Vocational education and 21st century skill: Promoting adaptability through curriculum, pedagogic and personal practices

Changes in occupational, workplace requirements and working life suggests a fresh focus on the goals and processes of vocational education. These changes include:

- addressing specific workplace requirements, as well as occupational competence;
- learning knowledge that is difficult to directly experience (e.g. symbolic & digital knowledge);
- developing both canonical and adaptable occupational capacities; and
- students needing to be active, intentional and adaptable learners for their initial occupational preparation and ongoing development beyond graduation.

Central here is adaptability within domains of occupational practice and interdependence in working and learning, for both initial and continuing vocation education

Requires curriculum and pedagogic practices aligned with these outcomes.

Stephen Billett, Griffith University, Australia - June 2019

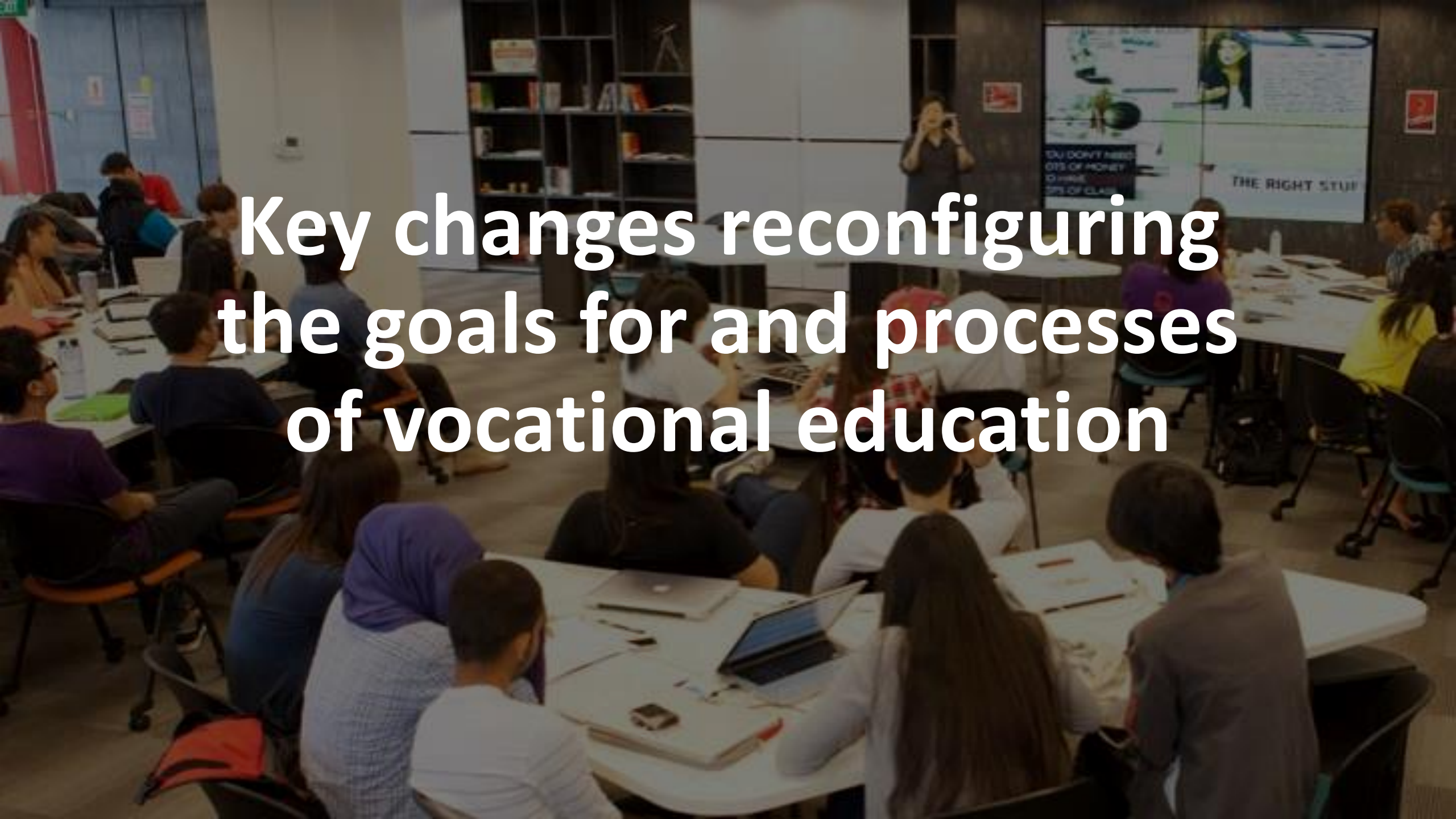
Progression

Some key changes to be addressed:

1. Focus on occupational preparation and ‘job readiness’ ;
2. Securing ‘hard to learn’ conceptual knowledge for contemporary work;
3. Developing adaptability and interdependence; and
4. Continuing vocational education and training.

Curriculum and pedagogic practices promoting adaptability

1. Institution-based activities inciting authentic work experiences
2. Organising and providing workplace experiences
3. Intentionally and actively integrating students’ workplace experiences
4. Educational processes promoting adaptability
5. Securing ‘hard to learn’ (e.g. symbolic – e.g. digital) knowledge
6. Promoting learner agency
7. Provisions of continuing education and training



Key changes reconfiguring the goals for and processes of vocational education

1. Job readiness as well as occupational preparation

Traditional role of vocational education - to prepare students for occupations

Employers, governments, community and students now expect graduates to be ‘job ready’

Tough educational goal, because:

i) we do not know where VET graduates will be employed and requirements of that employment;

ii) it requires different educational objectives and processes than ‘occupational’ preparation; and

iii) extends to so-called 21st Century skills (WEF): i) complex problem-solving, ii) critical thinking, iii) creativity, iv) people management and v) coordination (Nokelainen, et al 2018).

Requires knowing something about variations of occupational practice, for what reasons and educational processes accommodating these variations, including these b

Positions occupational adaptability as a key educational goal.

Yet, governments focussed on statements of competence, rather than pro kinds of outcomes (Hamalainen, et al 2018)

Adaptability

Early views suggest some forms of knowledge are very adaptable (Bartlett 1958)

some capacities not restricted to specific activities (e.g. literacy, numeracy)

Faure et al (1972) favour general problem-solving over specific occupational preparation.

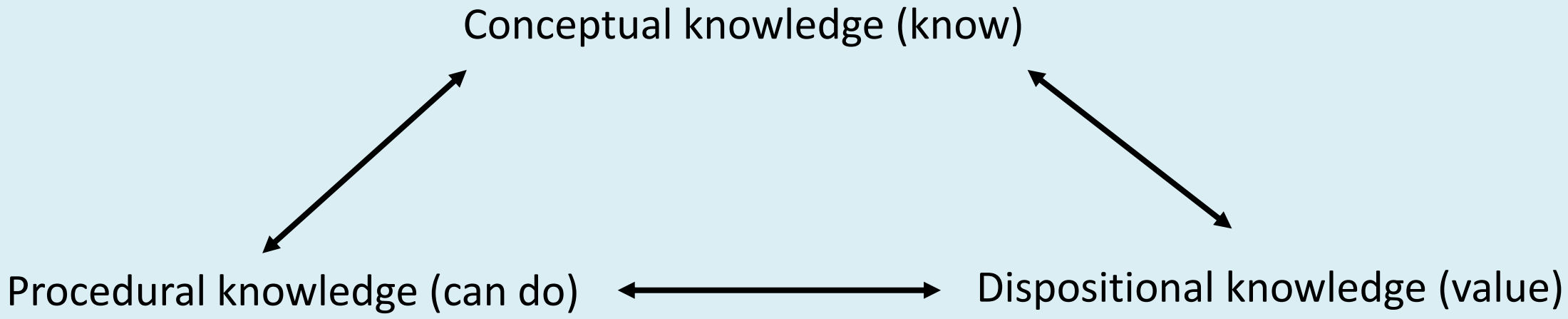
Yet, expertise studies emphasise domain-specificity (e.g. occupations) (Glaser 1984, Ericsson,1996) - cleverness is insufficient for non-routine domain-specific problem-solving.

Accounts suggest occupational performance and expertise are situated (2001).

Means that competence at both the occupation (i.e. canonical) and situational level is necessary (2017), but also adaptability across them.

As with earlier versions (i.e. Key competences, SCANS), capacities posited as 21st Century skills (WEF) and processes of adaptability need to be embedded in domains of occupational knowledge and its practice.

Dimensions of knowledge deployed and developed further through work



This knowledge enacted comprises both: canonical occupational requirements and situational performance requirements

Importantly, there is no such thing as an occupational expert, per se (2001, et al 2018)

‘Occupational competence’ is shaped by the circumstances of practice and practitioners response to them, as are i) complex problem-solving, ii) critical thinking, iii) creativity, iv) people management and v) coordinating with others (Nokelainen, et al 2018)

Develop principled understandings – broadly applicable concepts in a domain of activity

Knowledge required to be learnt for occupational performance

Canonical occupational knowledge (i.e. what practitioner need to know, do and value)

'know' – conceptual knowledge – factual, propositional, causal knowledge

'do' – procedural knowledge – specific through to strategic knowledge

'value' – dispositional knowledge – interest, intentionality

Situational manifestations (e.g. workplace requirements)

- what permits job performance (expertise)
- particular kinds of what is need be known, can be done and valued

Educational intents should focus on students adapting to these variations and processes (i.e. promoting adaptability)

Three domains

1. Canonical domain of knowledge of occupation (including informed principles & practices, "21st C skills")
2. Situated domain of requirements for practice (i.e. workplace requirements & "21st C skills")
3. Personal domain of knowledge constructed through experiences (Billett, Harteis & Gruber, 2018)

Addressing the first two domains and generating the third are goal for vocational educational provisions

2. Securing ‘hard to learn’ knowledge

Much existing and ‘future work’ is reliant on conceptual and symbolic knowledge – and understandings that cannot easily arise through direct experience.

Yet, “… hardly have we approached the problem of understanding the intellectual impact of the printing press than we are urged to confront the psychological implications of computerisation.” (Scribner, 1985: 138)

It is important – Three Mile Island, Chernobyl, (poss Max8(?), less dramatic examples in banking, commerce, metal machining etc.

Computer Numerically-Controlled (CNC) lathes – the integration of traditional machining knowledge with symbolic knowledge and logical skills involved in new informatics (Martin & Scribner, 1991)

Often difficult to learn because it cannot be directly engaged with or experienced

Differences in capacities and familiarity across generations

3. Developing adaptability and interdependence

Work and learning are reliant on ability to:

i) work interdependently with others and artefacts; and

ii) adapt to changing circumstances and problem-solving.

<u>Interdependence</u> - Working with others directly or indirectly is an increasing necessity.

Much of educational provisions premised on and are mediated individually.

Also, much educational effort is directed individually and generating independence

Yet, interdependence is sometimes a far more important student outcome

<u>Adaptability</u> - PIAAC data indicates workers of all kinds engage in routine and non-routine problem-solving.

In Australia, 82% and 48% report engaging in routine and non-routine p-s every week

All classes of Australian workers engage in these adaptive practices: each working week, 43% of skilled workers; 62% of professionals; 73% of technical workers, 34% of service workers and 29% of operatives (2015) engage in non-routine problem-solving.

The case is similar here.

Table 1: Problem solving by country - Denmark, Finland, Norway & Sweden

Problem solving	Country	n	Never (%)	< once a month (%)	< once a week (%)	At least once a week (%)	Everyday (%)
How often does work involves confronting simple problems	Denmark	5922	5.7	8.8	10.2	27.0	48.3
	Finland	4386	3.1	8.9	15.0	37.8	35.2
	Norway	4249	3.6	8.4	11.4	30.6	46.0
Routine problem solving	Sweden	3764	3.8	7.0	9.7	29.1	50.4
How often work involves confronting demanding problems	Denmark	5920	21.6	21.4	21.7	27.5	7.8
	Finland	4386	15.0	25.9	28.0	26.2	4.9
	Norway	4248	16.4	24.5	25.2	27.6	6.3
Non-routine problem-solving	Sweden	3766	17.0	23.5	24.3	28.4	6.8

- 75% of Danish, 73% of Finnish, 77% of Norwegian and 80% of Swedish workers report engaging in **routine problem-solving** and, respectively, 35%, 31%, 34% and 35% in **non-routine problem-solving** of the kind that requires and generates higher order cognitive capacities – at least weekly.

Table 2 Problem solving across Denmark, Finland, Norway and Sweden

Problem solving	n	Never (%)	Less than once a month (%)	Less than once a week (%)	At least once a week (%)	Everyday (%)
How often does work involves confronting simple problems	18321	4.2	8.4	11.5	30.9	45.1
Routine problem solving						
How often work involves confronting demanding problems	18320	17.9	23.6	24.6	27.4	6.6
Non-routine problem-solving						

Across these countries, **76% of workers consistently report** engaging at least weekly in **routine problem-solving** and **34% in non-routine problem-solving** requiring and generating higher-order cognitive capacities.

Suggests: i) goals for initial VET and ii) processes to be drawn on for continuing education and training – also workplace innovation

For all classes and kinds of workers, it seems

Table 3 - Non-routine problem-solving by level of educational achievement

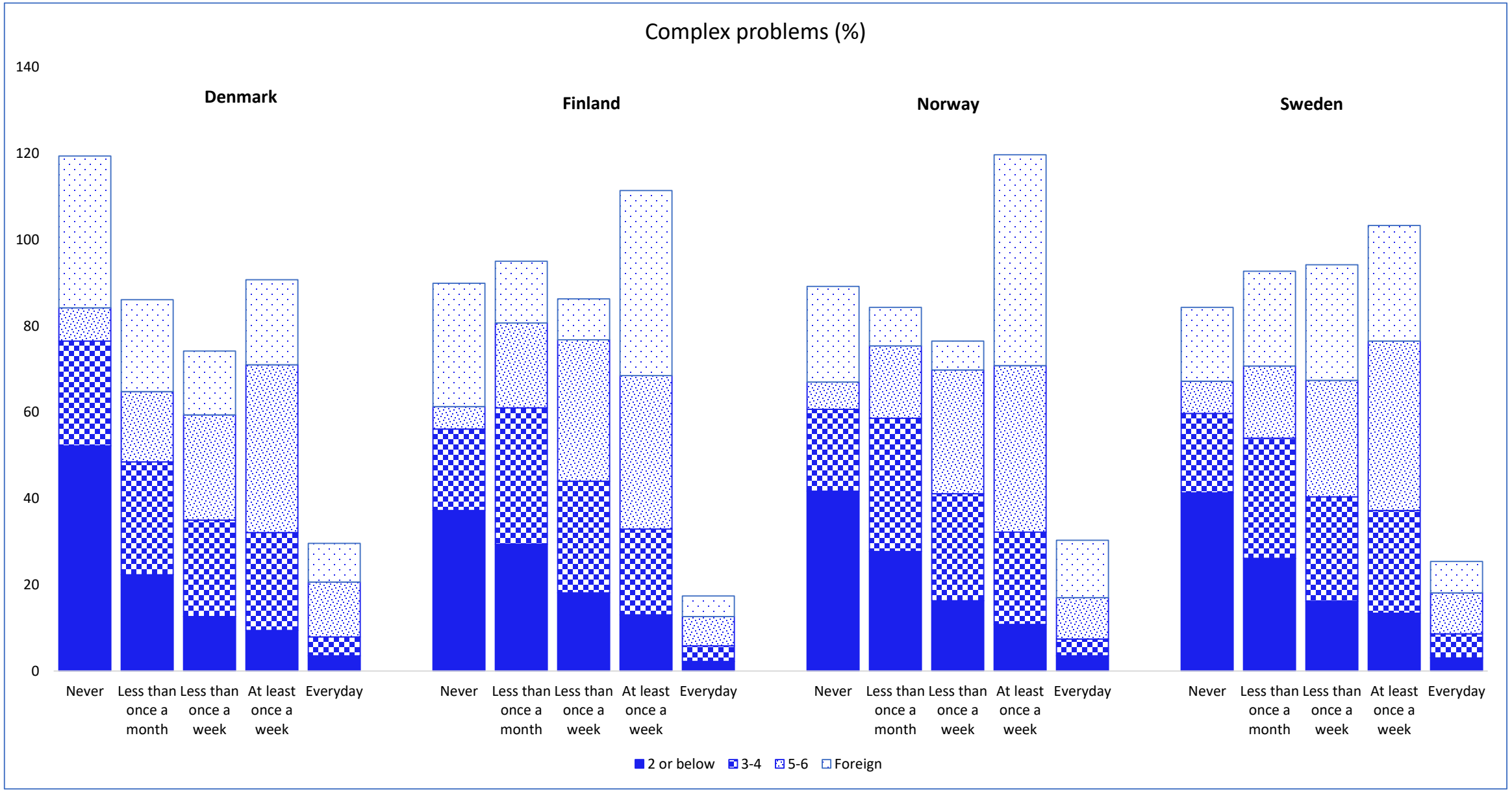


Table 4 -Task discretion by country with a focus on high extent of discretion

Task discretion *Extent to which you can*	**Country**	**n**	**To a high extent (%)**	**To a very high extent (%)**	**Totals**
choose the sequence of your work	Denmark	3373	28.9	36.3	**65%**
	Finland	2549	43.1	22.7	**66%**
	Norway	2343	34.5	24.8	**69%**
	Sweden	2311	36.9	32.2	**59%**
change main work tasks	Denmark	3441	30.8	33.8	**64%**
	Finland	2968	42.5	34.3	**76%**
	Norway	2576	38.3	23.7	**62%**
	Sweden	2463	41.5	32.2	**73%**
change the pace of your work	Denmark	2957	26.3	29.2	**64%**
	Finland	2583	40.8	26.0	**76%**
	Norway	2214	33.2	22.8	**62%**
	Sweden	1767	30.8	22.0	**53%**

These data indicates these workers utilise discretion (i.e. ability to be autonomous, problem-solve and monitor performance) to a high degree as part of their regular work activities.

Table 5 - Task discretion across Denmark, Finland, Norway and Sweden

Task discretion Extent to which you can	**n**	**Not at all (%)**	**Very little (%)**	**To some extent (%)**	**To a high extent (%)**	**To a very high extent (%)**	**Totals (high extent)**
choose the sequence of your work	16,503	4.2	8.0	23.2	35.2	29.5	**65%**
change main work tasks	16,490	3.0	7.6	20.8	37.5	31.2	**69%**
change the pace of work	16,499	3.4	10.7	28.2	32.3	25.4	**58%**

Across these four Nordic **countries, 65% workers report that they can to a high extent change the sequence of their work, 69% change main tasks and 58% change pace of work**.

All of this indicates workers have the ability to exercise decision-making and problem-solving in their work, thereby requiring and extending higher order capacities.

Emphasises qualities to be generated by initial VET and what might be utilised in continuing education and training

4. Increasing demand for continuing education and training (CET)

Growing need for CET provisions, because of:

- ageing populations,
- need for constant upskilling,
- changes in occupations/careers,
- overwhelmed social systems.

Yet, existing models of initial occupational preparation are often ill-suited to CET (i.e. mode, duration, teachers, access, educational processes), so new models are required

Qualification and administrative arrangements distinct from those of initial occupational preparation (e.g. duration, RPL)

Work-based models preferred by many workers, except when changing occupations.

Responsive curriculum and pedagogic practices: developing adaptive learners

What kinds of curriculum and pedagogic practices can promote occupational competence, job-readiness and adaptability and sustain employability across working life?

What kinds of pedagogic practices can support the development of conceptual and symbolic knowledge?

How can we promote learner interdependence and adaptability?

These questions are addressed in the following sections

1. Educational institution-based experiences

Making educational activities ‘authentic’ - promoting engagement and interdependence (e.g. grading classes) - support indexing, recall, rich simulations

Making task’s ‘problem-space’ authentic – press students into practice-related thinking and acting

Focussing on ‘diverse solution search and strategy’ – as in differential diagnoses

Identify what is best ‘taught’ and what is best ‘learnt’ – emphasise the latter - learning

Not always possible to provide students with workplace experiences - consider other options – hybrid activities

Verbalisation of working knowledge - story-telling – narratives as mnemonics

Collective and shared projects (e.g. information technology) – sharing experiences

Individual projects (e.g. fashion) – guided by teacher, sharing experiences

2. Workplace learning experiences

Workplace provide access to the knowledge required for both occupational capacities and situational performance:

- authentic activities and interactions;
- richly contextualised experiences (i.e. engages multi-sensory processes, provides clues, cues etc.);
- purposive activities (i.e. directed to goals, engages in decision-making);
- practice (i.e. engage, refine, hone);
- episodic experiences (establishing causal and propositional links); and
- monitoring progress and outcomes (i.e. appraising and evaluating performance).

They also have a range of weaknesses and limitations

So, these experiences need to be provided and integrated with those within vocational education programs to optimise their contributions and redress limitations.

Table 6. Processes of learning by country

Learning at work	Country	n	Never (%)	Less than once a month (%)	Less than once a week (%)	At least once a week (%)	Everyday (%)
How often you learn from co-workers and supervisors	Denmark	5054	5.3	17.0	25.3	31.2	21.3
	Finland	3625	4.2	20.4	29.5	32.2	13.8
	Norway	3791	3.2	11.5	24.2	38.3	22.8
	Sweden	3173	4.2	17.3	26.3	32.7	19.5
How often work involves learning by doing through performing job	Denmark	5324	4.0	18.3	25.5	29.7	22.5
	Finland	3868	1.6	13.1	22.0	31.6	31.7
	Norway	3941	1.7	10.6	22.5	34.2	31.1
	Sweden	3343	2.2	13.5	22.2	34.3	27.9

These findings suggest that learning both mediated by workers and others arises frequently through work.

Workers report learning from others in: Denmark (52%), Finland (46%), Norway (61%) and Sweden (52%) and through their own mediation in Denmark (52%), Finland (62%), Norway (65%) and Sweden (62%), at least weekly,.

This appears to be the case for all classes of workers

Table 7: Guided learning through work by level of educational achievement

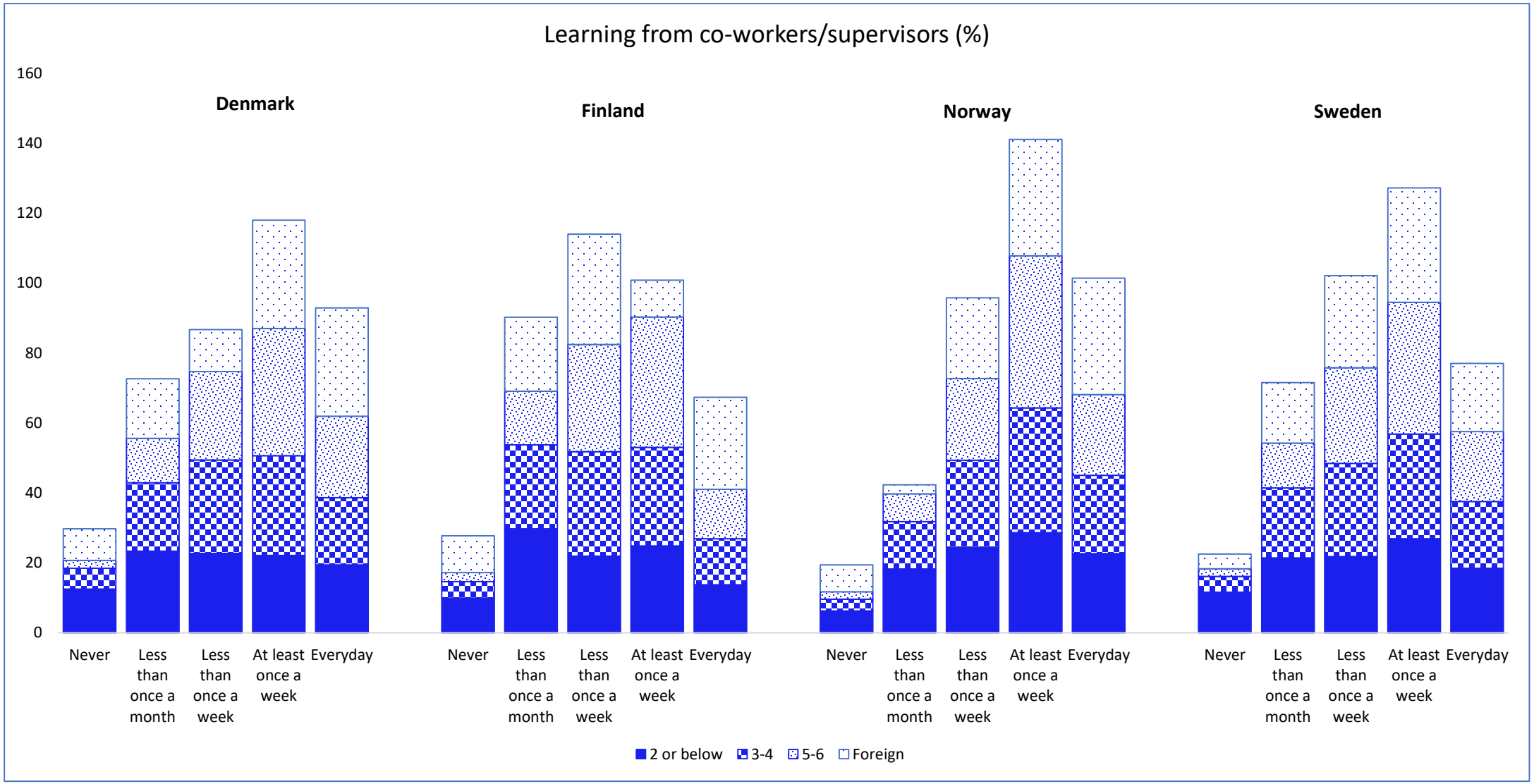
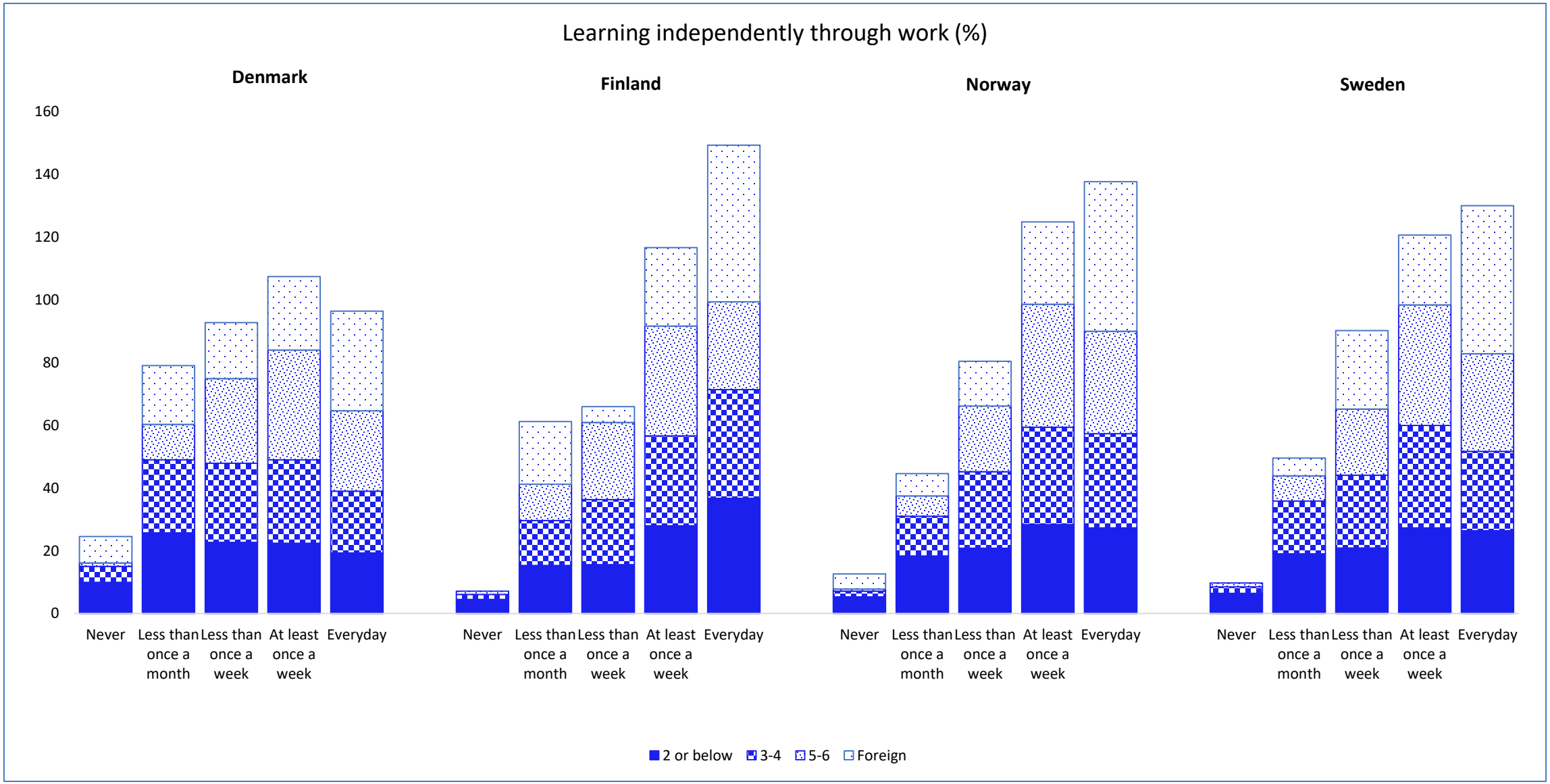
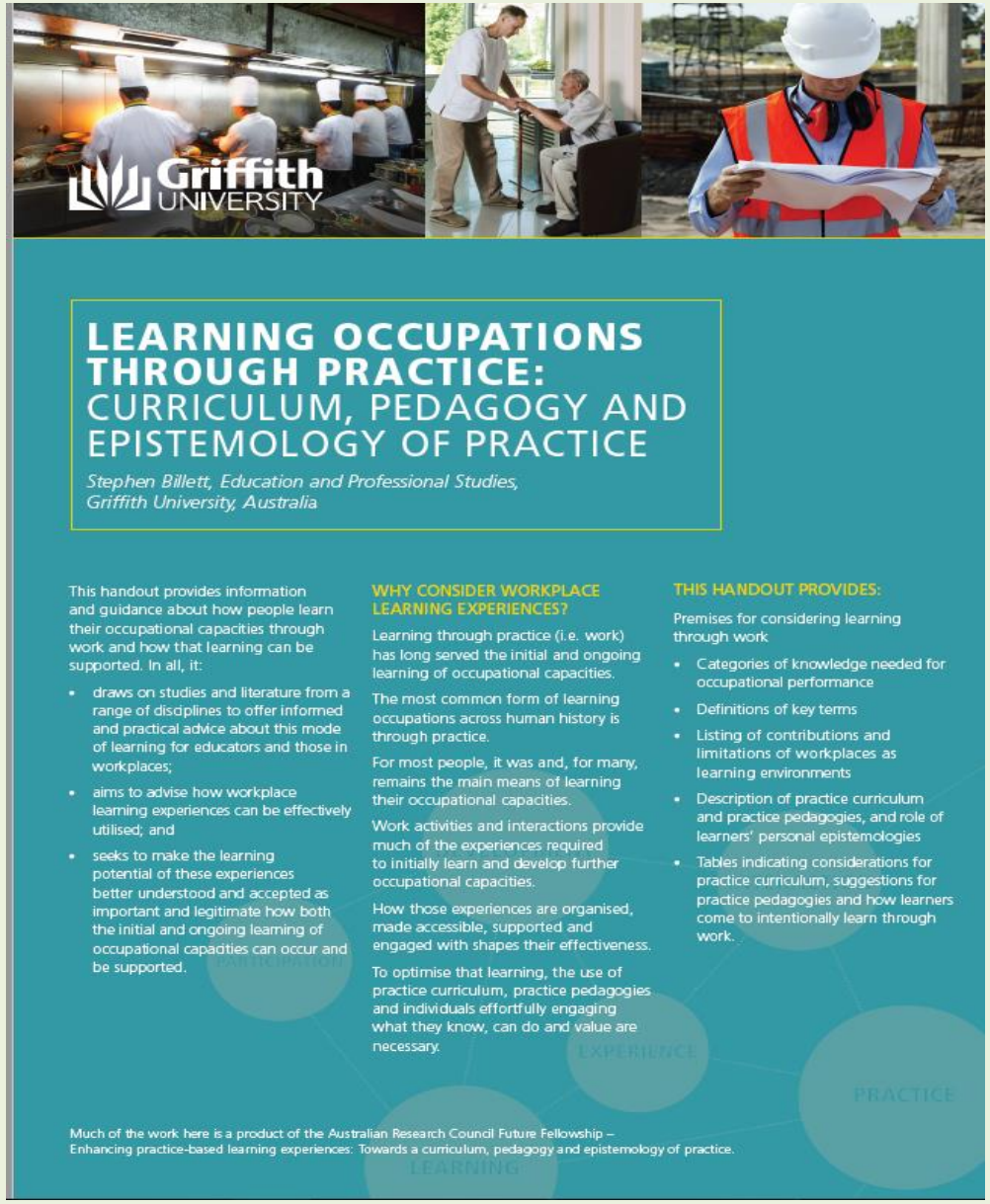


Table 8 - Learning independently through work by level of educational achievement



Workplace curriculum, pedagogy and personal practices

Models of workplace curriculum	Learning curriculum, Learning activities at work, Learning pathways, Parallel practice
Workplace pedagogic practices	Verbalisation, Pedagogically rich activities, Guided learning (proximal guidance), Partially worked example/direct instruction and hands on, Heuristics, Mnemonics, artefacts
Personal epistemological practices	Ontogenetic ritualization, Embodied knowledge, Deliberate practice, Guided re-discover, Active engagement & construction, Observation, Averting gaze, Readiness, Assent



Griffith UNIVERSITY

LEARNING OCCUPATIONS THROUGH PRACTICE: CURRICULUM, PEDAGOGY AND EPISTEMOLOGY OF PRACTICE

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This handout provides information and guidance about how people learn their occupational capacities through work and how that learning can be supported. In all, it:

- draws on studies and literature from a range of disciplines to offer informed and practical advice about this mode of learning for educators and those in workplaces;
- aims to advise how workplace learning experiences can be effectively utilised; and
- seeks to make the learning potential of these experiences better understood and accepted as important and legitimate how both the initial and ongoing learning of occupational capacities can occur and be supported.

WHY CONSIDER WORKPLACE LEARNING EXPERIENCES?

Learning through practice (i.e. work) has long served the initial and ongoing learning of occupational capacities.

The most common form of learning occupations across human history is through practice.

For most people, it was and, for many, remains the main means of learning their occupational capacities.

Work activities and interactions provide much of the experiences required to initially learn and develop further occupational capacities.

How those experiences are organised, made accessible, supported and engaged with shapes their effectiveness.

To optimise that learning, the use of practice curriculum, practice pedagogies and individuals effortfully engaging what they know, can do and value are necessary.

THIS HANDOUT PROVIDES:

Premises for considering learning through work

- Categories of knowledge needed for occupational performance
- Definitions of key terms
- Listing of contributions and limitations of workplaces as learning environments
- Description of practice curriculum and practice pedagogies, and role of learners' personal epistemologies
- Tables indicating considerations for practice curriculum, suggestions for practice pedagogies and how learners come to intentionally learn through work.

Much of the work here is a product of the Australian Research Council Future Fellowship – Enhancing practice-based learning experiences: Towards a curriculum, pedagogy and epistemology of practice.

3. Integrating workplace experiences

Students' workplace experiences, however, need to be integrated into their college-based experiences

Such integrations exercise curriculum, pedagogic and learners' personal practices

Considerations for curriculum and pedagogic practices

Curriculum practices – intended, enacted and experienced

Pedagogic practices – before, during and after workplace experiences

Personal practices – how students come to engage, mediate, reconcile and accommodate those experiences.

Assists identity and structure canonical knowledge and situational variations of practice

Curriculum considerations for integrating workplace experiences (see Table 1 in handout)

Intended curriculum – *what is planned*	**Enacted curriculum** – *what is implemented*	**Experienced curriculum** – *what students experience and learn*
being clear about what is to be learnt through workplace experiences	augmenting or maximising available opportunities (e.g. appropriate settings)	students' interest and readiness central to their engagement and learning in practice settings, and reconciling it with their coursework
aligning experiences provided for students with the intended learning outcomes	considering options other than supervised placements to secure experiences	immediate concerns (e.g. performing in practicum) focus of students' interest
aligning the duration of experiences with educational purpose (e.g. orientation vs skill development)	accounting for students' readiness (e.g. interest, capacities, confidence) when selecting and enacting experiences	early and staged engagement in practice settings boosts many students' confidence to re-engage and learn effectively
intentionally sequencing preparatory experiences to secure, consolidate and reconcile learning from practice experiences	additional or specific experiences may be needed for particular student cohorts (e.g. overseas students)	challenges to personal confidence and competence can be redressed by effective group processes, including sharing of experiences.

Pedagogic practices to integrate students' workplace experiences (see Table 2 in handout)

Before workplace experience	**During workplace experience**	**After those experiences**
orient students to requirements for effectively engaging in work practices	direct guidance by more experienced practitioners (i.e. proximal guidance)	facilitate the sharing and drawing out of students' experiences
clarify expectations about purposes of, support in and responsibilities of parties in practice settings etc.	active engagement in pedagogically rich work activities or interactions (e.g. handovers)	make explicit links to, and reconciliations between, what is taught (learnt) in the academy, and what is experienced in practice settings
prepare students to engage as agentic learners (e.g. importance of observations, engagement)	effective peer interactions (i.e. students' collaborative learning)	emphasise the active and selective qualities of students' learning through practice
develop procedural capacities required for tasks in workplace	active and purposeful engagement by the students as learners in workplace	generate students' critical perspectives on work and learning processes
prepare for contestations that might arise		

Table 8: Matrix of educational purposes and processes (Billett 2015)

Educational purpose	Timing and sequencing	Duration	Organisation	Engagement	Kinds of experiences
Learning about the occupation	Early in program	Short, long enough to observe	Access to variations of practice	Observation and participation in peripheral tasks	Observation and opportunity to experience
Learning about variations of that occupation	After some initial experience of the occupation	Short, long enough to observe and listen	Access to variations of practice	Opportunities to engage across workplaces and also with other students	Access to a range of work settings
Extending the knowledge learnt in university settings	During or after this knowledge has been imparted	Possibly short, but well focused engagements	Pathways of experience used to make explicit the applicability of knowledge learnt	Effortful engagement to assist the application of knowledge to novel circumstances	Engagement in authentic workplace activities of different kinds
Orientations to the settings where the occupation is practiced	Early in program	Long enough to observe a range of work settings	Rotation through a range of workplaces to understand how practice is enacted	Engaging students in their developing understandings about these activities	Rotation through a range of workplaces to understand how the occupation is practiced
Building the occupational capacities required to be an effective practitioner	Building upon some initial experience	Longer periods of engaging in a range of workplace activities	Progressively longer periods of practice and more demanding tasks during those periods	Engaging in a range of authentic activities, initially guided by more expert partner	Provision of access to authentic work practices and engagement in appropriate level tasks
Meeting requirements of occupational or professional licensing	Gradual engagement and building capacity across program	Adequate enough to build capacities and understanding	Built into program to develop required capacities	Increasingly engaging in activities reflecting occupational requirements	Gradual engagement and rotation through different kinds of experiences

4. Educational processes promoting adaptability

Engaging students in domain-specific problem-solving tasks

Developing adaptable understandings and practices (i.e. informed principles and practices) – (e.g. fashion, cooking) to promote adaptability

Sharing and justifying approaches - opportunities for students' engaging, sharing, comparing etc. - discussion and dialogue

Opportunities to apply knowledge in a variety of circumstances – procedural development - successive approximation of mature practice

5. Learning conceptual and symbolic knowledge

Three key observations about learning conceptual and symbolic knowledge:

1. hard to capture in written form;
2. difficult to access and learn; and
3. cannot easily be ‘taught’, needs to be learnt.

Provision of selected experiences and learner engagement likely to be essential.

Making accessible and able to understand conceptual and symbolic knowledge

Use of stories, analogies, explanations, illustrations

Symbolic knowledge become personal tools to mediate our work and learning.

Not restricted to technology – ways of knowing to understand and respond to workplace tasks

Assist students create mental models – concept maps, diagrams, mental representation, mnemonics

Need experiences and pedagogic practices to provide access to this knowledge

Xerox technicians (Orr 1996) developed an understanding of principles and then enriched with stories from practice:

- principled understanding and practices
- then, development of strategic practices, heuristics and problem-solving strategies.

6. Promoting the development of active engagement by learners

Aware of learner readiness to engage in tasks

Select and enact activities that warrant engagement (interesting, relevant) – projects and tasks

Place them in ‘driving seat’ – get them to do the thinking and acting

Also, position them to evaluate their or peers’ activities/outcomes

Guide rather than teach

Provisions of continuing education and training

Provisions of CET accommodating working age adults:

with three lives (work, family and study) – needs to be accessible;

different levels of readiness – needs to be flexible and responsive;

possessing lots of work experiences, with much to contribute - needs to be facilitative;

relevant and engaging; and

may need compulsory attendance.

Processes:

Work-based projects, group-based activities, professional clusters, individual and group based activities can be used to (identify), consider and generate innovations for work practice and/or their implementation.

Teachers: tolerant of and able to use contributions of adult learners, and possess expertise that makes them credible

So what?

Vocational education goals need to go beyond the canonical to address workplace requirements

A view of curriculum and pedagogies that focuses on developing students' adaptable domains of occupational knowledge

These are premised on gaining access to appropriating canonical and situational domains of occupational knowledge and in ways that promote adaptability.

This includes educational interventions required to address the growing elements of 'hard to learn' symbolic and conceptual knowledge

Promoting learner agency and interdependence is also an important educational outcome, not just for immediate employability, but for learning across working life.

In all, focus on learning, not just teaching.

These concerns are not just about individuals' personal learning, they extend to the efficacy of work practices, workplaces and communities.