Education Spaces have qualitative issues that are easily forgotten

TU Delft

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Is this question still asked …

Do we need WiFi and Power Sockets in Class?

We surely have passed discussions about WiFi and power sockets …

… still …

Is this question ever asked …

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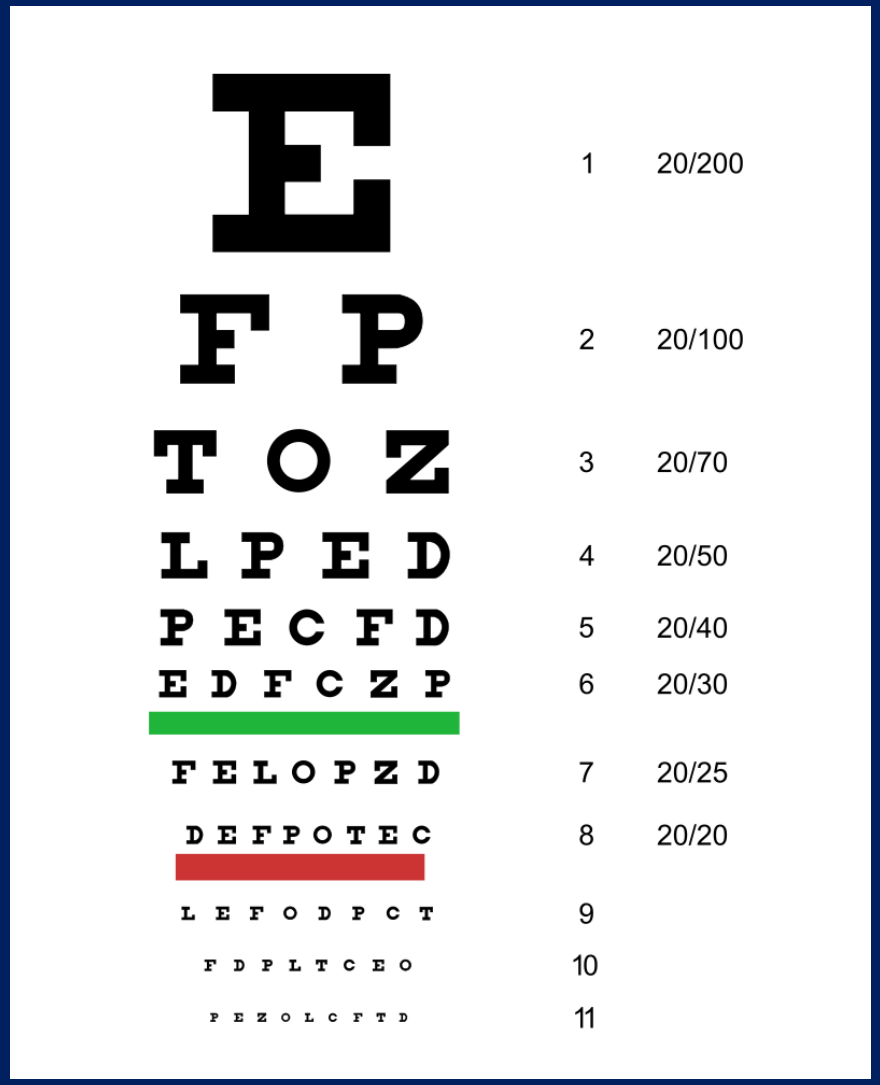
Can you read the subject matter?



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Snellen Chart … to measure visual acuity

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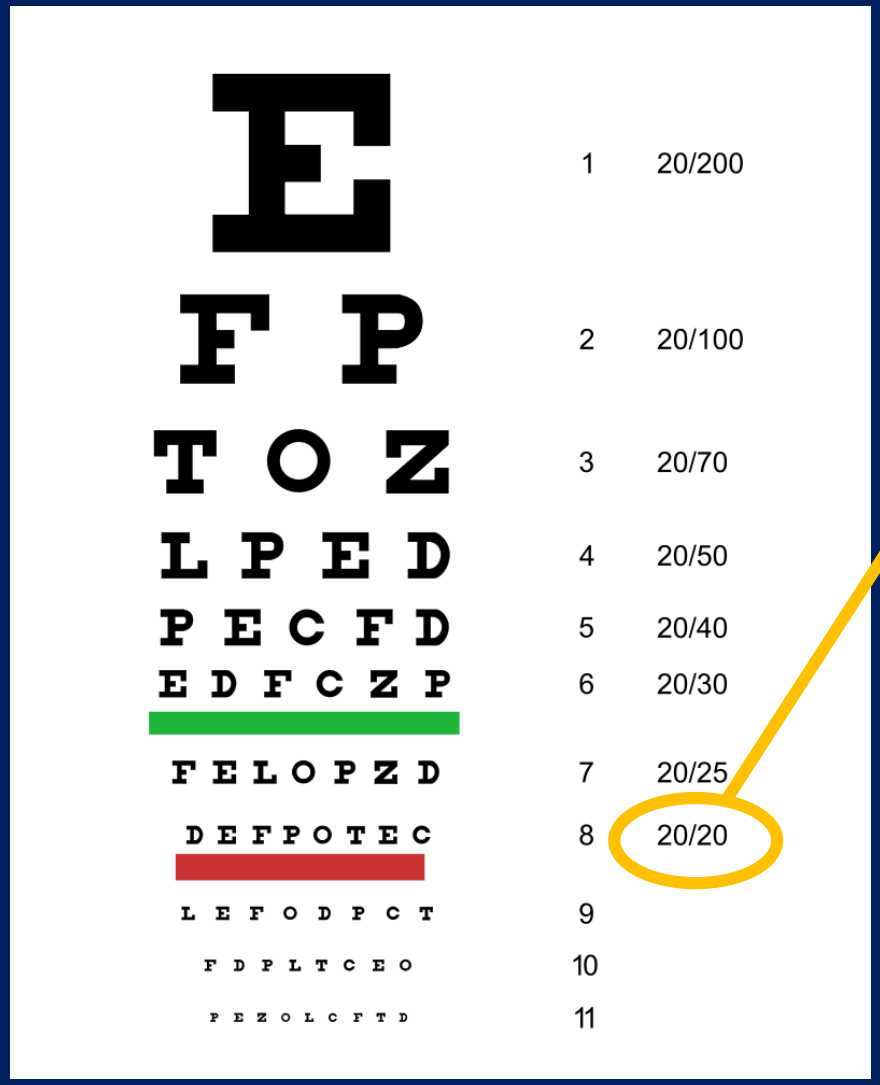
Can you read it now!



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Or is 100% visual acuity better…

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Education Spaces Configurator

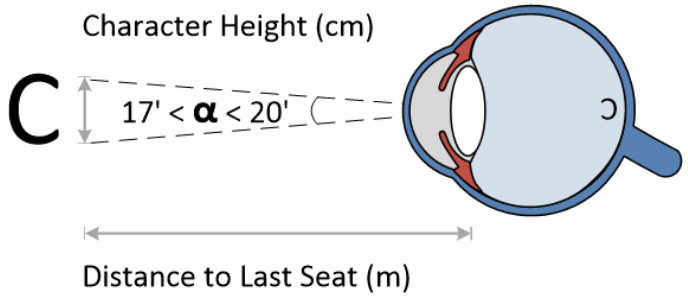
Readability is about …

Readability Tool for Education Spaces

Made by dr Piet van der Zanden

Select your Distance from Projection Screen to Last Seat

Lecture Hall	Meeting Room
	4
	5
	6
	7
8	
10	
12	
14	
16	
18	
20	
22	
24	
26	
28	



20' (arcminute) is based on 100% visual acuity (about the size of TV subtitling)
17' is minimal discernible angle for proper reading based on 100% visual acuity
14' lets you just discern the characters when proper luminance and contrast
1' is minimal angle to discern any pixels or lines based on 100% visual acuity

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DISCAS (Display Image Size for 2D Content Audiovisual Systems = AVIXA Norm)

22	Screen height should be at least 263.1 cm Character height should be at least 11.2 cm Test for yourself the distance from where you can properly read the (computer generated filler) text **Legibility distances**			
Angle of view (arc minutes)	20'	17'	14'	1'
	Normal readability guideline based on 100% visual acuity	Minimum readability guideline based on 100% visual acuity	Just dicernable characters with proper luminance and contrast	Distance from projection screen to first row at least
Distance to projection screen (m)	8.5	10.1	12.4	3.8
Calibri 11 Default Excel font	Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem. **Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Integer tincidunt. Cras dapibus. Vivamus**			
Distance to projection screen (m)	18.5	22.0	27.0	
Calibri 24 Typical PPT font	Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et **magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu**			

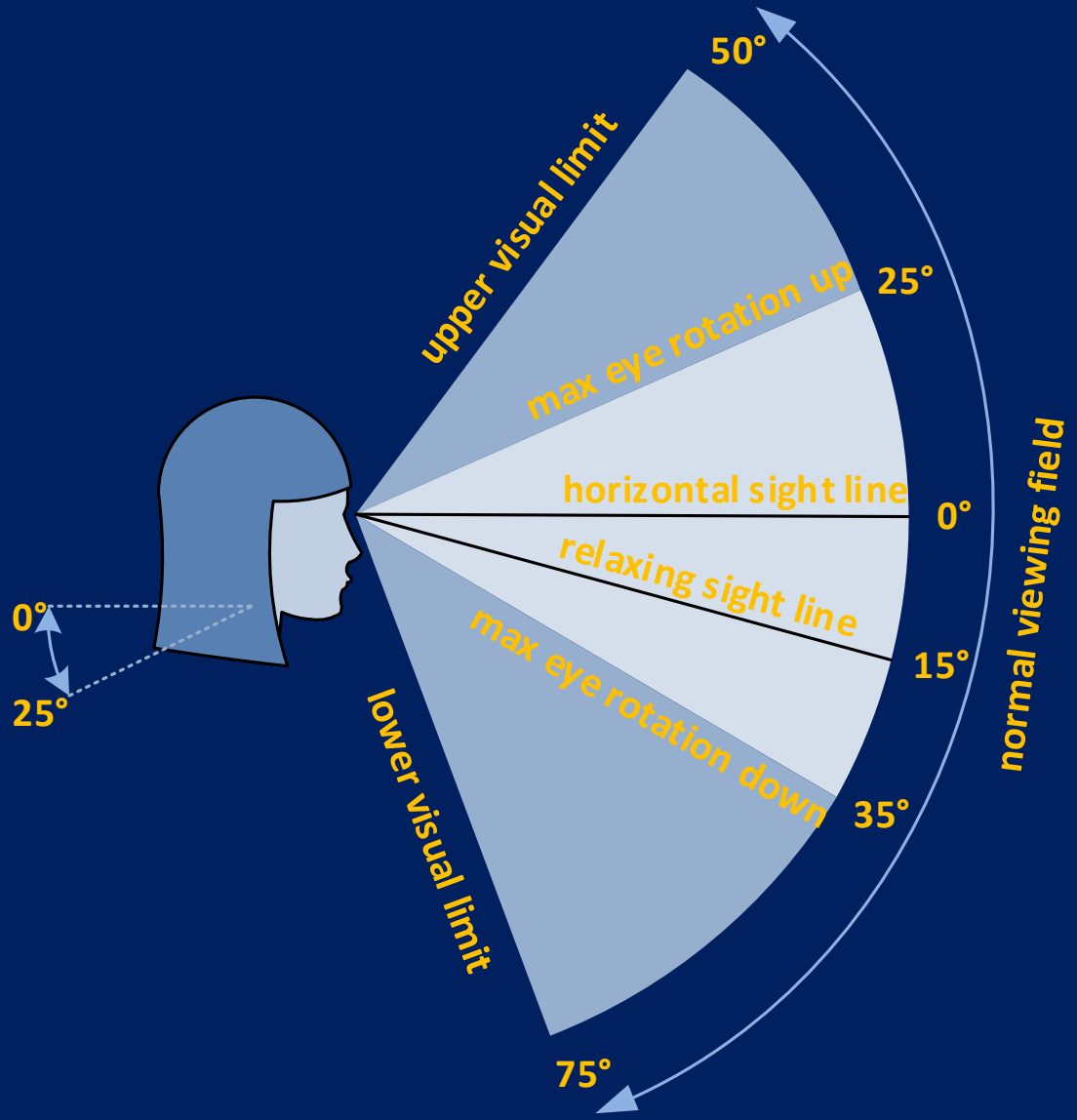
… Character-recognition

and not about words in your native language

Students have to discern strange Greek characters within complex formulas

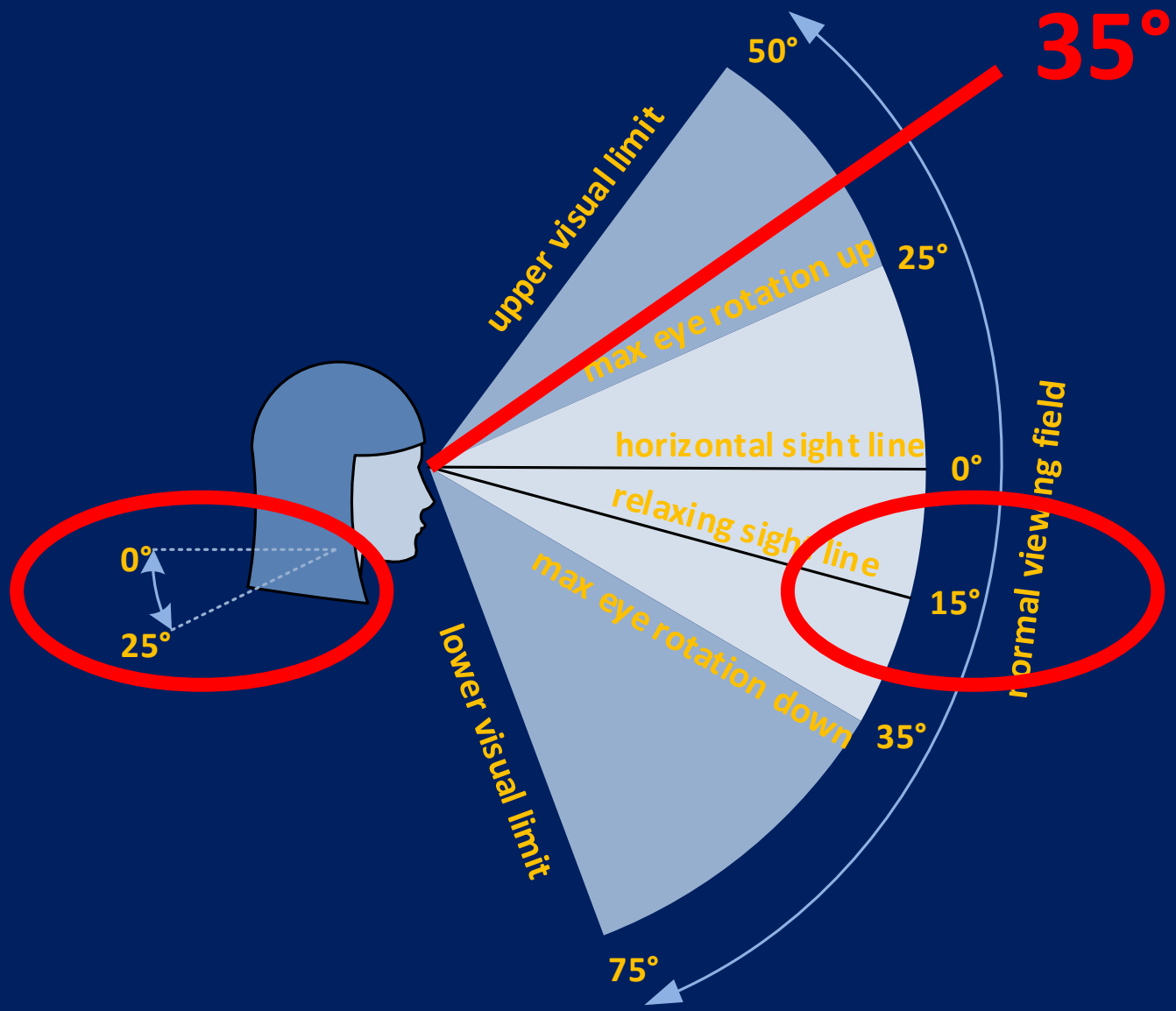
Education Spaces Configurator

… and vertical sightlines …



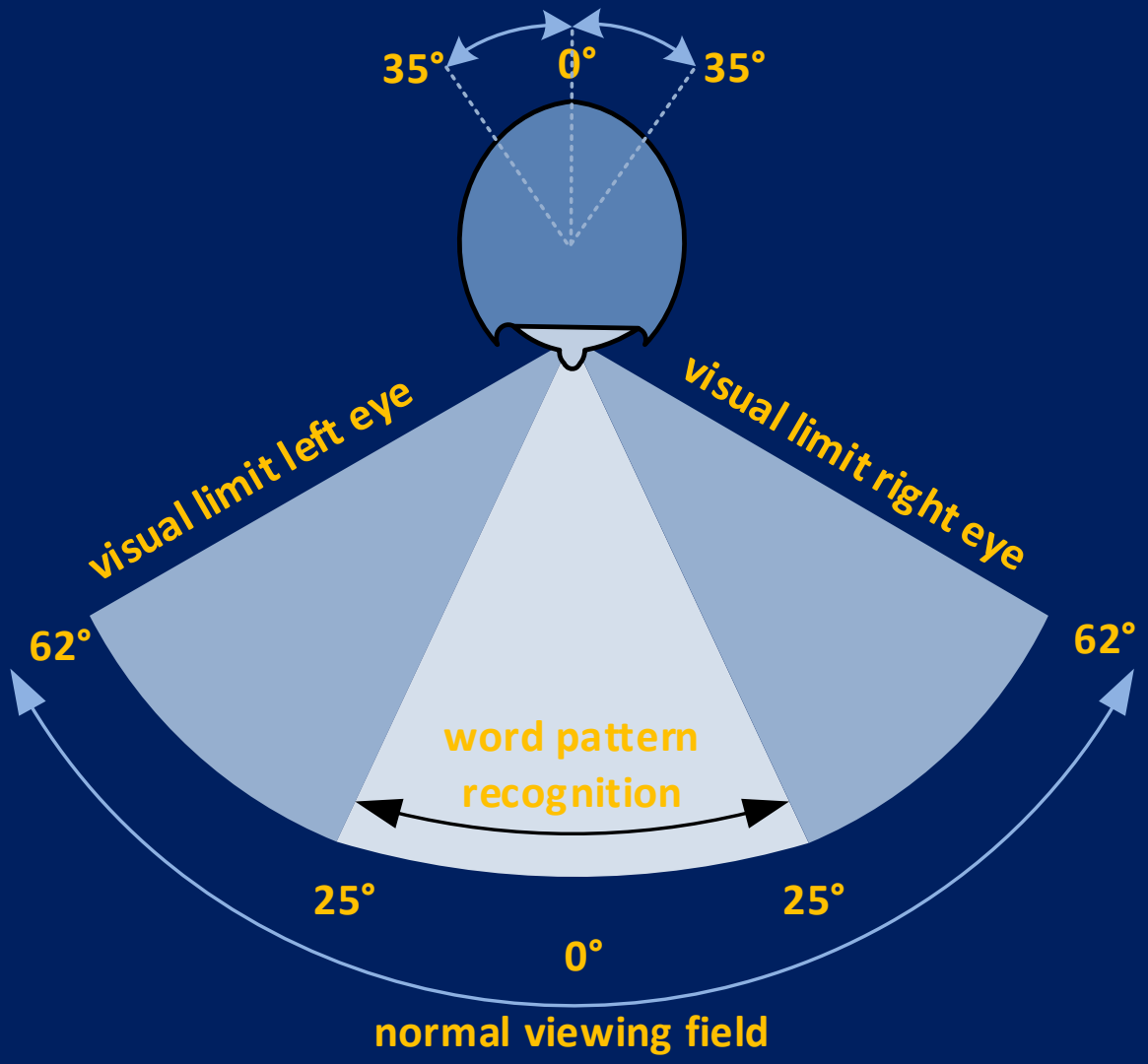
Education Spaces Configurator

… and vertical sightlines …



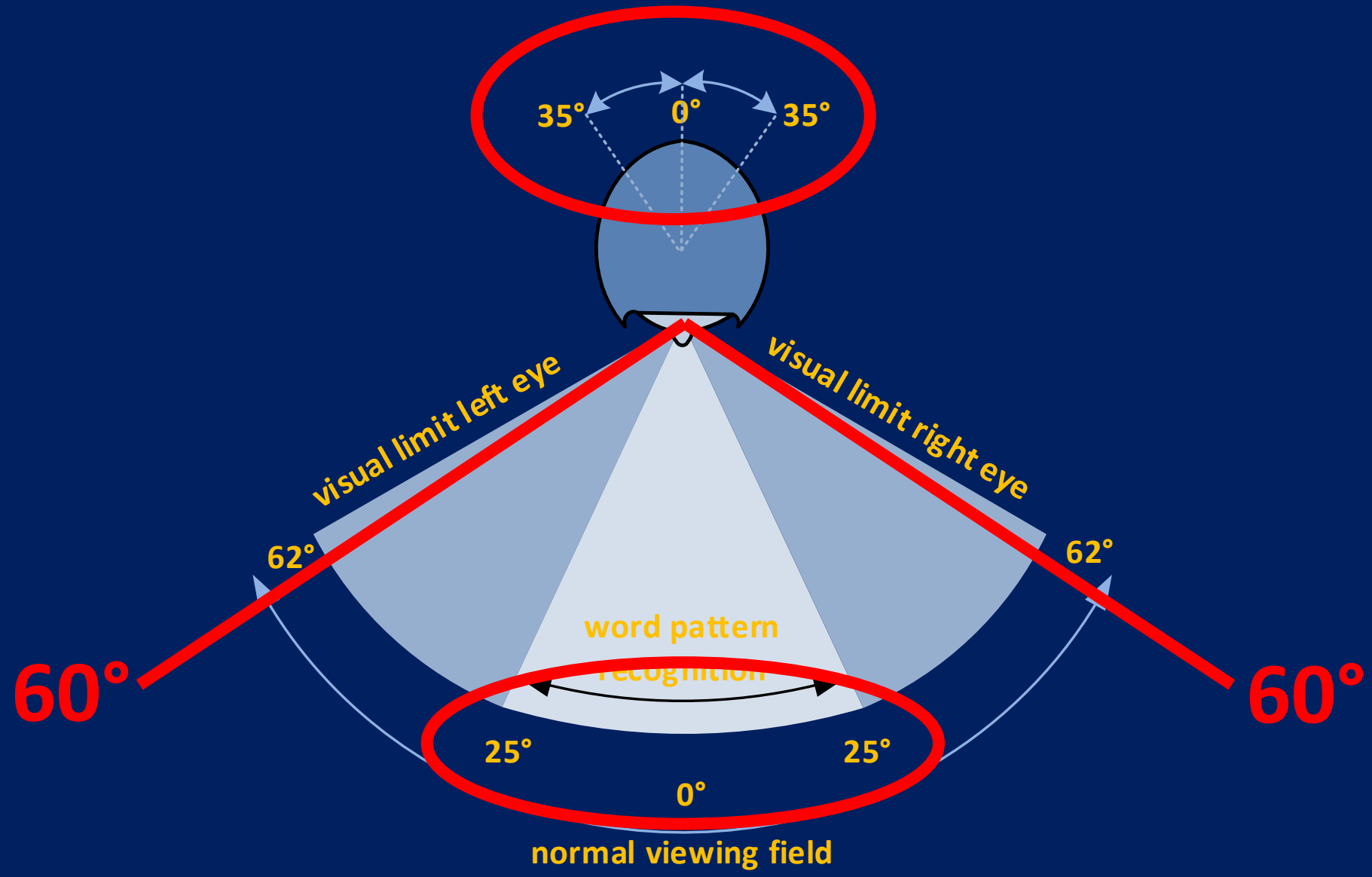
Education Spaces Configurator

… horizontal sightlines …



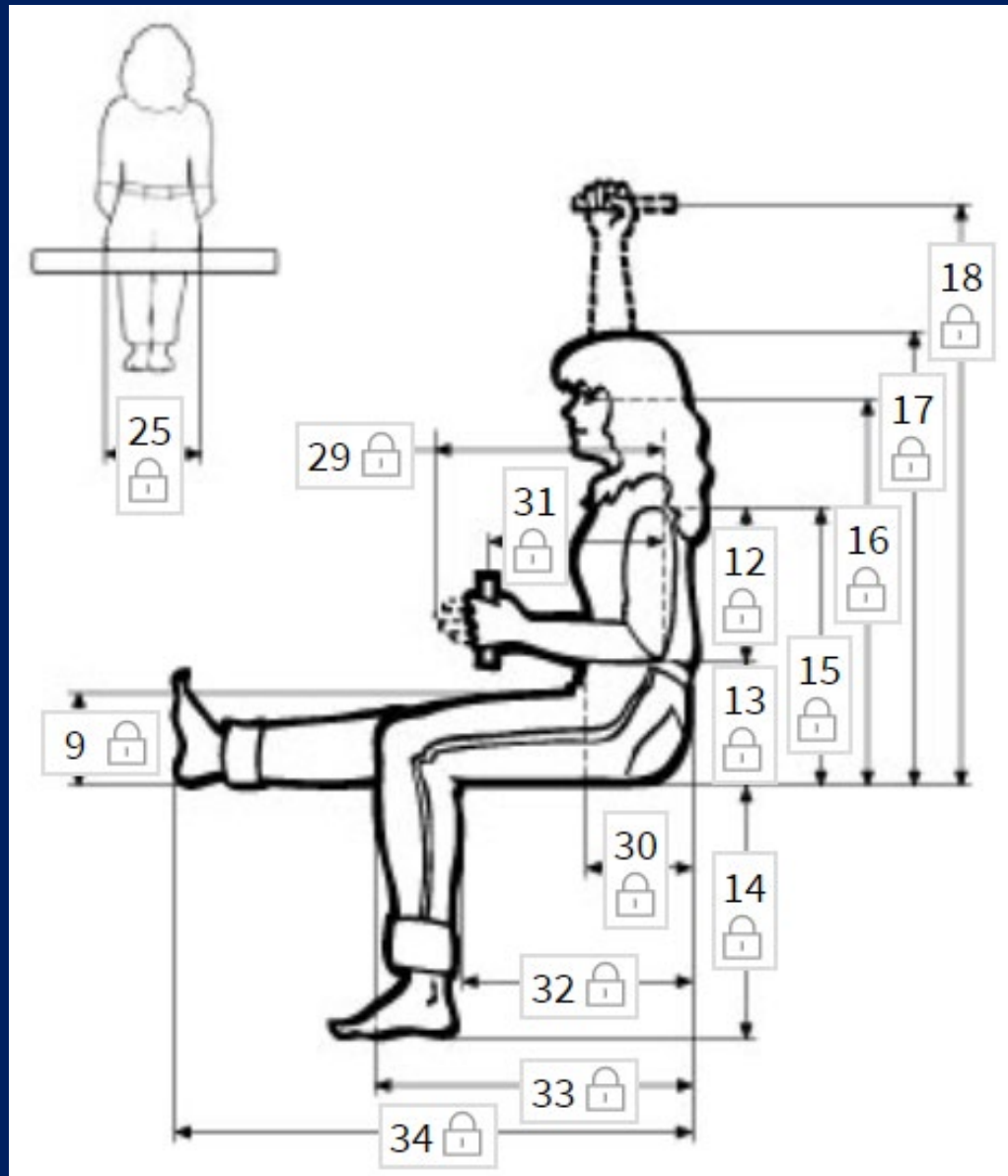
Education Spaces Configurator

… horizontal sightlines …



Education Spaces Configurator

… ergonomics …



https://dined.io.tudelft.nl

Human measurements

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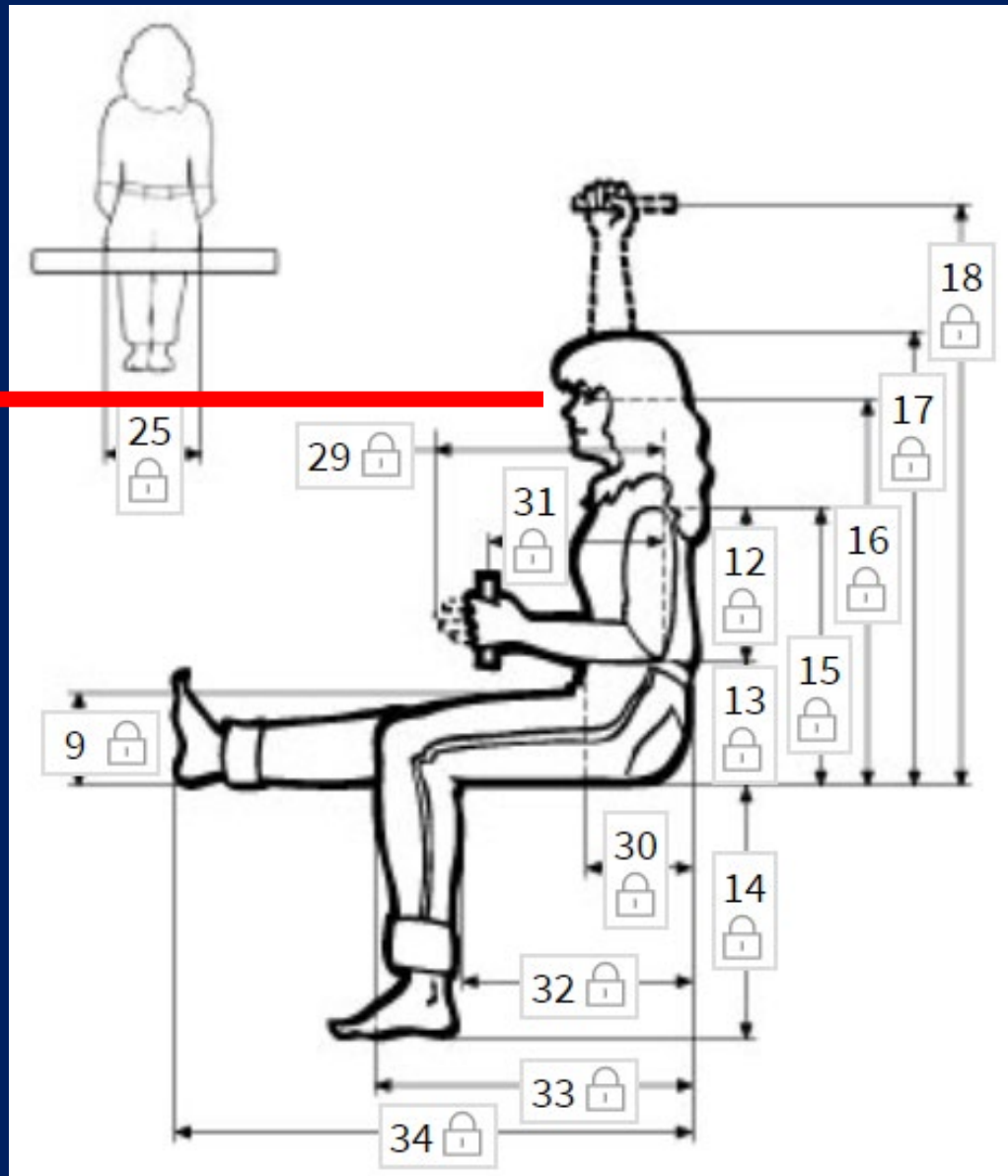
… ergonomics …

130 < eye height < 155 cm



https://dined.io.tudelft.nl
Human measurements

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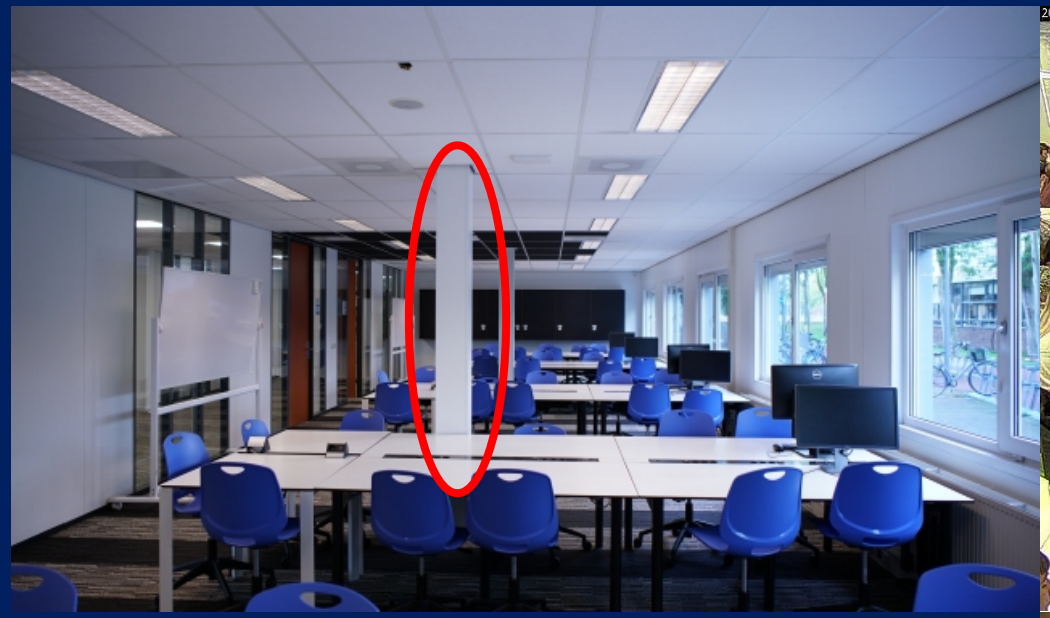
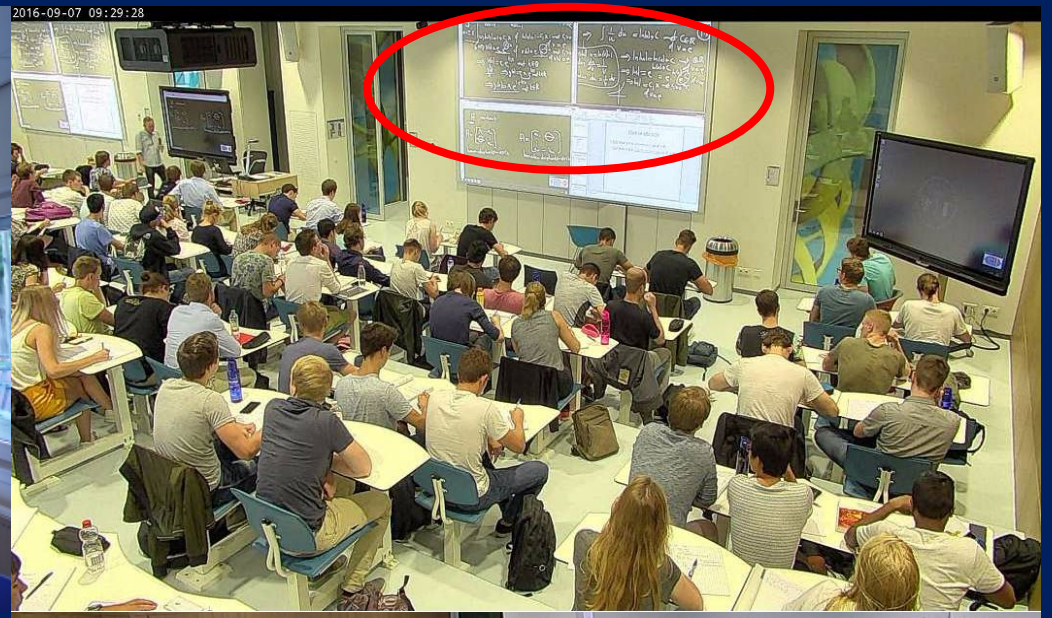
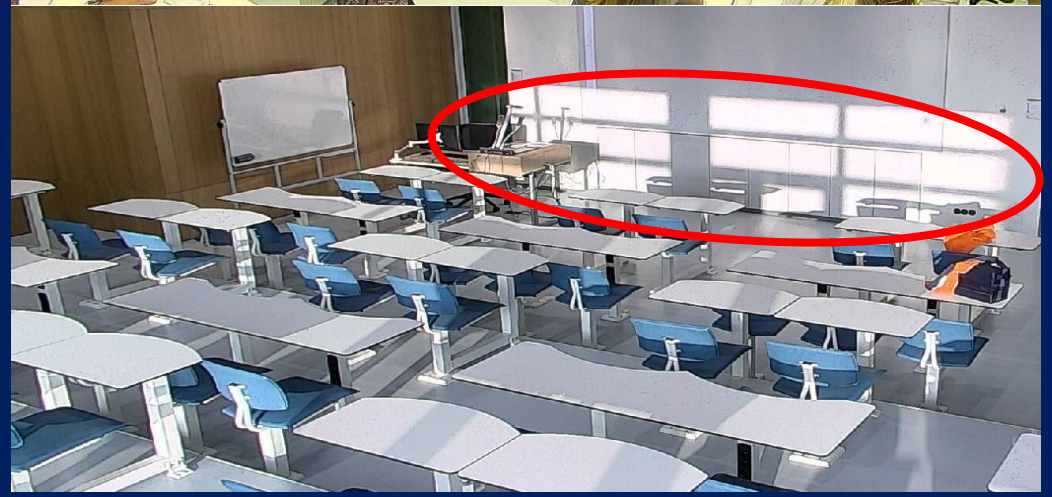
… and what about …







Obstructions …
Lighting …
Sunbeams …
Acoustics …
HVAC …

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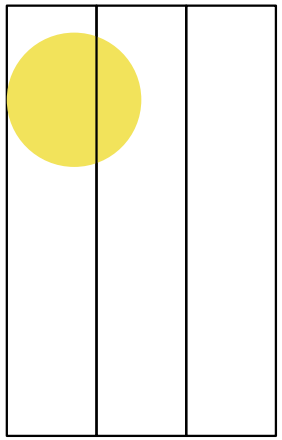
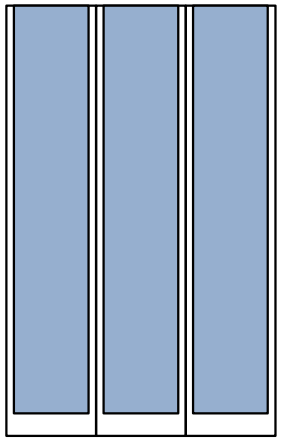
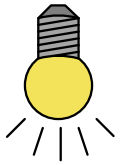
… up to the perceived image quality



Daylight:
Dependent on sun and season

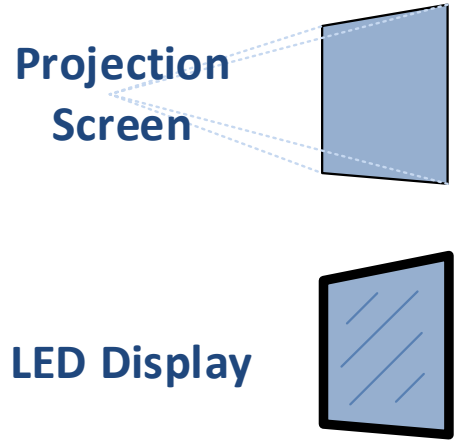


Blinds:
Dependent on glare and opacity



Lighting:
Dependent on lux and colour

Projector:
Dependent on illuminance and type



Projection:
Dependent on screen or display

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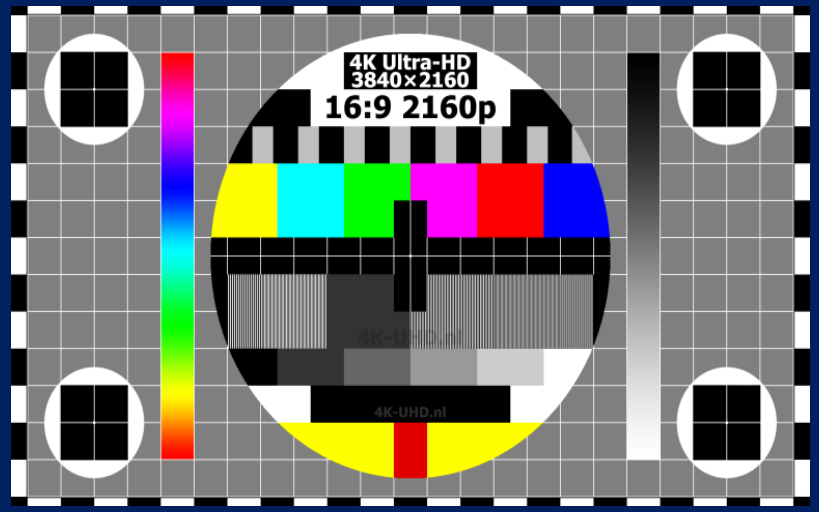
… image quality

AVIXA Norm PISCR (Projected Image System Contrast Ratio):

- Passive Viewing requires a minimum contrast ratio of 7:1
- Basic Decision Making requires a minimum contrast ratio of 15:1
- Analytical Decision Making requires a minimum contrast ratio of 50:1
- Full Motion Video requires a minimum contrast ratio of 80:1

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16



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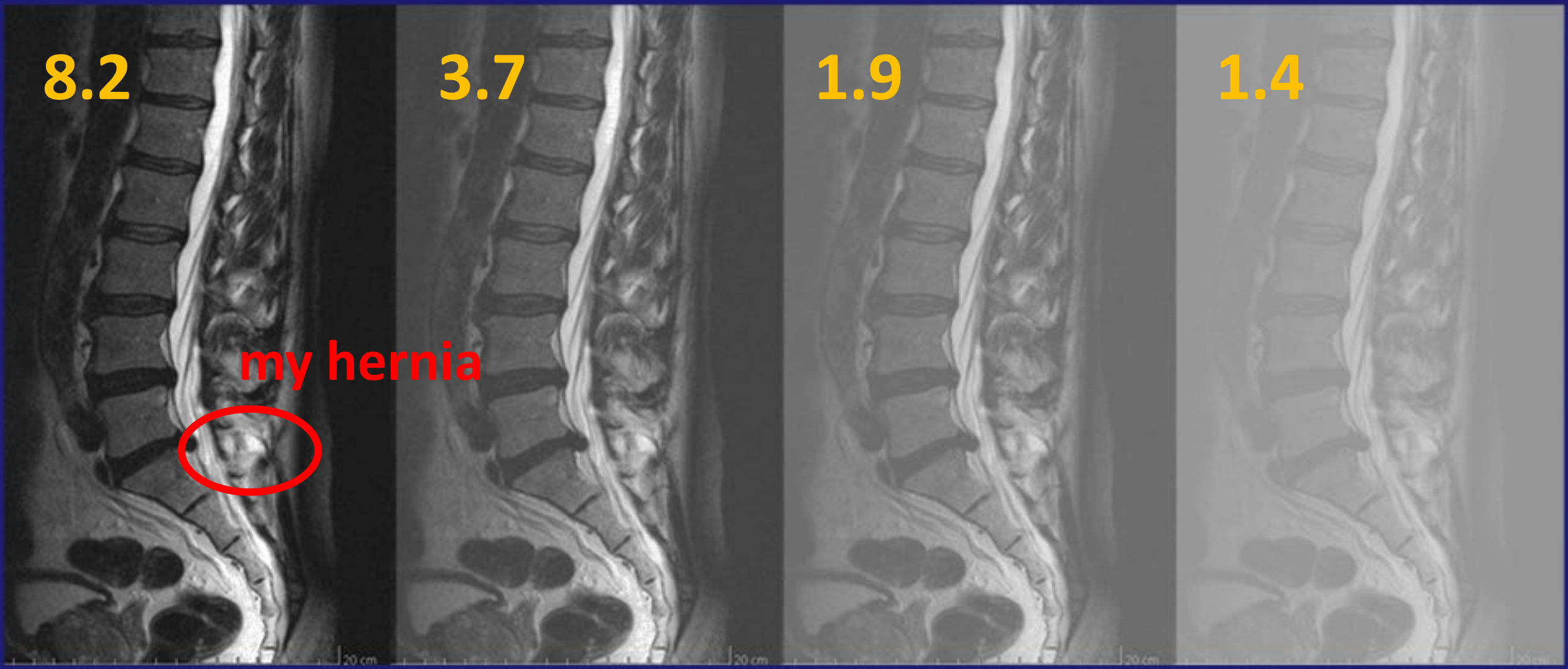
… Contrast Ratio's (PISCR)



Pedagogy is held hostage by Physical Constraints

" We shape our buildings,
and afterwards our
buildings shape us"

— Sir Winston Churchill

Without the proper affordances no educational change …

Teachers can only use affordances when available …

Teaching Facilities

What's going on today …

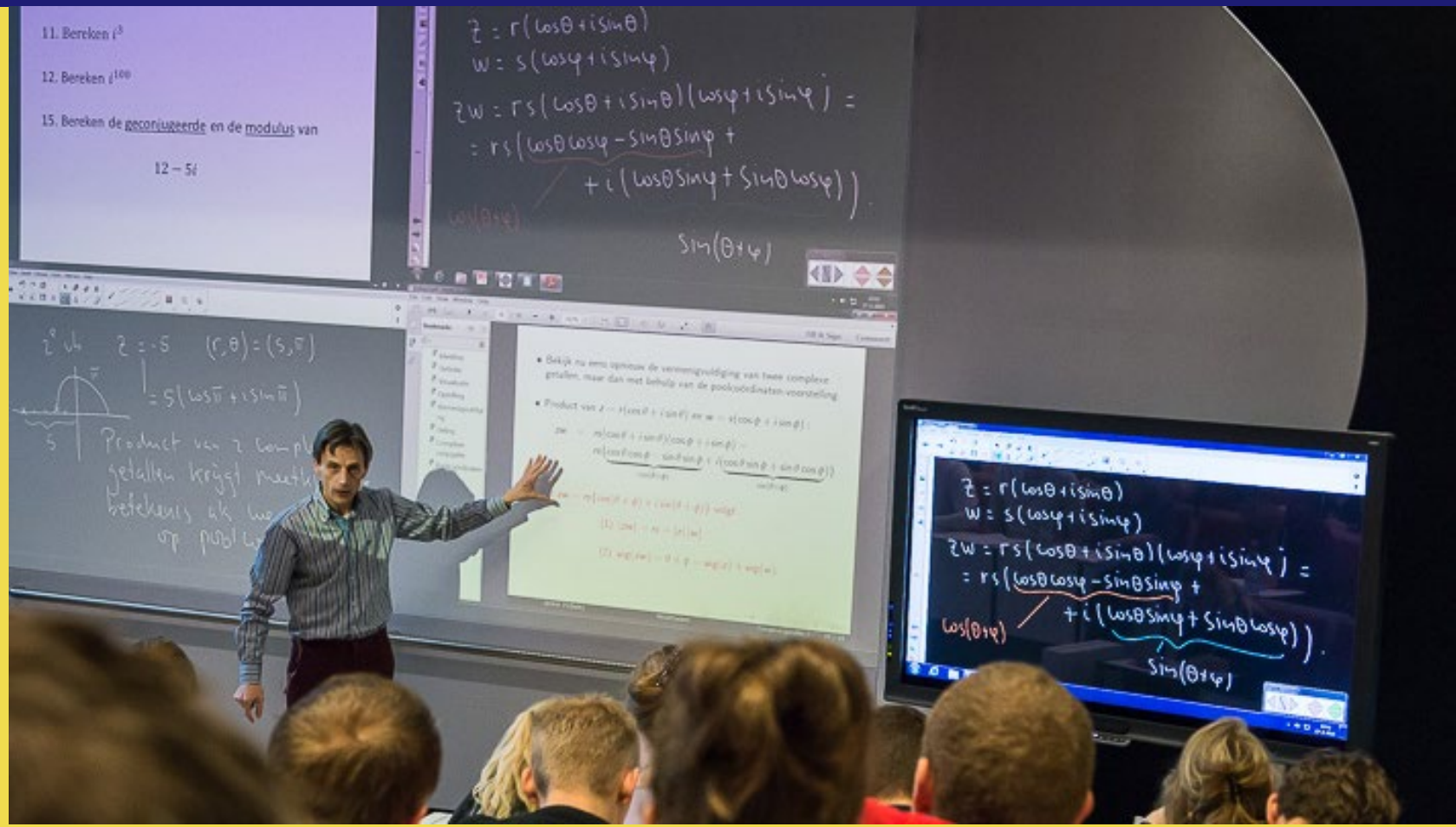
From Chalk to Digital Writing & Quad Signal System









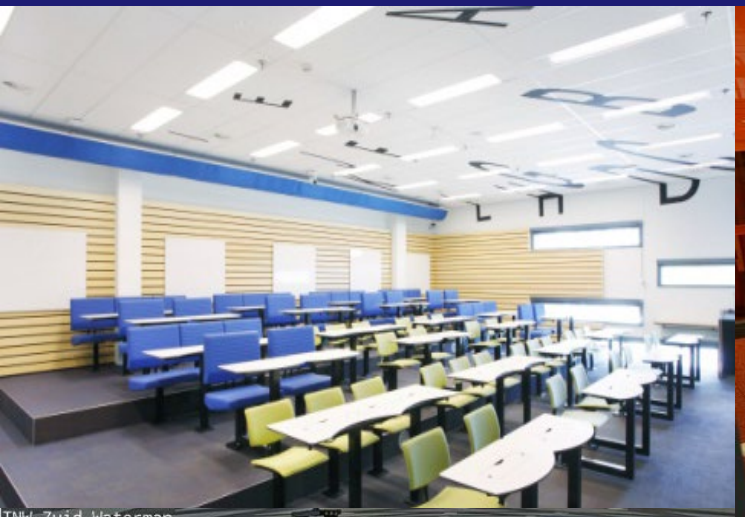


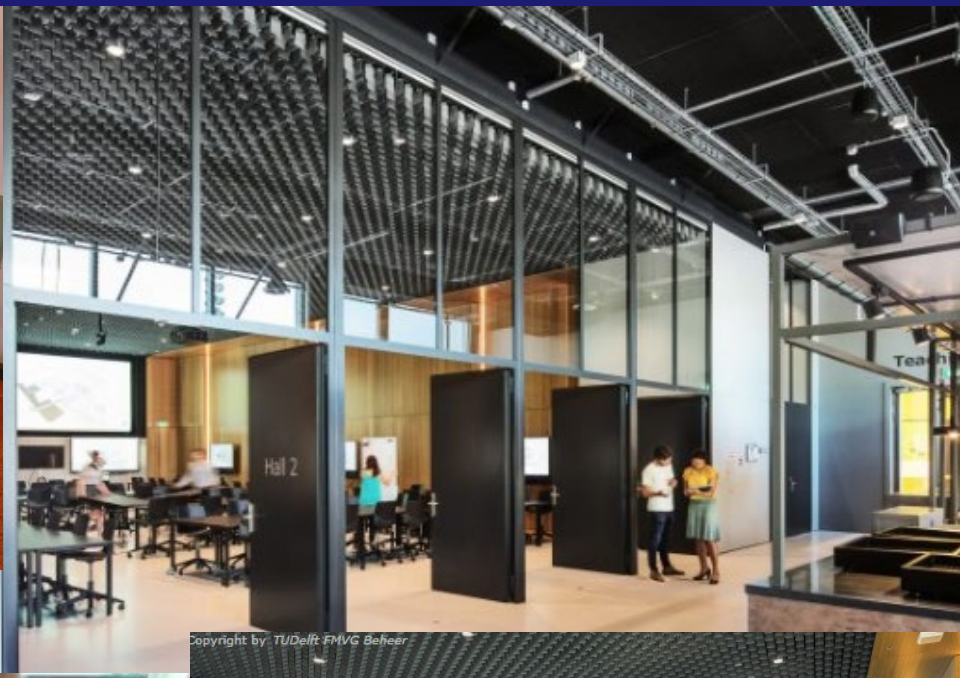
From Chalk to Digital Writing & Dual Signal System

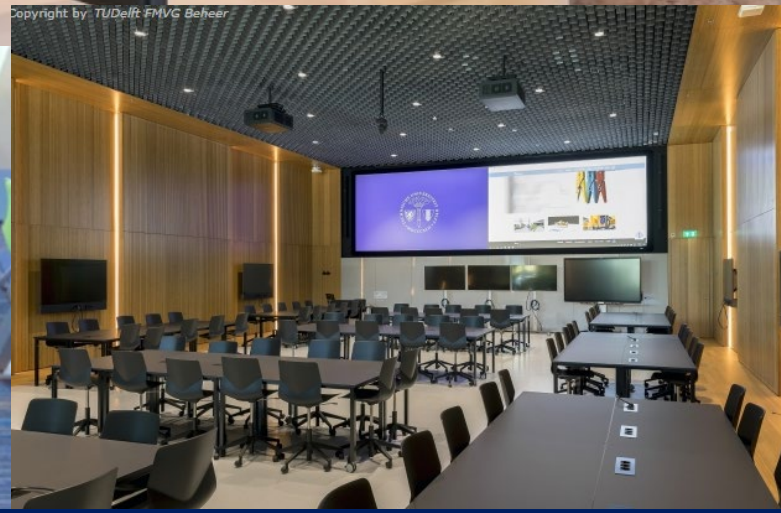
Dual presentation system for classrooms < 10 meters i.e. displays

Dual presentation system for classrooms > 10 meters i.e. projectors

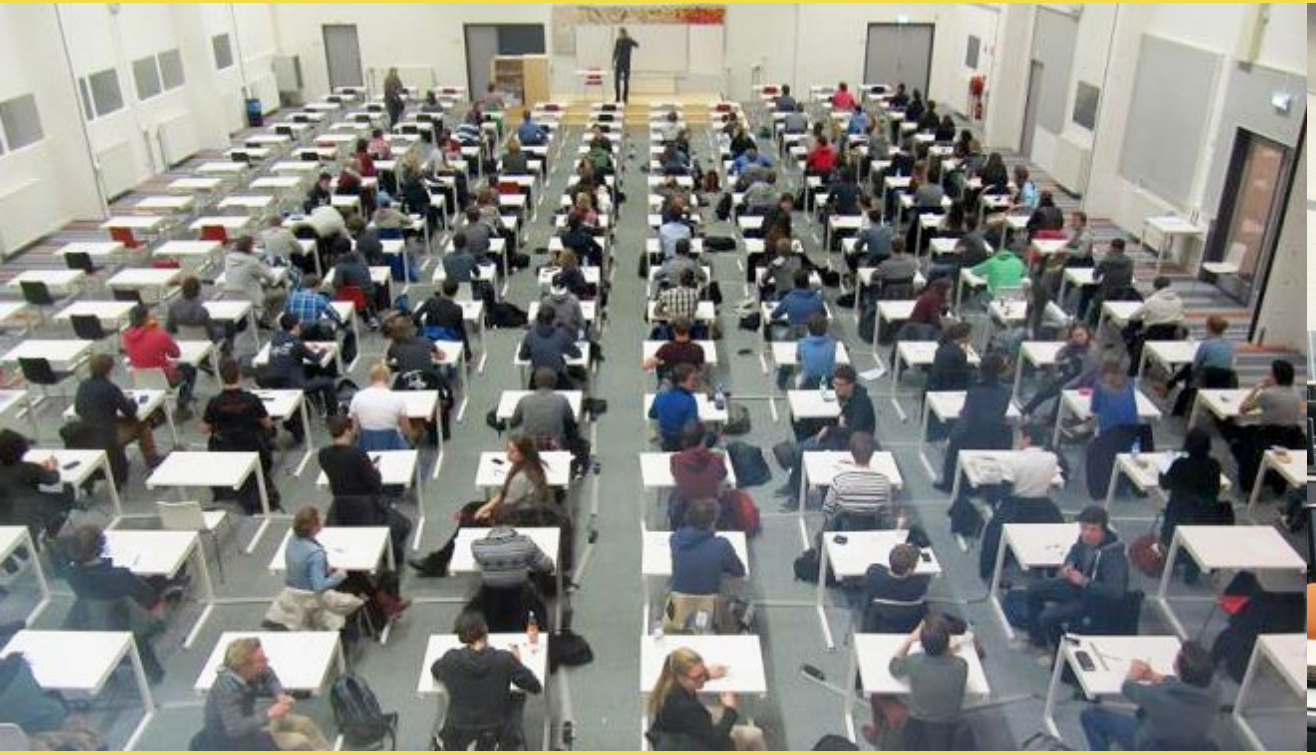
From Chairs in Rows to Mixed Practices







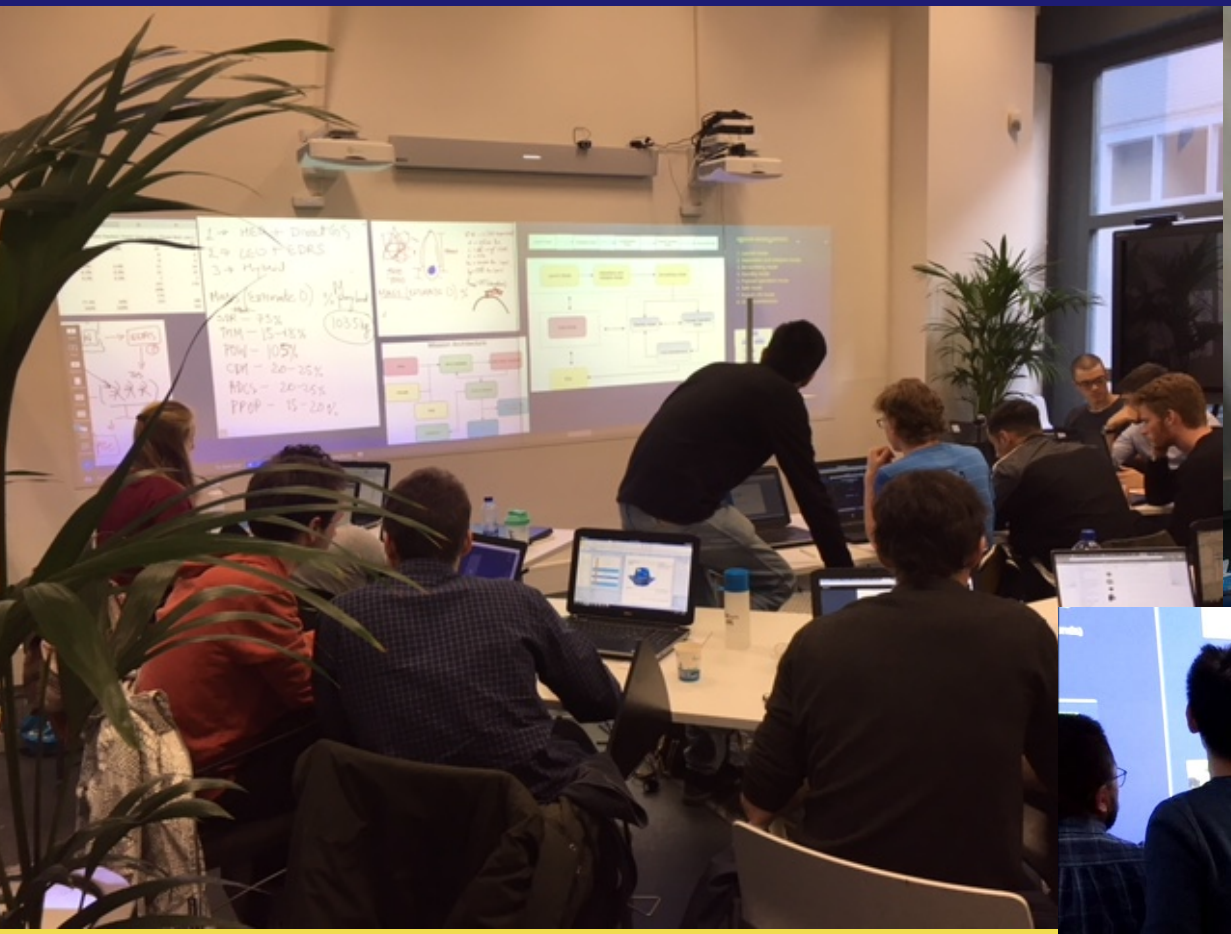
From Paper Exams to Digital Exams and Practicals

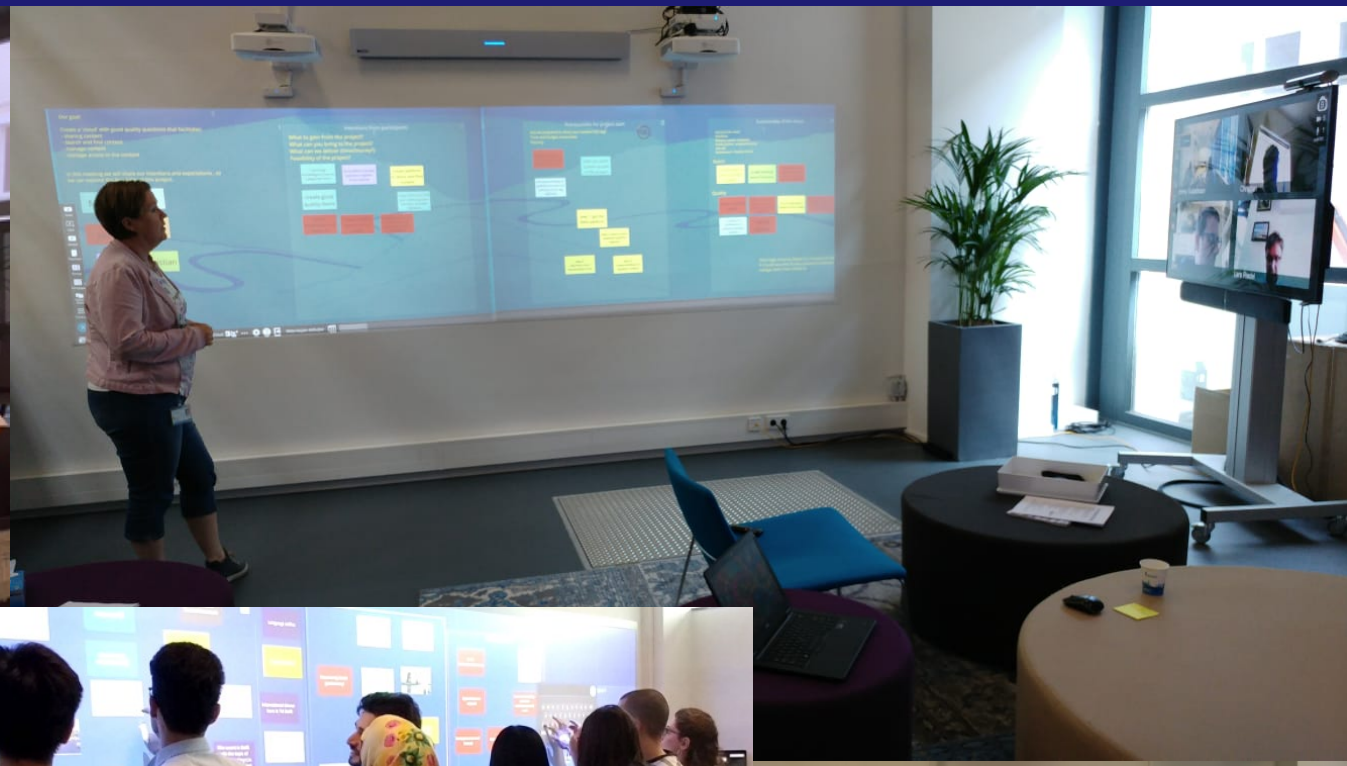


… still today we have old-fashion exams to test memory, methods and techniques

… it is growing to testing problem solving, creative design thinking, and collaboration to become mainstream

From Meeting to Dynamic Collaboration



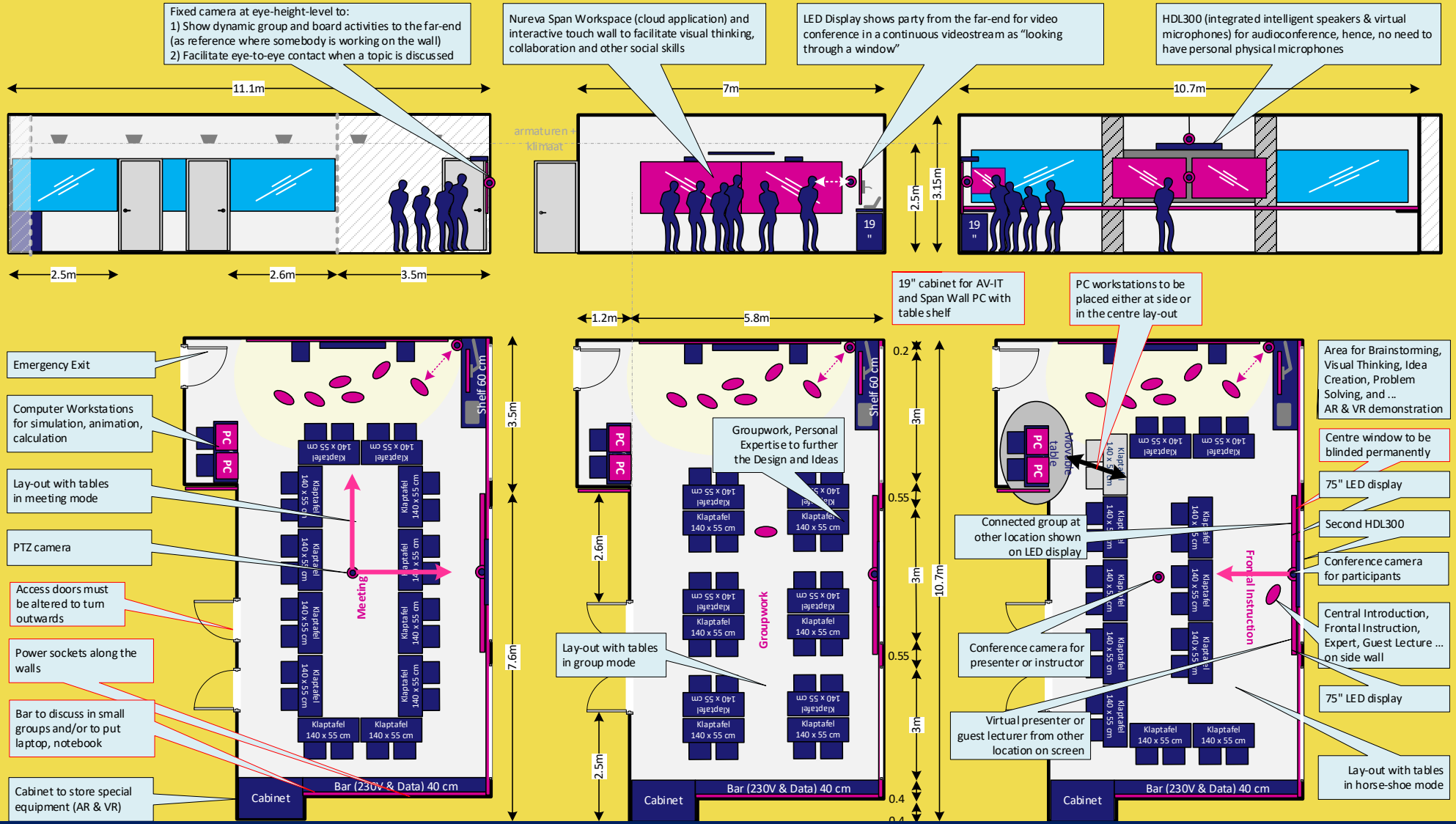


… Nureva Span Wall …
Externalizing your thoughts (visual thinking) helps matching different mind-sets

From Physical & Online to Hybrid Practices

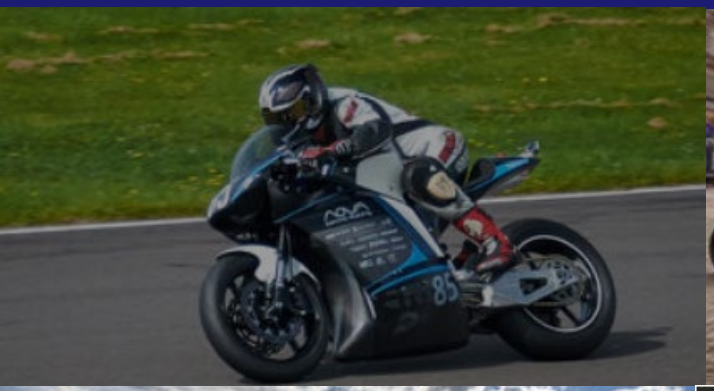
The start of a new era …
Hybrid Education Practices

Collaborative Design Lab (ready May 2020)



Engineering Education

From Theory to Authentic Problem Solving (STEAM)









Requirements

Readability, Sightlines, Contrast, Lighting, Acoustics, Seat Capacity, Accessibility, Safety

How to Transform the Education Spaces Legacy

… Situation at TU Delft

Situation two decades earlier:

- Research had main focus
- 12,000 students
- Faculties had **multi-functional** buildings
- Faculties managed their own research and education spaces

Situation today:

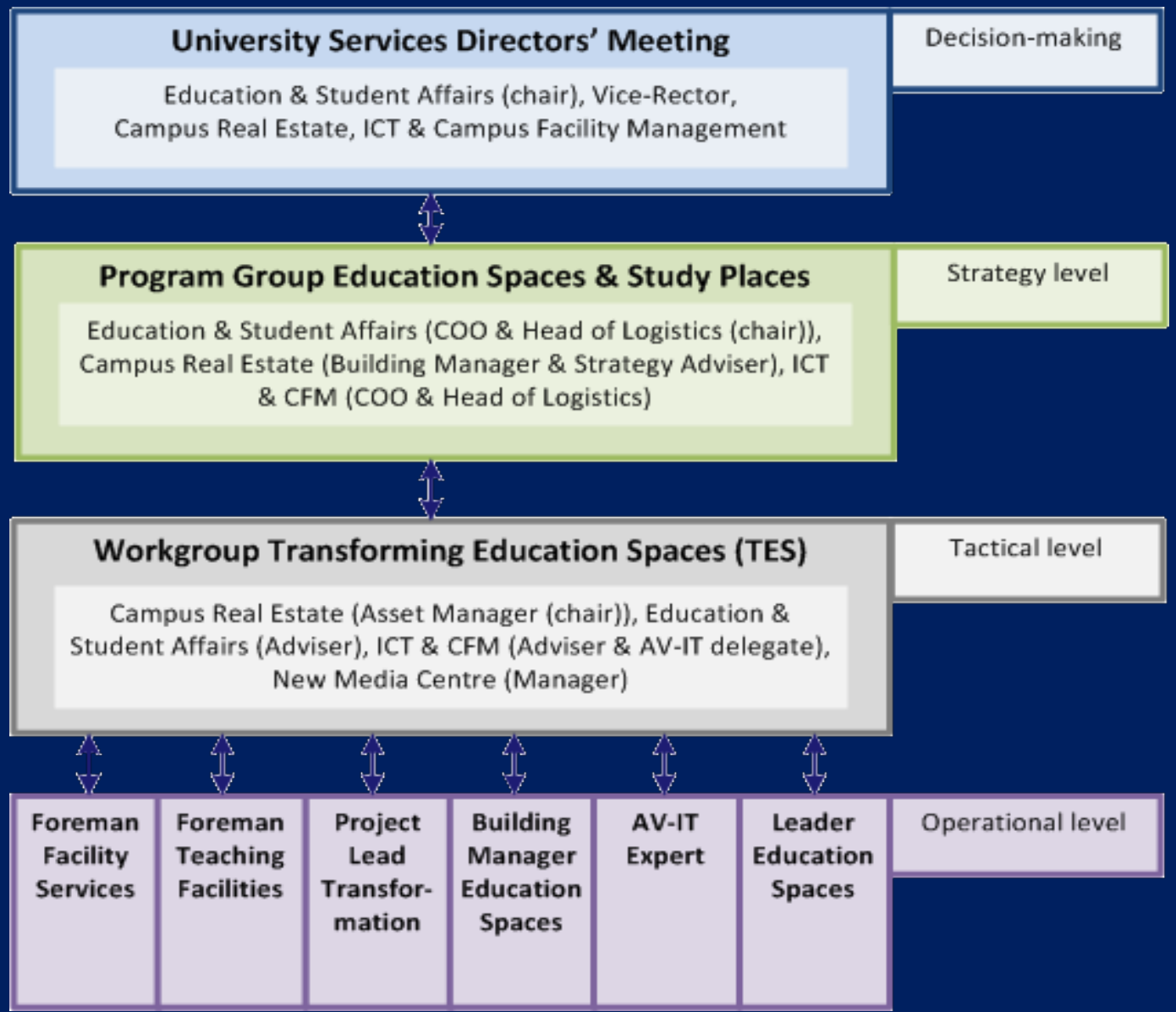
- Education & Research & Valorisation
- 26,500 students
- New buildings are **mono-functional**
- **Generic education spaces are** centrally managed and scheduled

Transformation Plan for Generic Lecture Halls and Classrooms (2015 – 2024)

- Education, Real Estate, IT & Facilities shall work together (shared task …)
- All generic education spaces have easy operation (how …)
- All generic education spaces should confirm to minimum standards (which …)
- All generic education spaces are classified to current pedagogies (basic and advanced)

Education Spaces Configurator

Governance Structure



Key Success Factor 1:

Several departments have been working together to put the management of learning spaces under central control

Work and speak as one …

Education Spaces Configurator

Cookbook Education Spaces

Key Success Factor 2:

Well defined requirements and guidelines written on paper started the general notion and definitions for the proper affordances

Shared and generally understood requirements and constraints between the several parties deliver a better result

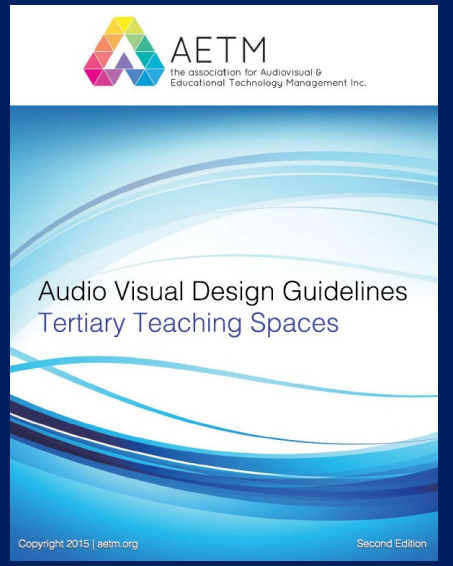
http://homepage.tudelft.nl/9c41c/Cookbook_Education_Spaces_v2_0.pdf

Education Spaces Configurator

What is in the Cookbook

- **Part A:** Classification of Teaching Practices **[frontal, mixed, collaborating, testing]**
- **Part B:** Education Spaces Typologies **[lecture hall, classroom, terraced classroom]**
- **Part C:** Education Spaces Requirements **[parameters, furniture, AV-IT, legilibility]**
- **Part D:** Study Workplaces **[silent study places, touchdown spots, meeting places]**

Interesting similar documents:



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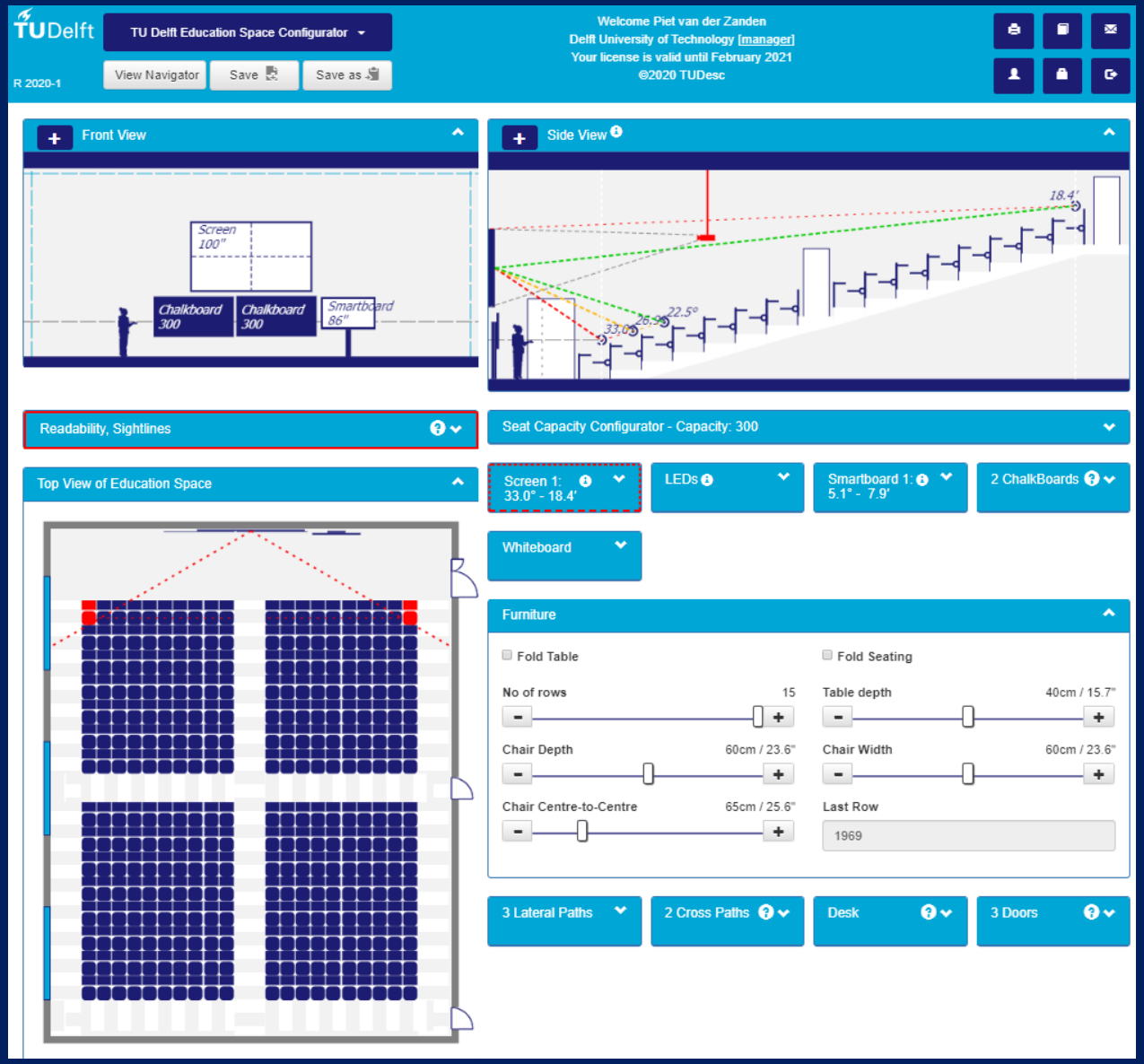
Now Readability is visualized



TU Delft Education Spaces Configurator (TUDesc)

Current features:

- Readability
- Sightlines
- Seat Capacity
- Accessibility

- Social Distancing

Demonstrating TUDESC

Education Spaces Configurator

TUDesc Benefits

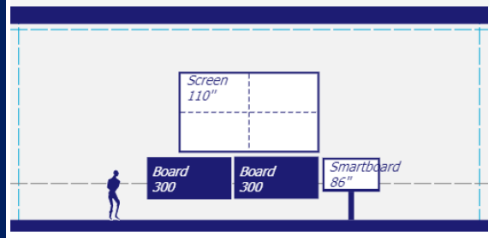
- Visualizing education related features in lecture halls and classrooms prevent problems before they occur
- Writing proper Programs of Requirements yourself helps with commissioning
- Being able to study an education space design beforehand saves lots of time and money (normally spent on third parties)
- Proposed changes and versioning during projects can be checked and approved instantly to prevent successive meetings (saving time of teams and third parties)
- Checking the requirements during acceptance and project discharge is easy

- Manage and document your pool of education spaces
- Know the education related features of your pool of education spaces

TUDesc instant reports

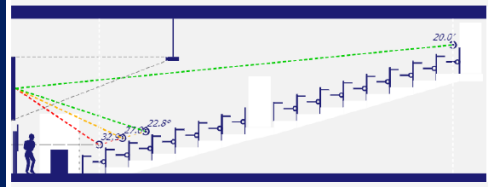
Education Spaces Configurator

TUDESC©2019	Undefined Building - Demo1 Quad Signal Tiered Lecture Hall 1/26/2020
University	Delft University of Technology
Building	Undefined Building
Space Name	Demo1 Quad Signal Tiered Lecture Hall
Space Number	Demo1
Comments	This education space is to show the several options.
Space Dimensions	
Space Width	1700cm / 669.3"
Space Height	800cm / 315.0"
Space Depth	2150cm / 846.5"
Ceiling Construction Area	60cm / 23.6"
Floor Construction Area	40cm / 15.7"
Clear Height	700cm / 275.6"
Clear Width	30cm / 11.8"

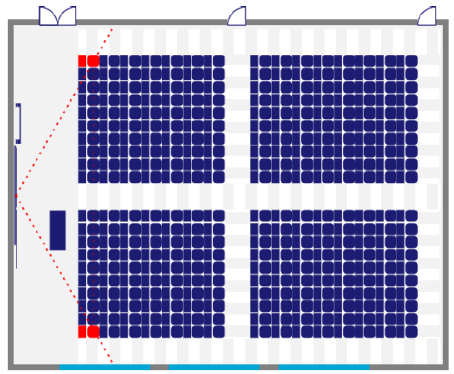


Projection Screens	
No. of screens	1
Size	110" 487.0x274.0cm
Aspect Ratio	16:9
Assembly space	20cm / 7.9"
Frame width	7cm / 2.8"
Position	599cm / 235.8"
Screen type	Quad
Readability	20.0
Angle First Row	32.9
Projector Pole	172cm / 67.7"
Projector Distance	700cm / 275.6"
Smartboard	
No. of screens	1
Size	86" 190.4x107.1cm
Distance	10cm / 3.9"
Aspect Ratio	16:9
Frame width	7cm / 2.8"
Position	1111cm / 437.4"
Readability	7.8
Angle First Row	4.8
LED	
No. of screens	0
Chalkboard	
No. of boards	2
Width 1	300cm / 118.1"
Height 1	150cm / 59.1"
Column height 1	240cm / 94.5"
Position 1	480cm / 189.0"
Double board 1	false
Show columns 1	false
Floor to underside 1	73cm / 28.7"
Width 2	300cm / 118.1"
Height 2	150cm / 59.1"

Chalkboard	
Column height 2	240cm / 94.5"
Position 2	790cm / 311.0"
Double board 2	false
Show columns 2	false
Floor to underside 2	75cm / 29.5"



Classroom Lay-out	Tiered Lecture Hall
Distance first row	400cm / 157.5"
Vertical Angle First Row	32.9 °
Distance last row	2000cm / 787.4"
Level height	30cm / 11.8"
Eye height	130cm / 51.2"



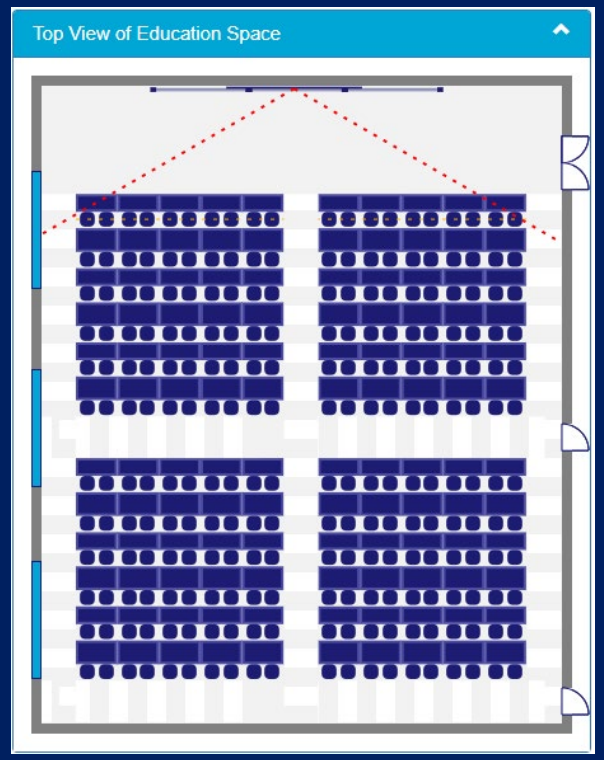
Horizontal Angle	60°
Paths	
Number of Lateral Paths	3
Width of Lateral Path 1	130cm / 51.2"
Width of Lateral Path 2	130cm / 51.2"
Width of Lateral Path 3	130cm / 51.2"
Number of Cross Paths	2
Width of Cross Path 1	130cm / 51.2"
Width of Cross Path 2	105cm / 41.3"
Lectern Desk	
Desk depth	80cm / 31.5"
Desk width	200cm / 78.7"
Desk height	110cm / 43.3"
Desk distance	180cm / 70.9"
Desk position	575cm / 226.4"
Furniture Configuration	

Furniture Configuration	
Fold Table	false
Fold Seating	false
Table Depth	40cm / 15.7"
Chair depth	60cm / 23.6"
Chair width	60cm / 23.6"
Chair centre to centre	65cm / 25.6"
Row Passage	5cm / 2.0"
Furniture Results	
Safety Regulations	??
No of rows	15
Seat Capacity	300 (298)
Blocked Seats	0
Exam Capacity	150
Doors	
No. of Doors	3
Width door 1.1	90cm / 35.4"
Width door 1.2	90cm / 35.4"
Height door 1	270cm / 106.3"
Distance door 1	130cm / 51.2"
Door outwards 1	true
Wall door 1	1
Width door 2.1	100cm / 39.4"
Width door 2.2	90cm / 35.4"
Height door 2	230cm / 90.6"
Distance door 2	1075cm / 423.2"
Door outwards 2	true
Wall door 2	2
Width door 3.1	100cm / 39.4"
Width door 3.2	90cm / 35.4"
Height door 3	230cm / 90.6"
Distance door 3	2030cm / 799.2"
Door outwards 3	true
Wall door 3	2

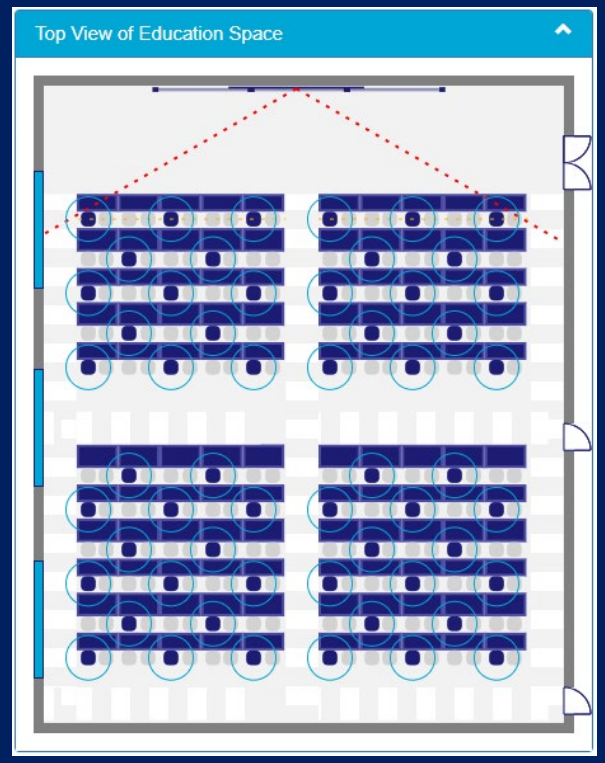
Education Spaces Configurator

Social distance and floorplan

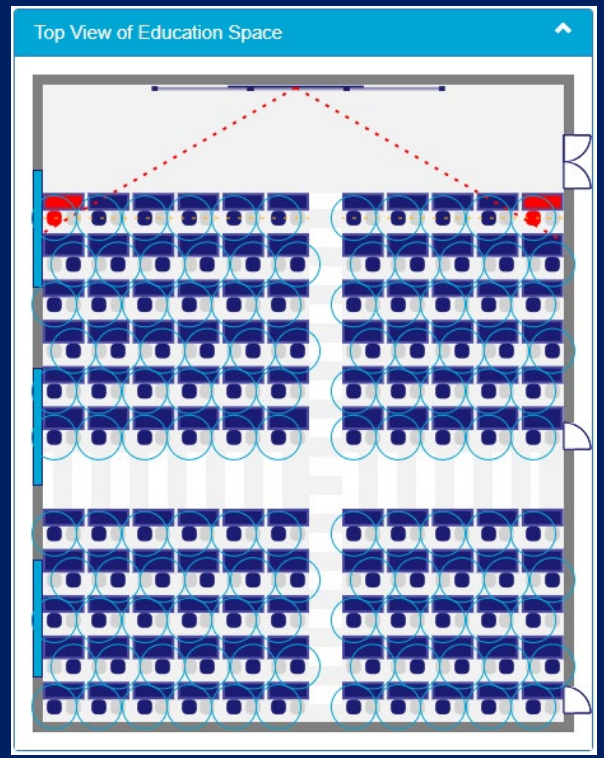
Normal layout = 240



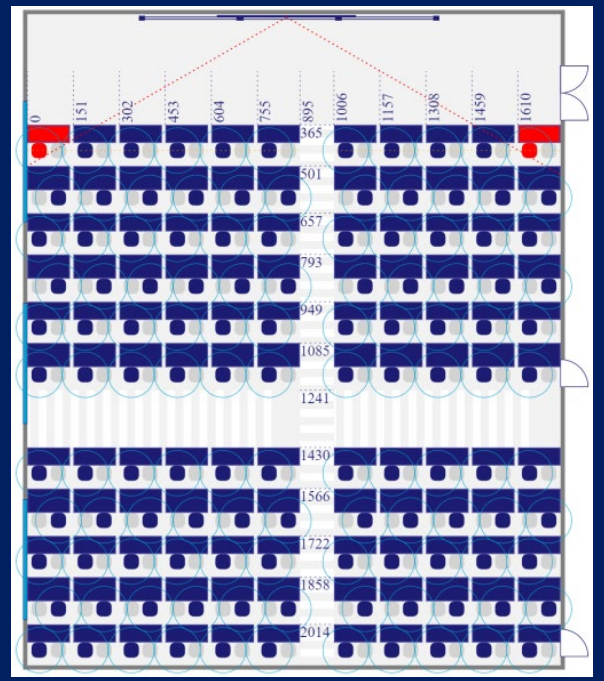
Regular algoritm = 60



Optimized layout = 121



Printed floorplan with exact placement



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