UNIVERSITY OF TWENTE.

TEACHER LEARNING IN DESIGN-CENTRIC PARTNERSHIPS

SUSAN MCKENNEY

Our very reason for existing is to

- Engage in ground-breaking research
- Have profound societal impact
- Excel in Innovative Education
- Construct multi-disciplinary answers
  to the grand challenges of tomorrow's world

UNIVERSITY OF TWENTE.

Zoeken

Welkom bij ELAN

Opleidingen en Professionele Ontwikkeling +

Onderzoek

Pre-U

Medewerkers

Contact

Nieuws

ELAN bijdragen ORD Antwerpen juni 2017 +

18 mei 2017: symposium en oraties +

NL | EN | DE

FACULTEIT BMS | ELAN Docentontwikkeling

ELAN is het Instituut voor lerarenopleiding en professionele docentontwikkeling van de Universiteit Twente. ELAN verzorgt de eerstegraads lerarenopleiding Science Education, de eerstegraads lerarenopleiding maatschappijleer & maatschappijwetenschappen en de educatieve minor Leren Lesgeven die via een aanvullend programma kan leiden tot een lesbevoegdheid onderbouw. Onder het thema 'Advances in Theory and Practice of Teacher Professional Development' verricht ELAN onderzoek naar de professionalisering van docenten, in science onderwijs en science-gerelateerde maatschappelijke vraagstukken. ELAN werkt nauw samen met Pre-U, het pre university college van de UT, dat activiteiten verzorgt op het gebied van outreach, wetenschapseducatie en talentontwikkeling.

FEEDBACK

x ; x∈ℝ
f : x → p(x) / q(x)
1)
2)
3)

DESIGN-CENTRIC RESEARCH-PRACTICE PARTNERSHIPS

DC-RPPS

THIS PRESENTATION

1: Infrastructure for teacher professional growth

2: DC-RPPs as infrastructure for professional growth

3: Moving forward: Tensions & possibilities

HOW-TO RESOURCES ALSO AVAILABLE

McKenney, S. (2016). **Researcher-practitioner collaboration in educational design research: Processes, roles, values & expectations.** In M. Evans, M. Packer & K. Sawyer (Eds.) Reflections on the Learning Sciences (pp. 155-188). New York: Cambridge University Press.

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INFRASTRUCTURE FOR TEACHER PROFESSIONAL GROWTH

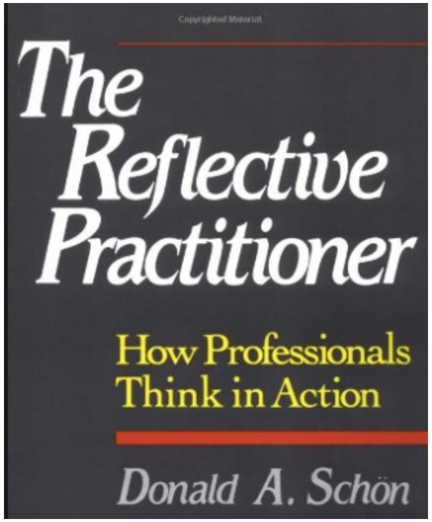
PART 1

CORE TASKS PERFORMED BY TEACHERS

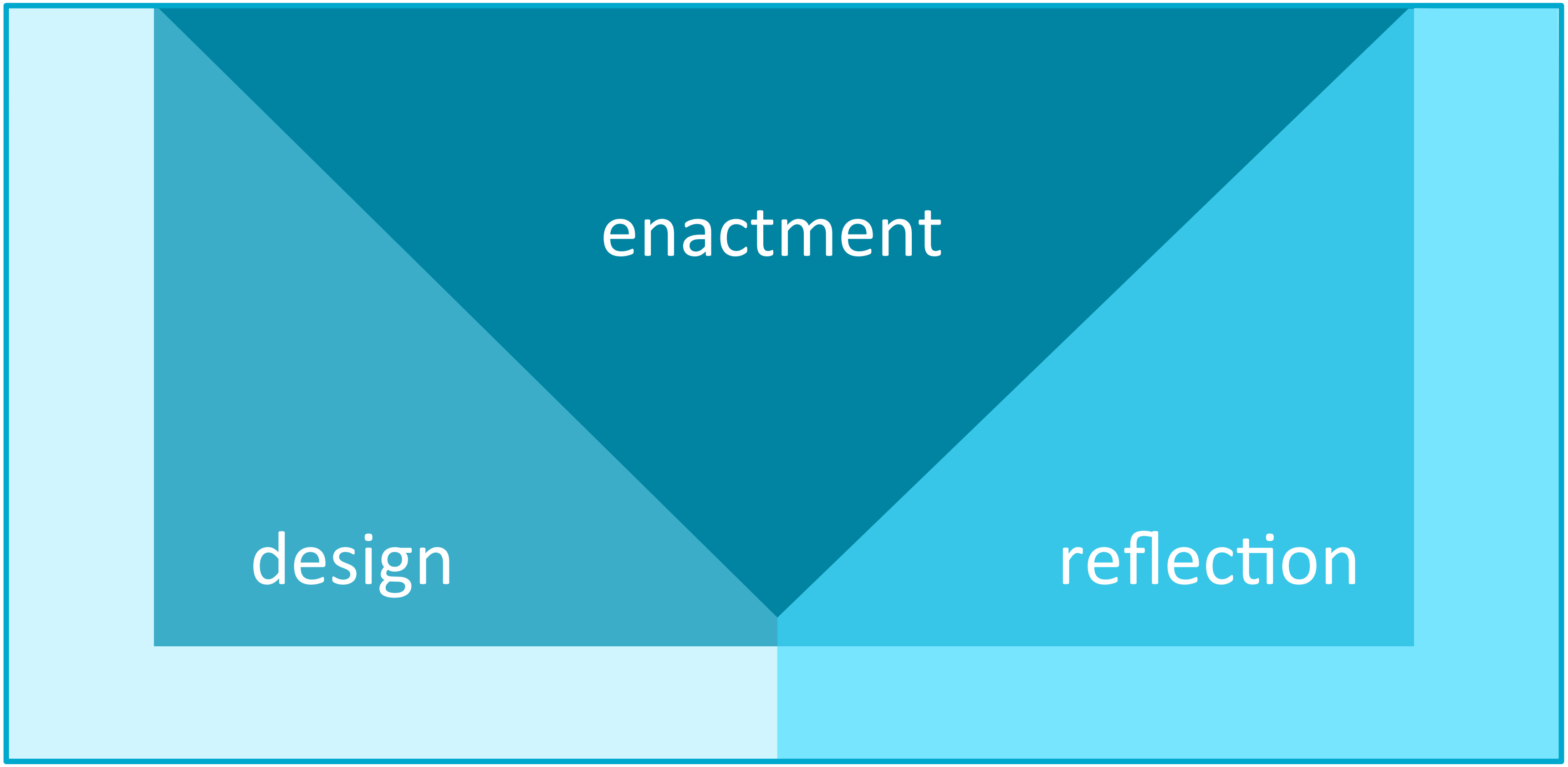
DESIGN

ENACTMENT

REFLECTION



CORE TASKS PERFORMED BY TEACHERS



KEY EXPERTISE FOR TEACHING

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KNOWLEDGE	*Fundamental*: learners, subject matter, pedagogy, integrated knowledge of these three *Enabling:* curriculum, assessment, and learning environments

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SKILLS	Crafting activities and resources Facilitating development of norms and discourse Noticing salient features Reflecting on own practice

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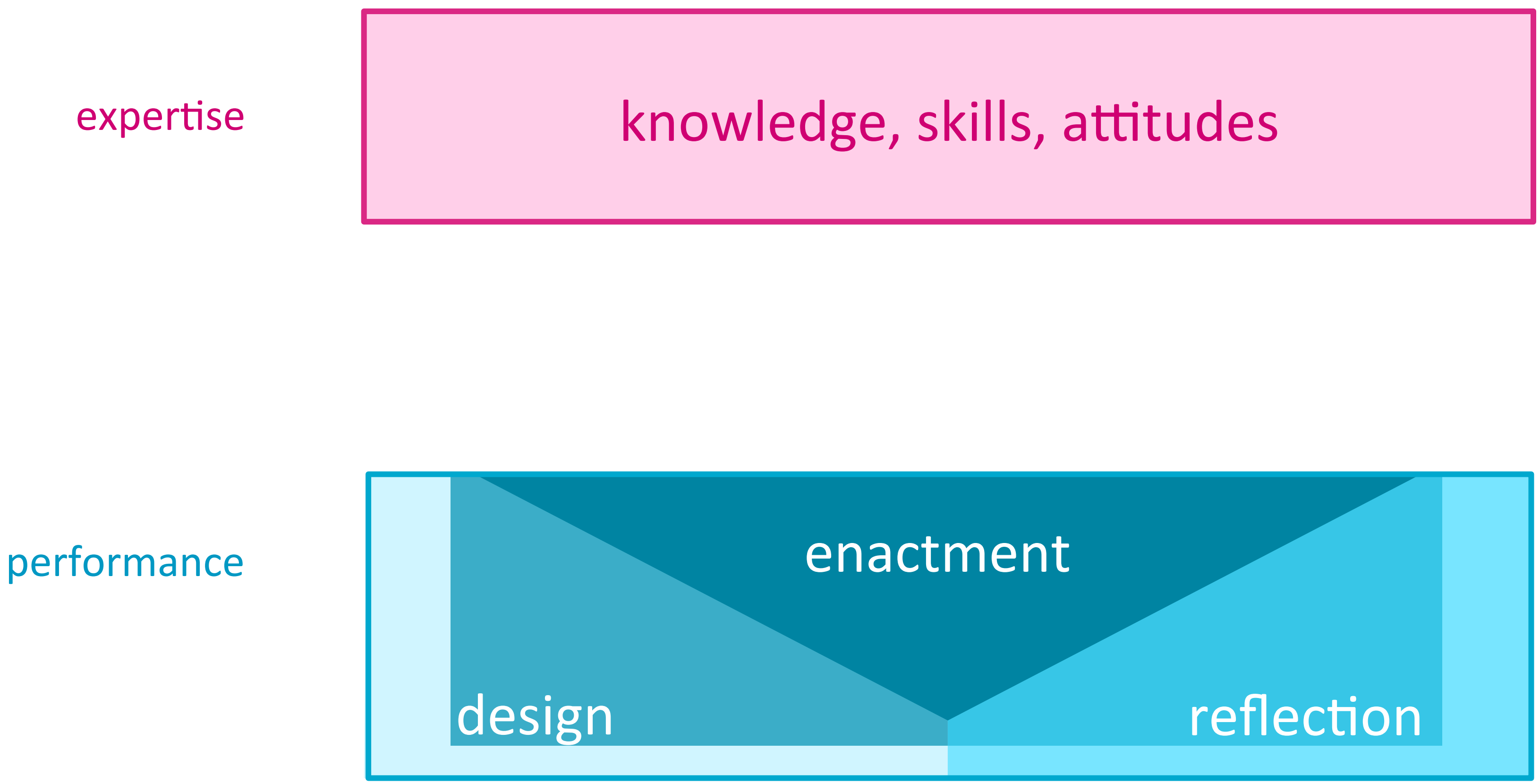
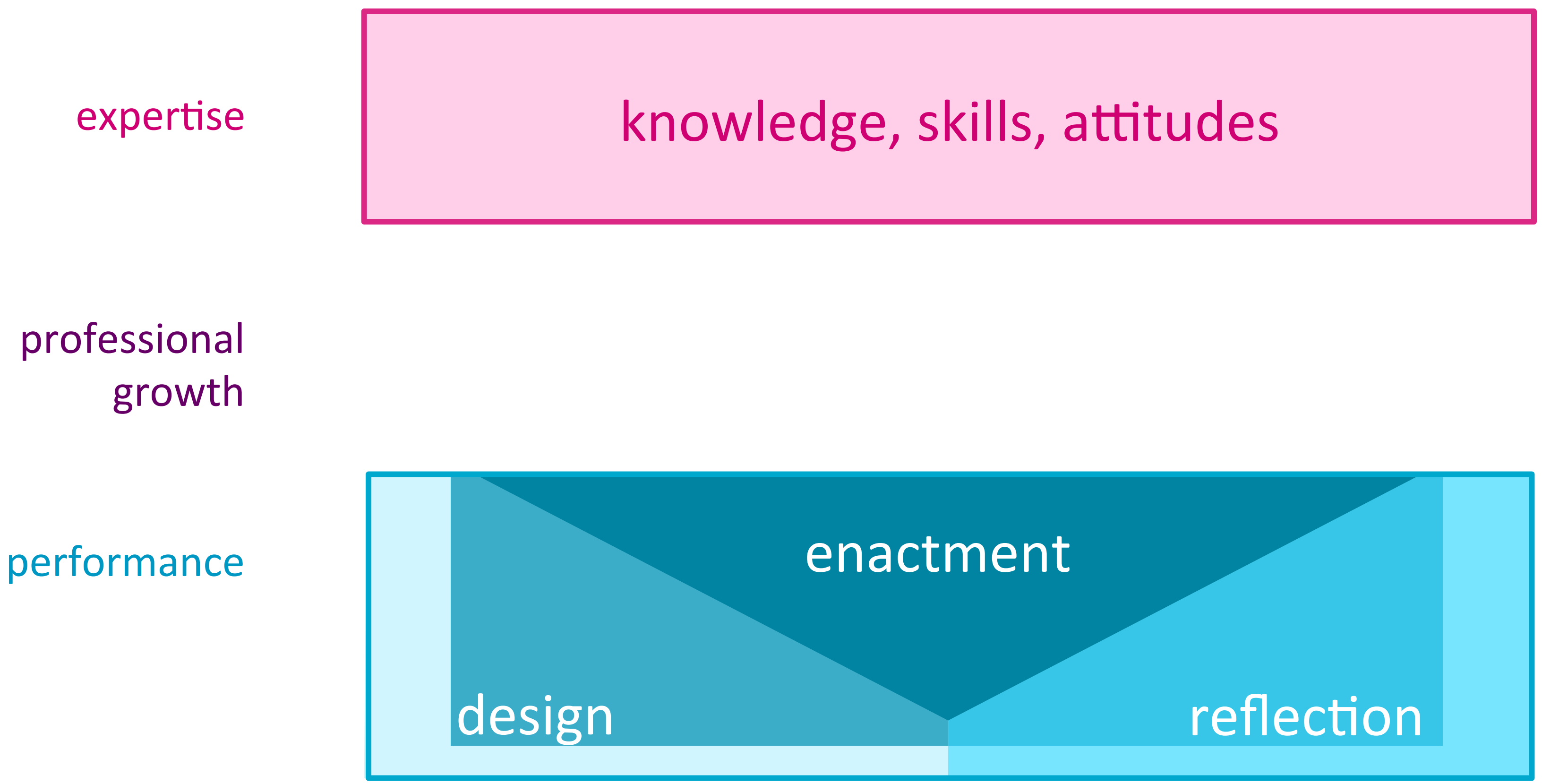
SKILLS	Crafting activities and resources Facilitating development of norms and discourse Noticing salient features Reflecting on own practice
ATTITUDES	Beliefs about learners and pedagogies Perceptions of value of external goals Convictions regarding professional identity

EXPERTISE FOR AND THROUGH PERFORMANCE

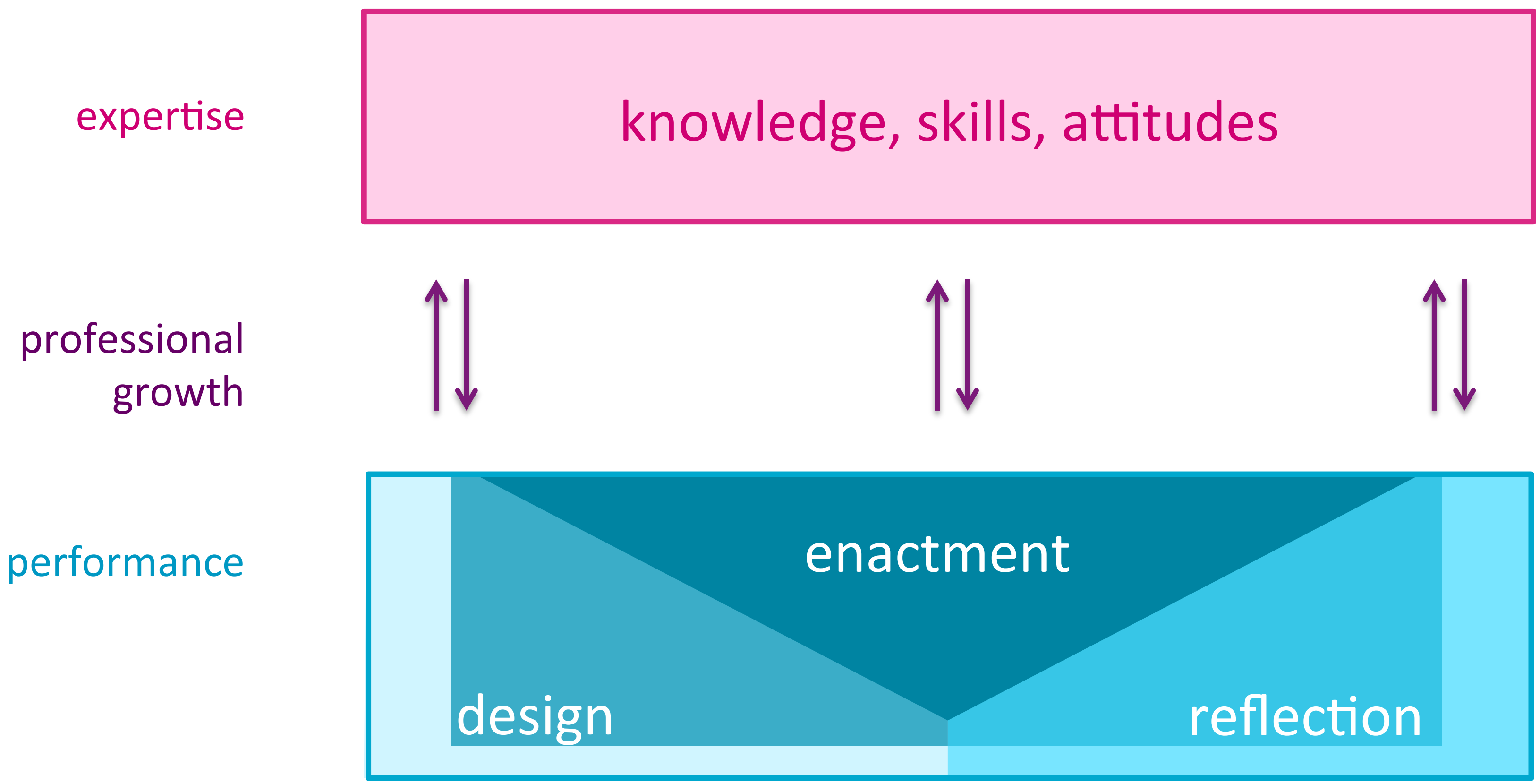


STRUCTURE OF EXPERTISE

EXPERTISE FOR AND THROUGH PERFORMANCE



EXPERTISE FOR AND THROUGH PERFORMANCE



GROWTH THROUGH INTERACTION: EXAMPLES

PERFORMANCE		EXPERTISE => PERFORMANCE	PERFORMANCE => EXPERTISE
	DESIGN	Use pedagogical content knowledge to differentiate learning activities	Create new pedagogical routines through design
	ENACTMENT	Use interaction skills to manage classroom disruptions	Automate communication routines through practice
	REFLECTION	Use formative assessment to identify areas for improvement	Identify patterns in learner thinking through reflection

PROFESSIONAL GROWTH IN CONTEXT

Ministerie van Onderwijs, Cultuur en Wetenschap

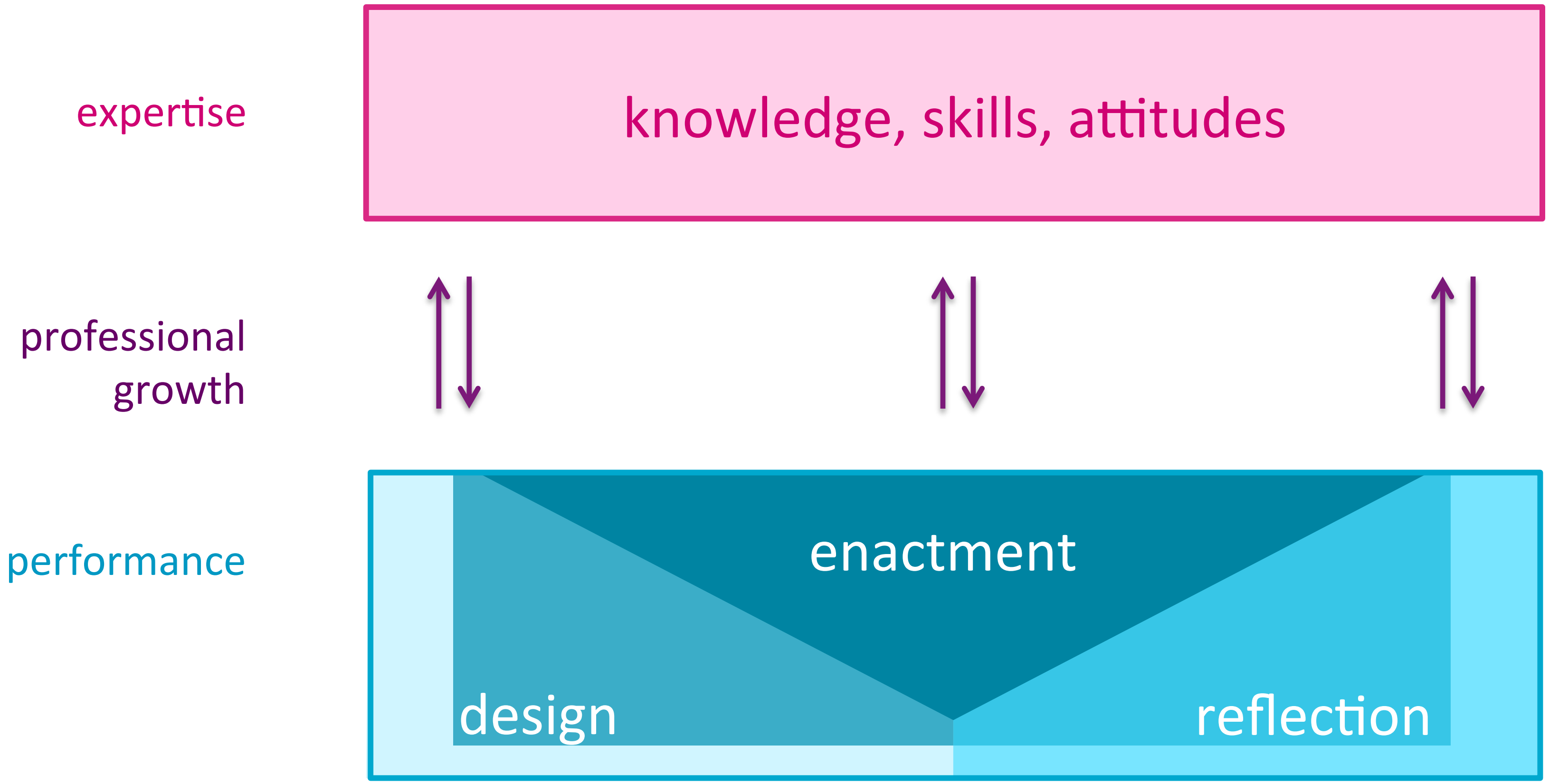
UNIVERSITY CODE, POLICIES, AND GUIDELINES

HUMAN

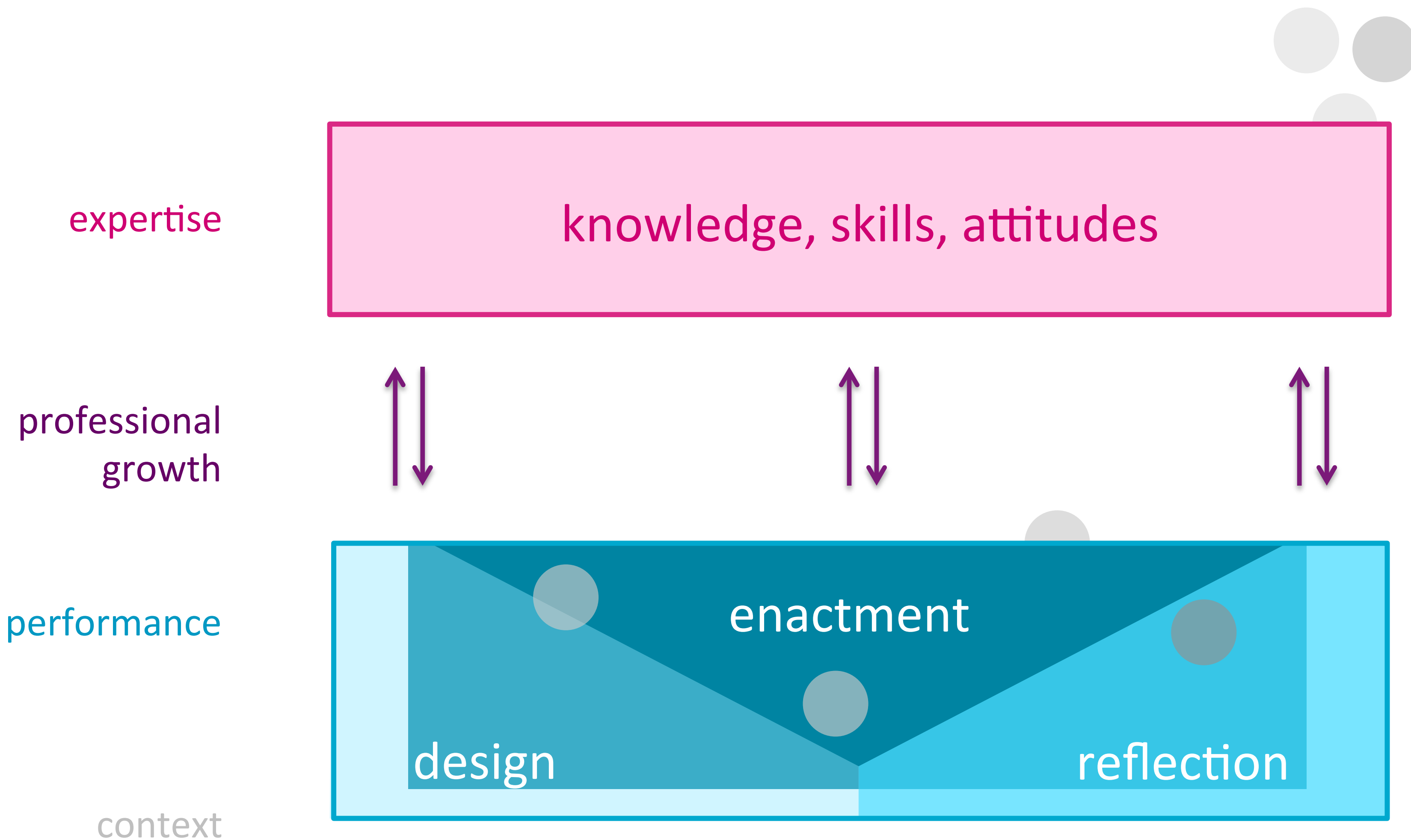
MATERIAL

STRUCTURAL

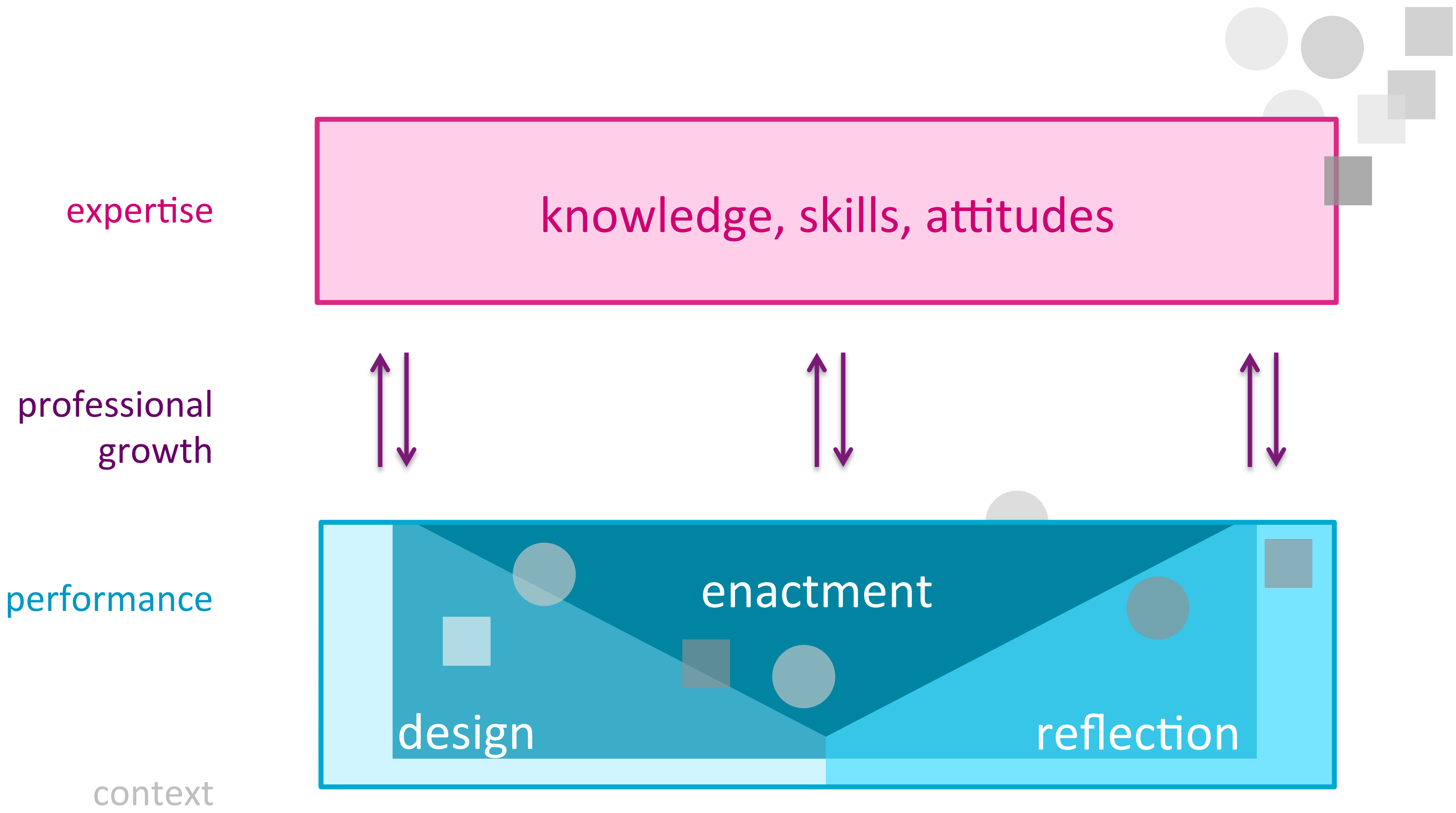
THE SITUATEDNESS OF PROFESSIONAL GROWTH



THE SITUATEDNESS OF PROFESSIONAL GROWTH



THE SITUATEDNESS OF PROFESSIONAL GROWTH



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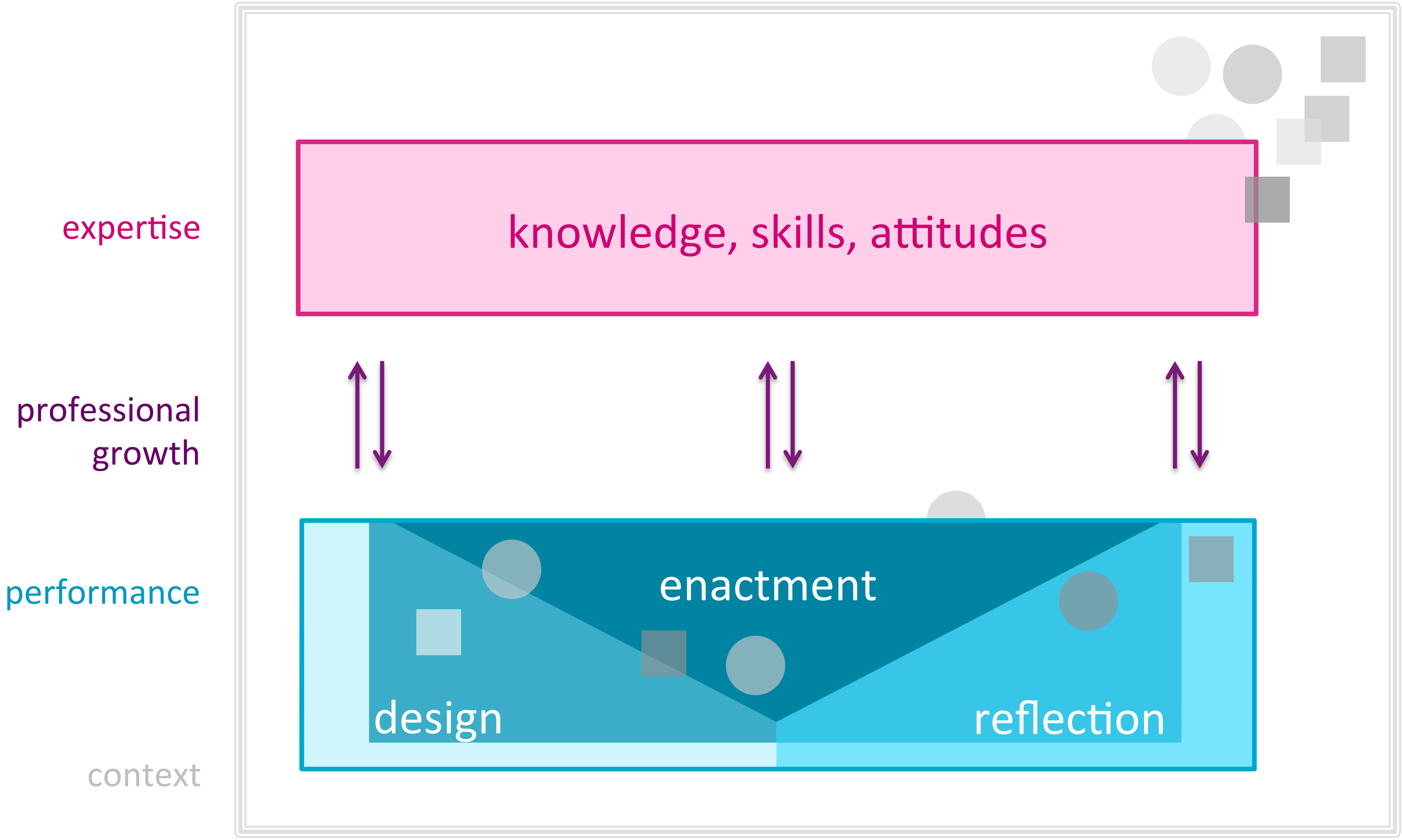
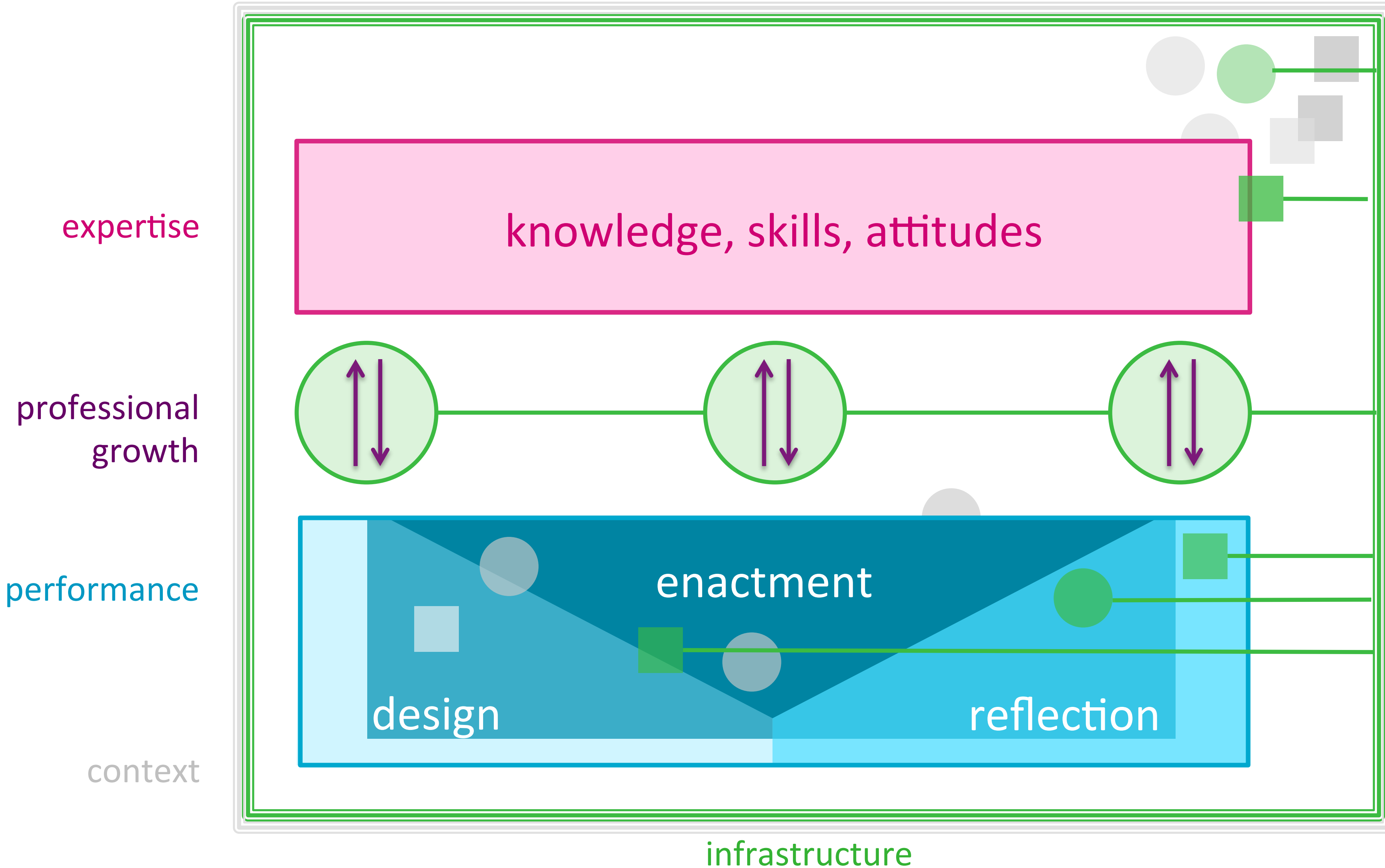


INFRASTRUCTURE FOR PROFESSIONAL GROWTH



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DC-RPPS AS INFRASTRUCTURE FOR TEACHER PROFESSIONAL GROWTH

PART 2

SITUATING DC-RPPS
DESIGN-BASED (IMPLEMENTATION) RESEARCH

3 main outcomes

- Designed solutions
- Professional development of participants
- Theoretical understanding

Core processes

- Analyze existing and past situations to understand people, problems, context
- Design generative solutions in and with practice
- Evaluate successive approximations of interventions

Penuel, W. R., Fishman, B. J., Haugan Cheng, B., & Sabelli, N. (2011). Organizing research and development at the intersection of learning, implementation, and design. *Educational Researcher*, 40(7), 331-337.

McKenney, S. & Reeves, T. C. (2012). *Conducting educational design research*. London: Routledge

learndbir.org
www.educationaldesignresearch.org
international.slo.nl/edr/

DC-RPP EXAMPLE: IMPULS

Cutting-edge university research gives new meaning to STEM learning in high school

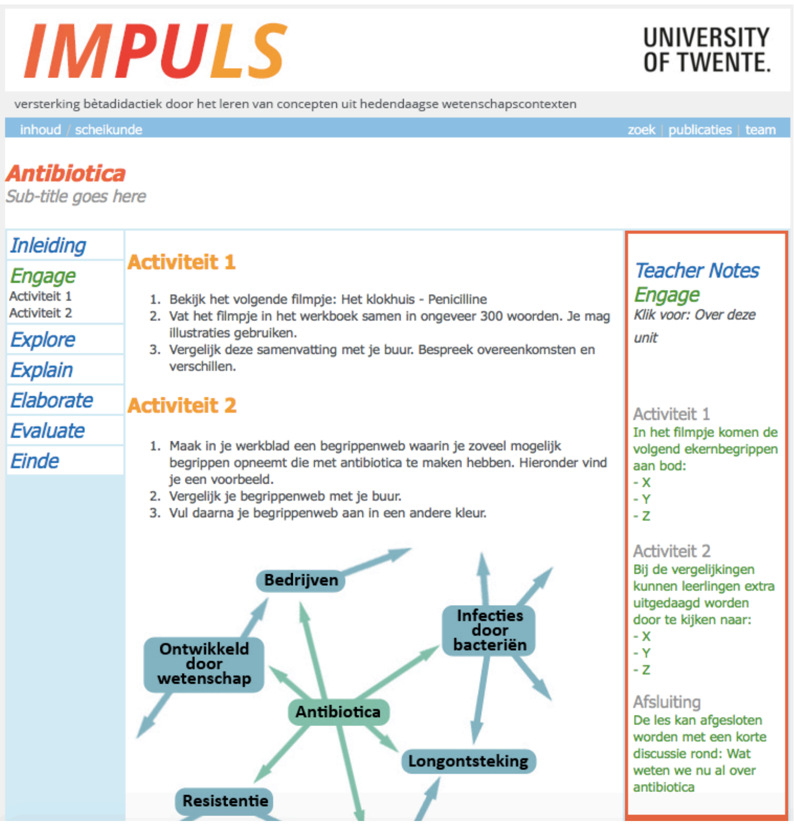
Research area	High school course	Context for learning
Quantum mechanics	Physics	Scanning tunneling microscope
Molecular nanofabrication	Chemistry	Early cancer diagnosis
Game theory	Mathematics	Game development
Social robots	Computer science	Facial expressions
Lab-on-a-chip	Nature, life & technology	Portable cell separation

DC RPP EXAMPLE: APPROACH

- Multidisciplinary design teams
  - Professors & graduate students from STEM fields
  - Teacher educators & education students
  - High school (pre- and inservice) teachers

- Evidence-informed development cycles
  - Analysis: Literature review & data collection
  - Design: Skeleton, evolutionary prototypes
  - Evaluation: Screening, pilots, field testing

DC RPP EXAMPLE: OUTCOMES



DC-RPP EXAMPLE: GROWTH INFRASTRUCTURE

- Expertise-performance interactions
  - PCK, pedagogy (5E model, context-based learning)
  - Crafting activities and resources
  - Especially during design and reflection, enactment limited so far

- Infrastructure
  - **Human**: Team composition
  - **Material**: Website template, research tools
  - **Structural**: TDTs, learner lab on campus, partner school network

PERSPECTIVES ON DC-RPPS
3 LENSES & 3 CASES

TEACHER RESEARCH

SCHOLARSHIP OF TEACHING & LEARNING, TEACHER INQUIRY

Teachers learn about

- learners
- pedagogy
- PCK

Core processes

- Systematic investigation of questions that relate own practice and student learning
- Within a professional community of teaching,
- While committing to sharing findings, negotiating, and refining cross-cutting principles

Cochran-Smith, M., & Lytle, S. L. (2009). Inquiry as stance: Practitioner research for the next generation. New York: Teachers College Press.

Hutchings, P., & Shulman, L. S. (1999). The scholarship of teaching: New elaborations, new developments. *Change, 31*(5), 10–15.

Trigwell, K., Martin, E., Benjamin, J., & Prosser, M. (2000). Scholarship of teaching: A model. *Higher Education Research and Development, 19*(2), 155-168.

DC-RPP1: TWENTE EDUCATION MODEL (TOM)

TOM is the model with which the University of Twente decided to match its vision and goals for undergraduate education to insights from the study of higher education.
There are three core aspects of TOM:

1. **Three professional roles,**
2. **Student-driven learning, and**
3. **Module and project-based work.**

1. THREE PROFESSIONAL ROLES

The University of Twente wants to train highly skilled professionals who are able to critically assess, combine and apply scientific knowledge, and to add new knowledge. According to the UT's vision on teaching, students must learn to function in three roles to achieve this: being a researcher, a designer, and an organizer.
The best way to learn this is by taking on these roles in the curriculum by working on projects as soon as possible. Throughout their studies, students can discover which roles suites them best. They become adept in a certain field of learning, but will also discover where their true strengths are lying - professionally and personally.

2. STUDENT-DRIVEN LEARNING

Flexibility and an entrepreneurial attitude are not developed in a lecture hall. To better prepare students for an uncertain future, the aim is to have them at the helm of their education as much as possible. This approach to learning is what we call Student-driven Learning (SDL).
In SDL students can make decisions in what they want to learn, how they want to learn and when, but this does not mean that students decide on all these aspects. Some of these aspects can be more 'student-driven' than others.
In its current form, TOM is made student-driven mostly by projects that not only help students assess their understanding and develop skills, but also invite them to ask new questions and seek other ways of learning. However, module designers can go further and find other ways of activating students and making them less dependent on course-book lecturing.
Read the Student-driven Learning brochure for more information about SDL at the University of Twente.
www.utwente.nl/sdl

3. MODULE AND PROJECT-BASED WORK

All our bachelor programmes consist of modules, organized in 10-week, fulltime thematic units of each 15 ECTS. Every module has a theme with all sorts of subjects and learning activities, such as feedback sessions with students, workshops and lectures. Central to each module is a project in which students address a real-world problem. This way, students put scientific theory into practice. Challenging and exciting!

A CLOSER LOOK

TOM-modules preferably utilise different educational methods. One method, in which the University of Twente has a long tradition, is project-led education. TOM sets this method centre stage. Below is an elaboration on. Below elaborates on project-led education, the module structure, assessment in TOM and finally the overall curriculum structure of our bachelor programmes.

PROJECT-LED EDUCATION

Project-led education has a number of advantages. It is a very active method that involves students in their learning. For their project, students need to choose a focus and a method, make a plan, appoint roles, etc. The latter are not mere skills to learn; they can also be ways to assess and develop talents, and to follow specific interests.

In essence, a project is a challenge that invites students to independently gain knowledge and skills. A typical project will be done in a small group, but it can also be a solo endeavour. Within a project, a student can take on specific roles. A student can work on critically assessing existing knowledge and systematically adding new knowledge (researching), integrate this knowledge in the development of a solution for a well-defined problem (designing), or work on matching solutions to a highly complex context (organizing). In projects that provide a variety of roles, students can focus on one of the roles or perhaps combine roles. This is a good way to train different aspects of the specific Twente academic profile.

Group projects also offer the opportunity of developing collaboration skills. Moreover, explaining a problem or a solution to peers is a great way for students to learn and assess their own understanding. This is not to say there will not be any free riding in projects. Fortunately, group-pressure, well-trained tutors, and sufficient individual assessments have proven to be good instruments to counter that risk.

The extent to which the project is pre-defined can depend on the type of programme, the position of the module including the project in the programme, and the learning objectives of the module. In a very open project the outcome is not fixed in advance, while in a more closed project this is the case. However, in a less open project it is still possible to offer open assignments in fixed knowledge sections.

THERMODYNAMICS PROJECT
In this movie Applied Physics student Stan Verstappen is followed in the 'Thermodynamics' project. In this project students from Advanced Technology and Applied Physics are working on thermodynamics and design, building a cooler. Students take different roles and complement each other maximally by the interdisciplinary character of the process. At the end of the project there is a contest who built the best cooler.

HTTPS://VIMEO.COM/211915902

DC-RPP1: TWENTE EDUCATION MODEL (TOM)

- Design framework
- Inspirational market events
- Seminars for design teams
- Lunch with leadership (rector, deans)
- Teacher design stories published regularly

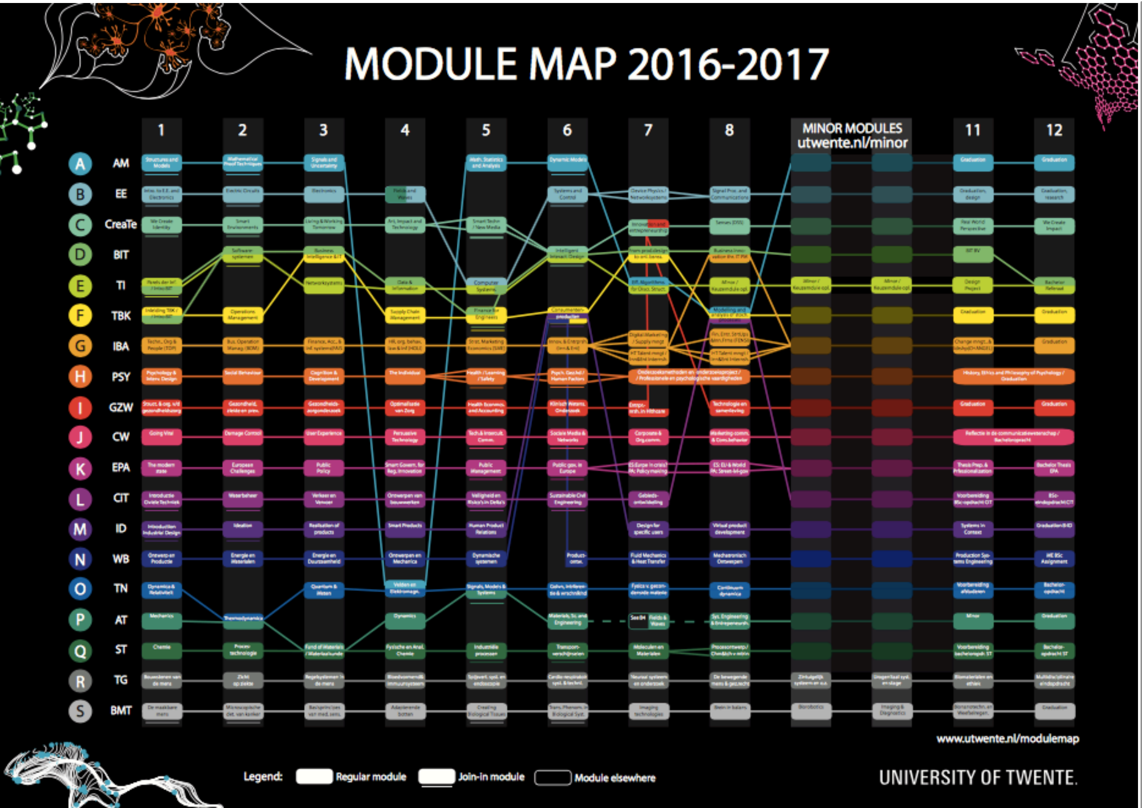
INTEGRATION OF MATH & PHYSICS
BY JASPER HOMMINGA

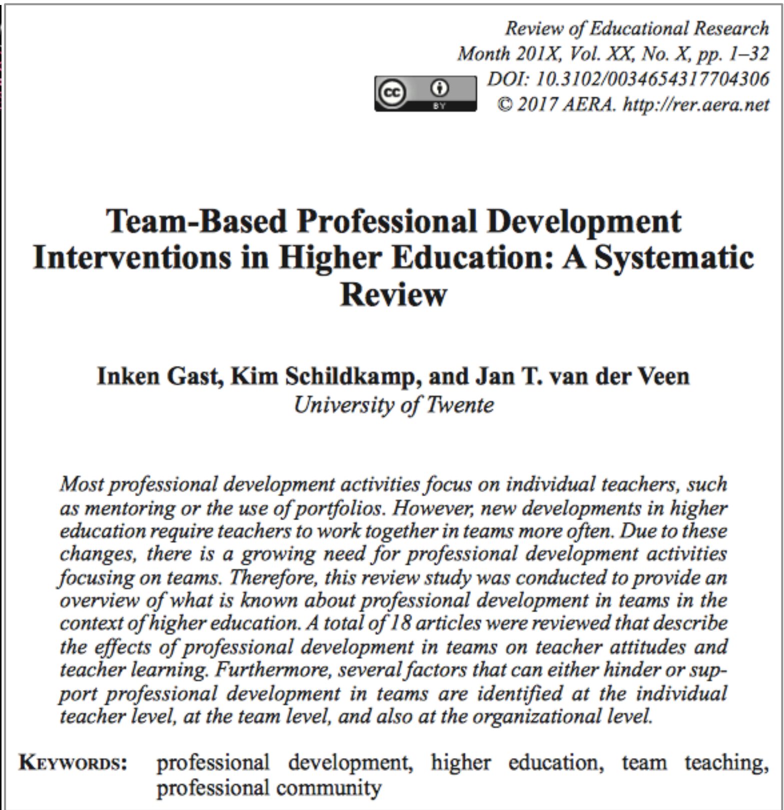
Jasper Homminga and Ruud van Damme integrated math & physics in their course at ATLAS. By creating challenging real-world problems they covered the different aspects of math & physics at the same time. They experienced that being flexible is very important. The benefits of integration are evident according to Jasper. But what are the benefits for a teacher? What were successes? And with which aspects were they confronted? Watch the video to know more about it.

http://tinyurl.com/Homminga

DC-RPP1: TWENTE EDUCATION MODEL (TOM)

- 12 modules used in 19 bachelor programs
- 2 PhD dissertations on HE teacher learning




Review of Educational Research
Month 201X, Vol. XX, No. X, pp. 1–32
DOI: 10.3102/0034654317704306

Team-Based Professional Development Interventions in Higher Education: A Systematic Review

Inken Gast, Kim Schildkamp, and Jan T. van der Veen
University of Twente

Most professional development activities focus on individual teachers, such as mentoring or the use of portfolios. However, new developments in higher education require teachers to work together in teams more often. Due to these changes, there is a growing need for professional development activities focusing on teams. Therefore, this review study was conducted to provide an overview of what is known about professional development in teams in the context of higher education. A total of 18 articles were reviewed that describe the effects of professional development in teams on teacher attitudes and teacher learning. Furthermore, several factors that can either hinder or support professional development in teams are identified at the individual teacher level, at the team level, and also at the organizational level.

KEYWORDS: professional development, higher education, team teaching, professional community

DC-RPP1: TWENTE EDUCATION MODEL (TOM)

- Expertise-performance interactions
  - Learners, pedagogy, PCK
  - Crafting activities and resources, reflecting on own practice
  - (Re)design, enactment for some, reflection

- Key aspects of this DC-RPP infrastructure
  - **Human**: Teachers as researchers and reviewers to advance own practice and overall profession
  - **Material**: Books, practical measures, collegial inspiration
  - **Structural**: Culture of scholarship, routines for systematic inquiry

INTERVENTION RESEARCH
CHANGE LABORATORY

Teachers learn about

- Noticing salient features
- Reflecting on own practice
- Learners and pedagogies
- Perceptions of external goals
- Professional identity

Core processes

- Practitioners as leaders of change, designers and experimenters; researchers provoke and support
- Reflect on object of activity
- Identify historically formed contradictions;
- Develop and experiment with solutions

Engeström, Y., Virkkunen, J., Helle, M., Pihlaja, J. & Poikela, R. (1996).The change laboratory as a tool for transforming work. *Lifelong Learning in Europe, 1*(2), 10-17.

Sannino, A., Engeström, Y., & Lemos, M. (2016). Formative interventions for expansive learning and transformative agency. Journal of the Learning Sciences, 25(4), 599-633.

Virkkunen, J. (2013). The change laboratory: A tool for collaborative development of work and education. Doorderecht: Springer.

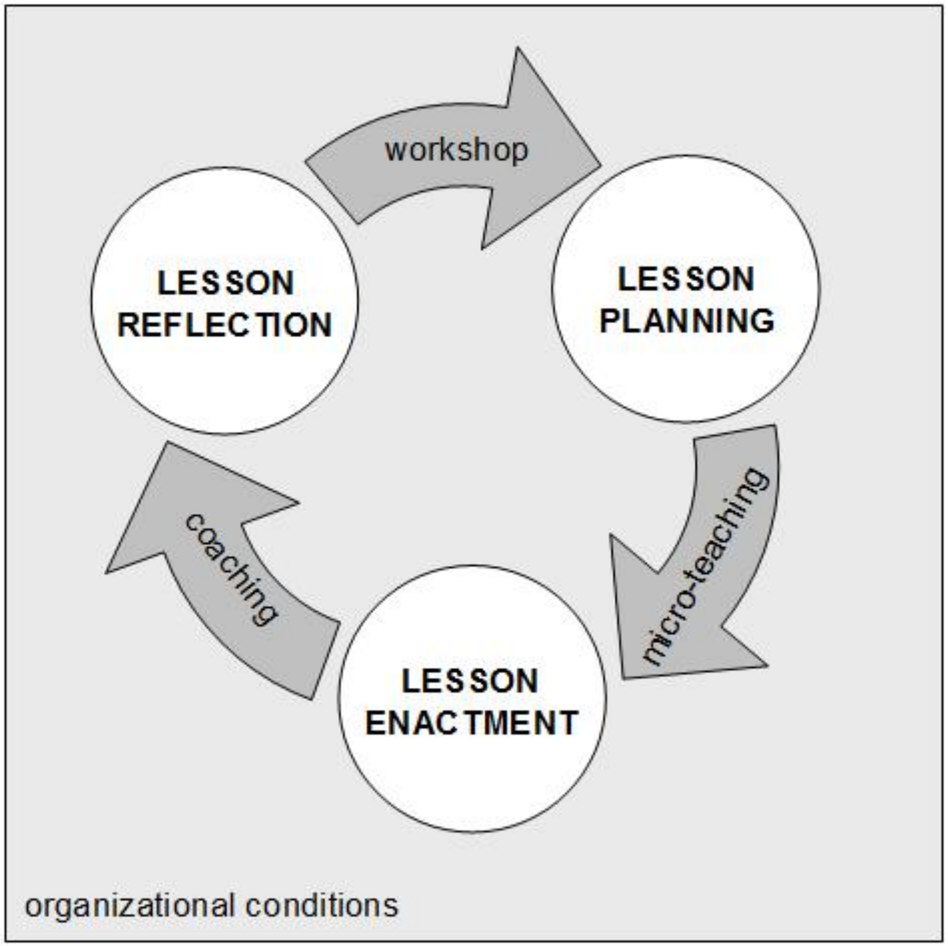
DC-RPP2: PARA-TEACHERS IN INDIA

DC-RPP2: PARA-TEACHERS IN INDIA

Analysis & Exploration	Design & Construction	Evaluation & Reflection
Learning needs and context analysis;	Design 1 evaluation (pilot)	Impact evaluation 24 months support subsided
Design framework underpinning professional development program	Design 2 evaluation (institutionalization) Design 3 evaluation (summative)	Systematic reflection to distill design heuristics
- Management interviews - Teacher interviews - Classroom observations - Literature review	- Document review - Self-reporting - Teacher interviews - Management interviews - Pupil pre/post tests	- Structured self-report - Classroom observation - Pupil pre/posts tests - Teacher interviews - Management interviews

- 7 sub-studies (white boxes)
- Research methods per phase (grey boxes)

DC-RPP2: PARA-TEACHERS IN INDIA



DC-RPP2: PARA-TEACHERS IN INDIA

- Expertise-performance interactions
  - Classroom management, learners, pedagogy (learner-centered teaching)
  - Noticing salient features, reflecting on own practice
  - Beliefs about learners and pedagogies
  - Design, enactment and especially reflection

- Key aspects of this DC-RPP infrastructure
  - **Human**: Multiple roles of practitioners, consultants, designers, researchers
  - **Material**: Books, research instruments, protocols
  - **Structural**: Theoretical and evidence-informed frameworks and processes, organizational ownership

MULTI-LEVEL BOUNDARY CROSSING

OFTEN WITHIN TEACHER OR INTERVENTION RESEARCH

Teachers learn about others'

- expertise
- practices
- habits of mind

Core processes

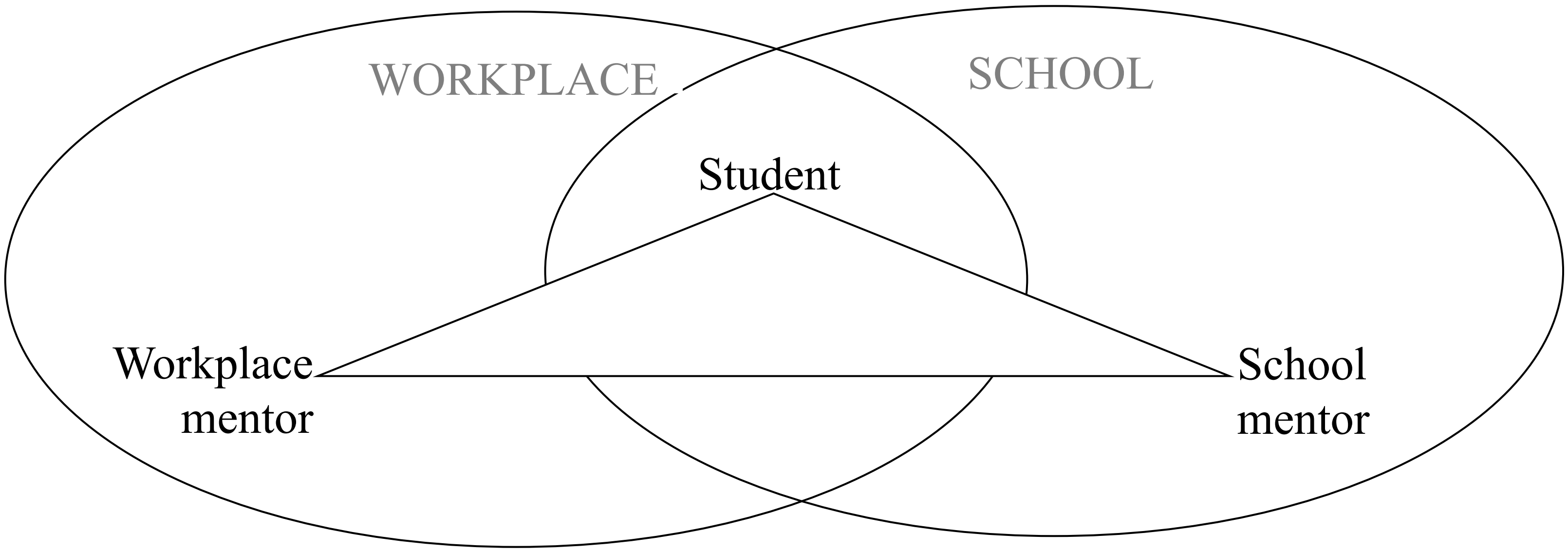
- Engage in activities that help individuals, groups and institutions
- Identify and respect the various expertise within the partnership,
- Coordinate distributed work, and
- Reflect at own practice

Akkerman, S. F., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research, 81*(2), 132–169.

Akkerman, S. F., & Bruining, T. (2016). Multi-level boundary crossing in a professional development school partnership. *Journal of the Learning Sciences, 25*(2), 240–284.

Star, S. L. 1989. The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. M. Huhns and L. Gasser, (Eds). Readings in Distributed Artificial Intelligence. Morgan Kaufman, Menlo Park, CA.

DC-RPP3: VOCATIONAL EDUCATION IN NL



DC-RPP3: VOCATIONAL EDUCATION IN NL

- 6 teams of workplace learning (intern) mentors from industry together with vocational & professional education teachers
  - Their focus: improving the quality of workplace learning in education, economics, engineering
  - Internally-focused research & development: analyze needs, design interventions, evaluate effects
- Scientific research: examines how such teams function and how to support them
  - Team phases: forming, storming, norming, performing
  - Team focus: mutual engagement, joint enterprise, shared repertoire
- Data collected through:
  - Questionnaires, interviews, focus groups, discourse analysis

DC-RPP3: VOCATIONAL EDUCATION IN NL

- Interventions in 6 contexts
- Materials, resources and expertise to support them
- Publications on the team processes

Routledge
Taylor & Francis Group

Educational Research and Evaluation

An International Journal on Theory and Practice

ISSN: 1380-3611 (Print) 1744-4187 (Online) Journal homepage: http://www.tandfonline.com/loi/nere20

Extended teams in vocational education: collaboration on the border

Marco Mazereeuw, Iwan Wopereis & Susan McKenney

DC-RPP3: VOCATIONAL EDUCATION IN NL

- Expertise-performance interactions
  - Curriculum, assessment, learning environments
  - Perceptions of value of external goals
  - Design, enactment and reflection in workplace and away

- Key aspects of this DC-RPP infrastructure
  - **Human**: Brokers especially help understand socio-cultural differences between groups
  - **Material**: Design process artifacts and designed products as boundary objects
  - **Structural**: Procedures support the understanding and coordination of diverse practices

CONCEPTUALIZING INFRASTRUCTURE FOR TEACHER LEARNING IN DC-RPPS

Learning per lens	Human	Material	Structural
Teacher research Learning about PCK, learners, pedagogy	Teachers as researchers & reviewers to advance own practice & overall profession	Books, design tools Practical measures Collegial inspiration	Culture of scholarship Routines for systematic inquiry
Change laboratories Learning about noticing, reflecting, pedagogies, perceptions	Practitioners as leaders of change, designers and experimenters; researchers provoke and support	Books, articles Instruments Protocols	Evidence-informed frameworks and processes Organizational ownership
Boundary crossing Learning about and from the expertise of others (often within teacher or intervention research)	Brokers especially help understand socio-cultural differences between groups	Design process artifacts and designed products as boundary objects	Procedures support understanding and coordination of diverse practices

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MOVING FORWARD:
PITFALLS & POSSIBILITIES
PART 3

ALL TALK VS MEANINGFUL TALK

Human infrastructure challenge

- Most teacher talk focuses on practical concerns
- Teachers able to frame practice benefit the most from collegial interaction => challenge to make perspectives accessible to others

DC-RPPs could

- Exemplify and support meaningful talk focused on learner-self, learner-learner and learner-teacher activity (after addressing practical concerns)

COACH FOR PREVIEWS, REVIEWS, REVISIONS

Boschman, F., McKenney, S., Pieters, J., & Voogt, J. (2016). Exploring the role of content knowledge in teacher design conversations. *Journal of Computer Assisted Learning, 32*(2), 157-169.

Horn, I. S., Garner, B., Kane, B. D., & Brasel, J. (2016). A Taxonomy of Instructional Learning Opportunities in Teachers' Workgroup Conversations. *Journal of Teacher Education 68*(1), 41-54.

SHAPING THE WORK: TOOLS FOR THE JOB

Material infrastructure challenge

- Many resources for research methods: How to choose?
- Limited resources specifically for DC-RPPs: Tools for partnership development and leadership roles especially needed

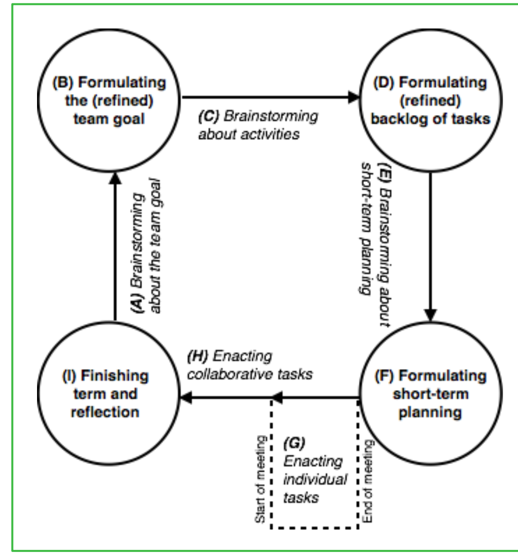
DC-RPPs could

- Inventory, analyze and share tools that design team partners negotiate meaning and vision

TOOLS FOR ROLES, VALUES & EXPECTATIONS

Image	Title and Theme	Activity
	***Crossing National Boundaries (Pervasiveness).*** Nations have different rules, customs, and infrastructure that affect use of a technology. What challenges will be encountered by your system if it is used in other countries?	Choose three countries across the globe and envision challenges for your system if it was deployed in each of those countries. Label any common concerns across the identified challenges.
	***Consider Children (Stakeholders).*** Children often appropriate systems originally designed for adults. How might this system influence a child's social and moral development?	Develop a scenario that portrays a seven-year old interacting with the system. How might the system influence the child's learning, or play with other children?
	***Environmental Sustainability (Values).*** Many systems can be applied or extended to support a desirable environmental outcome (e.g., a system designed to support efficient printing from web browsers may lead to less use of paper and ink). At the same time, systems may have unintended negative effects on the environment (e.g., pollution and waste created in the production of electronics).	Specify the required resources needed to create and support your system, and the byproducts of its production and use. Can your design be applied or extended to support a more positive environmental outcome?
	***Choosing Not to Use (Time).*** Some people may decide to use your system, or may attempt to remove themselves from an indirect stakeholder role (e.g., choosing not to publish a telephone number). How might deliberate non-use of the system affect a person's daily life (e.g., employability, relationships, civic participation)?	Picture your system in use many years from now. Identify three ways in which an individual's intentional non-use of the system might affect that person's daily life or the system as a whole.

Table 1. Sample Envisioning Cards with Image, Title, Theme, and Activity.



Your resource here?

TEACHING SCHOLARSHIP VS ADD-ON DUTY

Structural infrastructure challenges

- Time allocated for teaching
- Academic reward systems structures

DC-RPPs could

- Lobby for support and recognition of higher education teachers in the scholarly inquiry of their own practice

E.G. SENIOR TEACHING QUALIFICATION

Senior teacher qualification	Description
Intake interview	Identify entry level, personal pursuit options, align with curriculum challenges, availability (160 hours in 12 months).
Kick-off	Outline of the program. Meeting participants and coaches.
Personal pursuit	Personal educational research or design activity. Link to literature. Finishes with a reflection and a presentation.
Coaching	Educationalists available to help design, plan and evaluate.
Intervision	Small peer groups supporting and commenting each other.
R&D sessions	Familiarizing engineers with educational R&D methods.
Inspiration sessions	Workshops on ‘flipped classroom’, ‘assessment for learning’ etc.
Personal travel budget	Funding of a work visit or conference presentation.

TEACHING IS IMPOSSIBLE

"Teaching is impossible. If we simply add together all that is expected of a typical teacher and take note of the circumstances under which those activities are to be carried out, the sum makes greater demand than any individual can possibly fulfill."

- Lee Shulman

SUPPORTING THE IMPOSSIBLE

1: Infrastructure for teacher professional growth

2: DC-RPPs as infrastructure for professional growth

3: Moving forward: Tensions & possibilities

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DISCUSSION?

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WWW.EDUCATIONALDESIGNRESEARCH.ORG