



How innovation in radiation oncology changes educational models

Jesper Grau Eriksen

Professor, Dept. Experimental Clinical Oncology, Aarhus University Hospital

Director, ESTRO School

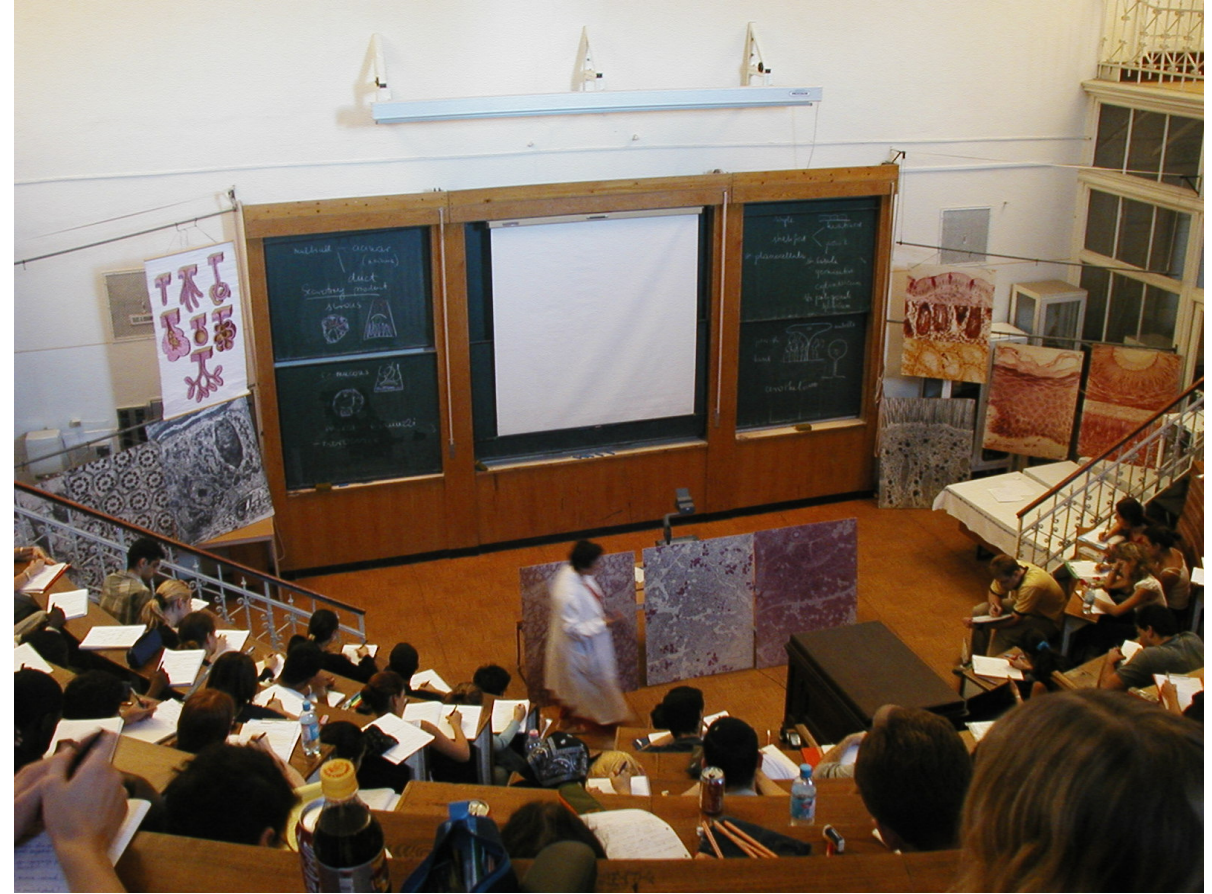
“There has always been and will always
be too much to know.
Medical knowledge is theoretically and
practically limitless”

Prof. Christakis
Harvard, **1910**

How do we learn?

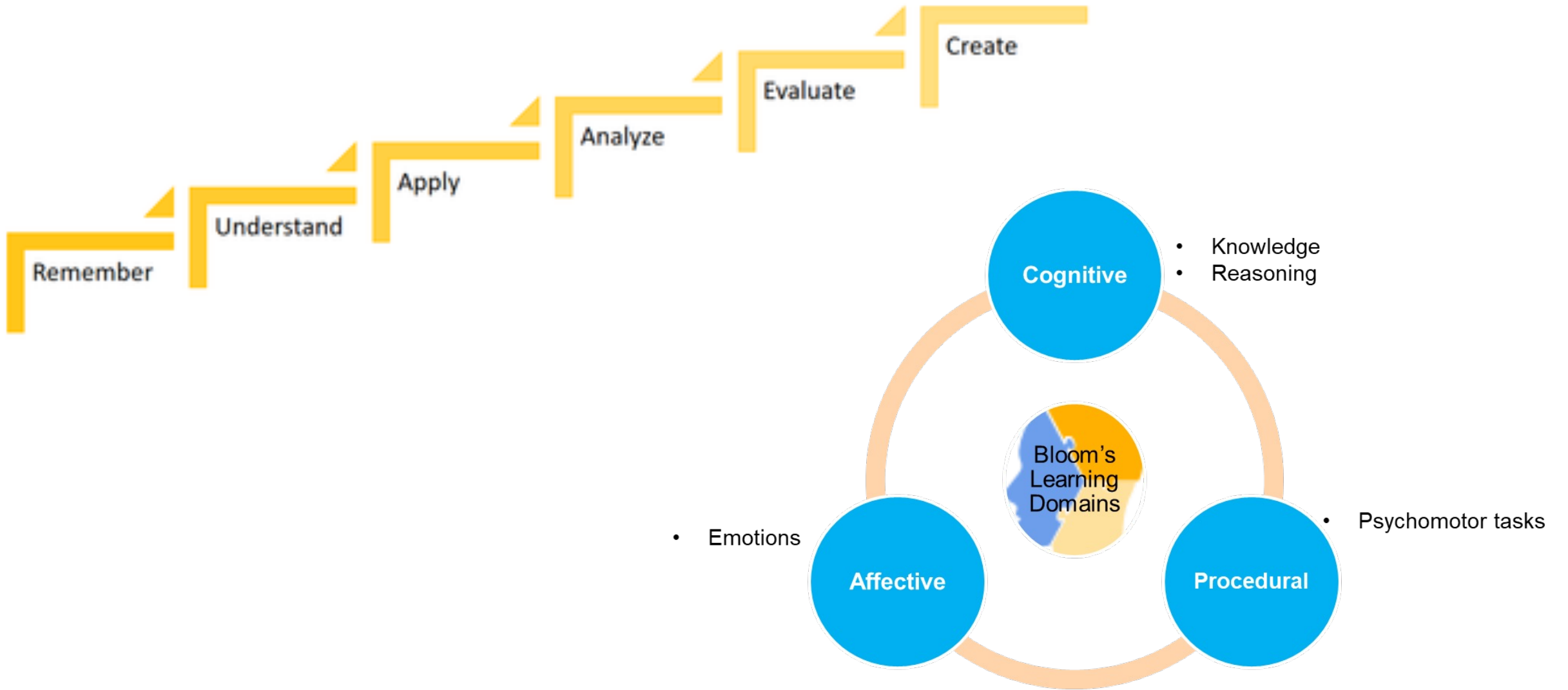


Medical School lecture hall – Budapest 1909



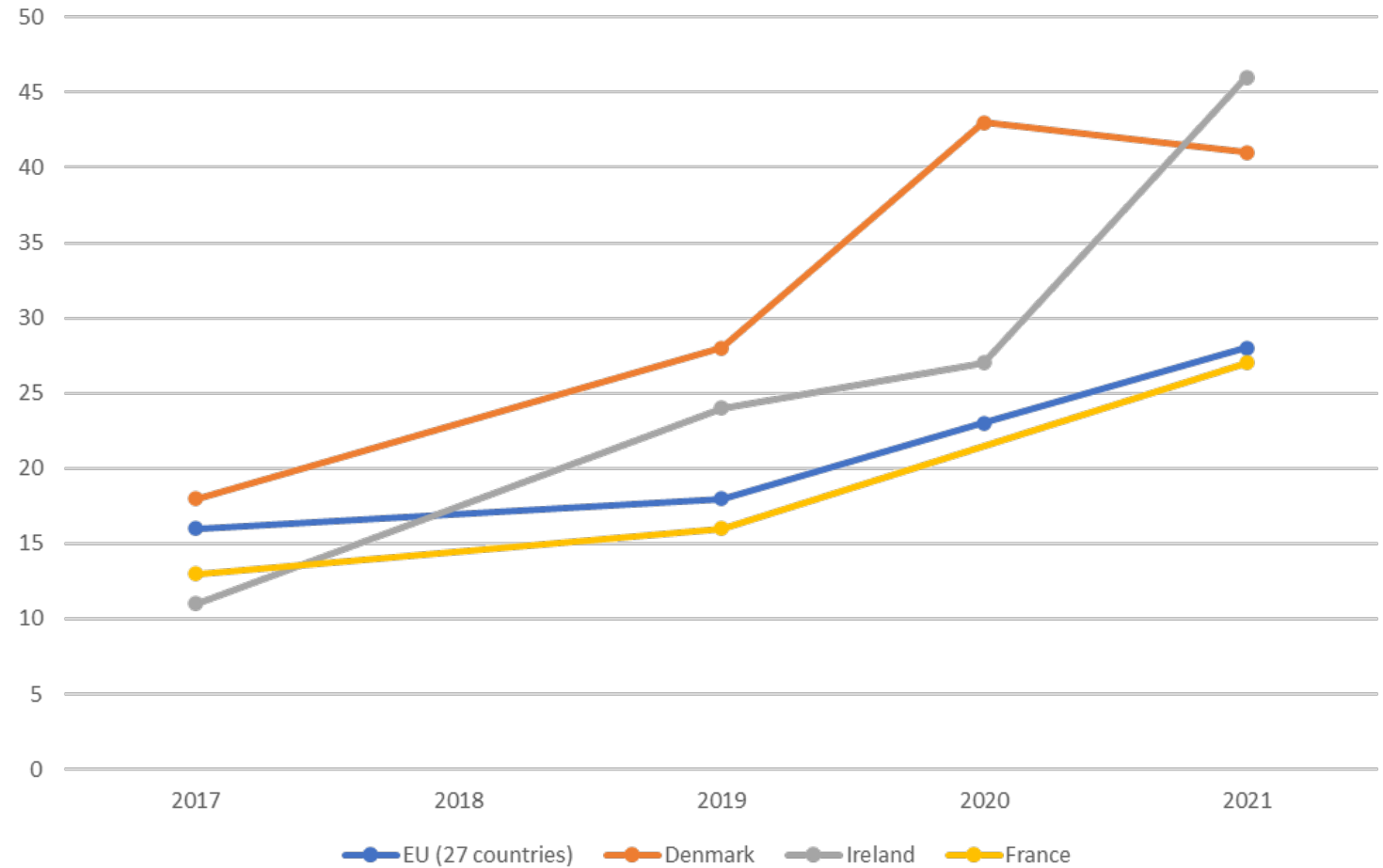
Medical School lecture hall – Budapest 2012

The way we learn



Online education on the rise

% of individuals who are doing an online course or using online learning material (2017-2021)



Is on-demand learning the new black in the 21st century?

Stanford | Center for Health Education



Nutrition Science
Online short course
Inform your ability to provide sound nutritional guidelines

[VIEW COURSE BROCHURE](#)

Rooted in strong disciplines, researchers and students have been generating new knowledge here for over 90 years. Aarhus University is Denmark's second-largest university, with 38,000 students, five faculties, research activities all over the country and campuses in Aarhus, Herning and Emdrup.

Endorsed by 7
ESTRO
Online Teaching Course Particle Therapy
17 October 2022 - 25 November 2022

#69 Ranking 2 Courses Public Institution Type

8 weeks, online 8-10 hours per week, Flexible learning through

(e:  Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Distance Learning Courses

Computer Science & IT (1)

Faculties and Schools Courses Research A

Search School of Medicine ral Sciences & Mathematics (1)

School of Medicine

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Research Degrees


Online Standalone CPD modules

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RADIATION THERAPY / POSTGRADUATE / ONLINE TAUGHT POSTGRADUATE EDUCATION



Advanced Radiation Therapy Online

Course Title	Advanced Radiation Therapy
Qualification	Postgraduate Certificate / Diploma / M.Sc
Duration	Options 1-3 years
Next Intake	September 2022
Video	Course Overview
Expressions of Interest	pgradrt@tcd.ie
Closing date	July 31st 2022

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The education in ESTRO School

ESTRO SCHOOL 2021



POSTGRADUATE COURSES

- Evidence based radiation oncology**
22 February - 5 March | ONLINE
- Lower GI: Technical and clinical challenges for radiation oncologists**
25-26 March | ONLINE
- Upper GI: Technical and clinical challenges for radiation oncologists**
27-31 March | ONLINE
- Imaging for physicists**
14 April - 13 May | ONLINE

- Target volume determination**
19-22 September | Brussels, Belgium
- Physics for modern radiotherapy**
26-30 September | Bucharest, Romania
- Image guided radiotherapy in clinical practice**
3-7 October | Ljubljana, Slovenia
- Multidisciplinary management of prostate cancer (back to back)**
10-13 October | Lisbon, Portugal
- Brachytherapy for prostate cancer (back to back)**

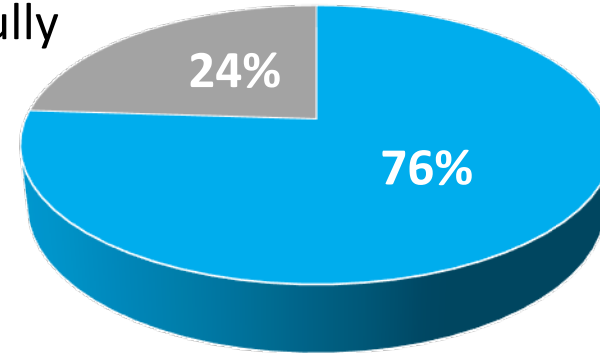
PRE-MEETING COURSES

5 Pre-Meeting Courses at ESTRO 2021
27 August | Madrid, Spain

UNDERGRADUATE COURSES

- Medical Sciences Summer School Oncology for Medical Students**
Vienna, Austria
- ESO-ESSO-ESTRO Multidisciplinary Course in Oncology for Medical Students**
23 August - 3 September | Antwerp, Belgium

Keep a reduced number of fully live courses



Keep a large curriculum and include both live and online courses

Haematological malignancies

18-21 April | ONLINE

- ESTRO-CARO-RANZCR Foundation of leadership in radiation oncology**
20 April - 20 May (to be confirmed) | ONLINE
- IMRT and other conformal techniques in practice**
30 May-3 June | Novi Sad, Serbia
- Dose modelling verification for external beam radiotherapy**
31 May-4 June | Budapest, Hungary
- Clinical practice and implementation of image-guided stereotactic body radiotherapy**
13-17 June | Brussels, Belgium

- Research course in radiation oncology**
17-20 October | Brussels, Belgium
- Research course in radiotherapy physics**
ONLINE module 15-19 June
24-26 October | Budapest, Hungary
- Positioning and immobilisation for radiation therapy**
6-7 November | Tallin, Estonia
ONLINE module in September
- In room MRI guided RT**
7-9 November | Amsterdam, The Netherlands
- Advanced skills in modern radiotherapy**

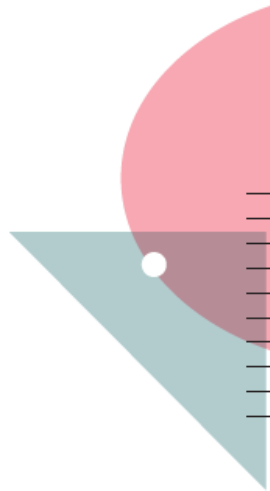
Particle therapy

17-21 June | Aarhus, Denmark

- Advanced treatment planning**
5-9 September | Prague, Czech Republic
- Image guided radiotherapy and chemotherapy in gynaecological cancer**
11-15 September (to be confirmed) | ONLINE

- Palative care and radiotherapy**
28-30 November | Brussels, Belgium
- Paediatric radiotherapy**
5-7 December | Brussels, Belgium
- Multidisciplinary management of brain tumours**
5-7 December | Athens, Greece

- MULTIMODAL CANCER TREATMENT
- RADIOTHERAPY TREATMENT PLANNING AND DELIVERY
- BIOLOGY
- IMAGING
- RESEARCH
- BEST PRACTICE

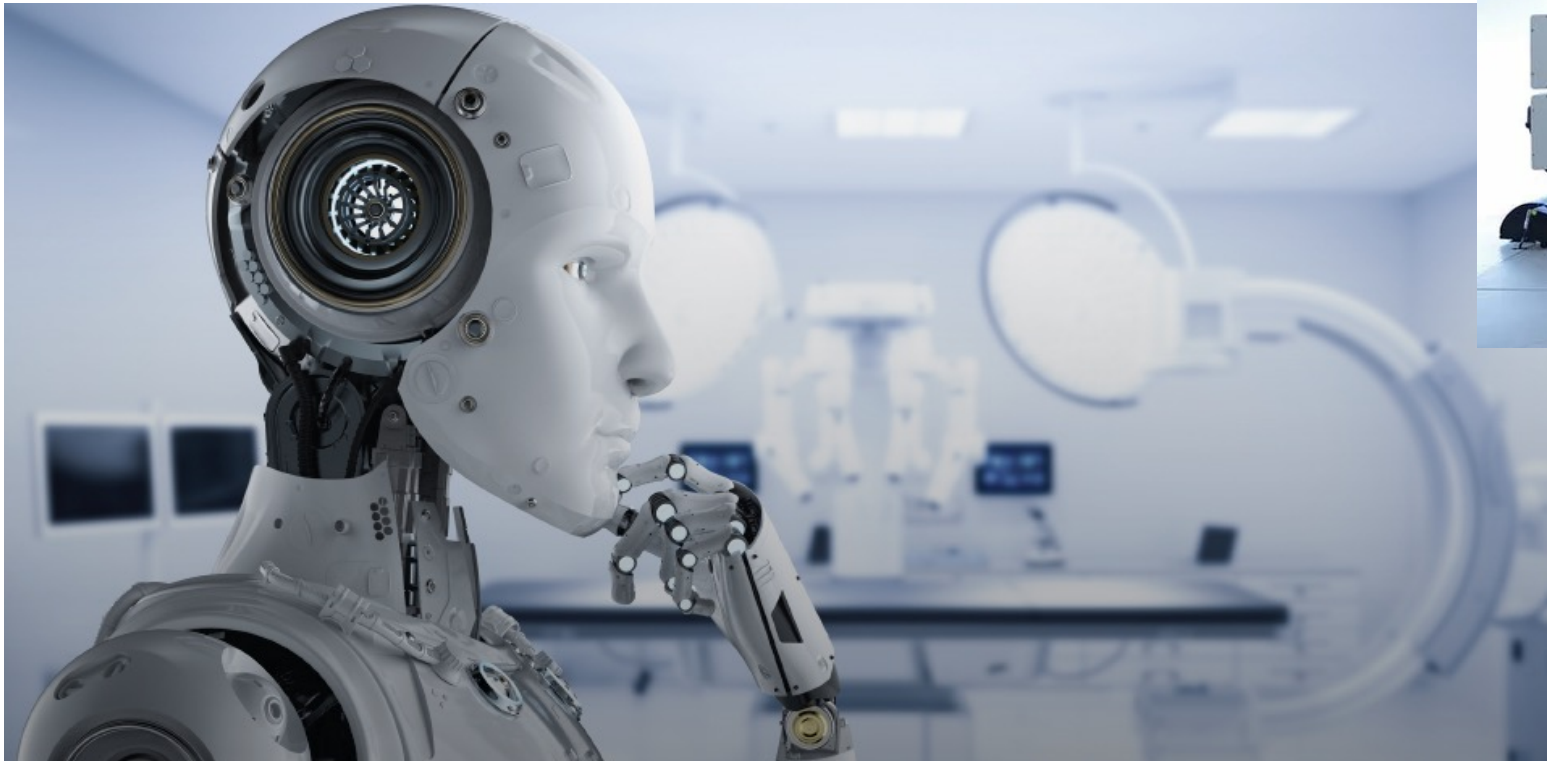


Question	Available Responders/ all participants	Not useful/ fairly useful	Useful/ extremely useful
How useful for your professional activity did you find this event?	481/853 (56% responded)	39/481 (8%)	442/481 (92%)
Question	Available Responders/ all participants	Poor/sufficiently average	Good/ excellent
How would you rate the quality of the education/program of this event?	479/853 (56% responded)	83/479 (17%)	396/479 (83%)
How would you rate the online course?	477/853 (56% responded)	22/477 (5%)	455/477 (95%)
Question	Available Responders/ all participants	Not at all/not much	Somewhat/ very much
Did the event fulfil your educational goals and expected learning outcomes?	479/853 (56% responded)	14/479 (7%)	465/479 (93%)
Question	Available Responders/ all participants	Never/ only rarely	Sometimes/ almost always
Did the program allow adequate time for discussion & questions?	485/853 (57% responded)	60/485 (12%)	425/485 (88%)

But are we really ready to educate health care professionals how to implement and use AI-augmented technologies?

Innovation in radiation oncology changes our lives

Fully AI-based in 2030?



Innovation in radiation oncology changes our lives

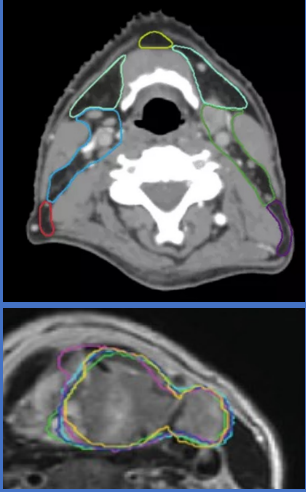
Automation
(to meet increased demand)

Risk modelling
(for personal treatment adaption)

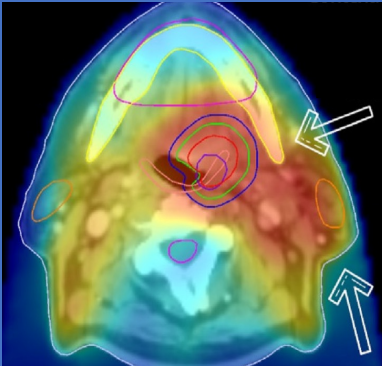
Pretreatment imaging – image reconstruction and co-registration



Segmentation of OAR and tumor ID



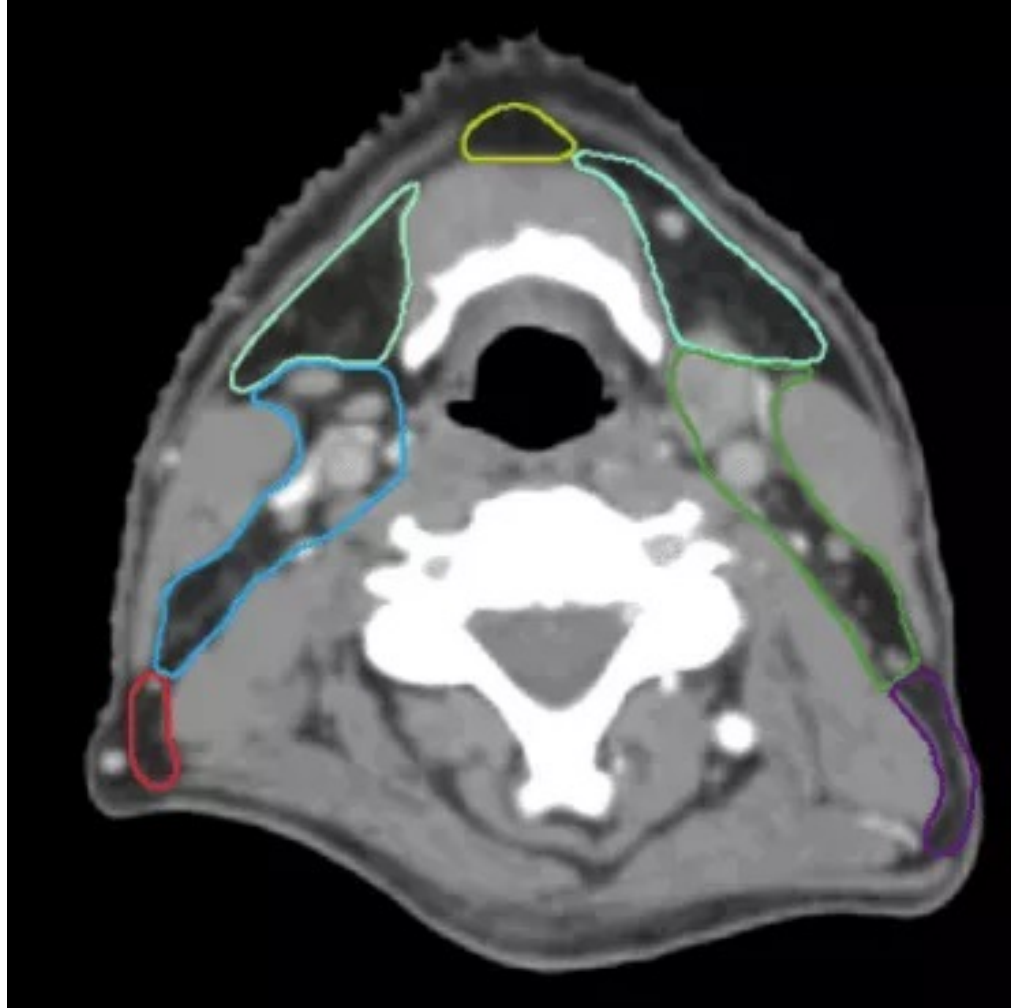
Optimisation of radiation dose



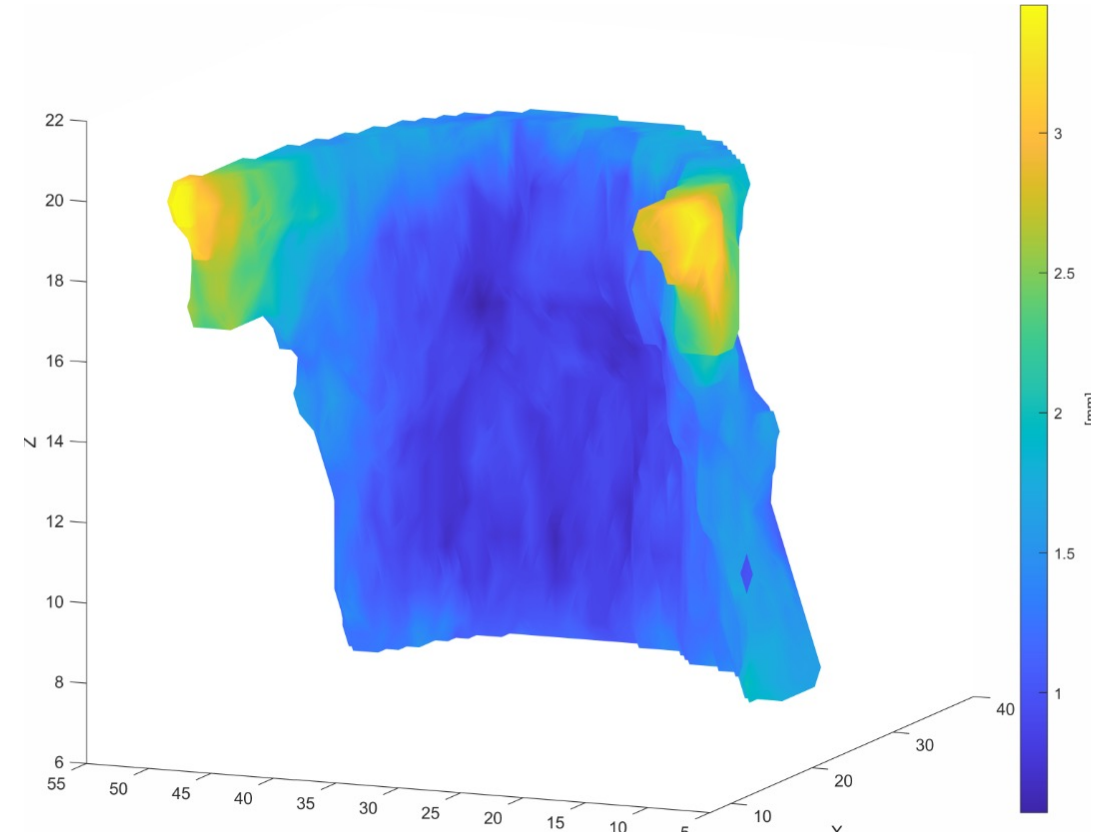
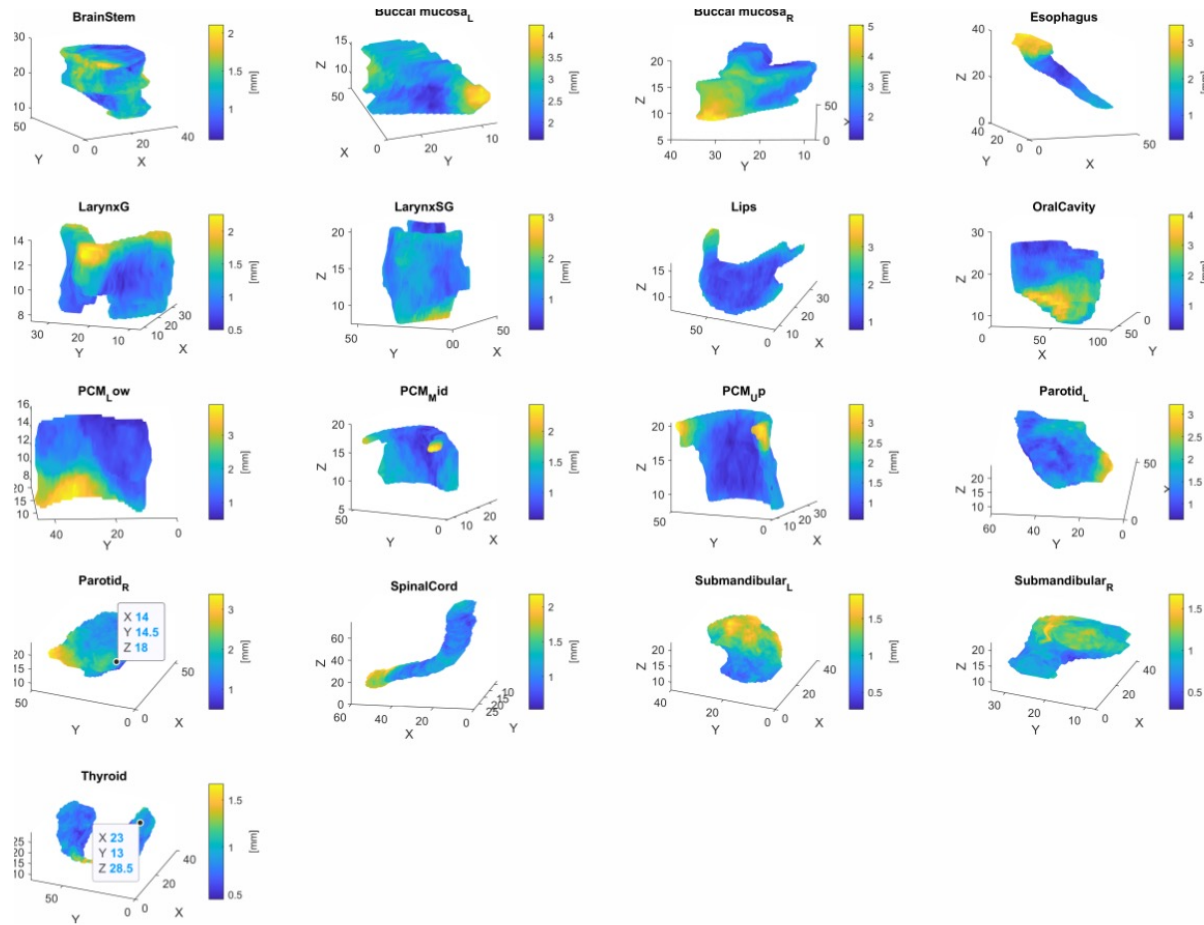
Daily verification and beam-on treatment



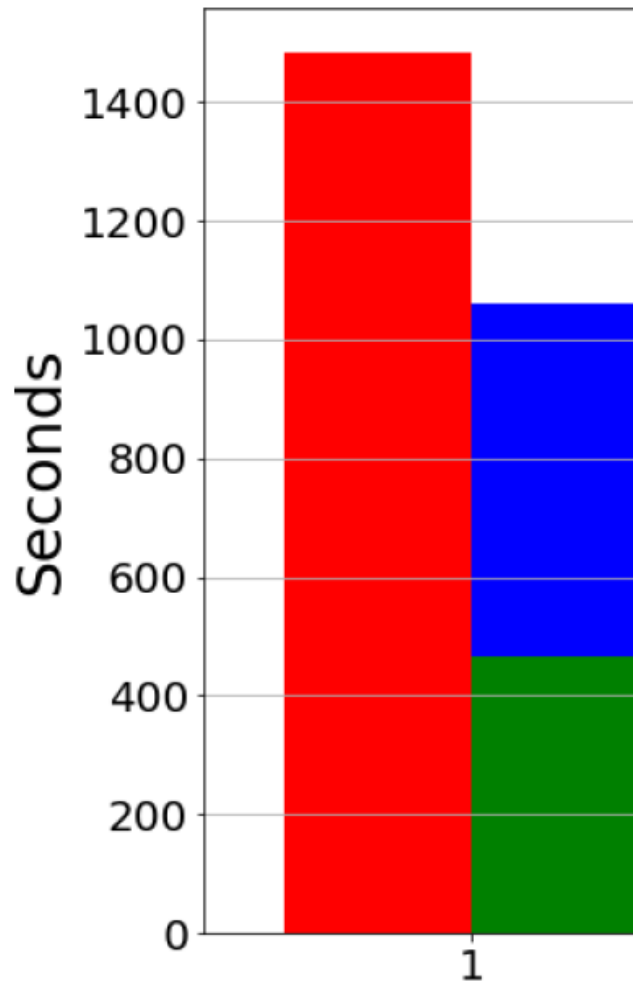
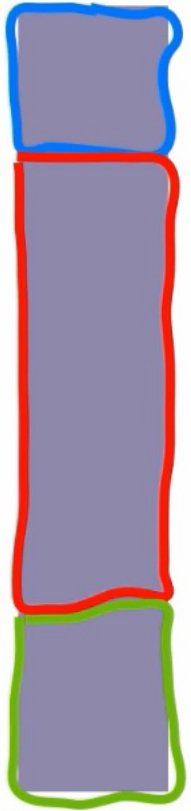
Delineation of organs at risk



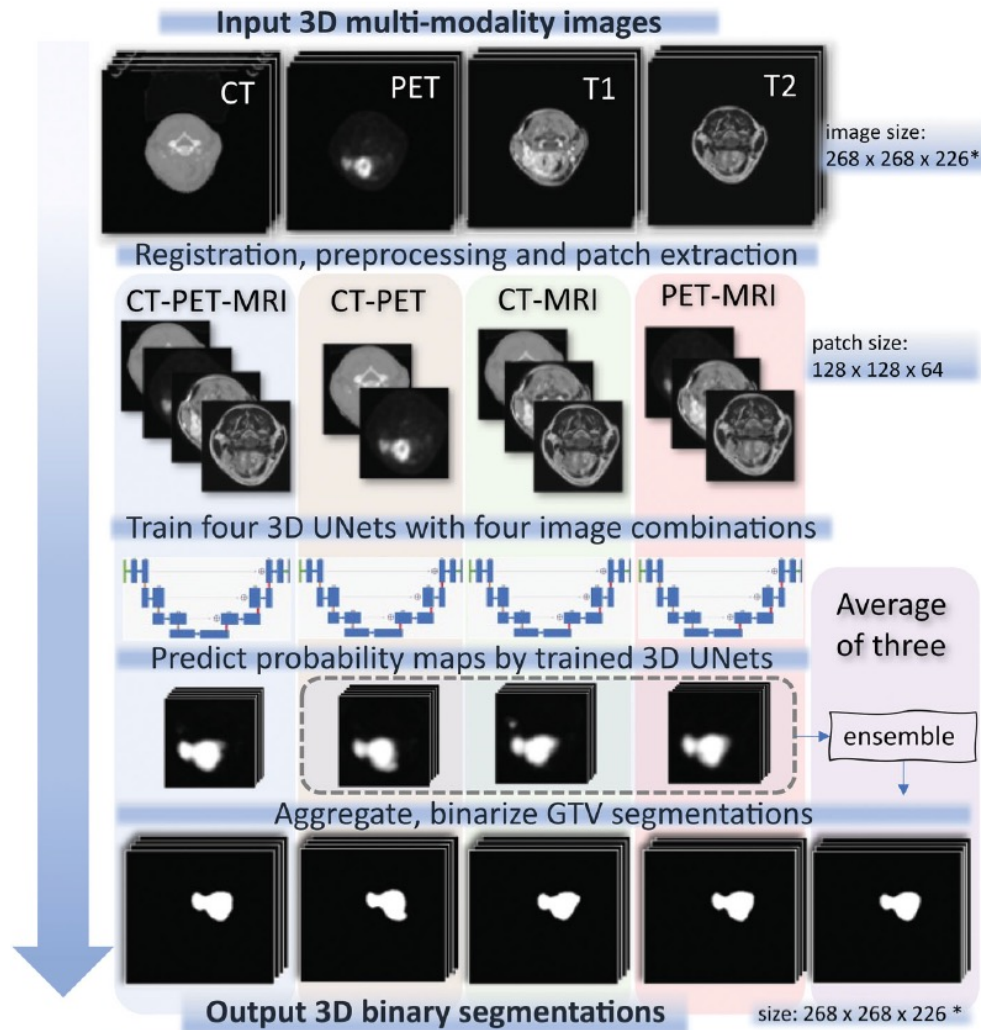
Delineation of organs at risk with a little help



Delineation of organs at risk with a little help



Delineation of target volumes



Delineation according to risk modelling

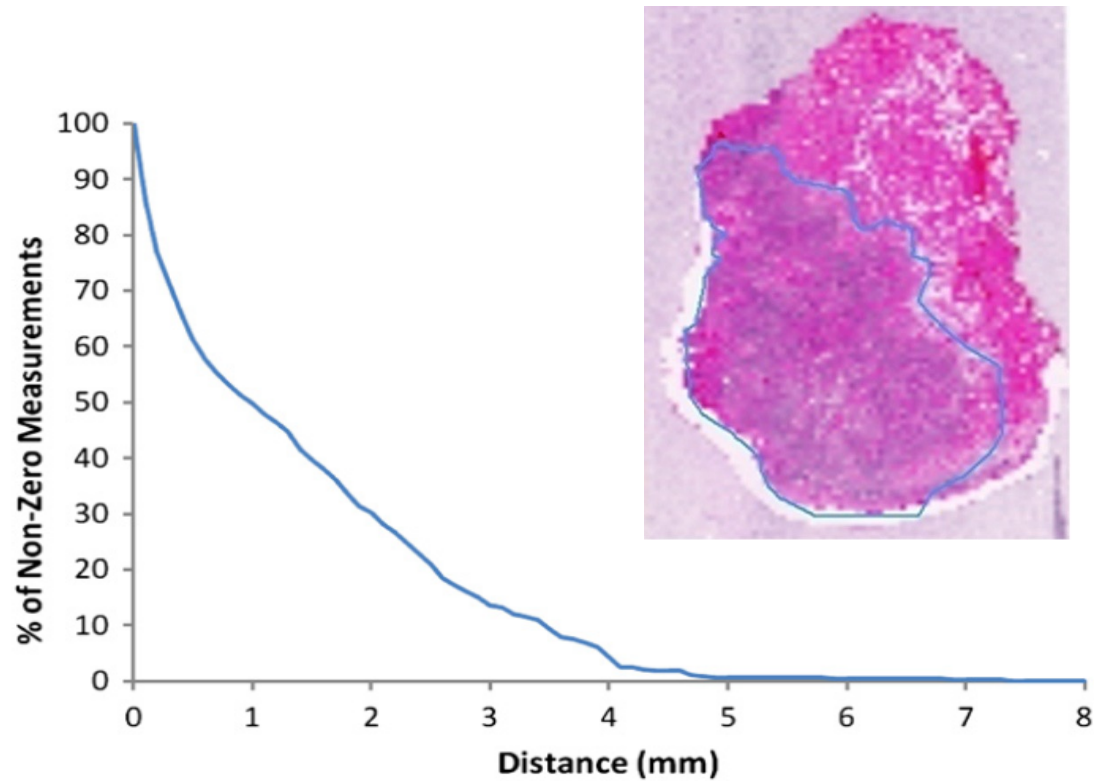
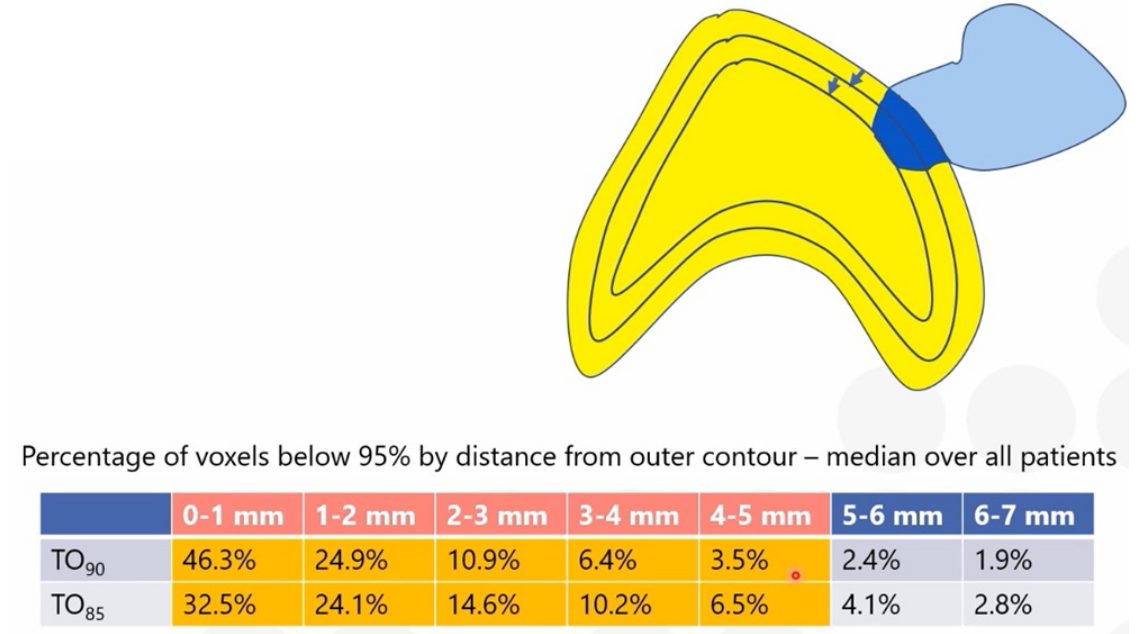


Fig. 8. Graph showing the percentage of nonzero measurements against distance from the gross tumor volume.



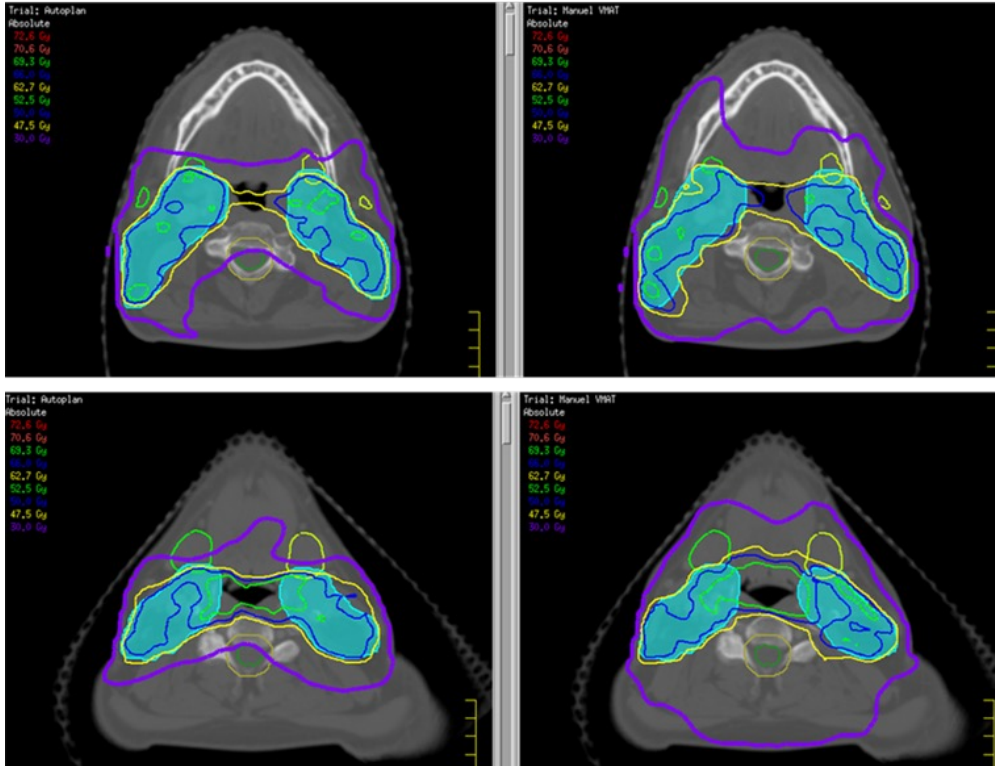
Percentage of voxels below 95% by distance from outer contour – median over all patients

	0-1 mm	1-2 mm	2-3 mm	3-4 mm	4-5 mm	5-6 mm	6-7 mm
TO ₉₀	46.3%	24.9%	10.9%	6.4%	3.5%	2.4%	1.9%
TO ₈₅	32.5%	24.1%	14.6%	10.2%	6.5%	4.1%	2.8%

AI for treatment planning

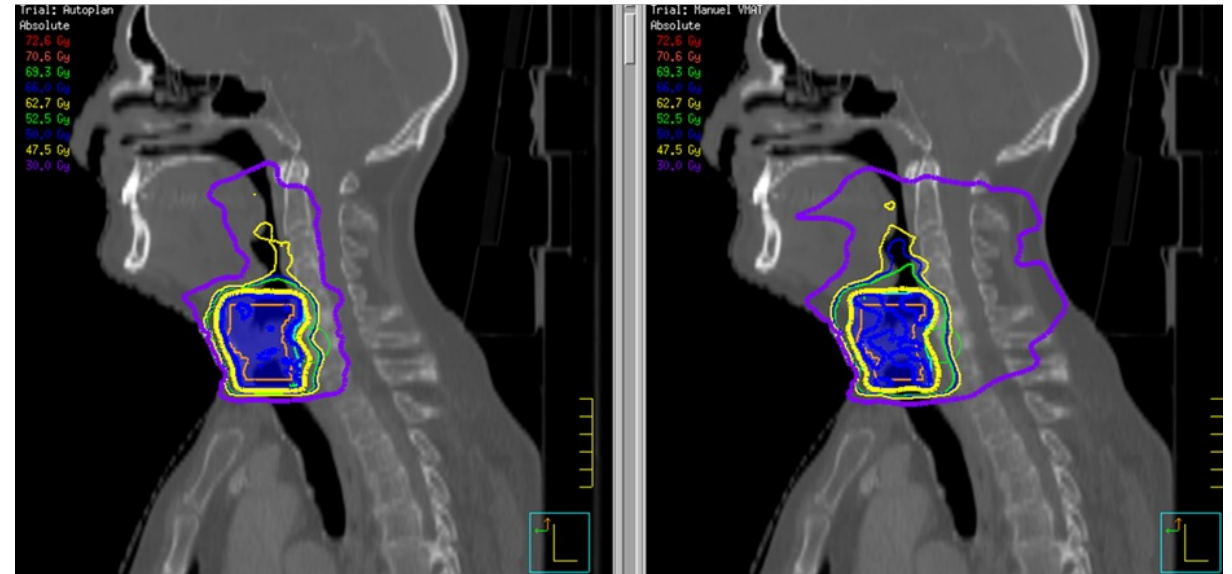
Autoplan

Manual plan

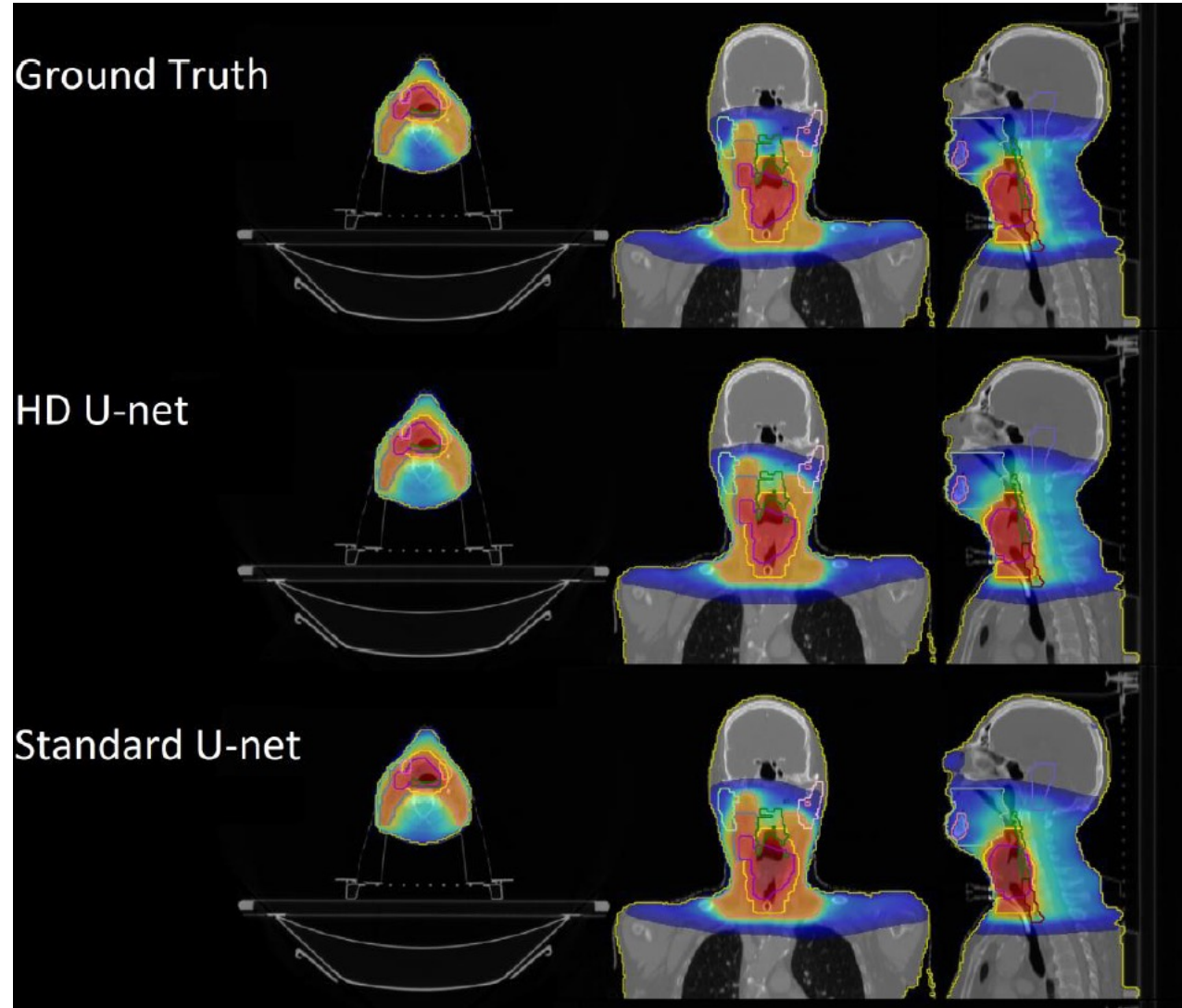


Autoplan

Manual plan



AI for treatment planning



How do we teach the use of AI-based tools?



First step is to decode what people are doing

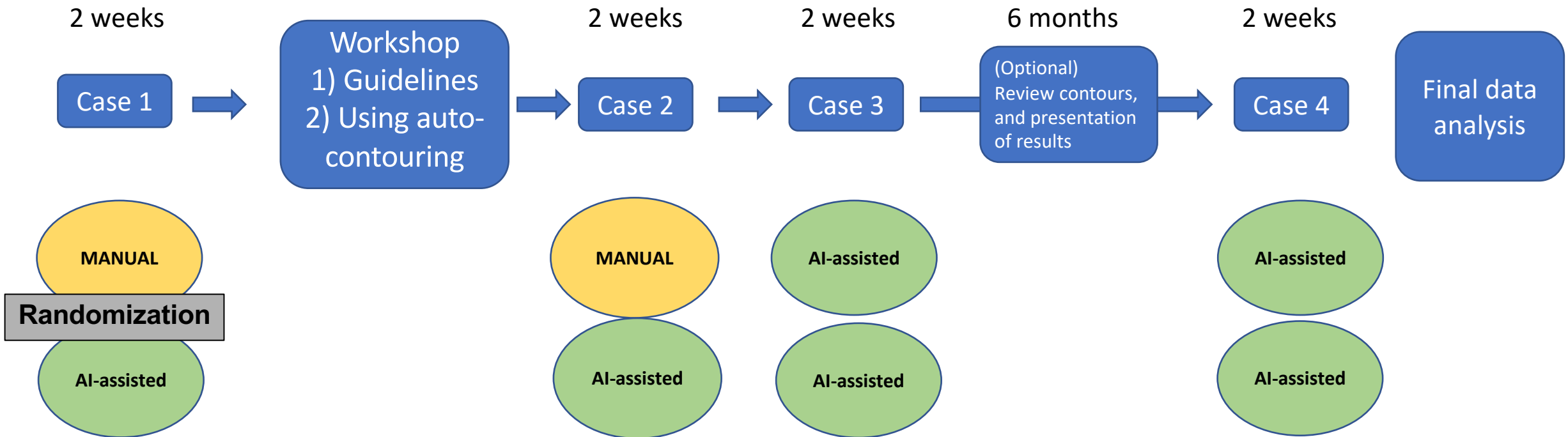
ELAISA study (E-Learning interventions for AI-assisted contouring Skills in rAdiotherapy)

AIM:

1. What are the consequences of introducing AI assisted contouring without prior training and education?
2. How does training and education affect AI assisted contouring skills?
3. Are the effects of AI assistance on contouring skills retained on the long term?

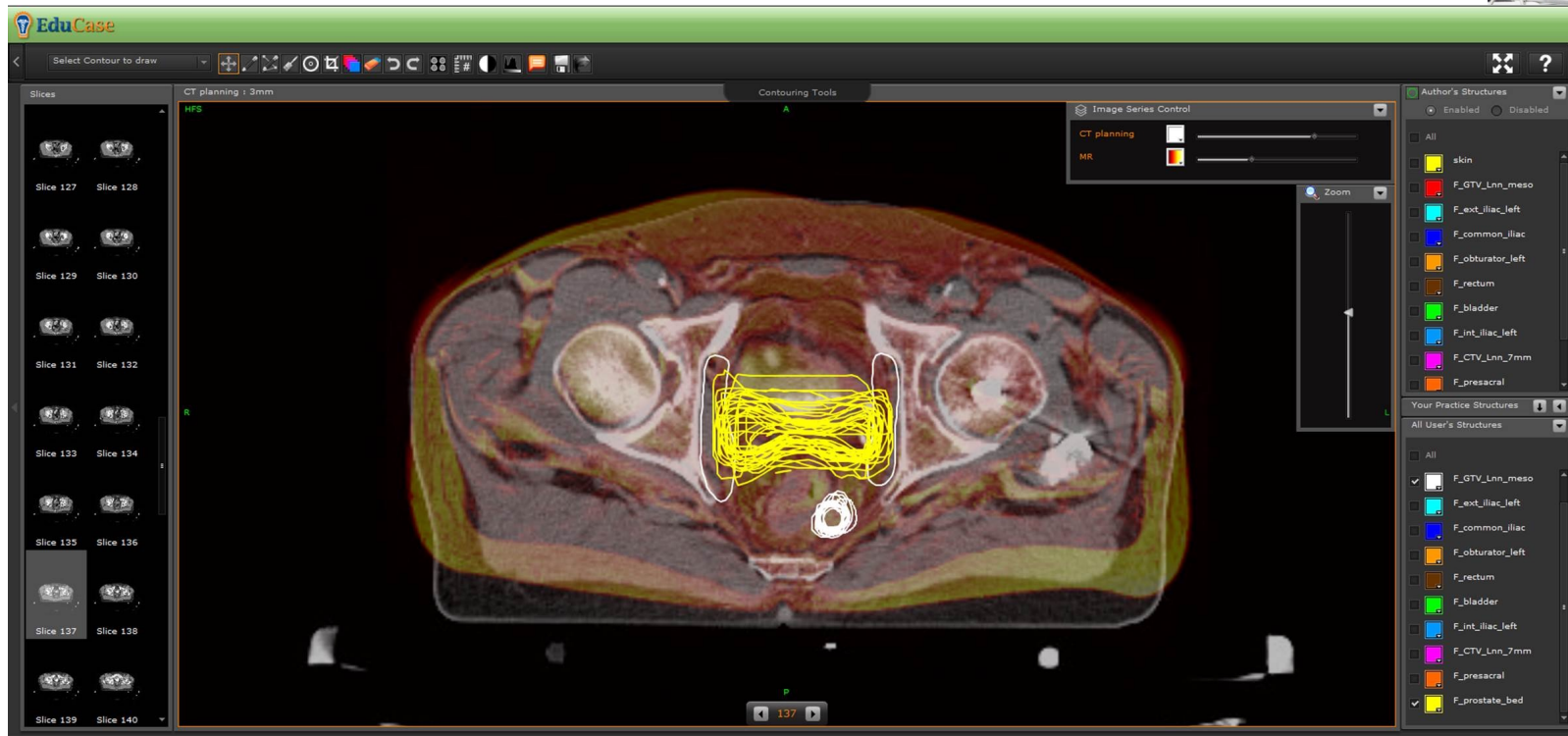
ELAISA: Study design

- Organs-at-risk**
- Parotid (one side)
 - Submandibular gland
 - Oral cavity
 - Mandible
 - Brainstem
 - Optic nerve
 - Thyroid
 - Spinal cord

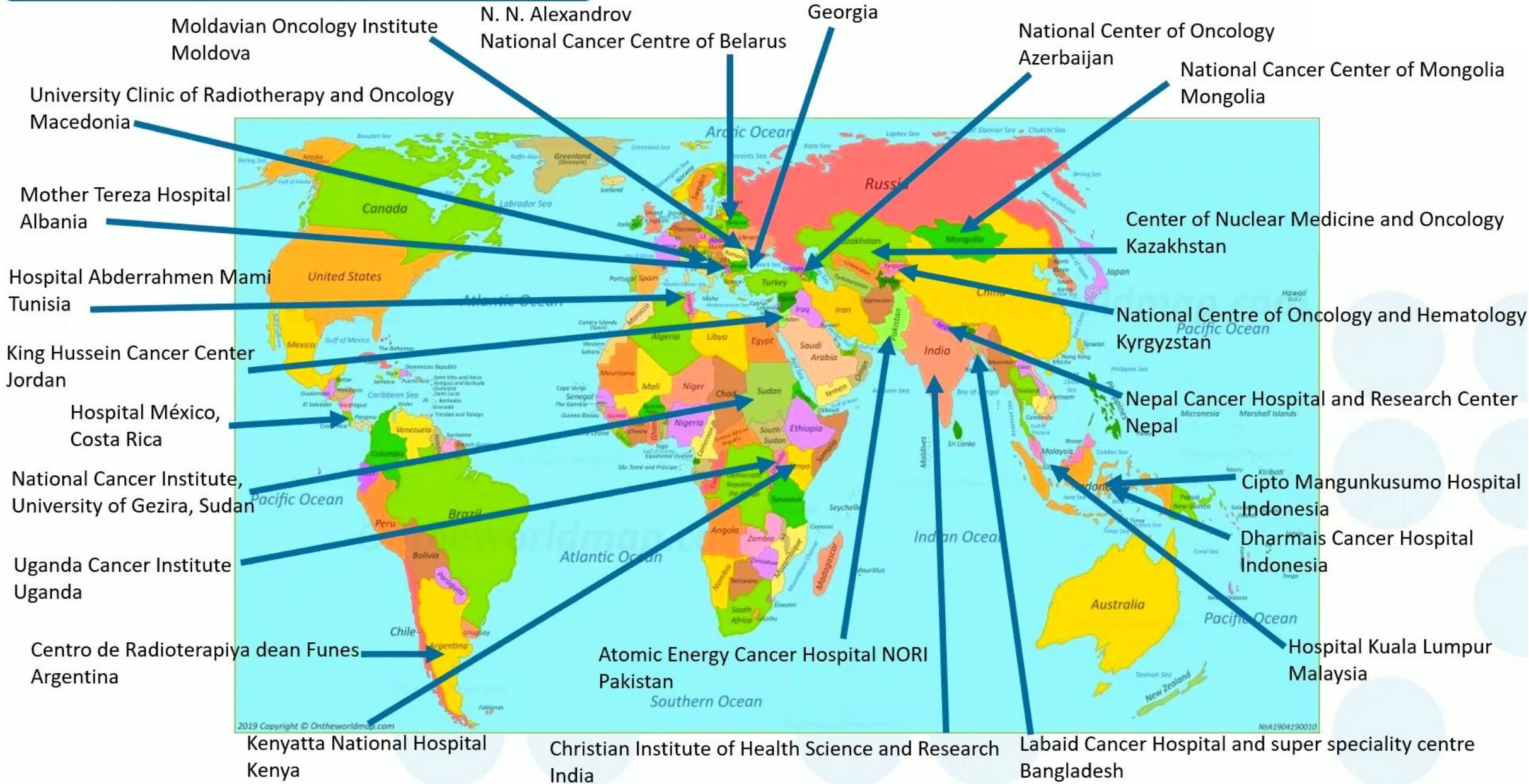


FALCON-EduCase

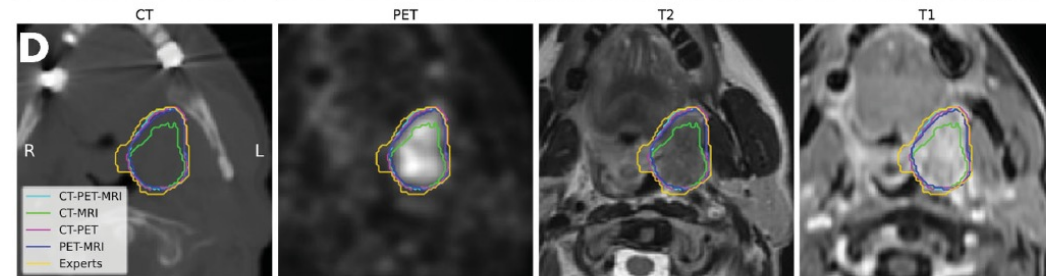
Build-in Big Brother tool



Participating centers



Testing target delineation



Primary curative RT
No surgery
Larynx or pharynx

Randomize

Delineate
from scratch

AI-supported
delineation

This are just the first scratches in the surface



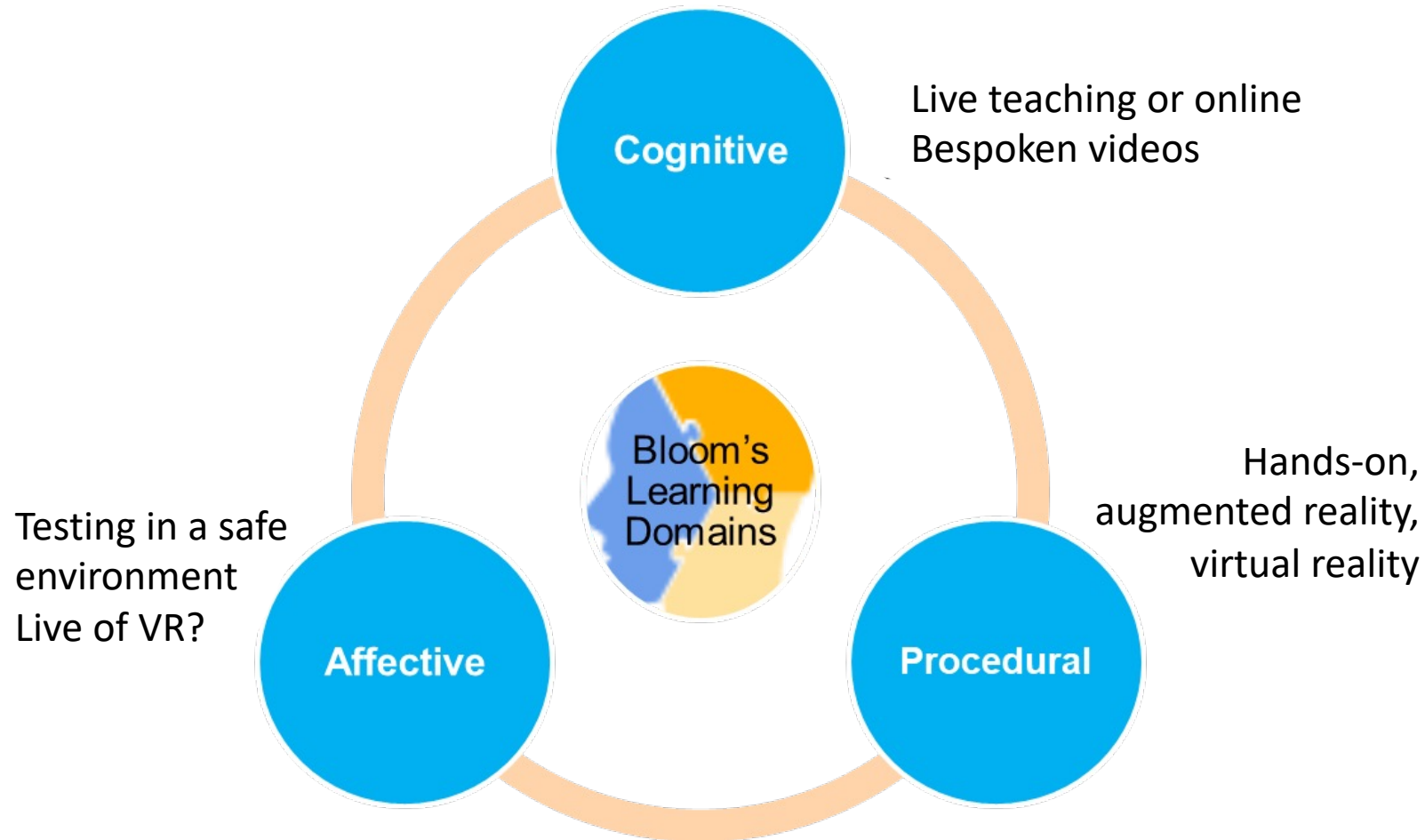
This knowledge has to be transformed into teaching



But the same way as we always have done?



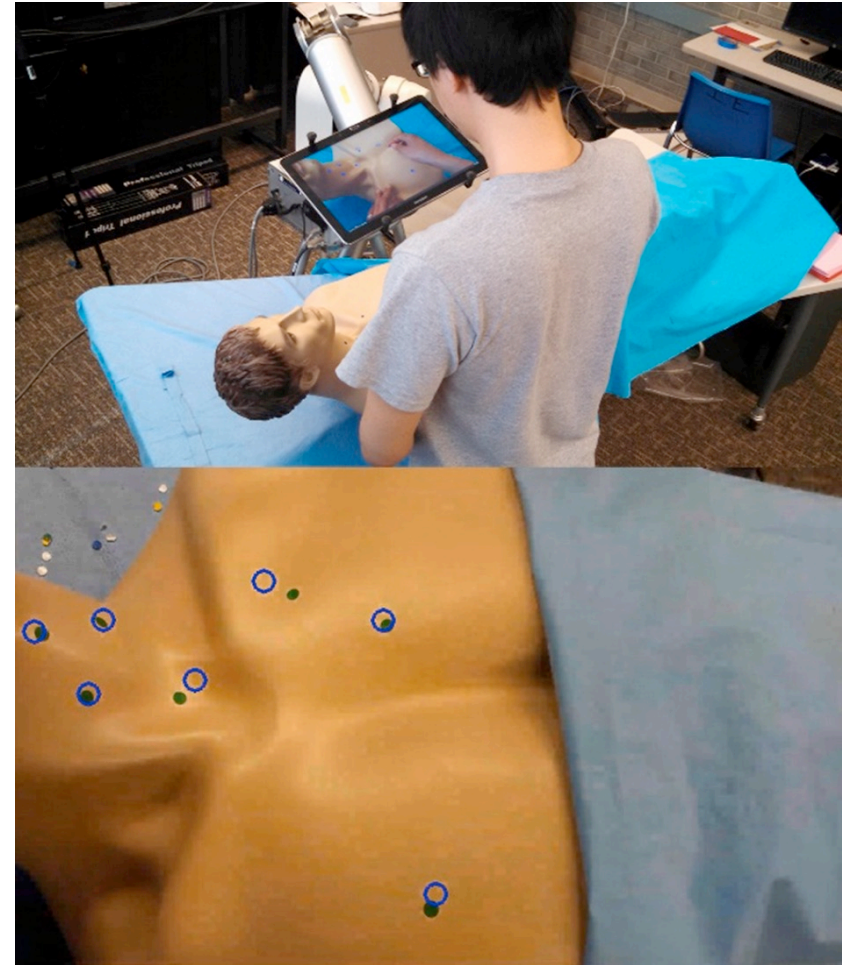
Future steps of screen-based learning that fit innovations in radiation oncology



What could the next steps be?



Augmented Reality?



Virtual Reality for RT training?

Maybe not a dream

Conclusion and perspectives

- AI-augmented radiotherapy is here and will grow in the years to come
- Will revolutionize the way we are working
- The bottle neck is how we will perceive it and use it
- There is a need for research in that field
- If we are ready to embrace new learning technologies - then we have a unique possibility to better teach how to use AI-augmented tools in the future