KU LEUVEN

FACULTY OF SCIENCE

SCIENCE, ENGINEERING AND TECHNOLOGY GROUP

ASSOCIATIE KU LEUVEN

Linking pedagogy and space with ALINA

Evert Binnard, Iris Peeters

Transitions 18, Copenhagen

16 november 2018

KU LEUVEN LESEC

LEUVEN ENGINEERING AND SCIENCE EDUCATION CENTER

KU Leuven

- Founded in 1425
- > 45.000 students from 147 nationalities
- > 10.000 staff
- Covering all scientific disciplines

KU Leuven Association

- Founded in 2002
- University of Leuven and associated colleges
- Founded in 1425
- > 100.000 students
  - 43% of Flemish students in higher education

Reuters ranks KU Leuven as Europe’s most innovative university

Europe’s Most Innovative Universities | 2018

« Top University Rankings

#1 KU Leuven Belgium

Compare Universities

Website: www.kuleuven.be Students: 56,351 Academic Staff: 1,107

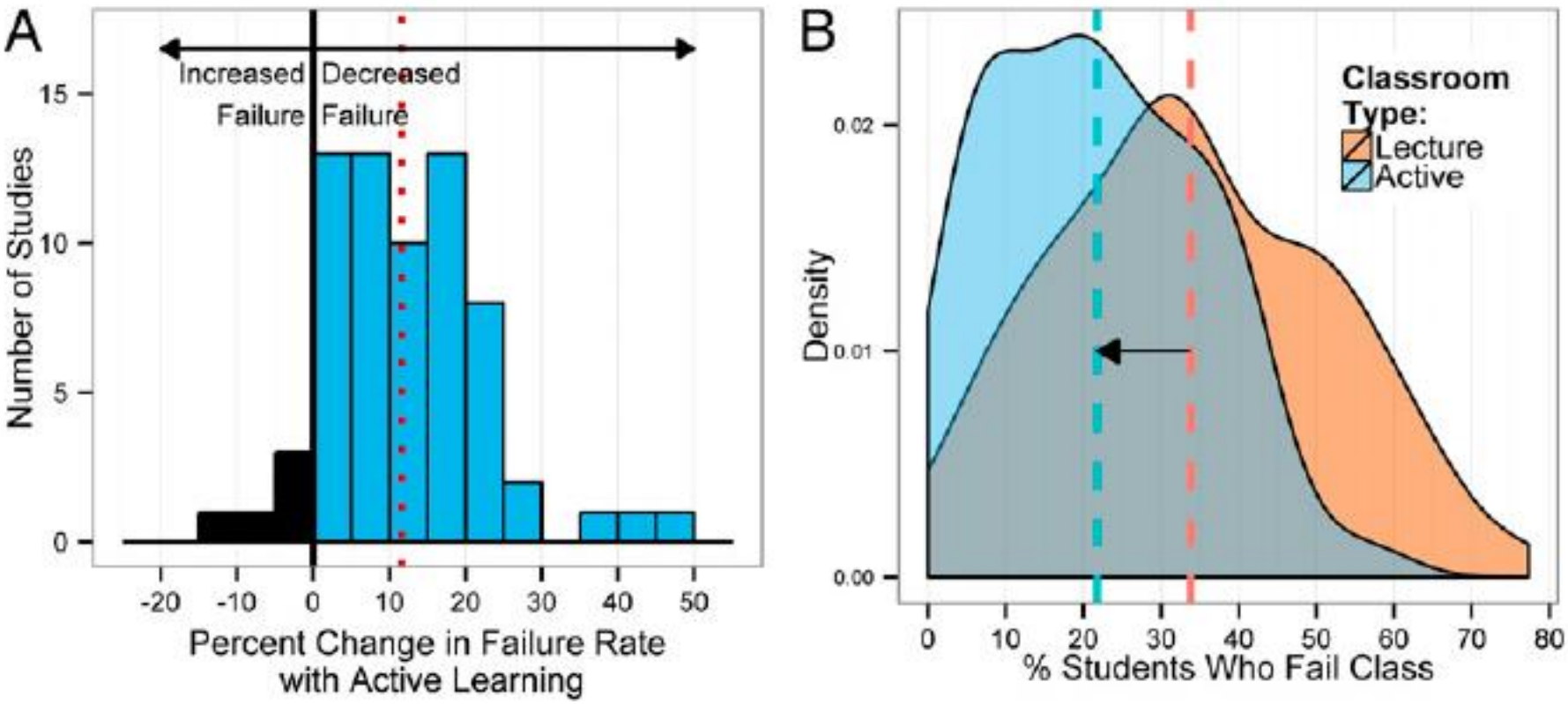
TOP UNIVERSITIES | 2018 RANKINGS

1. KU Leuven
2. Imperial College London
3. University of Cambridge
4. Federal Institute of Technology in Lausanne (E
5. University of Erlangen Nuremberg
6. Technical University of Munich
7. University of Manchester
8. University of Munich

Active learning increases student performance in science, engineering, and mathematics

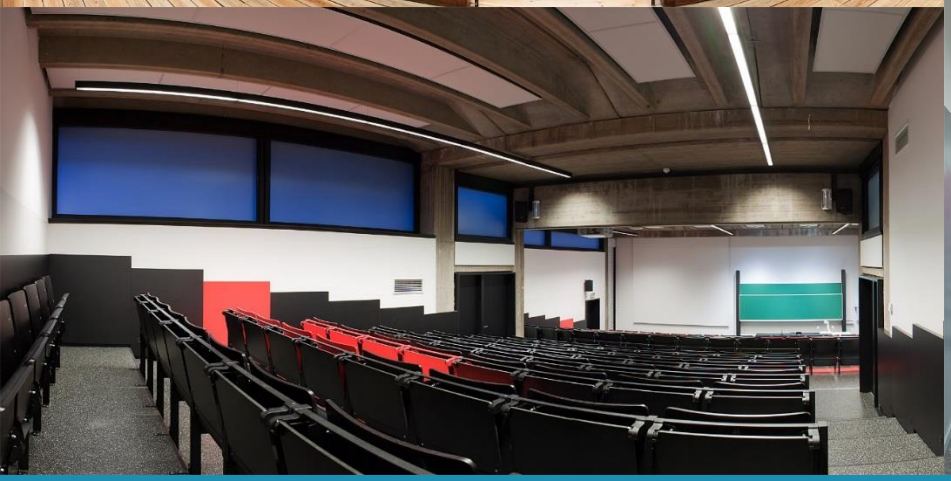
Scott Freeman[a,1], Sarah L. Eddy[a], Miles McDonough[a], Michelle K. Smith[b], Nnadozie Okoroafor[a], Hannah Jordt[a], and Mary Pat Wenderoth[a]

PNAS 111, 23 (2014)



Learning spaces @ KU Leuven Association

Large lecture theatres (> 90 seats)



Learning spaces @ KU Leuven Association

Seminar rooms (< 90 seats)

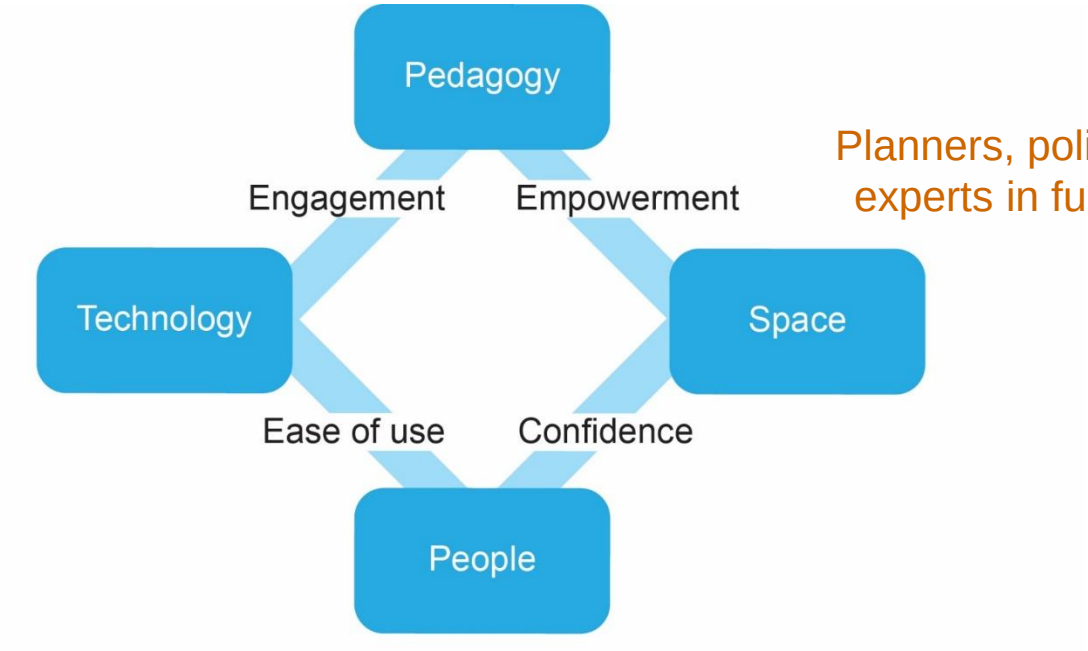
Stakeholders

Involved in active learning

Lecturers, didactic teams, study counselors, central educational development unit, …

Planners, policymakers, architects, experts in furniture, acoustics, …

Central IT office, technical services



Students, policymakers, staff, …

D. Radcliffe, 2009

M. Veugelers, 2017

Different perspectives on active learning

Common ground: qualitative education

Active / collaborative learning works!

Space influences pedagogy

Insufficient relevant best practices

Pedagogy is no criterion for assigning rooms

Lack of facilities

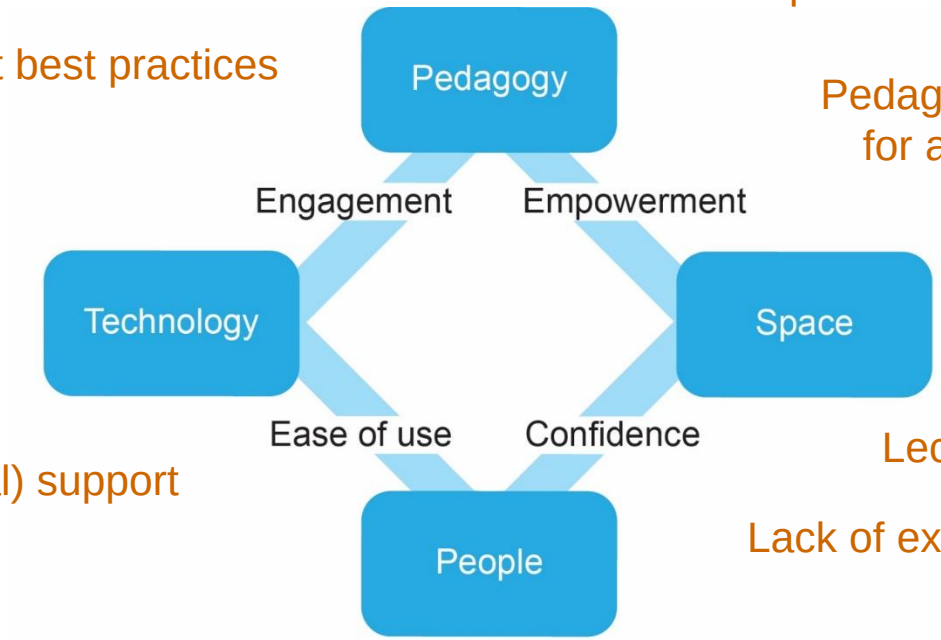
Pressure on existing rooms

User-friendly

Lecturers do want more NGC's

Lack of (technical) support

Lack of extrinsic motivation



Attract students to campus

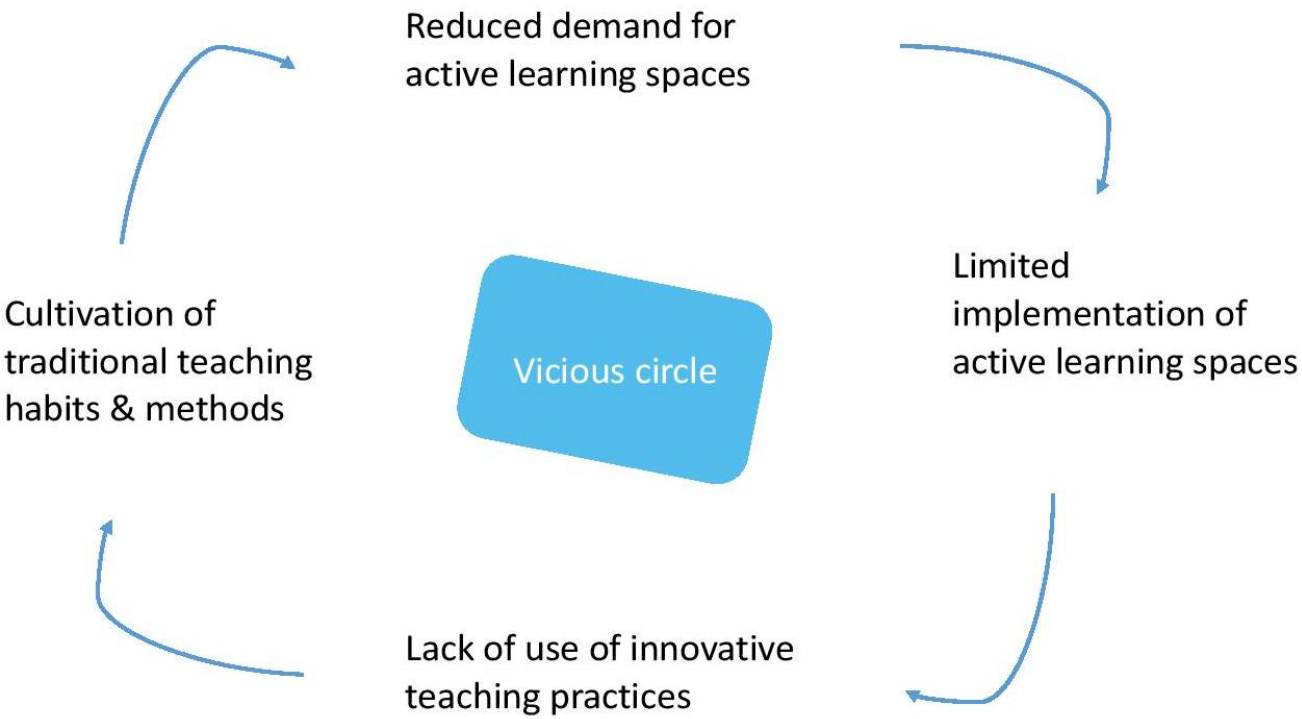
Change management!

Involvement of all stakeholders!

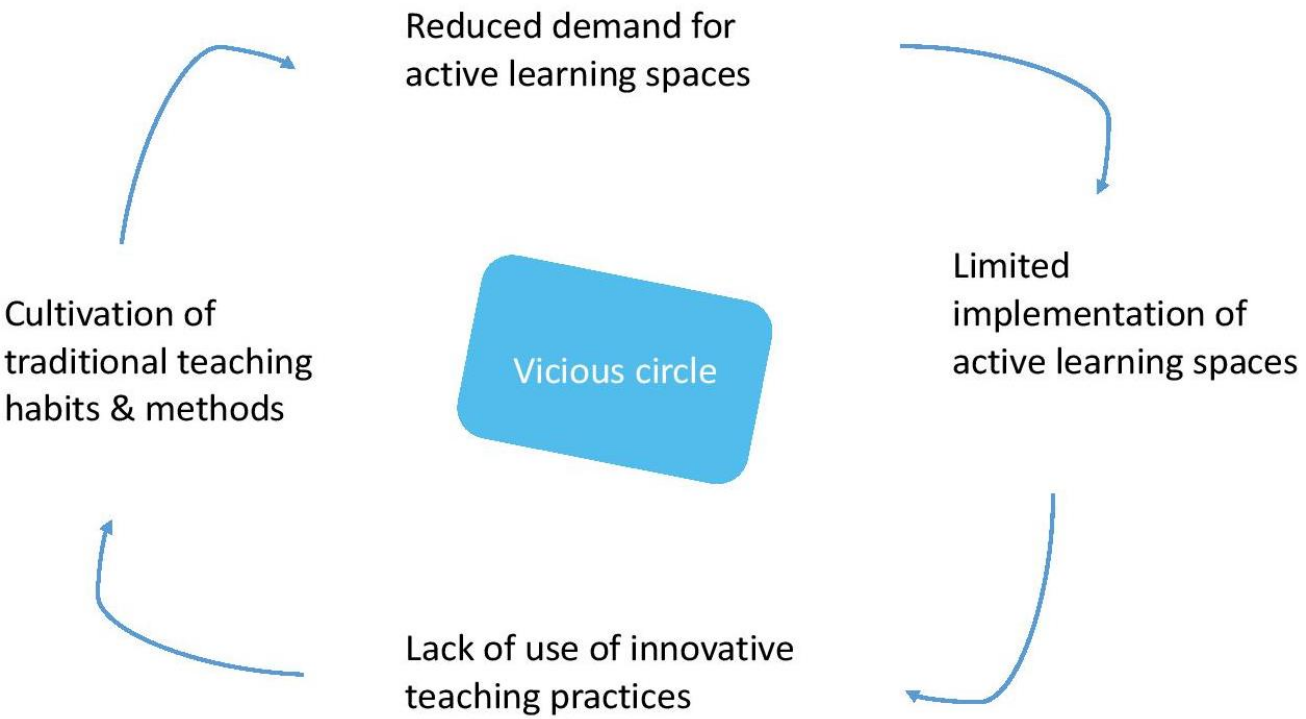
D. Radcliffe, 2009

M. Veugelers, 2017

Summarised:


Reduced demand for active learning spaces
Limited implementation of active learning spaces
Lack of use of innovative teaching practices
Cultivation of traditional teaching habits & methods
Vicious circle

Cause?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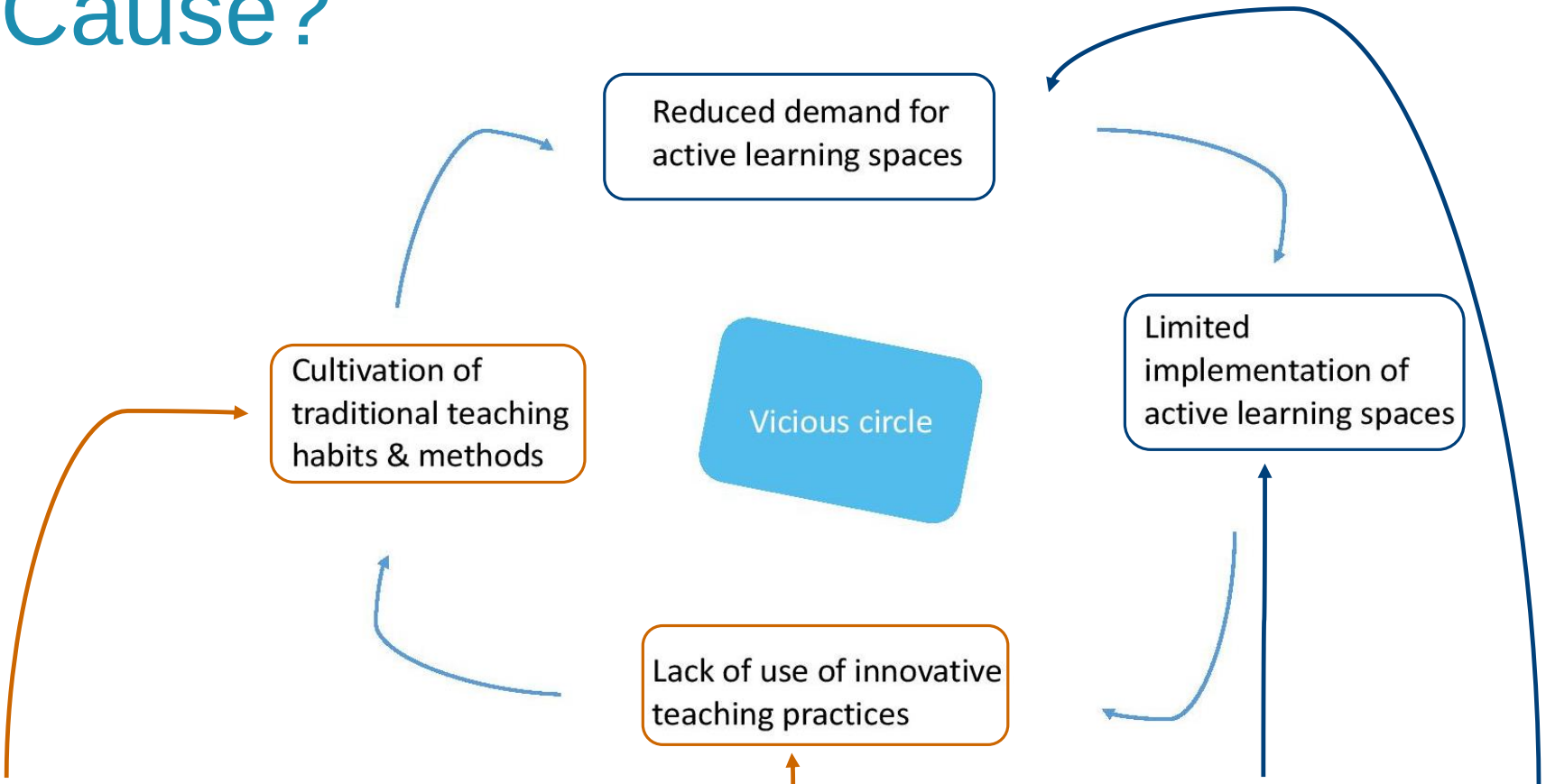
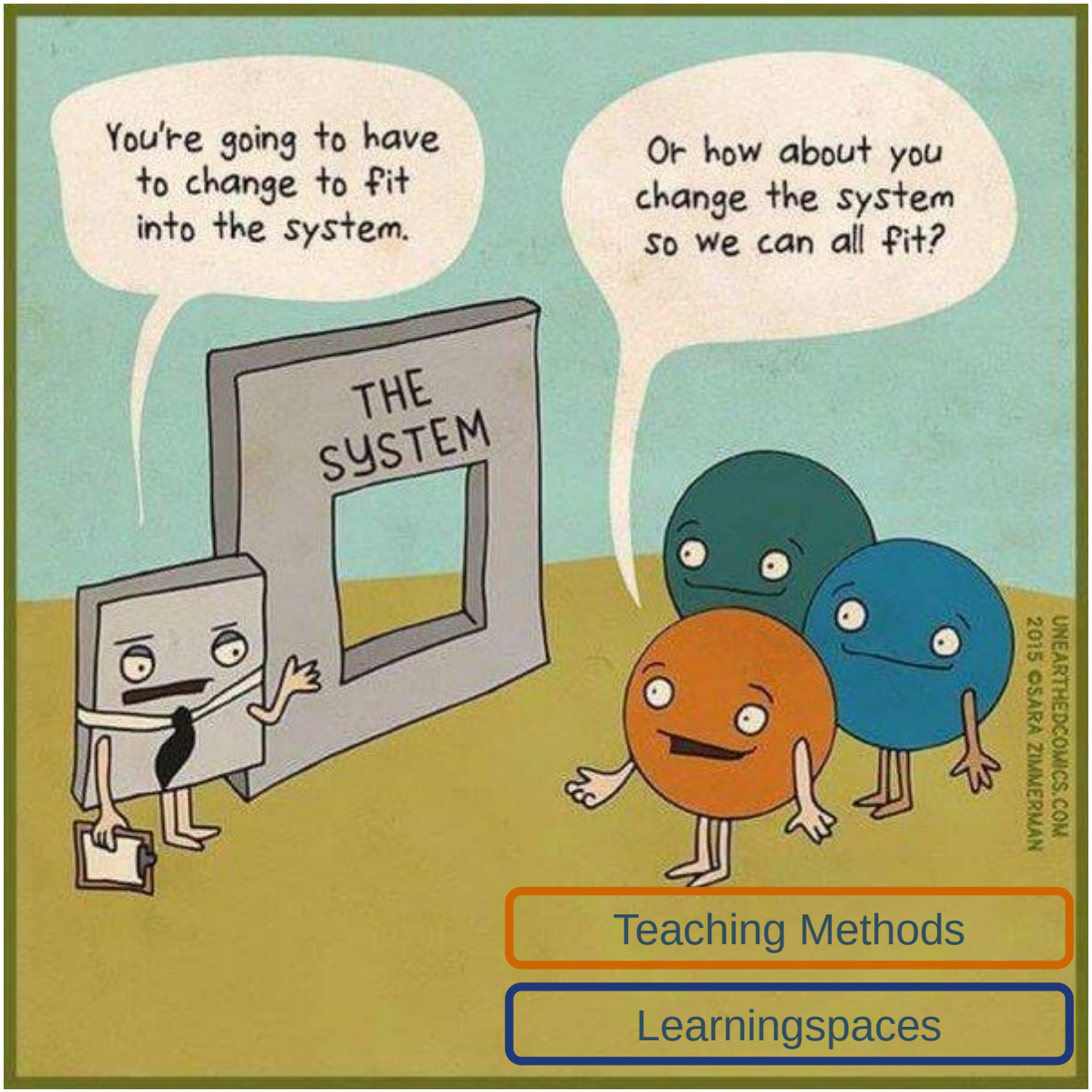


Teaching methods
Those who teach and try to improve teaching

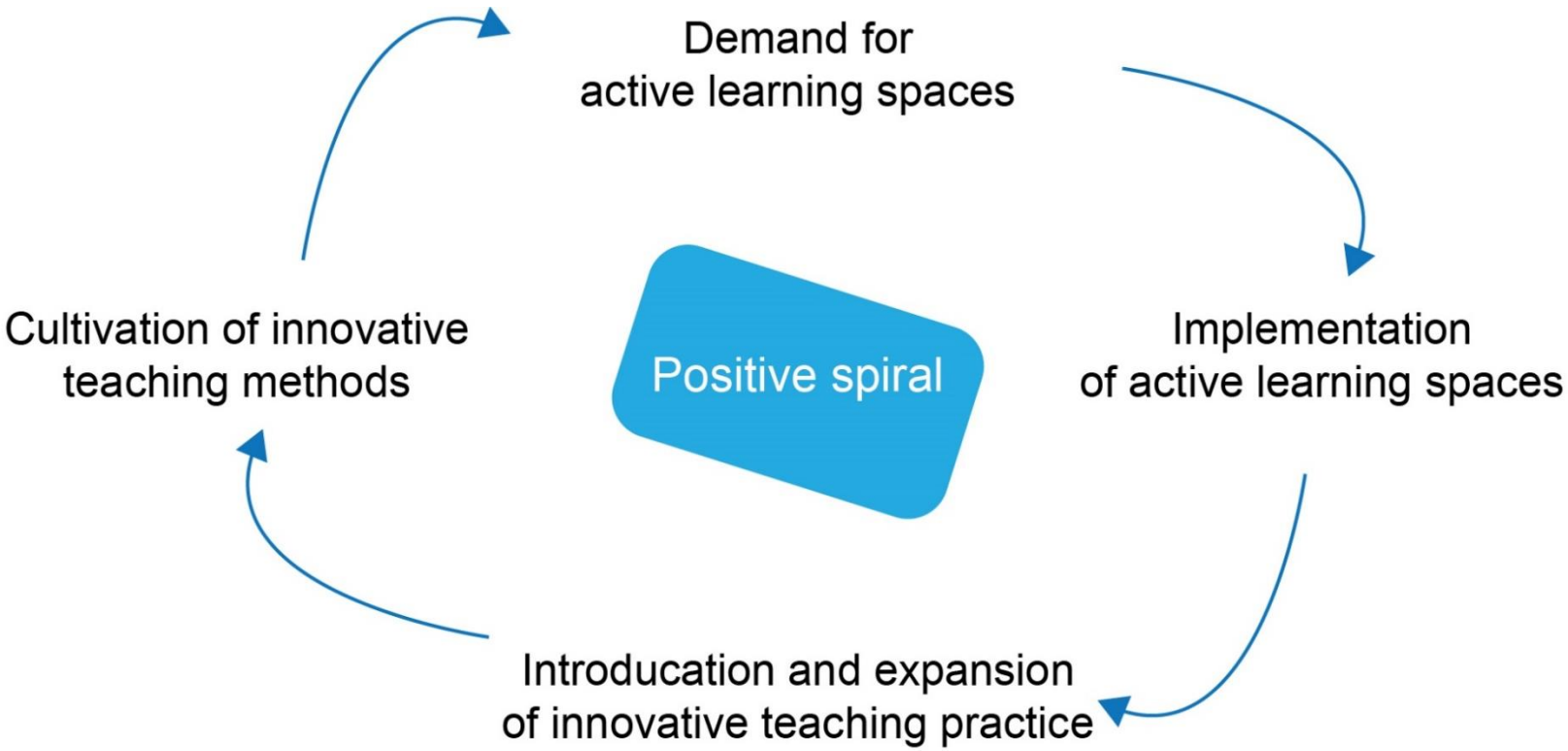
Space
Those who design learning spaces and try to improve them

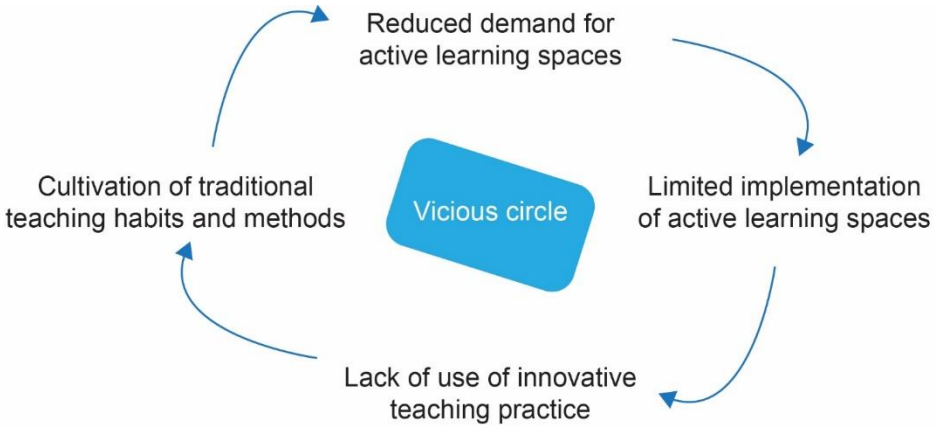


Teaching Methods

Learningspaces

What we actually want:





Pedagogy

Lecturers
Teaching assistants
Tutors
Students
Educational developers
…

ALINA

Negotiator
Translator

Space

Policy makers
Educational technologists
Planners
Technical services
Architects
…

Pedagogy

Lecturers
Teaching assistants
Tutors
Students
Educational developers
…

ALINA

Negotiator
Translator

Space

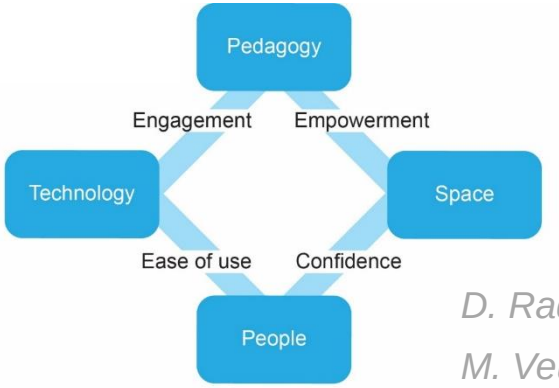
Policy makers
Educational technologists
Planners
Technical services
Architects
…

5 interventions

Multidisciplinary taskforce
Recommendations for policymakers and lecturers
The ALINA model & proof of concept
Coaching trajectory for didactic teams
Guidelines for (re)building active learning spaces

1. Multidisciplinary taskforce

- Goals:
  - Networking
  - Mutual understanding
  - Tranparency
  - Hollistic approach



D. Radcliffe, 2009

M. Veugelers, 2017

2. Recommendations

For policymakers

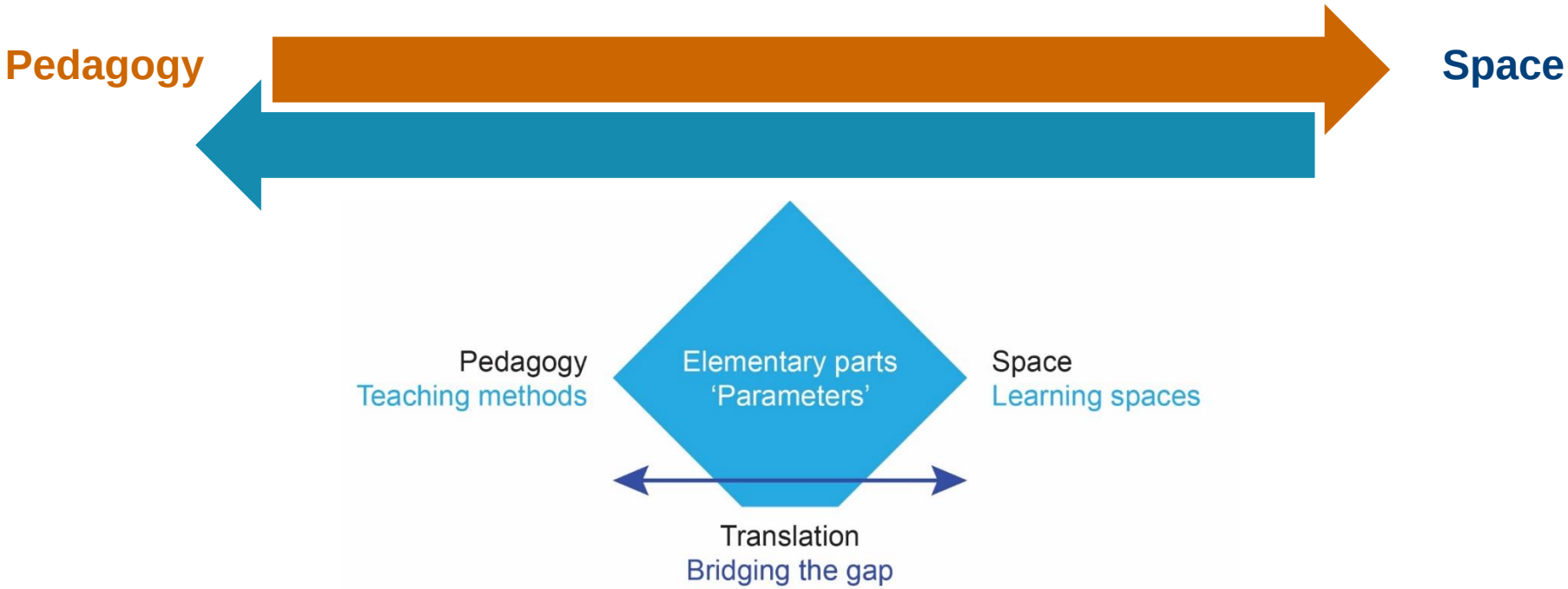
- Start from a clear and holistic vision and remain faithful to this vision
- Involve all possible stakeholders from the beginning.
- Appoint a taskforce or a person as an ambassador of next generation spaces.
- Define ownership

For lecturers

- Start today with challenging, activating, stimulating your students.
- Give yourself time and space for trial and error to grow in your role as a ‘coach’.
- Do not underestimate the influence of student attitudes.
- Communicate with colleagues, exchange experiences.
- Use the available technical and didactical support.

3. The ALINA model & proof of concept

Peeters, I. and Binnard, E. (2018) Collaborative Learning in Space and Time: Bridging the Gap with ALINA. Proceedings of EDULEARN18 Conference, 2nd-4th July 2018, Palma, Mallorca, Spain, pp. 7090-7099.



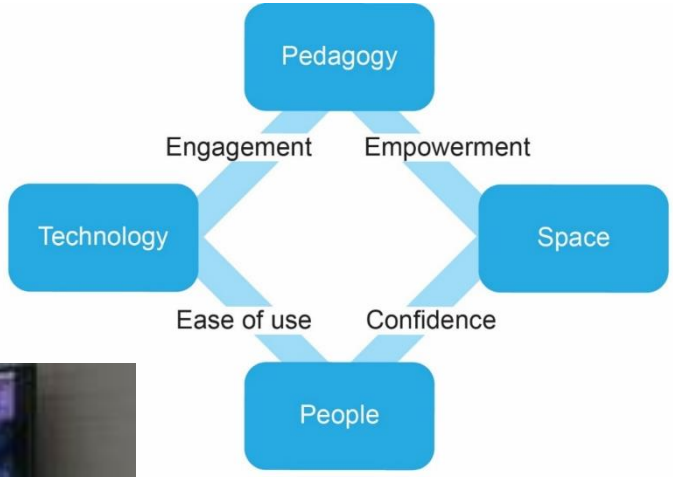
Lecturers search for a suitable learning space for their didactic methods

Lecturers search for inspiration on didactic methods in a certain learning space

Policy makers optimise their learning spaces according to desired didactic methods

Policy makers consult user data, visualising lecturer needs and interests in a dashboard

4. Coaching trajectory for didactic teams



- Triple win:
  - Didactic teams receive support for all aspects of active learning
  - Educational development unit gain experience and knowledge
  - Technical services receive direct feedback

D. Radcliffe, 2009

M. Veugelers, 2017

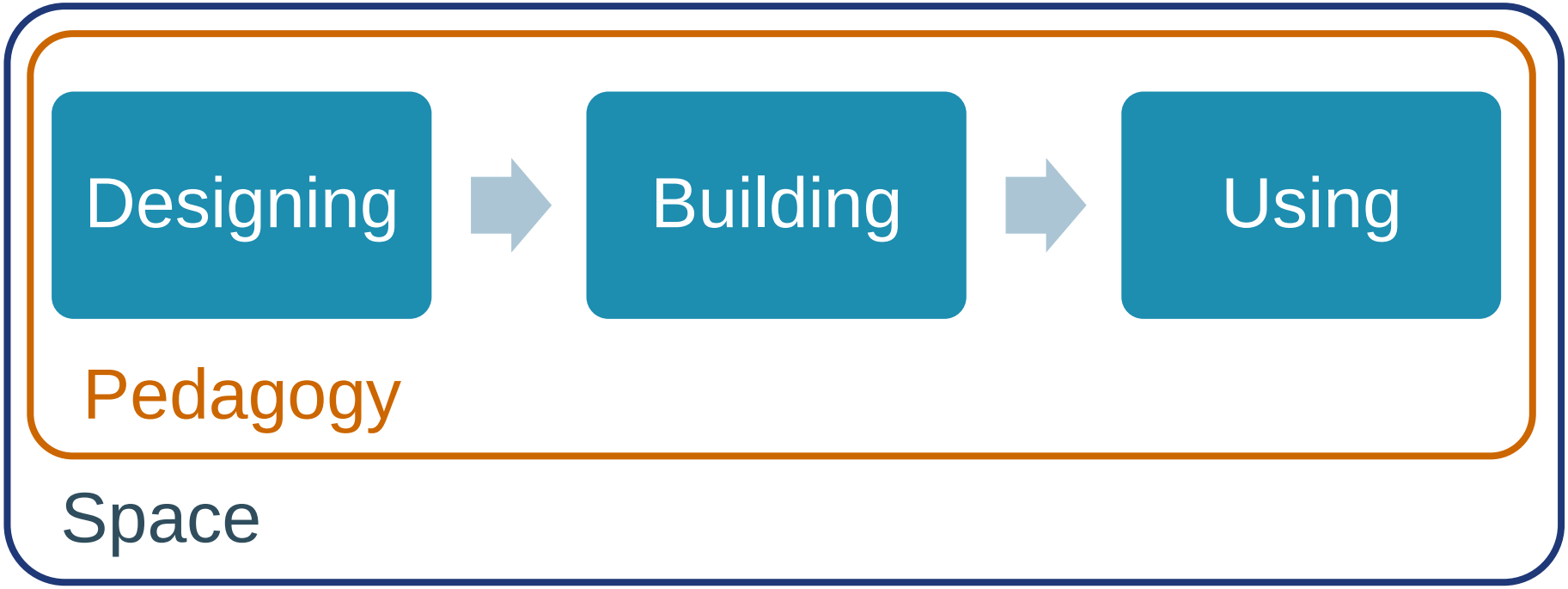
5. Guidelines for (re)building active learning spaces

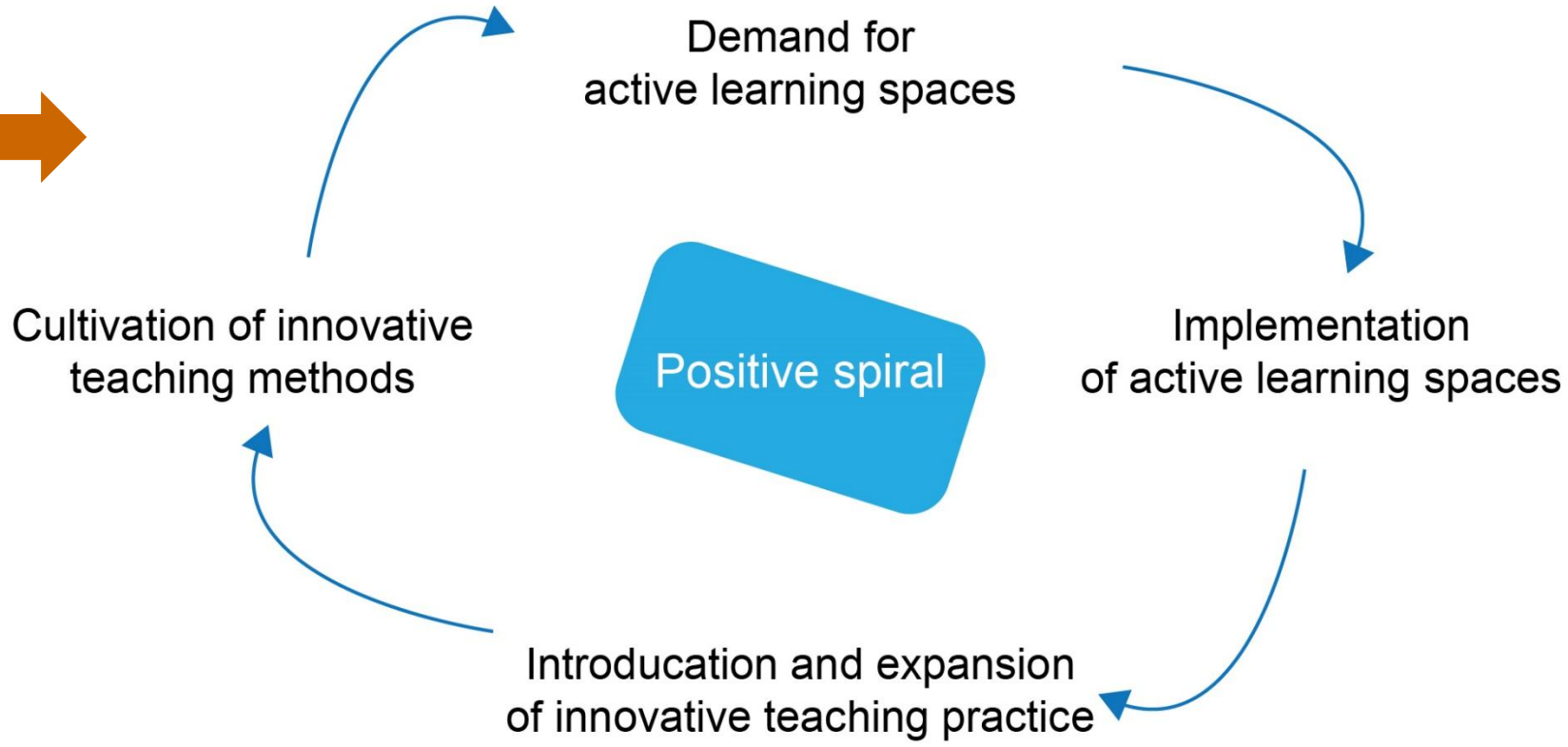
Designing → Building → Using

Space

Pedagogy

5. Guidelines for (re)building active learning spaces




Demand for
active learning spaces
Implementation
of active learning spaces
Introducation and expansion
of innovative teaching practice
Cultivation of innovative
teaching methods
Positive spiral

Thank you!

…Questions?

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Iris.Peeters@kuleuven.be

References and further reading

C. Wieman, K. Perkins, “Transforming physics education,” *American Institute of Physics*, vol. 58, no. 11, pp. 36-41, 2005.

L. Deslauriers, E. Schelew, C. Wieman, “Improved learning in a large-enrollment physics class,” *Science*, vol. 332, no. 6031, pp. 862-864, 2011.

S. Freeman, S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt, M.P. Wenderoth, “Active learning increase student performance in science, engineering and mathematics,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 111, no. 23, pp. 8410-8415, 2014.

K.A. Bruffee, “Collaborative learning and the “Conversation of Mankind”,” *College English*, vol.46, no. 7, pp. 635-652, 1984.

M. Prince, “Does active learning work? A review of the research,” *J. Engr. Education*, vol. 93, no. 3, pp. 223-231, 2004.

A. Deal, *Collaboration tools, A teaching with technology white paper*, Carnegie Mellon Univ., 2009.

J. O'Flaherty, C. Phillips. “The use of flipped classrooms in higher education: a scoping review,” *Internet High. Educ.*, vol. 25, pp. 85–95, 2015.

K.A. Graetz, M.J. Goliber, “Designing collaborative learning places: Psychological foundations and new frontiers,” *New Directions for Teaching and Learning*, vol. 92, pp. 13-22, 2002.

A. Whiteside, D.C. Brooks, J.D. Walker, “Making the case for space: Three years of empirical research on learning environments,” *Educause Quarterly*, vol. 33, no. 3, 2010.

D. Lee, A. Morrone, G. Siering, “From swimming pool to collaborative learning studio: Pedagogy, space, and technology in a large active learning classroom,” *Educational Technology Research and Development*, vol 66, no. 1, pp. 95-127, 2018.

D.C. Brooks, “Space and consequences: The impact of different formal learning spaces on instructor and student behavior,” *Journal of Learning Spaces*, vol. 1, no. 2, 2012.

D. Radcliffe, “A Pedagogy-Space-Technology Framework for Designing and Evaluating Learning Places” in *Learning Spaces in Higher Education: Positive Outcomes by Design* (Radcliffe et al. eds.), pp. 9-16, Next Generation Learning Spaces 2008 Colloquium. St Lucia: University of Queensland, 2009.

M. Veugelers, “Roadmap tot implementatie innovatieve learning spaces,” *SURF onderwijsdag*, 7 November 2017.

C. Kreitzberg, *The LUCID framework*, Princeton Junction, New Jersey: Cognetics Corporation, 2008.

Joint Information Systems Committee, *Designing spaces for effective learning. A guide to 21st century learning space design*, 2006.

K. Fisher, C. Newton, “Transforming the twenty-first-century campus to enhance the next-generation student learning experience: using evidence-based design to determine what works and why in virtual/physical teaching spaces,” *Higher Education Research & Development*, vol. 33, no. 5, pp. 903-920, 2014.

McGill University, *Interactive Strategies in an Active Learning Classroom (ALC)*, Montreal: Teaching and Learning Services, 2012.

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Backup slides

Iris Peeters, Evert Binnard

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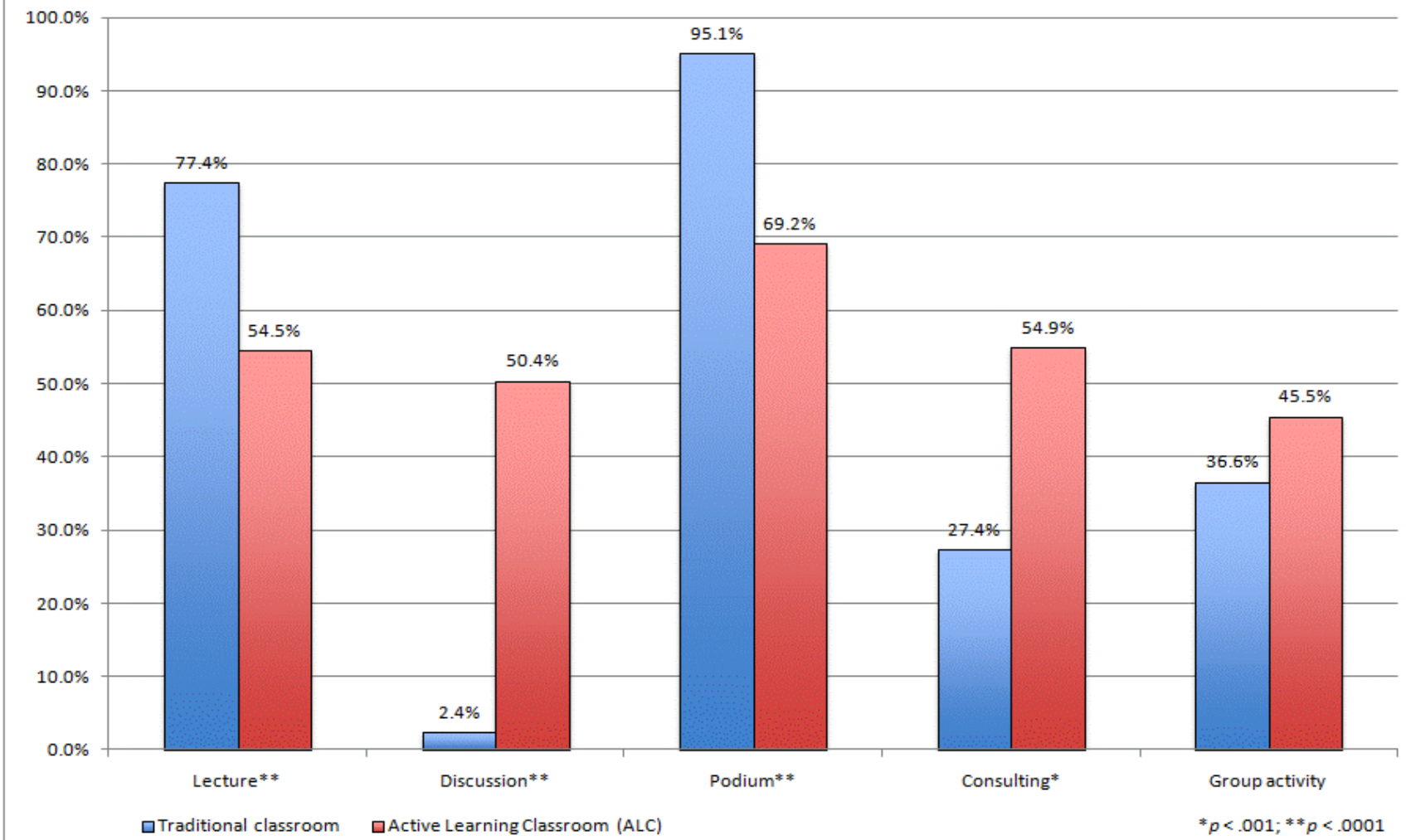
LEUVEN ENGINEERING AND SCIENCE EDUCATION CENTER

Making the Case for Space: Three Years of Empirical Research on Learning Environments

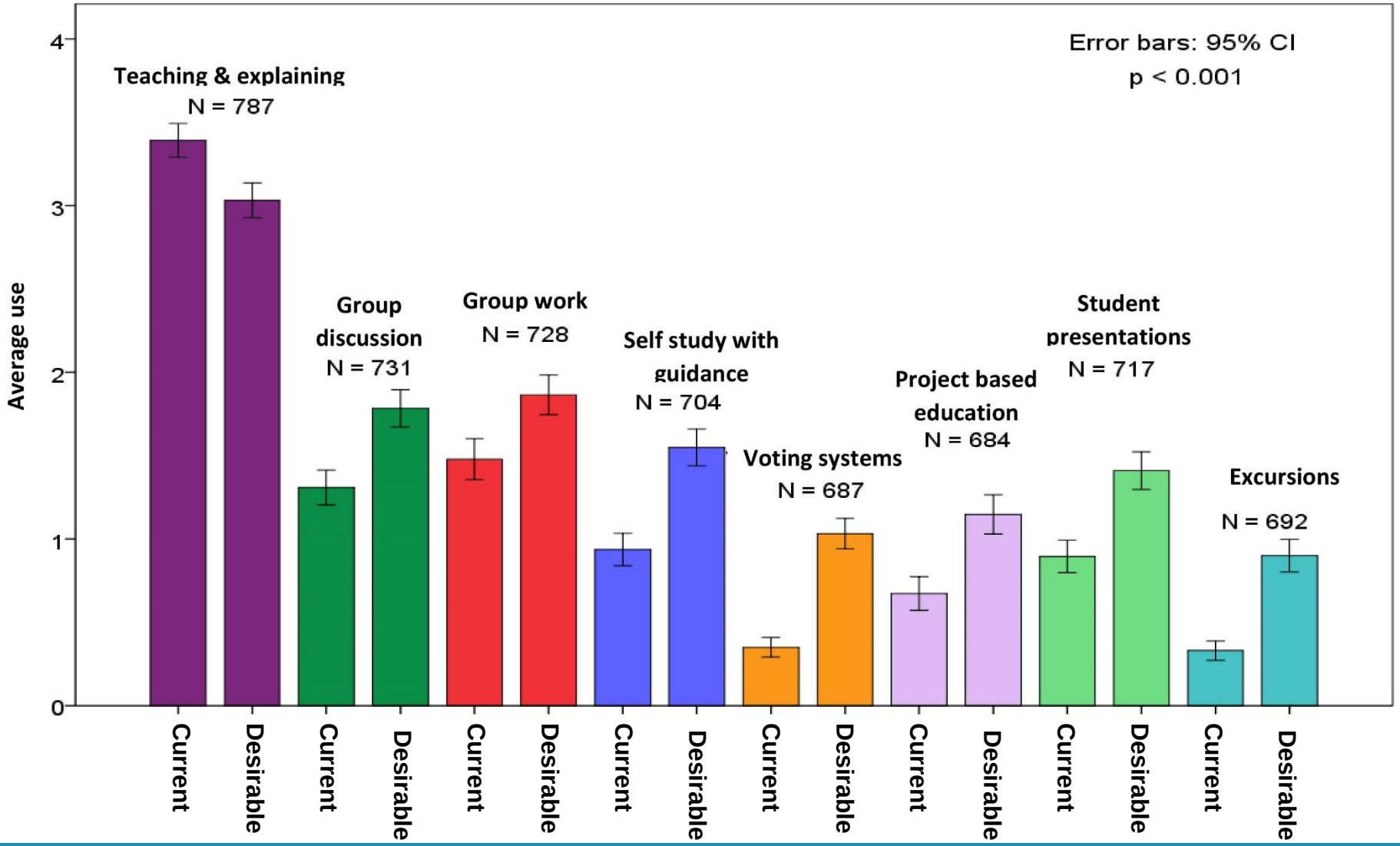
by **Aimee Whiteside**, **D. Christopher Brooks** and **J. Walker** Wednesday, September 22, 2010



Frequency of used teaching methods in a traditional learning space vs. an active learning space

Teacher survey Teaching method: current versus desirable use

850 respondents (2015)



Teacher survey Learning space: current versus desirable use

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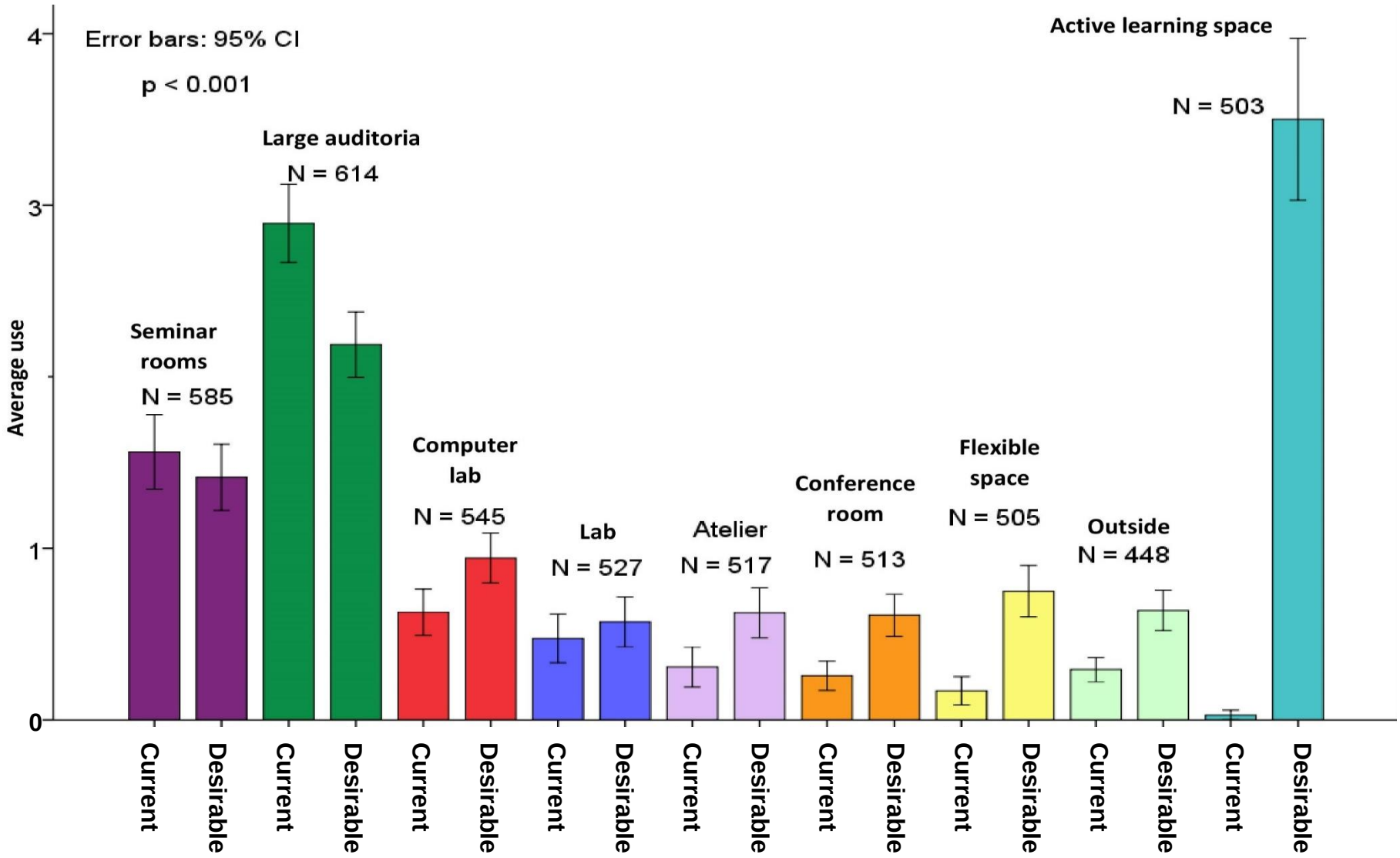
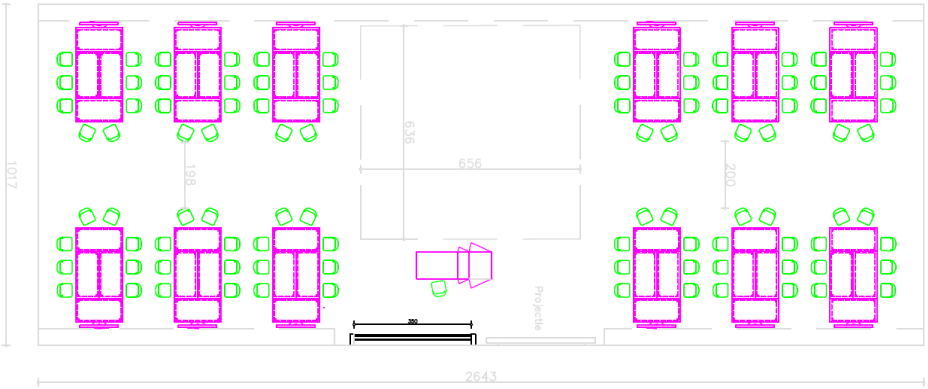


Learning spaces @ KU Leuven Association

Collaborative spaces

- Introduced after evaluation of existing asset of rooms in 2012 and the pedagogical need to activate students
- Rollout has been slow due to
  - lack of existing large flat spaces (>100 m²)
  - need for more space per student
  - lack of a shared vision of innovation in learning
- Incorporated in new educational buildings for the coming years (2017-2019)



Learning spaces @ KU Leuven Association

Library Learning Centres

- Group work facilities, flexible furniture
- Informal spaces (lounge, coffee corner)
- Lending services (laptops, tablets, beamers, etc.)
- Events (hackathons, business games, etc.)

KU Leuven –
AGORA Learning Centre

KU Leuven –
Arenberg Campus Library

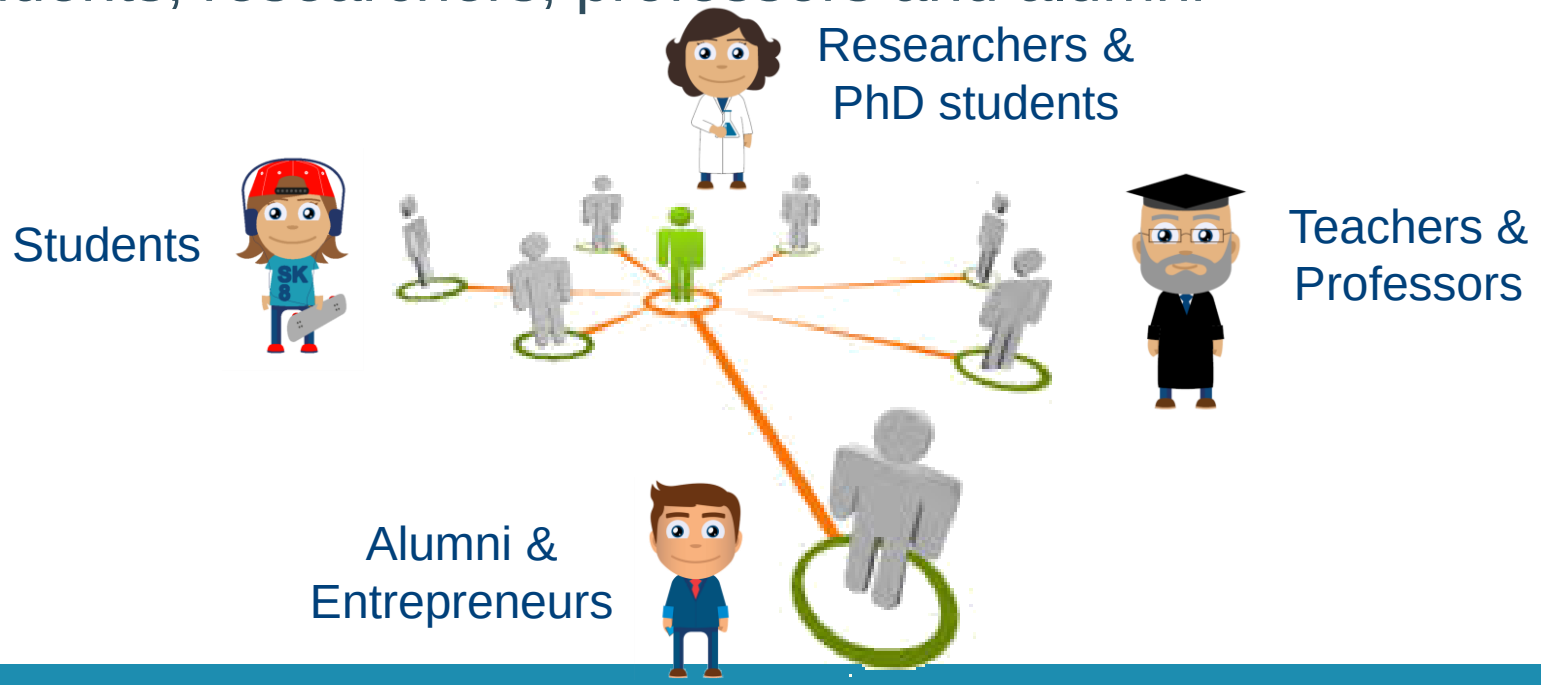
Thomas More –
The Hive (campus Geel)

Learning spaces @ KU Leuven Association

Innovation & entrepreneurship spaces

Lcie

- Lcie: A university-wide initiative (since 2014) to promote, stimulate and support entrepreneurship **<u>with and by</u>** students, researchers, professors and alumni



Learning spaces @ KU Leuven Association

Innovation spaces

Lcie

Library	Learning centre	Innovation space
		
Reading	Learning	Doing
Researcher	Student	Team
Formal	Flexible	Ecosystem

Learning spaces @ KU Leuven Association

Entrepreneurship spaces

- Student driven initiatives supported by the university
- Co-working
- Project-based learning

Incubator

Workspace

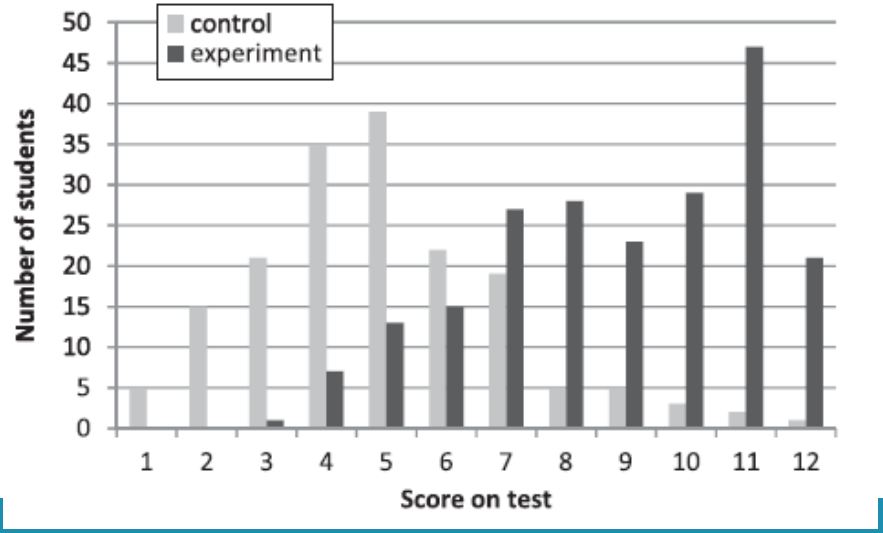
Creativity Lab

Improved Learning in a Large-Enrollment Physics Class

Science 332, 862 (2011)

Louis Deslauriers,[1,2] Ellen Schelew,[2] Carl Wieman*†‡

We compared the amounts of learning achieved using two different instructional approaches under controlled conditions. We measured the learning of a specific set of topics and objectives when taught by 3 hours of traditional lecture given by an experienced highly rated instructor and 3 hours of instruction given by a trained but inexperienced instructor using instruction based on research in cognitive psychology and physics education. The comparison was made between two large sections (N = 267 and N = 271) of an introductory undergraduate physics course. We found increased student attendance, higher engagement, and more than twice the learning in the section taught using research-based instruction.



- Preclass reading assignments & quizzes
- In-class clicker questions with student-student discussion
- Small-group active learning tasks
- Targeted in-class instructor feedback

Active learning increases student performance in science, engineering, and mathematics

Scott Freeman[a,1], Sarah L. Eddy[a], Miles McDonough[a], Michelle K. Smith[b], Nnadozie Okoroafor[a], Hannah Jordt[a], and Mary Pat Wenderoth[a]

PNAS 111, 23 (2014)

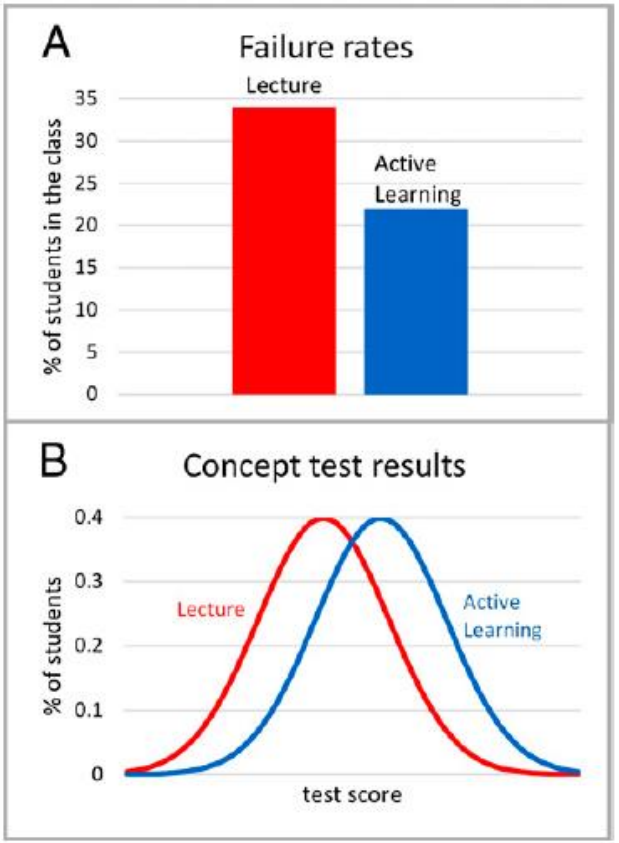
To test the hypothesis that lecturing maximizes learning and course performance, we metaanalyzed 225 studies that reported data on examination scores or failure rates when comparing student performance in undergraduate science, technology, engineering, and mathematics (STEM) courses under traditional lecturing versus active learning. The effect sizes indicate that on average, student performance on examinations and concept inventories increased by 0.47 SDs under active learning (n = 158 studies), and that the odds ratio for failing was 1.95 under traditional lecturing (n = 67 studies). These results indicate that average examination scores improved by about 6% in active learning sections, and that students in classes with traditional lecturing were 1.5 times more likely to fail than were students in classes with active learning. Heterogeneity analyses indicated that both results hold across the STEM disciplines, that active learning increases scores on concept inventories more than on course examinations, and that active learning appears effective across all class sizes—although the greatest effects are in small ($n \leq 50$) classes. Trim and fill analyses and fail-safe n calculations suggest that the results are not due to publication bias. The results also appear robust to variation in the methodological rigor of the included studies, based on the quality of controls over student quality and instructor identity. This is the largest and most comprehensive metaanalysis of undergraduate STEM education published to date. The results raise questions about the continued use of traditional lecturing as a control in research studies, and support active learning as the preferred, empirically validated teaching practice in regular classrooms.

COMMENTARY

Large-scale comparison of science teaching methods sends clear message

Carl E. Wieman[1]

PNAS 111, 23 (2014)



Should the goals of STEM education research be to find more effective ways for students to learn or to provide additional evidence to convince faculty and institutions to change how they are teaching? Freeman et al. do not answer that question, but their findings make it clear that it cannot be avoided.

…Interactive-engagement methods!