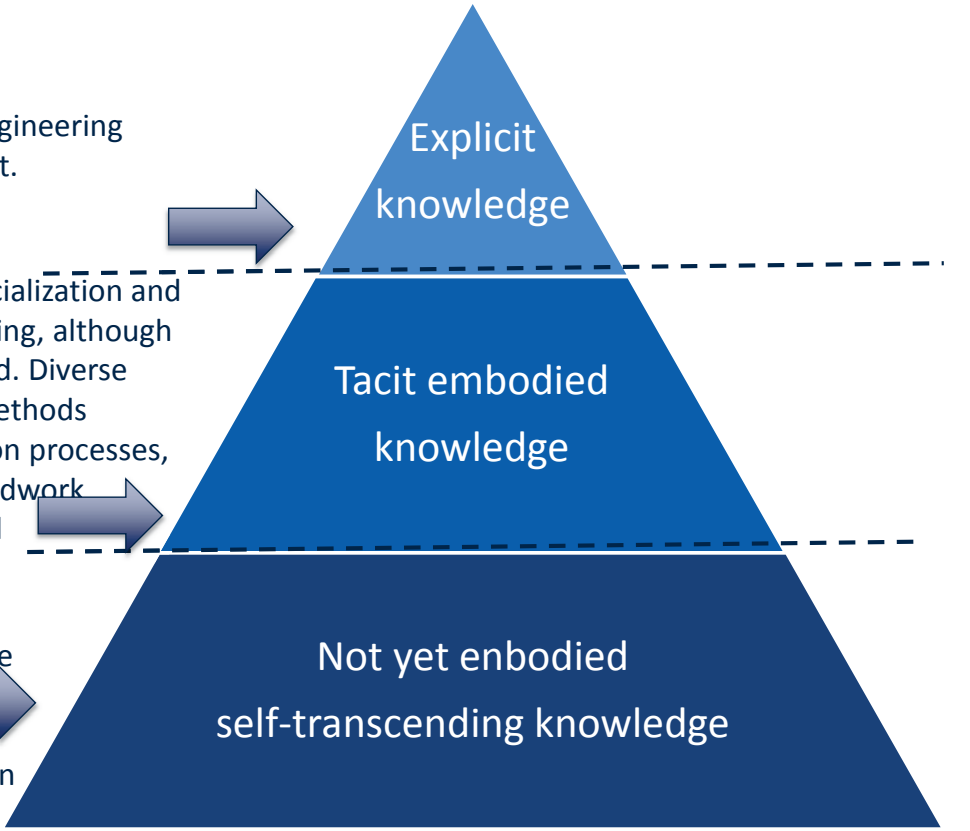
Source: Korhonen-Yrjänheikki 2011.

LEARNING PROCESS AND ENVIRONMENT	• Learning environment characterized by trust, commitment and love (see first layer). • Clear intention = defined learning objectives, proritized content, systematic pedagogic management • Requisite variety and redundancy = multidisciplinary and -cultural learning context, but balance of similarity and diversity to ensure shared context • Creative chaos / autonomy = participative active learning methods (project-based, problem oriented,use of drama &art) • Enhance deep listening = contemplative practices • Conversational field-structures= dialogue and presencing • Prototyping = learning environment that is a combination of theory and practice
ABILITY TO LISTEN, REFLECT AND SHARE ONE'S OWN KNOWLEDGE AND SKILLS	• Knowing of oneself = ability to identity and define one's own competencies, skills and personal qualities • Ability to listen = deep listening skills without prejudice • Ability to communicate in heterogenous contexts = across disciplinary borders, also in multicultural teams and virtually • Systems understanding = role of technology, engineers and one's own field of engineering in the society and as part of value networks
COMMITMENT AND WILLINGNESS TO LISTEN, REFLECT AND SHARE ONE'S KNOWLEDGE AND SKILLS	• Values = Trust, commitment, love (oneself and others), openness,courage, benefit of oneself can not be separated from benefit of others, appreciate deep listening, acceptance of uncertainty • Attitude = knowledge grows through self-reflection and reflection with others and only through shared context Ba is possible to grasp emerging knowledge, be passionate in whatever you do. • Field structures of attention = I-in-you and I-in-now

Main focus of the engineering curriculum at present.



Acquired through socialization and dialogue during training, although mostly not recognized. Diverse learning-by-doing methods (group communication processes, prototyping,arts, handwork and excersise) would enhance.

Through collaborative learning in partcipative group communication processes applying presencing mode (I-in-now).

Source: Korhonen-Yrjänheikki 2011, nature of knowledge applied from Scharmer 2009.

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”Although we cannot know exactly what they should be taught, we can focus on the environment in which they learn, and the forces, ideas, inspirations, and empowering authentic situations to which they are exposed… In the long run making universities and engineering schools exciting, creative, adventurous, rigorous, demanding and empowering milieus is more important than specifying curricular details.” –Vest 2005, 161-

Learning environment is much more important than details of the curriculum.

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Even at its best, engineering education can only provide a solid foundation for lifelong learning.

Every other engineer in Finland says that 50% of their duties at work have changed totally during past two years. 40% of the working hours are spent learning new things.

Source: Savolainen. 2010.TEK.

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Values and attitudes are at the core of engineering competence

- Values cannot be taught, but it is possible to facilitate recognition of values and to enhance reflection.
- Intuition, creativity and innovativeness can be taught, but it requires new kind of thinking.
- Knowledge of oneself, self-respect and balance of different aspects of life are important.
- Three ways of reflecting action like learning: results, process and source (Scharmer 2009).
- At present source is undervalued. What are the values behind learning? What are the aims that learning serves?

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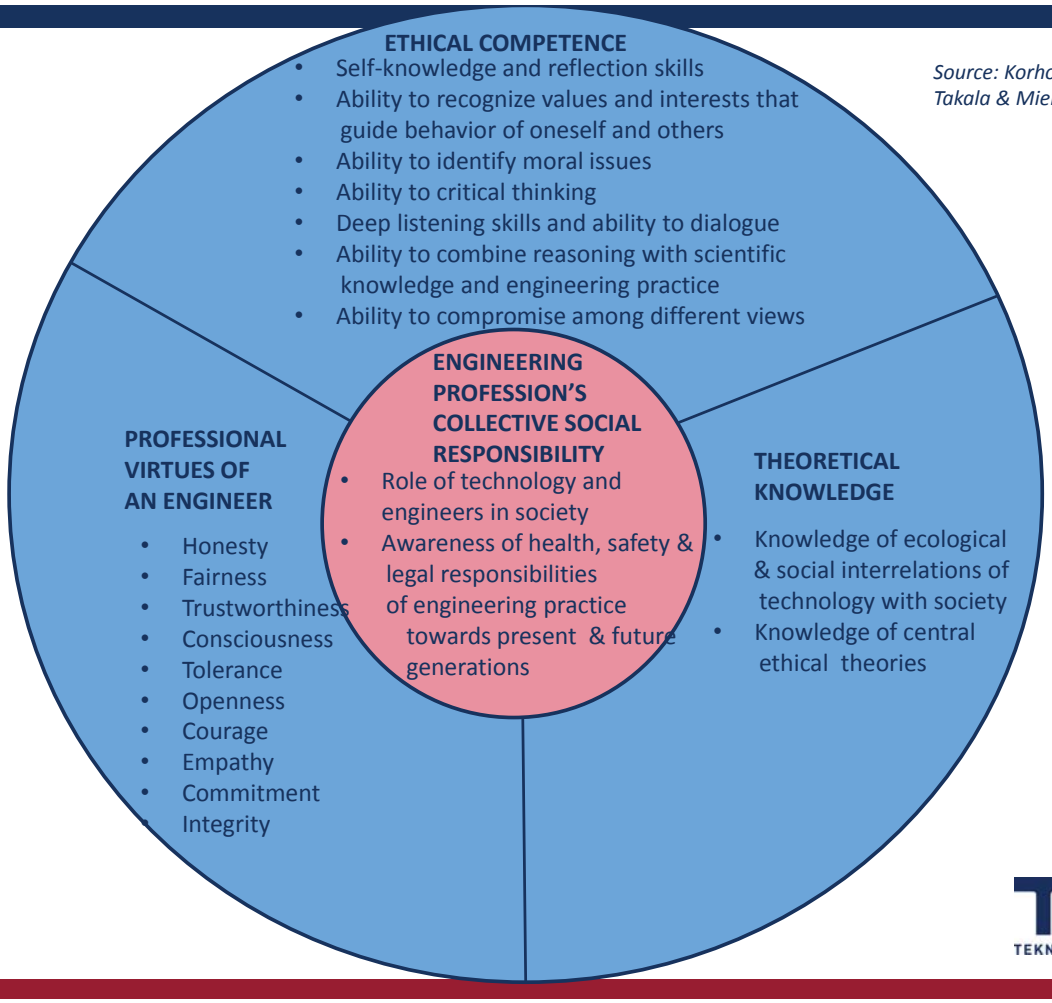

Source: Korhonen-Yrjänheikki, Takala & Mielityinen 2011

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Tell me and I'll forget;
show me and I may remember;
involve me and I'll understand.

- Konfutse-

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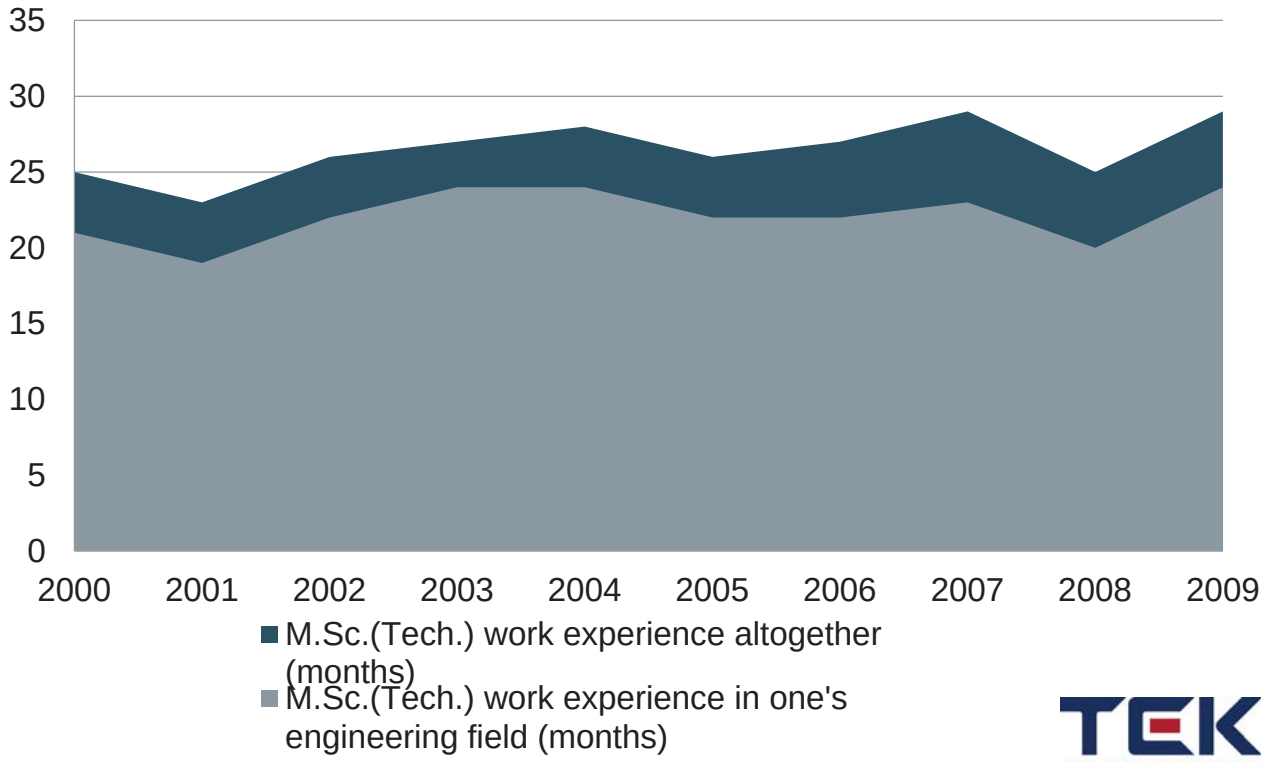
Work experience of M.Sc.(Tech.) graduates years 2000–2009



Source: TEK and UIL research on recently graduated engineering students 2000-09.

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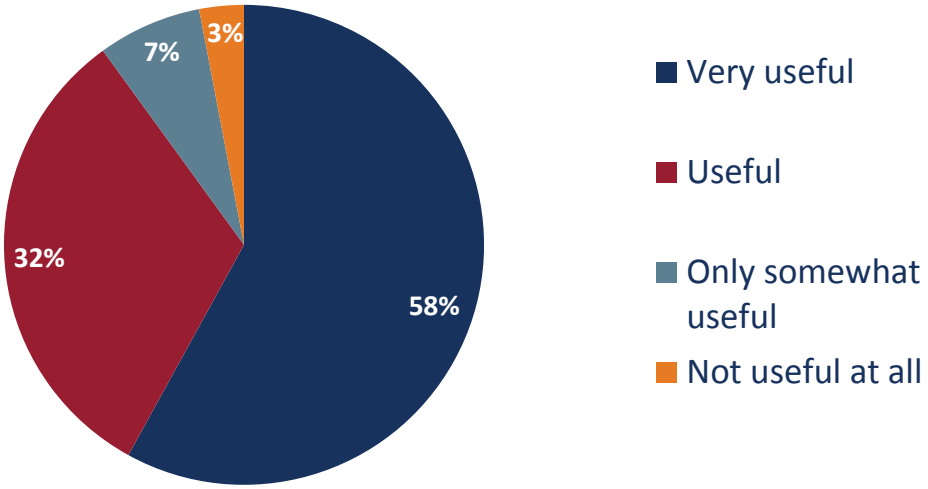
For developing your expertise, how useful do you consider the study-field related experience gained through work or work practice during your studies?



Source: Jalasjoki. 2012. Tutkimus vuonna 2011 valmistuneille diplomi-insinööreille ja arkkitehdeille.

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Select five skills whose improvement most benefited from work experience during your engineering studies

Source: Jalasjoki. 2012. Tutkimus vuonna 2011 valmistuneille diplomi-insinööreille ja arkkitehdeille.

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Labor-market intensity in Finnish engineering education

Year	Labormarket intensity
1960	0.4
1970	0.2
1980	0.3
1990	0.4
2007	0.5
2008	0.5
2009	0.5

Labor-market intensity = share of graduates that get employed after graduation through contacts created during practical training or thesis work.

Korhonen-Yrjänheikki. 2011, 129. Years 1960-90 based on Hautala et al. 1995. Years 2007-09 Based on TEK and UIL surveys on recently graduated engineers.

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Training as part of learning environment

- One key strength of Finnish engineering is close co-operation between industry and HEIs, including the tradition to acquire remarkable amount of work experience during studies.
  - Congnitive-constructivist perspective: possibilities to integrate theory and practice
  - Sosio-cultural perspective: opportunities for professional socialization
  - Pragmaatist perspective: a vast amount of experiental learning, both knowledge acquisition and creation of new knowledge.
- Learning objectives to training periods. Learning diaries reflecting the source of learning and learning process.
- Staff: need to be active in systematic collaboration with labor market.
- HEI management: strategic development of labor-market co-operation

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Thank you!

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