CURRICULUM CHANGES TOWARDS AGILITY AND FLEXIBILITY

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Towards Agile, Interdisciplinary and Individualized Engineering Education

CDIO Seminar, October 17th, 2019

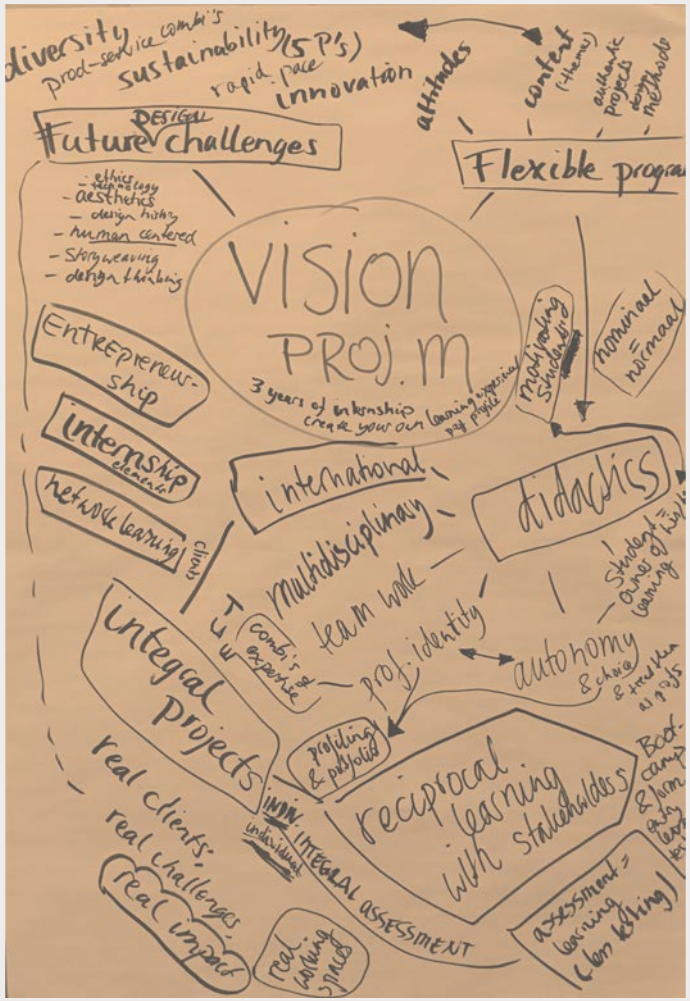
IDE CURRICULUM M

WORKING GROUP CURRICULUM AGILITY

SURVEY CURRENT CURRICULUM CHANGE AND INNOVATION


IDE
THE HAGUE
UNIVERSITY OF
APPLIED SCIENCES
CURRICULUM INNOVATION

Industrial Design Engineering



Flexible, Modular Curriculum

Running since 2018

CDIO

100%

Competency-based

Teaching & Assessment

Reciprocal, Multi and interdisciplinary Learning

Innovation projects

within diverse, real contexts

Individual Semester Choice Cycle

½ year units

Why: direct, strategic & educational

More attention for **entrepreneurship** in the program.	Keep project-based, client-involved, active learning elements of the program for **Networking**	Half year modules with **less testing**
Internship is missed in program.	Keep **30EC minor** space	**New competence set central** and make sure each half year students practice all 5 competences
IIR (international Insights Research) project: can be either less than 12 EC it has now, or can be combined with internship and get full module credits.	Make a **flexible program** facilitating **collaborations** with other programs, faculties, universities and projects	**Freedom of choice** to specialize or broaden to **increase intrinsic motivation**
Entrepreneurship in Innovation needs to move to the major.	Work in **modular entities** that make exchange as easy as possible	**T-shaped, U-shaped or W-shaped profile**
Build in '**free space**' for interesting projects that are offered during the school year.	Offer students the opportunity to work on design projects all the way to the **implementation/ operation phase**	Better **Study progress & flow**
Restore **balance** in the program.		

Why (flexible)? Education research

THUAS' lector Frans Meijers on developing professional identity of students identified three main conditions for developing a professional identity:

- learning should take place in an **authentic setting**,
- students should have **the opportunity to choose** part of their study activities according to their personal developing goals
- there should be a **professional, reciprocal dialogue** between students and teachers about their development.

Trend research (Youngworks): what is important for our current/future students:

- Creativity
- **Autonomy**
- Room for **negotiation**
- **Entrepreneurship**
- Social learning
- **Create your own job**

Educational Researcher Janke Cohen on the necessary counterintuitive measures in assessment to increase study progress and effective learning

- Assessments every 5 weeks, as students start preparing 3-4 weeks beforehand.
- More than 6 tests/ assessments per year results in 50% more chance of unjust fails for tests.
- No competition of other tests
- Resits are within the same semester, falls in what could be cool portfolio project time.
- Independent working weeks for 4% more graduates per year.

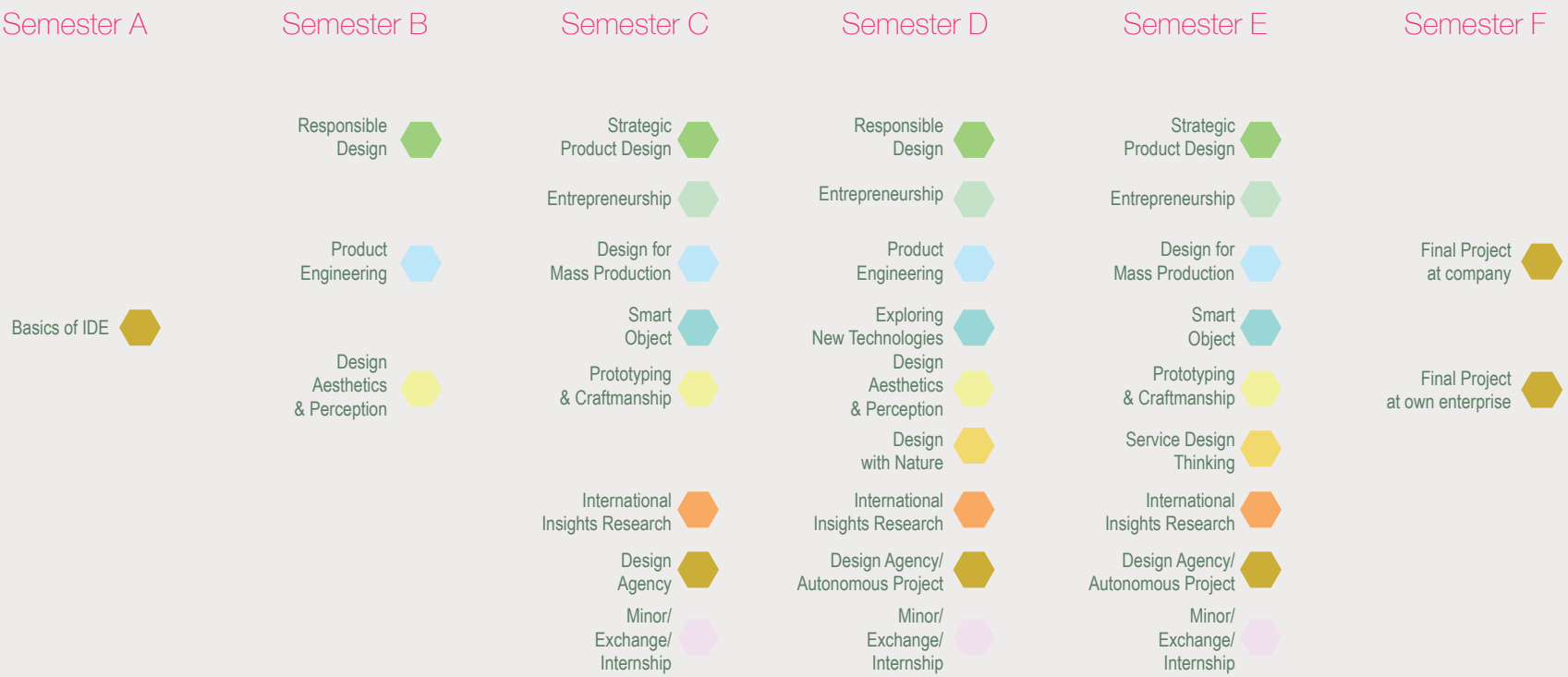
Co-creation

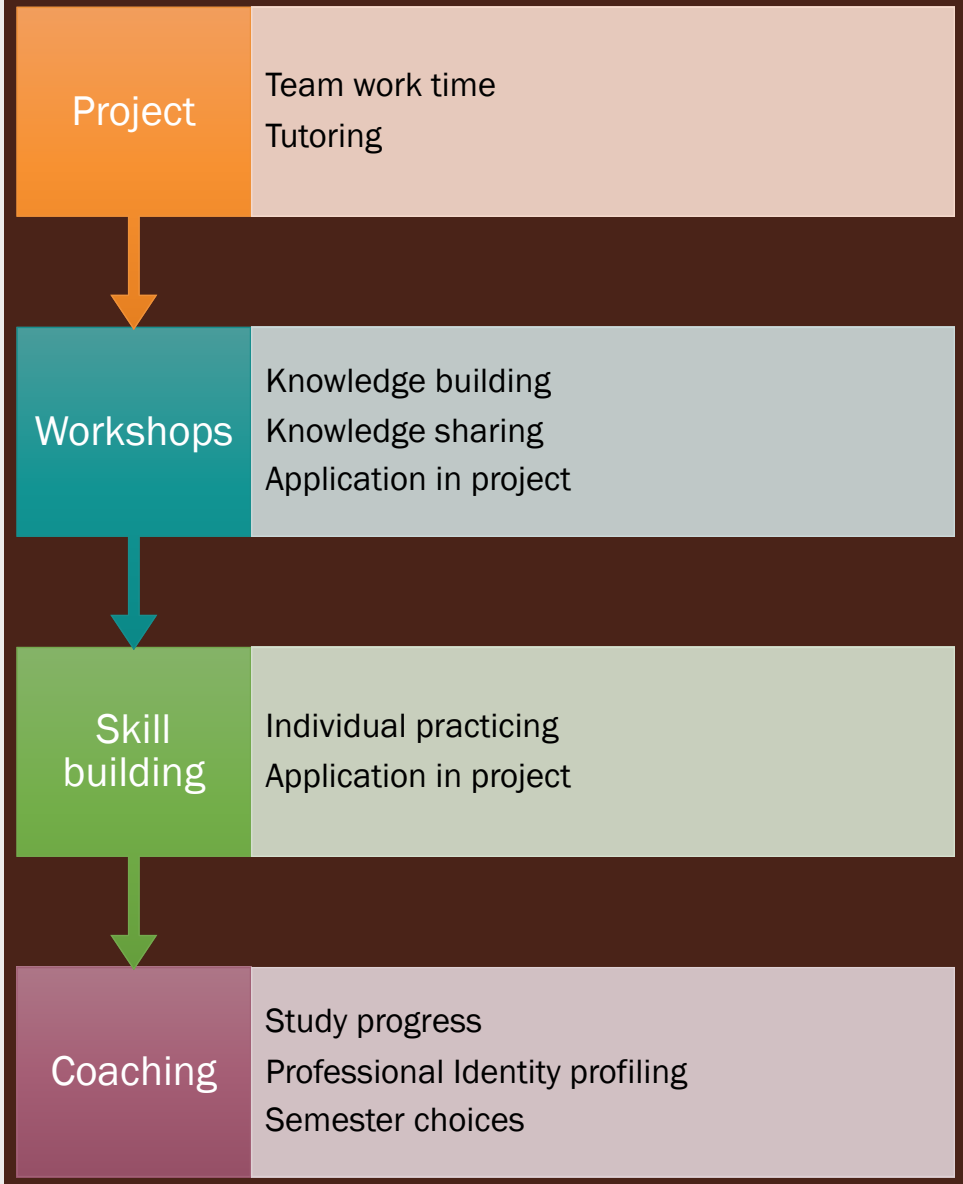
We co-created the curriculum with our lecturers, work field, alumni, students, prospective students & educational advisors

We schooled and trained ourselves to be able to teach in a flexible curriculum (coach training for all, assessment trails and calibration sessions etc)

Student Journey Map
Semester Choices
for Professional Identity Development

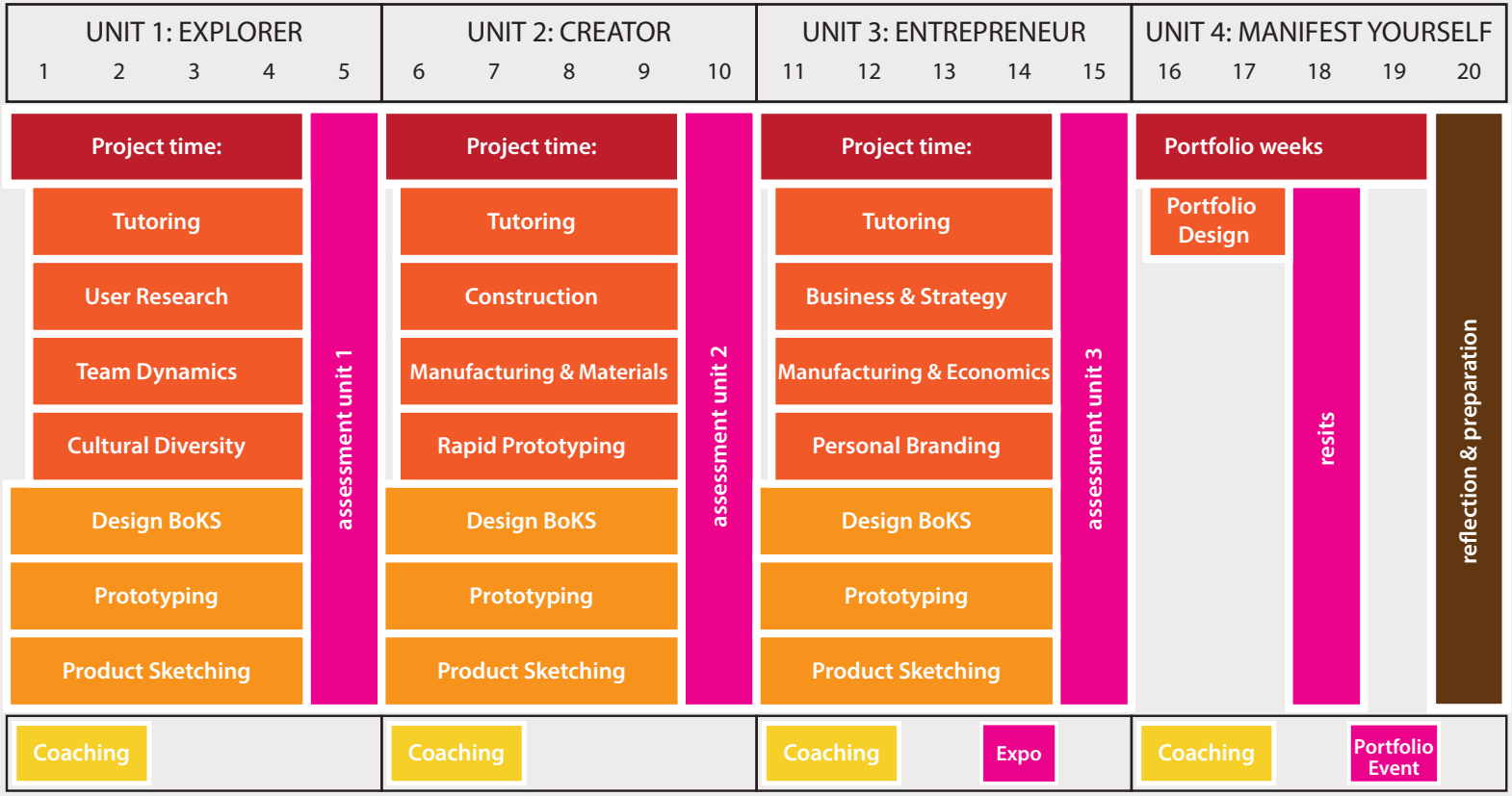
IDE Open innovator



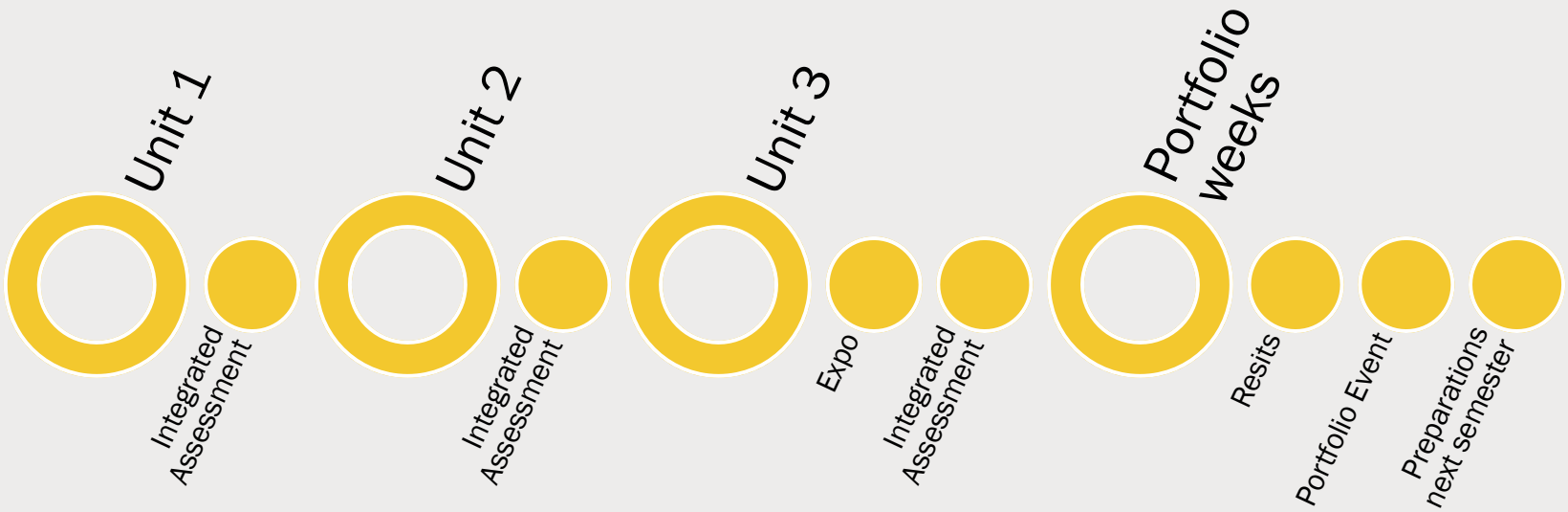


semester structure within a unit

Basics of IDE



semester structure



One programme-wide Rubric Test Matrix

Design Expertise levels	ENTRANCE level	NOVICE (apply strict rules)	ADVANCED BEGINNER (general thruths)	COMPETENT (problem solver)	THE MASTER (post bachelor)
Competencies IPO/IDE:	**Linear processing, guessing and assuming**	**Checking the boxes, following steps, explaining**	**Connecting design steps, reflecting**	**Judging, self-evaluating, reflecting, adapting, solving**	**developing and opening new ways, creating new domains**
1. Do Research					
1.1. (Re)define problems and reason analytically	Student retells client's and user's input literally	Student states client's and user needs and problems, based on general arguments	Student determines and interprets stakeholder needs and problems, based on relevant arguments	Student constructs the problem definition, based on triangulated arguments	Student adapts problem definition with client based on logical, experience-based analytical arguments
1.2. Discover knowledge by investigating and experimenting	Student finds existing general knowledge	Student investigates the user, context, needs and problems by given methods	Student discovers insights by experimentation, combining appropriate methods of the design/innovation process	Student constructs knowledge by selecting and combining the valuable outcomes of his/her experiments and investigation	Student dives deep for each new project by investigating and experimenting by prefered methods
1.3. Take external contexts into account (societal, environmental, entrepreneurial)	Student identifies societal, environmental and/or entrepreneurial factors	Student investigates and breakes down the context in the analysis phase	Student discovers insights by taking external context into account resulting in new relevant design requirements.	Student discusses and evaluates different societal, environmental and entrepreneurial factors influencing the design/innovation	Student creates nuanced image of external contexts around the project
1.4. Approach research in a (technical and) human-centered way	Student applies basic literature research methods to get insights	Student follows the steps of a human-centered research method	Student selects different research approaches to analyse technical and human centered aspects of the product/service and its context	Student evaluates the results and the selection of self-chosen methods for human centered and technical research	Student adjusts self-chosen research methods appropriately for human centered and technical research
1.5. Report on research using a practical scientific standard	Student spells correct and uses correct grammar.	Student reports on research using the required research format and reference standard	Student documents the research by combining and including the right elements	Student chooses appropriate formats for research reports, depending on the content and goal of the research.	Student applies practical research standard as the context desires

2. Design & Engineer					
2.1. Formulate design briefs containing vision and requirements, based on primary and secondary research	Student formulates a design brief from a personal perspective	Student identifies and lists basic components of a design brief	Student formulates a design brief following self-selected (research) methods	Student formulates and evaluates a design brief validating requirements and content	Student formulates a design brief after initial research in close collaboration with the stakeholders.
2.2. Use an iterative process with diverging and converging methods and techniques	Student considers the design process to be a 'straight line' process from A to B	Student iterates when requested to do so, and uses basic (given) diverging and converging techniques	Student selects and employs proper methods for the diverging and converging phases in the design process	Student selects, adapts and employs multiple methods for an iterative, diverging and converging design process	Student compiles, executes, and adapts an iterative design process, and evaluates along the way
2.3. Integrate human, market, technological, and context values during the design process	Student designs from personal values	Student identifies and integrates values of a requested or given context during the design process	Student identifies and integrates the values of the design within different contexts. These values are defined by research throughout process	Student assesses the integrated values of the design within different contexts by research and applied throughout the design process.	student offers a complete overview of the (complexity of the) context, prioritizes and pinpoints key values
2.4. Consider desirability, viability, and feasibility while designing and engineering	Student defines desirability, viability and feasibility	Student classifies desirability, viability and feasibily aspects of the design	Student analyses and incorporates desirability, viability and feasibily into the design	Student improves the design based on evaluation of desirability, viability and feasibility factors, weighing their relative importance	Student creates desirable, viable, feasible designs
2.5. Create and optimize ideas, concepts, prototypes, and product proposals	Students thinks up ideas and builds simple models	Student generates first ideas, concepts and (testing) prototypes as requested in the course using given techniques	Student generates ideas, concepts and (testing) prototypes using appropriate techniques, showing optimised detail in every iteration.	Student optimizes concepts and prototypes in detail, semi-ready for production	Student optimizes concepts and prototypes in detail, ready for production
2.6. Evaluate ideas, concepts, and (end) products based on requirements	Student generates ideas	Student generates ideas based on insights gathered by investigation/research and selects the best idea/concept based on (partly given) requirements	Student generates a list of requirements by investigation and research, and weighs and selects generated ideas and concepts based on that list	Student verifies and tests the design throughout the design process, based on a relevant, improved and updated program of requirements	Student continuously adapts list of requirements based on new insights by iterations, and verifies and tests specifications.

One programme-wide Rubric Test Matrix

3. Organise & Manage					
3.1. Work methodologically	Student follows a format	Student recognizes the methodological steps offered in the course and explains their relevance and differences	Student selects and employs methods correctly and explains why he/she has chosen this method	Student adapts chosen methods based on what the context of the projects demands	Student develops his/her own design methods
3.2. Collaborate within a design team in a multidisciplinary (international) setting	Student (occasionaly) takes part in team work	Student actively participates in group work and shares constructive feedback with team members	Student collaborates with team members from the perspective of a co-established specific role adapting to the feedback loops within the team	Student iteratively evaluates multiple team roles and dynamics and initiates and applies new strategies where and when needed	Student combines several signature roles as a designer in multidisciplinary team work
3.3. Show resourcefulness, flexibility and willingness to make decisions in fuzzy (complex) contexts	Student makes decisions when asked to	Student lists possible uncertainties and suggests argumented decisions on how to deal with these	Student follows decisions made earlier in the design process and integrates new decision making in the next steps	Student iteratively evaluates decisions made throughout the design process and recommends alternative action plans.	Student formulates a decision making strategy for an iterative design process
3.4. Show entrepreneurship or intrapreneurship	Student shows curiosity	Student outlines entrepreneurial components to the design project	Student applies intra- or entrepreneurial skills in the design process	Student formulates and integrates criteria for intra- or entrepreneurial aspects in a design process	Student elaborates on the intra- or entrepreneurial aspects in a design process
3.5. Practice project, stakeholder, time and resource management	Student plans his study activities	Student plans a first year project, lists the activities and modifies the planning to available resources, stakeholder availability, and unforeseen events during the process	Student applies and modifies a project planning and explains the adjustments made, which are based on challenges and needs of the project	Student designs and integrates a project planning and prioritises activities based on stakeholder opportunities, demands and (financial) resources	Student elaborates within the project management on planning, priorities, stakeholder opportunties/demands and (financial) resources
3.6. Break down and model systems and select relevant approaches	Student breaks down a model in several aspects based on association	Student labels relevant components of a system and explains the interrelations and applications	Student models a system and its relevant components and applies the proper application of the components and system	Student evaluates his/her model of a system with relevant arguments and defends the chosen approach towards the application of components and the system	Student compiles a system with detailed aspects and the proper approach how to deal with it

4. Communicate					
4.1. Manifest/present yourself in a (semi) professional setting	Student intuitively presents him/herself to a teacher, client or user.	Student presents his/her work to stakeholders in a clear and understandable way	Student presents work and vision on the work to stakeholders in a credible and convincing manner	Student manifests him/herself as a designer presenting his/her impact and role towards stakeholders.	Student manifests him/herself as a designer with a vision in his/her role towards stakeholders
4.2. Communicate within a team on team dynamics and (your) role	Student mentions behaviors of team members	Student examines team dynamics, connecting actions to achievements.	Students reflects on dynamics during team work and concludes bottlenecks and possible solutions	Student evaluates the team collaboration and adapts his/her own role to increase the project success	Student addresses team dynamics actively and offers effective solutions
4.3. Make deliverables tangible in a refined, communicative way	Student makes deliverables tangible in an intuitive way, based on availabe formats or personal taste	Student generates comprehensive audio/visual deliverables	Student creates communicative deliverables designed in a consistent style	Student experiments to find a consistent style fit for the purpose and target group and develops a personal style	Student manifests a consistent style with a clear personal signature
4.4. Communicate in a foreign language and/or in an international setting	Student is interested to speak in a foreign language, and/or is eager to learn about cultural differences in an international setting	Student communicates in English and identifies the impact of cultural differences in team work	Student employs cultural differences in group dynamics in the project	Student incorporates cultural differences in managing communication and content of the project	Student manifests his/her approach in communication and design concerning cultural differences
5. Learn					
5.1. Reflect on your role in projects and your impact on society as an innovator	Student mentions generic reflections when asked	Student illustrates reflection on role and impact by answering provided detailled questions (reflection-after-action)	Student interprets roles and impact, drawing conclusions from his/her reflection (reflection-after-action)	Student independently evaluates role and impact and modifies the design process accordingly (reflection-in-action).	Student integrates reflection in design process and creates professional vision on impact on society
5.2 Develop and adapt learning strategies	Student recognizes learning strategies	Student describes his/her learning strategies	Student uses learning strategies and demonstrates a developing learning curve	Student justifies learning strategies in different subjects and adapts these to new contexts	Student develops learning strategies based on self awareness, subject and learning context
5.3. Transfer and integrate acquired knowledge and experience in projects	Student recalls offered knowledge and experiences	Student discusses acquired knowledge and experience in the project	Student applies acquired knowledge and experience in the project	Student analyzes acquired knowledge and experiences and applies them in new contexts and projects	Student verifies acquired knowledge and experiences and applies them in new contexts

IDE's Reflection on using the CDIO framework for curriculum innovation

Standards and syllabus are very useful!

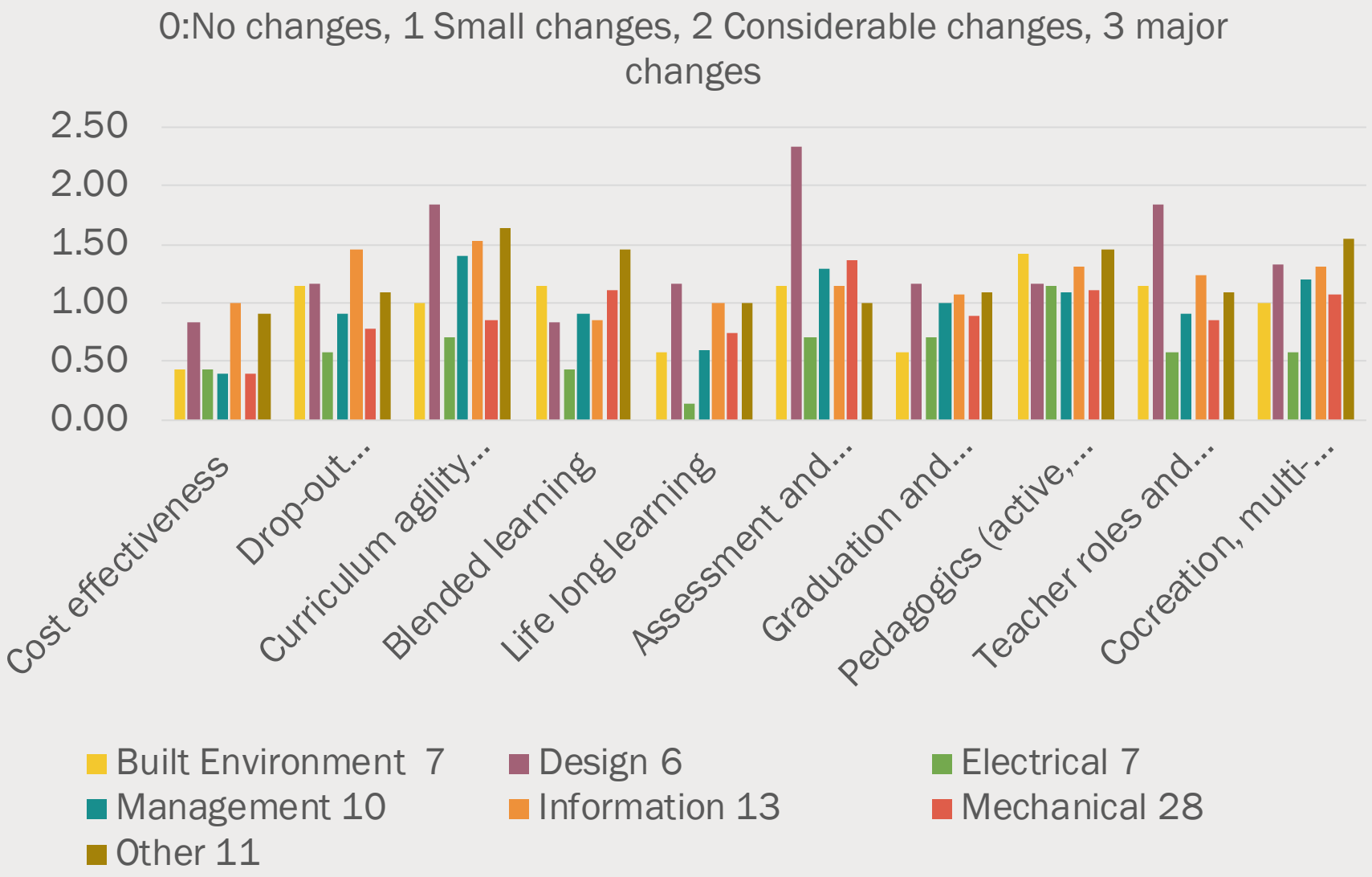
- Standard 2: Add intercultural competences beyond communicating in a different language, plus teamwork with (authentic) stakeholders
- Standard 5: Make it international, multi-disciplinary design-implement experience

- Standard 8: Active, Authentic, Autonomous Learning … Lifelong Learning Didactics
- Standard 11: Integrated Assessment for learning (and no more than 6 exams per year)
- Standard 12: Closing the evaluation circle by co–creation

Self-evaluation

- Rubric : We need a score of '6' in the CDIO when co-developing a standard in co-creation instead of checking with the stakeholders afterwards.

What we improve our curricula on these days



Survey

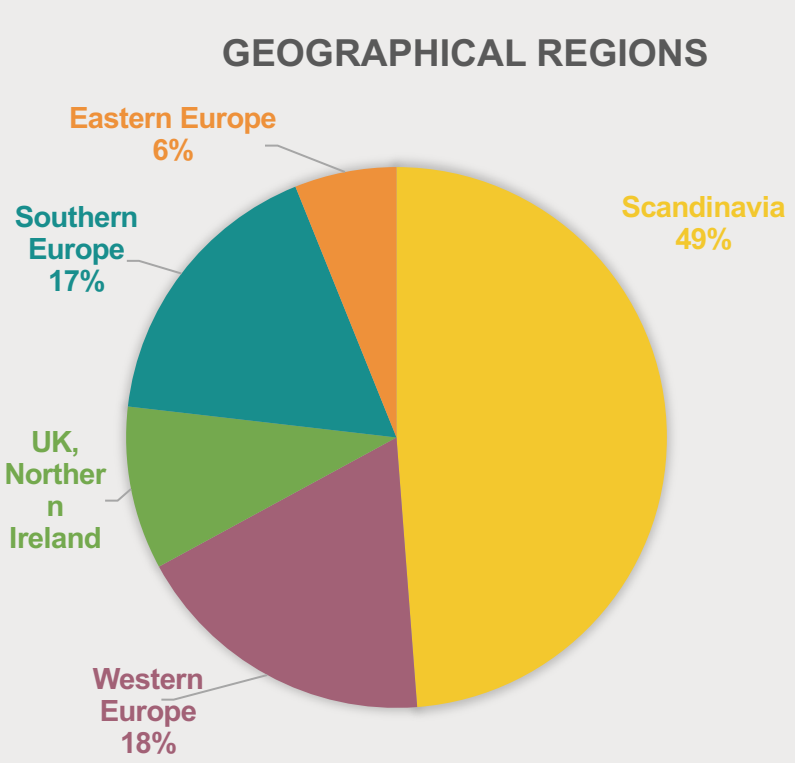
We asked engineering programs about the **kind of curriculum** they have, the current **curriculum improvements and priorities** they are making and the **barriers** they perceive along that way.

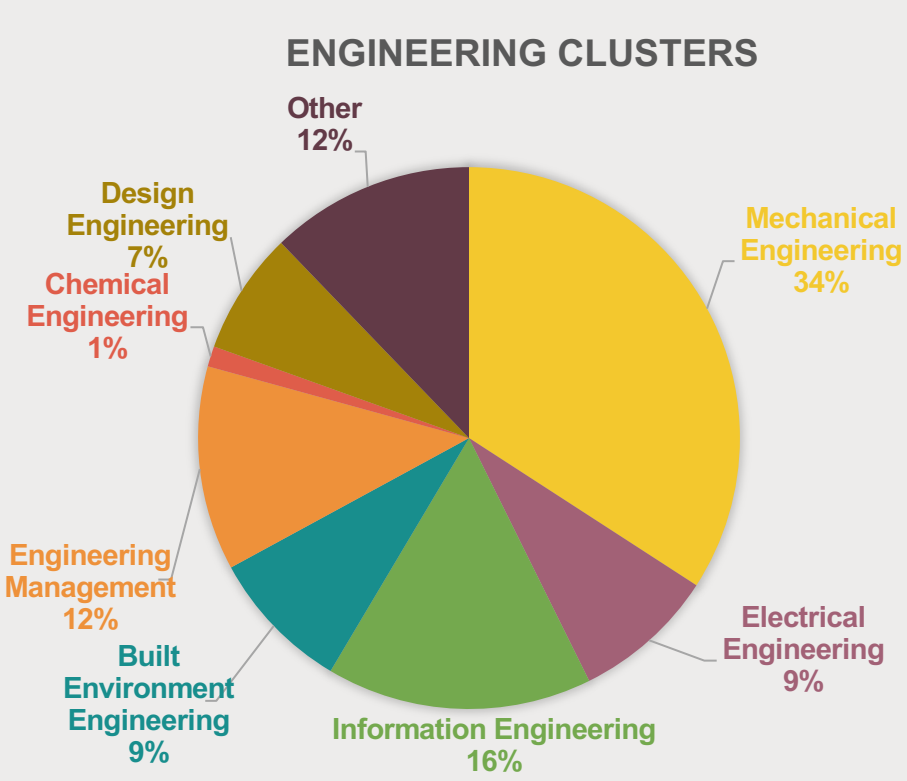
Aston University
Birmingham

UMEÅ UNIVERSITET

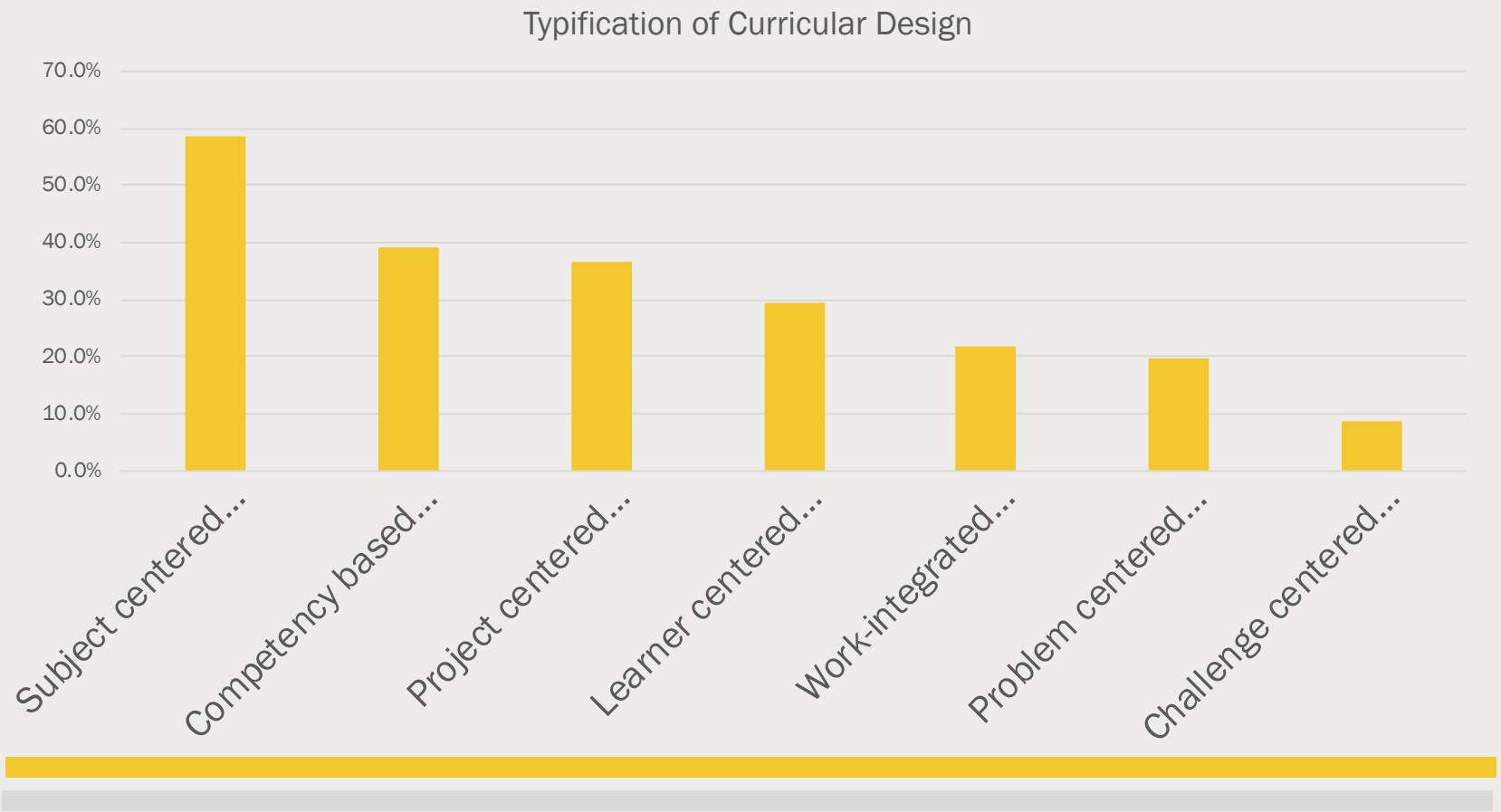
THE HAGUE
UNIVERSITY OF
APPLIED SCIENCES

82 Respondents

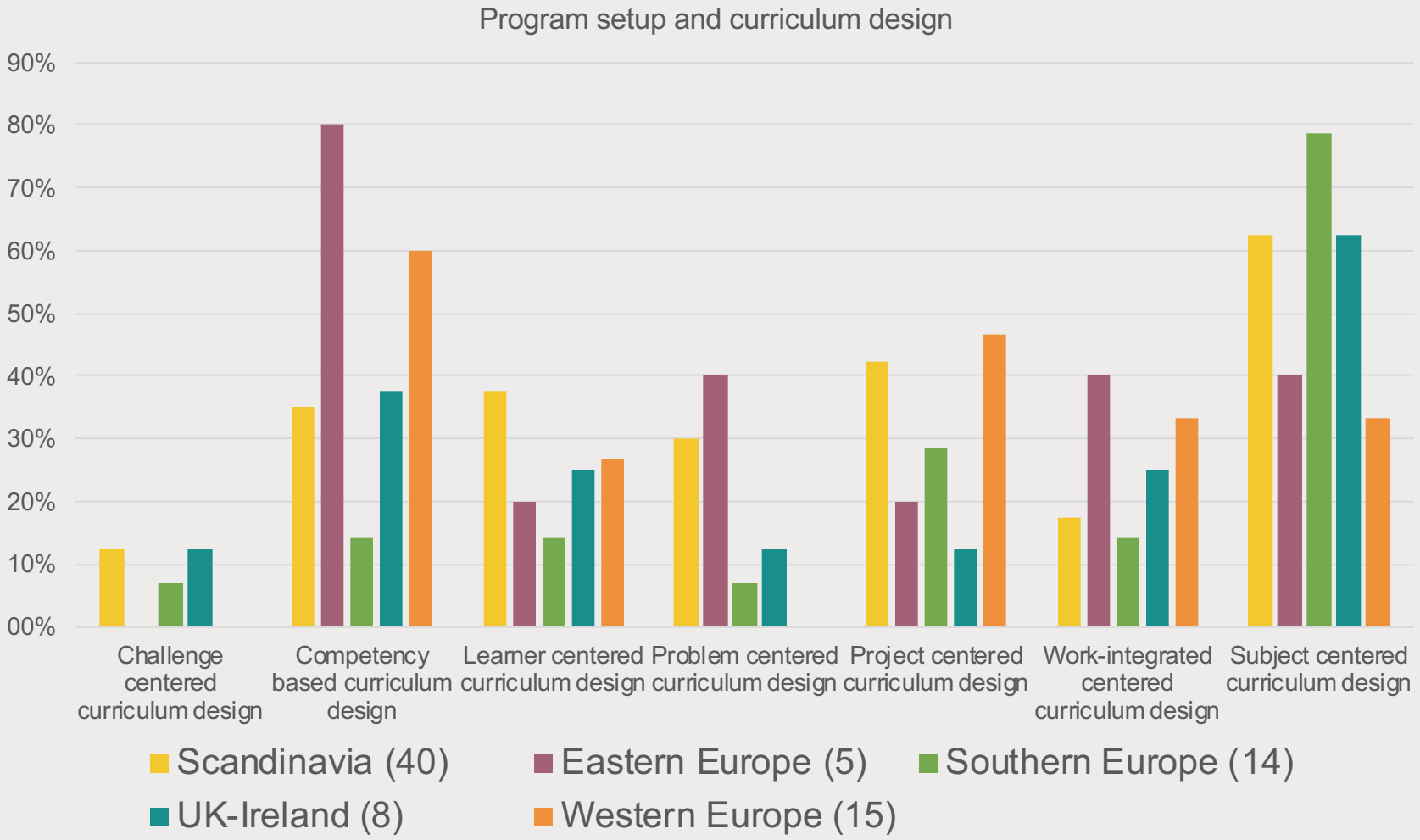




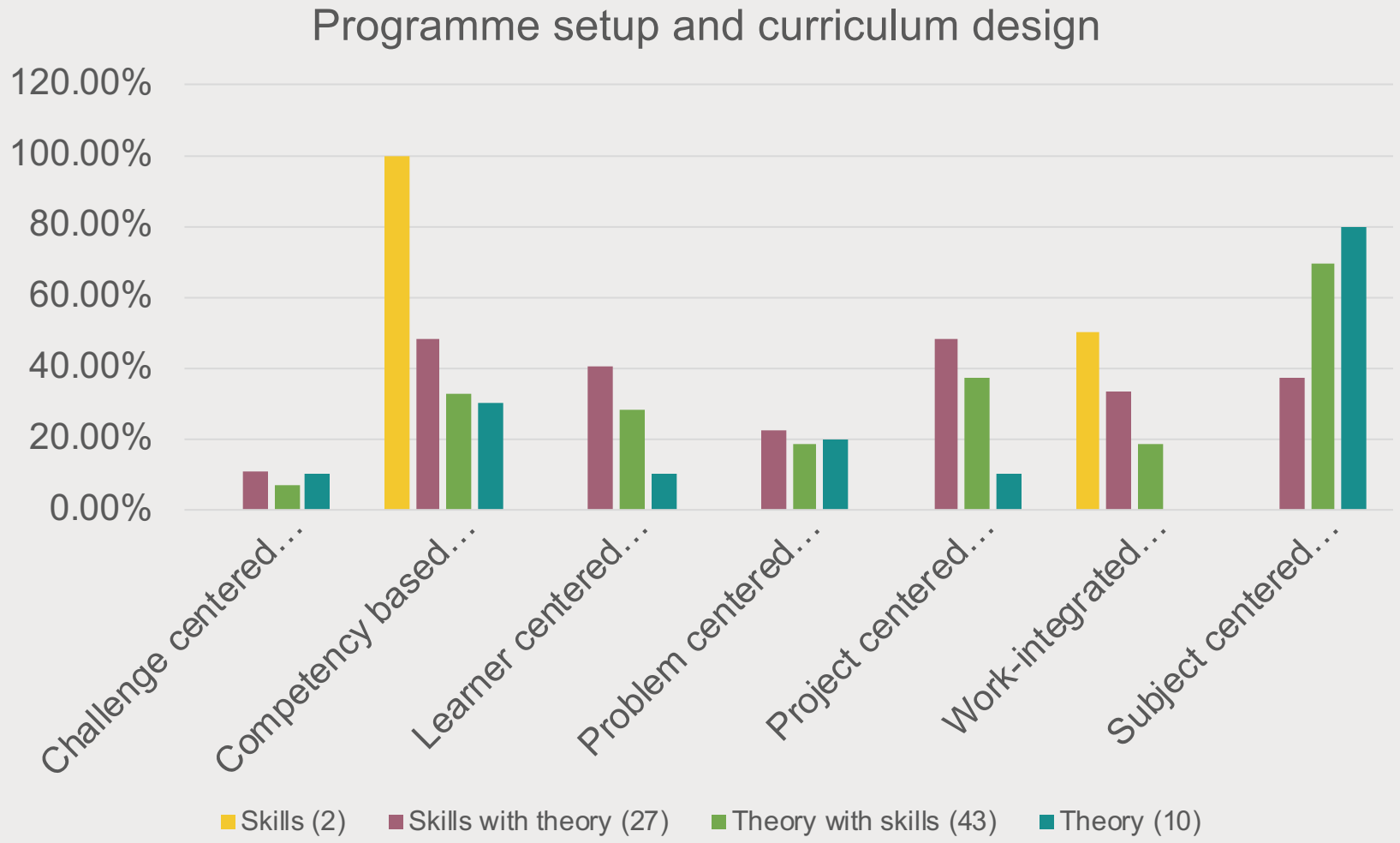
Prevailing Curricular Design



Curriculum Structure by Region



Curriculum Structure x Curriculum Focus

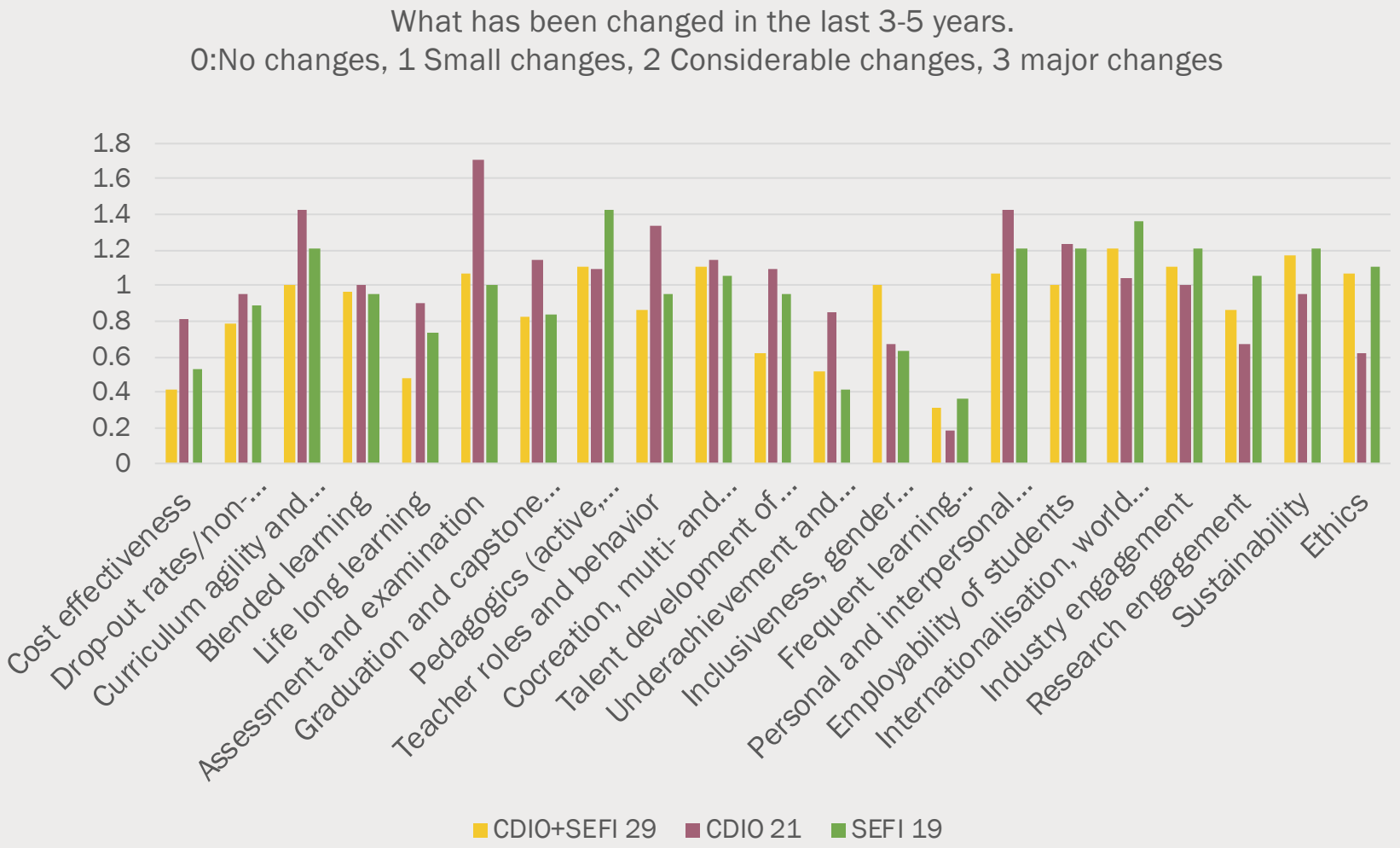


Current Curriculum Improvements

Proceedings of SEFI and CDIO conferences 2018, 2017, 2016:

- Cost effectiveness
- Drop-out rates/non-completion rates
- Curriculum Agility and Flexibility
- Blended learning
- Lifelong learning
- Assessment and Examination
- Graduation and Capstone Projects
- Pedagogics (Active, Authentic, High-Impact etc. learning)
- Teacher Roles and Behaviour
- Cocreation
- Multi- and Interdisciplinary Learning,
- Talent Development of Students
- Ethics
- Underachievement & Mediocre Student Work
- Inclusiveness
- Gender Equality
- Cultural Diversity
- Frequent Learning Disabilities (ADHD, autism, dyslexia)
- Personal and Interpersonal Skills of Students
- Employability of Students
- Internationalisation
- World Citizenship
- Industry Engagement
- Research Engagement
- Sustainability

Differences between CDIO and SEFI respondents



Most Mentioned Major Changes

- Employability of Students

- **Curriculum Agility and Flexibility**
- Assessment and Examination
- Industry Engagement

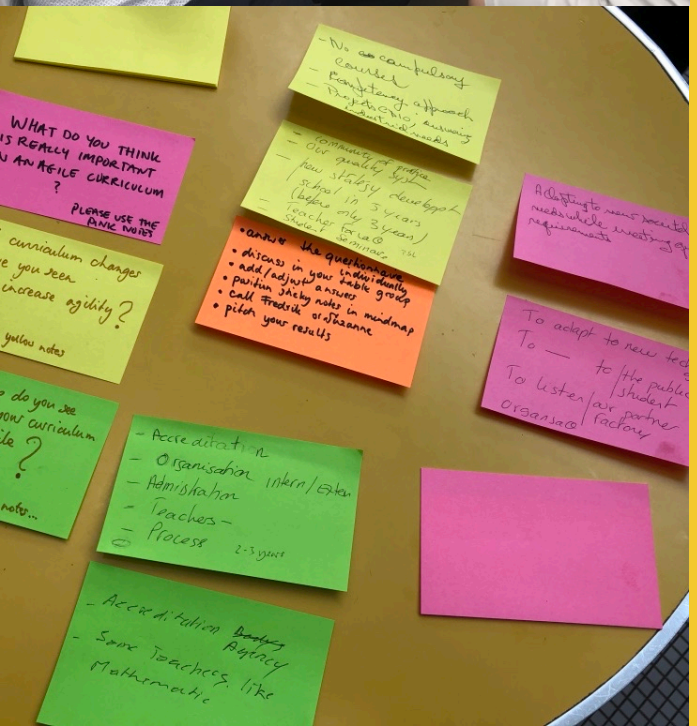
- Personal and Interpersonal Skills
- Internationalisation and World Citizenship

Not mentioned:

- Underachievement and mediocre student results
- Frequent learning disabilities

“An agile curriculum is

…responsive and adaptable to changes in societal, industrial, and student characteristics and needs, by having the capacity to change structures, learning outcomes, and learning activities in a timely manner.”



CDIO Workshops Curriculum Agility

3 sessions:

Kanazawa 2018

La Rochelle 2019

Århus 2019

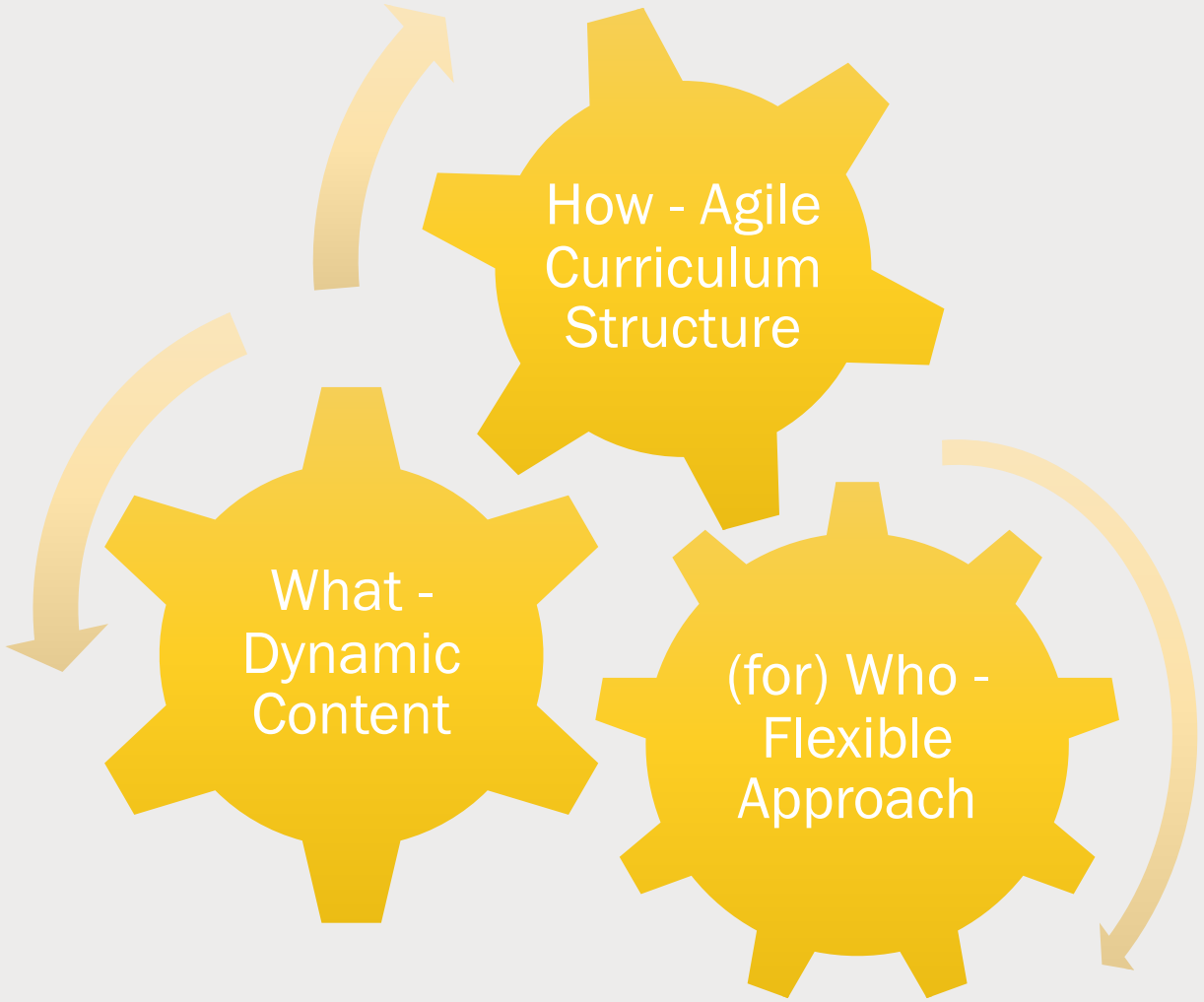
THE HAGUE UNIVERSITY OF APPLIED SCIENCES

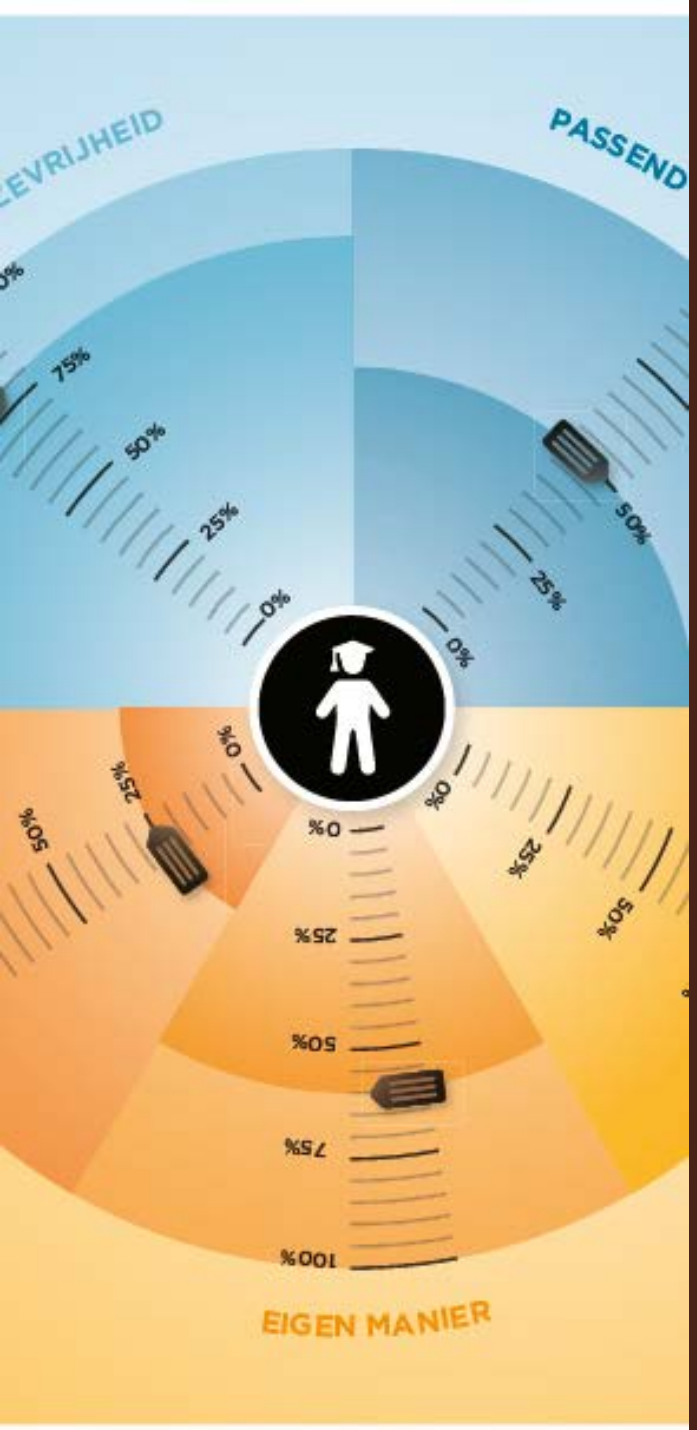
CHALMERS UNIVERSITY OF TECHNOLOGY

UMEÅ UNIVERSITET

Kanazawa

Curriculum Agility =





Flexibility within a Curriculum

What students learn:

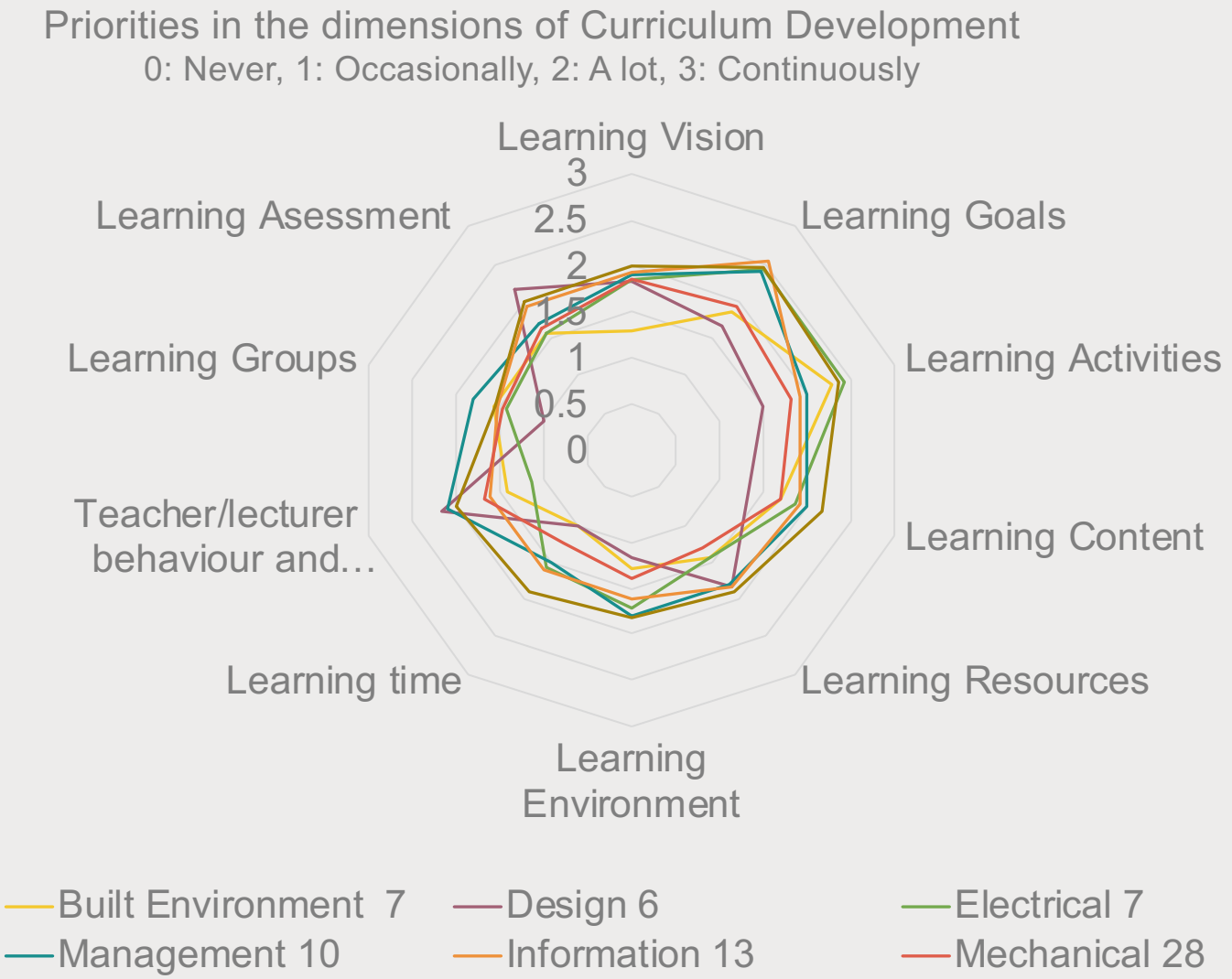
- Freedom of choice in the content
- Fitting to their background

How students learn:

- Own time, place and pace
- Own way
- Own level

– October 2019 – Suzanne Brink - Curriculum Changes towards Agility and Flexibility

Priorities in curriculum development

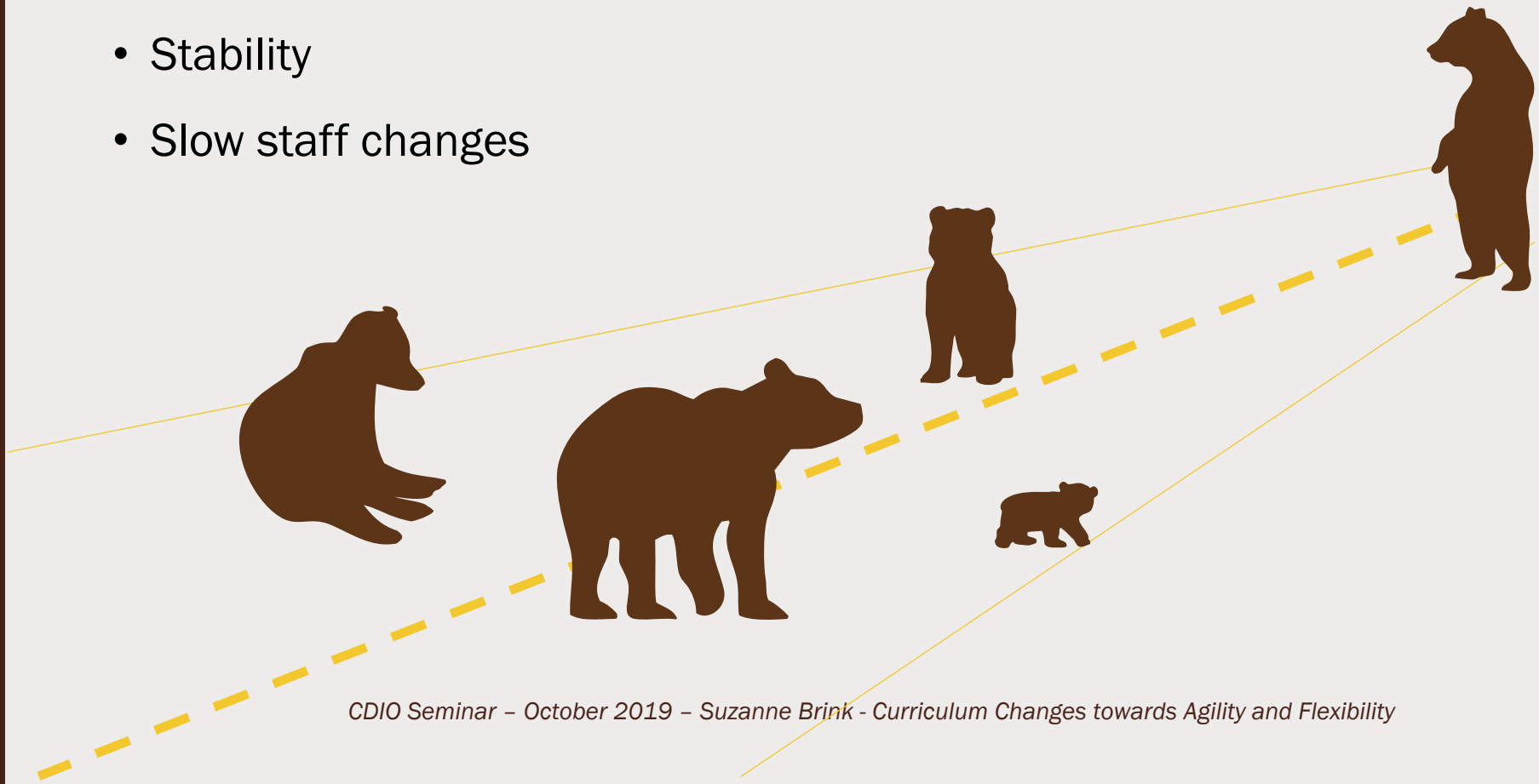


An agile curriculum is…

- aware of the changing needs of current students
- aware of the changing characteristics/demographics of students
- capable to react to those needs of students but also those of stakeholders, staff and society
- focused on developing more stable *competencies* via dynamic content
- changing to reflect societal needs for the discipline(s)
- allowing for changes within an acceptable time-frame
- facilitating multi- and interdisciplinary activities in the learning environment
- using evidence-based responsive approaches and content
- doing all of this in a timely, friction-free way

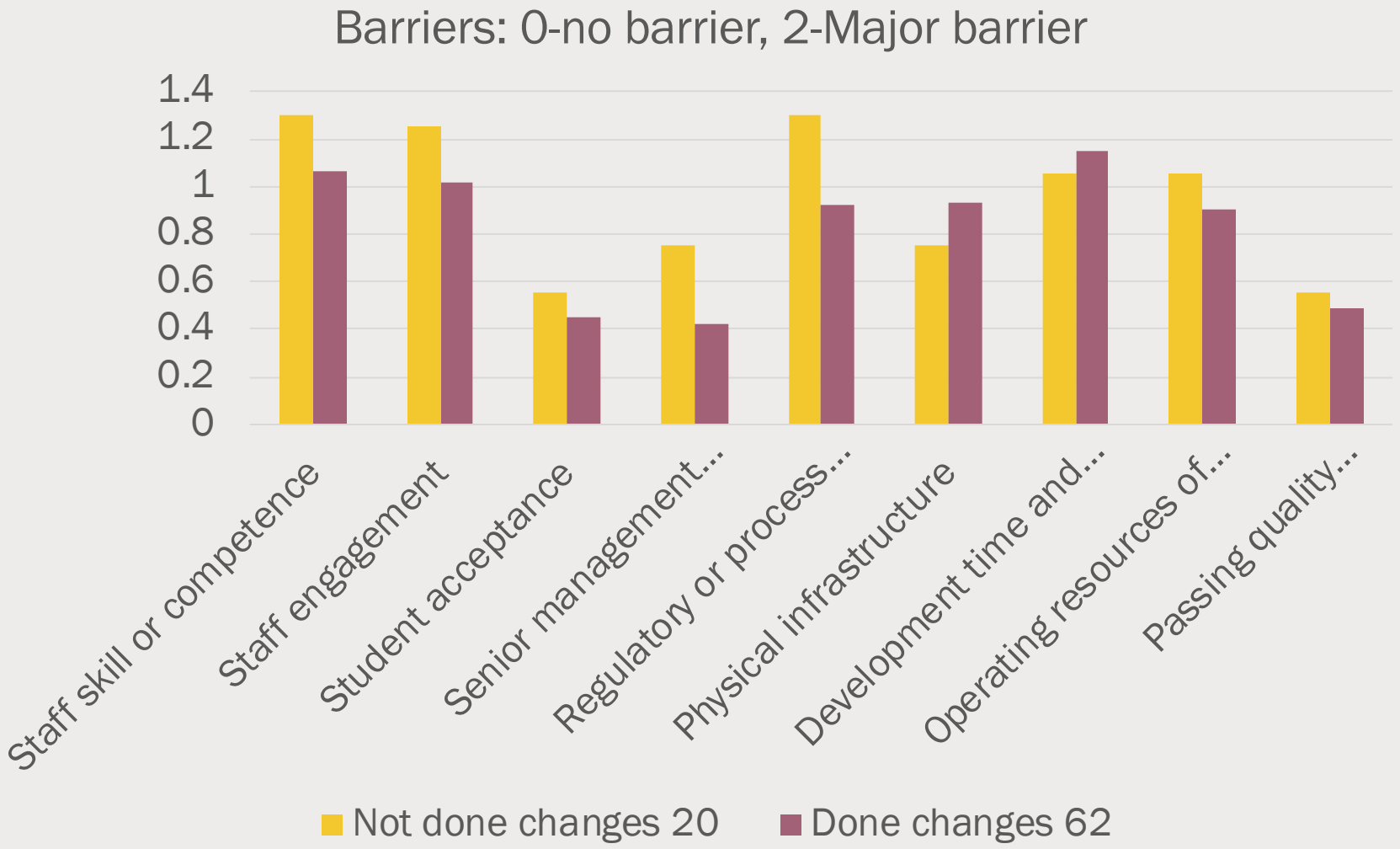
Bears on the road

- Internal, external and work field approval
- 5 year cycle of developing a curriculum
- Stability
- Slow staff changes



Perceived Barriers in Curriculum Improvement

- **Staff Skill or Competence**
- **Staff Engagement**
- Student Acceptance
- Senior Management Acceptance
- Regulatory or Process Inertia and Blocks
- Physical Infrastructure
- **Development Time and Costs**
- Operating Resources of the New Model
- Passing Quality Assurance or Accreditation.


Barriers: 0-no barrier, 2-Major barrier
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Staff skill or competence
Staff engagement
Student acceptance
Senior management...
Regulatory or process...
Physical infrastructure
Development time and...
Operating resources of...
Passing quality...
Not done changes 20
Done changes 62

La Rochelle

What do you think is really important in an agile curriculum?

Important goals

- Reactivity to change in need, professional etc.
- Ability to develop content, add new topics
- Adopt to new societal needs while meeting quality requirements
- To listen to our work field partners
- To adopt to new technology
- To adopt to the student
- To adopt to the public

Important ingredients

- Build an education where the student builds a matrix of ILOs so that a) progression and b) depth within a subject area is warranted
- Have real time connection with industry needs
- Organise mechanisms to listen to stakeholders
- Include coaching
- Include peer interaction
- Patience and hard work

Important constraints

- Students becomes “independent” of time and place
- Need for a sufficient amount of electives
- It should be socially driven and/or flexible
- Student coaching has to be subject specific

What curriculum changes have you seen to increase the agility?

- Starting a programme with a new name, so people will not have fixed ideas what must be in the programme (such is the case in e.g. 'Mechanical Engineering') and thus there is room for new things
- Inserting project courses: You can fill in a new project every time the course runs (subject courses are harder to change)
- Adopting a true competency-based (assessment) approach, so students are not assessed on certain specific knowledge, but can prove a competency with any kind of (dynamic) knowledge.
- Some free space in credits & time to do whatever students see fit to achieve personal goals
- Elective everywhere, liberal art style of programmes
- New strategy development from 3-year to 5-year programme
- CDIO projects answering industrial needs
- Community of practice
- No compulsory courses in a study programme
- Our quality systems (ISO 9001)
- Teachers using PBL method
- Student seminar
- University college is living lab
- 3+2 years could be separated
- New programs who inspire old programs
- Micro-credentials
- Combining with other partner universities

What barriers do you see to make your curriculum more agile?

- Accreditation (2)
- Accreditation agency
- Accreditation boards
- Administration (2)
- Board of exams
- Elephants: the old school traditional managers
- Organizational thresholds.

- Teachers
- Faculty motivation
- Mathematics teachers
- Unease with the unknown
- Resistance to change
- Culture within a team of lecturers

- Defense of ‘own values’ related to identity.
- Shortage of faculty skills needed for the change
- Internal organization
- Scheduling
- External organization
- Minister of higher education
- Process (it takes 2-3 years to change a course)
- Finances could be problematic

- How do you get progression between courses if courses can be taken in any order
- How can you afford small groups choosing a course

Århus

Curriculum Agility Working Group Day

Advantages Curriculum Agility

For curriculum

- Allows for educational trial and error of students
- Allows for teaching interdisciplinary perspectives

For student:

- More exploration possible (Rochester University)
- More meaning-finding (Rochester University)
- Helps them find their strengths and passion (University of the Western-Cape)
- Allows for a change of direction (University of the Western-Cape)
- Increases the numbers finishing their studies (University of the Western-Cape)

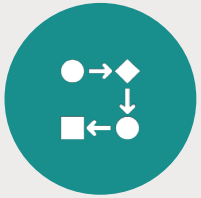
Challenges of Curriculum Agility

- Disruptive or transformational innovation
- Initiative fatigue
- Careful planning and effective leadership
- Making change stick
- Etc.

Objectives

provide an outline for identifying characteristics of an agile education

analyse good practice



suggest routines that need to be established

discuss how this work relates to the CDIO standards

Principles for an agile education:

- Stakeholder dialogues to identify the changing needs
- Keep organization and governance needs into account
- Appropriate decision making, (dis)approval processes
- Initiatives and execution, stakeholder engagement throughout
- Entrepreneurial management, proactive change culture
- Innovation, responsive to change
- Pedagogy and didactics, scholarship of teaching
- Customized, flexible curriculum design, learning outcomes and student profiles

Next actions

- No separate standard is necessary
- map the principles against the CDIO standards in a **matrix**
- when necessary, formulate new (specific) emphasis and additional good practices within the standards
- to be continued…. @ CDIO Bangkok

What do you take home from this presentation?

If you can spare 7 minutes, your input is still desired:

Curricular Changes

in European Higher Engineering & Design Education

https://tinyurl.com/y6xq5bk5

This survey aims to map current curriculum designs and curriculum changes in Europe's engineering education, in connection to membership of international engineering networks and current curriculum innovation trends.