

Minutes of the 17th European Orthodontic Teachers' Forum

University of Oslo Dental School. Oslo, Norway, 12nd June, 2023.

Chairpersons: Guy Willems, Andreu Puigdollers, Vaska Vandevska-Radunovic, Agneta Karsten

Attendees: 75 attendees (signed attendance list).

Happy Teacher, Happier Students: Boosting Learning Outcomes in Theoretical Subjects with a Dash of Entertainment and a Pinch of AI Magic

1. Opening, announcements

Guy Willems, Vaska Vandevska-Radunovic, Agneta Karsten and Andreu Puigdollers opens the meeting and welcomes the delegates.

The goal of the NEBEOP is to strengthen the training programs of postgraduate orthodontic education in Europe and is restricted to either provisional or full members. For more information on the provisional and full membership application procedure and bylaws: see <http://www.nebeop.org>.

The EOTF aims to be an open forum for everybody involved in strengthening orthodontic teaching.

In the past some interesting discussions on several pedagogical themes, trying to improve the quality of postgraduate education in orthodontics, have been held in both plenary and break-out sessions:

2006 Strengths and weaknesses of orthodontic education in Europe

2007 Development of NEBEOP and collaboration between programs

2008 Self-assessment for quality control

2009 The minimum requirements for the undergraduate orthodontic curriculum

2010 How do we learn? Adult learning

2011 New ways of learning

2012 E-learning

2013 Competency based postgraduate education

2014 Quality assurance in postgraduate education

2015 Final examination assessment procedures

2016 Adopting a coaching approach to teaching

2017 Short courses leading to a "Master". A new era in orthodontic education? .

2018 Inter-Professional Collaboration and Education'.

2019 Communication between postgraduate schools in Europe.

2020 Cancelled

2021 Adult learning in blended learning environments

2022 Assessing competence with high stakes exams.

This year the theme of the EOTF is: **Happy Teacher, Happier Students: Boosting Learning Outcomes in Theoretical Subjects with a Dash of Entertainment and a Pinch of AI Magic**

2. Charles Bolender Award – Dr. Melissa Disse, President of EFOSA

The Charles Bolender Award was again organised. Charles Bolender was a founding member and the first President of EFOSA. The award is given to a teacher or teachers, involved with orthodontic education, who have been identified with specific educational skills enhancing the delivery of specialist orthodontic knowledge. This year's award goes to Professor Gerald Torgerson, University of Oslo, Norway.

Prof. Gerald Torgersen holds a master's degree in theoretical physics, post-graduate teacher training, and continuing education in radiation physics and radiation protection. For the past fifteen years, he has been teaching radiation physics, radiation protection, and radiological technology at the Faculty of Dentistry, University of Oslo. Gerald and his colleagues have been experimenting with various teaching and assessment methods and have published several papers on the subjects. Recently he started exploring AI-based tools like Chat GPT to improve learning outcomes.

Happy Teacher, Happier Students: Boosting Learning Outcomes in Theoretical Subjects with a Dash of Entertainment and a Pinch of AI Magic

By: **Gerald Torgersen** (gerald.torgersen@odont.uio.no), Department of maxillofacialradiology

PART I- INTRODUCTION OF THE TEACHING TOOLS

Audience/student response systems (ARS/SRS)

Gerald Torgersen's (GT) first part of the Introduction was related to the use of clickers as a Teaching Tools.

Students have a positive attitude toward the Audience Response Systems (ARS) because it is a dynamic way to be engaged with the lecture and seems to encourage them to work harder.

These ARS/SRS systems should be combined with peer discussion to increase learning outcome.

There are two main types of ARS/SRS systems: 1. Online polling (Kahoot, Mentimeter). 2. Physical devices (Turning technologies), but there are more products on the market.

GT asked the question to the EOTF audience: Have you ever used any ARS-system? Answers of the audience: 28 Yes, as a teacher; 3 Yes, as a presenter; 12 Yes, both as a teacher and presenter; and 58 answered No

Some alternatives as a Collaboration Tools are: Padlet, Microsoft Whiteboard, Taskcards.

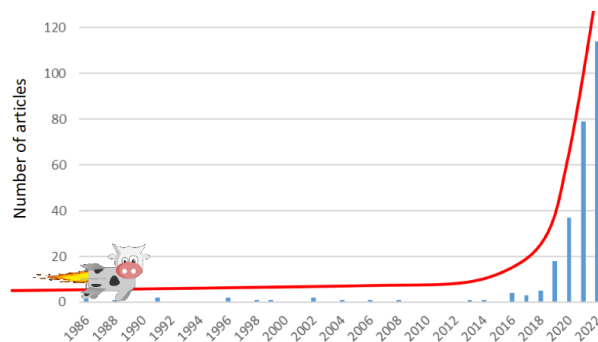
What is (artificial) intelligence?

GT asked to the audience. How do you define intelligence?

The Cambridge dictionary define **Intelligence** as: The ability to learn, understand, and make judgments or have opinions that are based on reason.

Asked to ChatGPT (GPT-4) what Artificial Intelligence (AI) is, the answer was: *Artificial Intelligence (AI) refers to algorithms and systems designed to perform tasks typically needing human intelligence, such as problem-solving, learning, and decision-making, by simulating or mimicking human cognitive abilities in machines.*

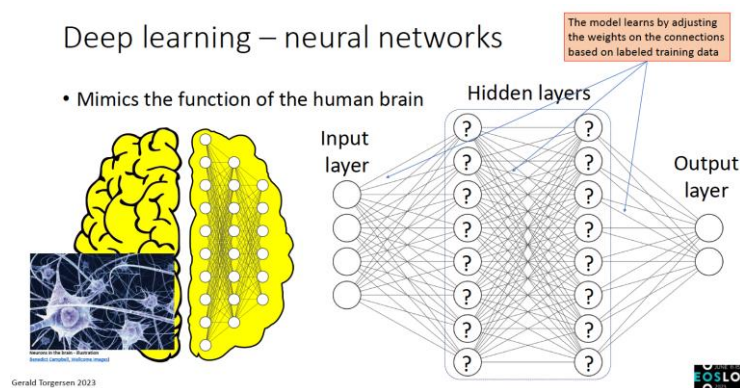
The number of articles of AI in orthodontics has increased in the last's years (PubMed: ("Artificial Intelligence« OR "Machine Learning" OR "Deep Learning») AND "Orthodontics"):



From this evidence, it is obvious that AI will significantly impact future dental education.

So, there is a need for dental professionals to master these tools, that could become a gift for student cheaters, also a powerful teaching assistant, or a tool for creativity.

Artificial Intelligence mimics the function of the human brain:



Artificial Intelligence work with Large Language Models (LLM). GPT-4 and Google Bard are LLM.

The language is encoded as tokens:

- Words/syllables → numbers (tokens)

Orthodontics is the most important

5574, 400, 375, 756, 873, 318, 262, 749, 1593

- ... field for those seeking to improve their quality of life through better oral health.

The AI very deep neural networks guesses the next word in a sentence.

But, ... **there is no “knowledge” in the system.**

GT asked to the audience: “Have you used GPT-4 or another of the new LLM?”.

31 answered no, and the other 69 members has used in different ways: working on scientific article, working on other texts, as a teaching tool, for private tasks, for translations, for brainstorming, or for procrastinating.

Concerning “What does GPT-4 know about orthodontists?”. **GT** took the task from the final-year dental students' exam in orthodontics 2022:

“An 8-year-old boy with fully erupted 1st molars and incisors. He has a unilateral crossbite on his right side with forced guidance, and a midline deviation in the lower jaw”.

The answer of the task by ChatGPT-4, was graded by EOTF audience as: 20 as Excellent, 39 as Very good, 20 as Good, 13 as Satisfactory, 7 as Sufficient, and no survey respondent graded the answer as Fail.

GT asked GPT-4 how teachers or students can use Large Language Models (LLM) in teaching?

GE

How can teachers in orthodontics use Chat-GPT? Give me five examples, only headings.



1. Utilizing ChatGPT for Interactive Learning and Quizzes in Orthodontics
2. Enhancing Student Engagement with ChatGPT in Orthodontic Case Studies
3. Using ChatGPT as a Virtual Teaching Assistant in Orthodontics
4. Incorporating ChatGPT in Orthodontic Curriculum for Self-paced Learning
5. Leveraging ChatGPT for Real-time Feedback and Assessment in Orthodontics

So, for teachers can be used for: Planning teaching sessions, as a brainstorm partner, for translations of text, and as an assessment?

GE

How can students in orthodontics use it? Answer as in the last question.



1. Using ChatGPT for Self-Study and Revision in Orthodontics
2. Leveraging ChatGPT for Interactive Case Study Analysis in Orthodontics
3. Utilizing ChatGPT as a Virtual Study Group Facilitator in Orthodontics
4. Incorporating ChatGPT in Personalized Learning Plans for Orthodontics
5. Engaging with ChatGPT for Real-time Query Resolution in Orthodontics

For students as a: Brainstorm partner, explanation of difficult subjects, for translations.

Regrettably, can be used also as a tool for **CHEATING**.

In this sense, **GT** asked to GPT-4:



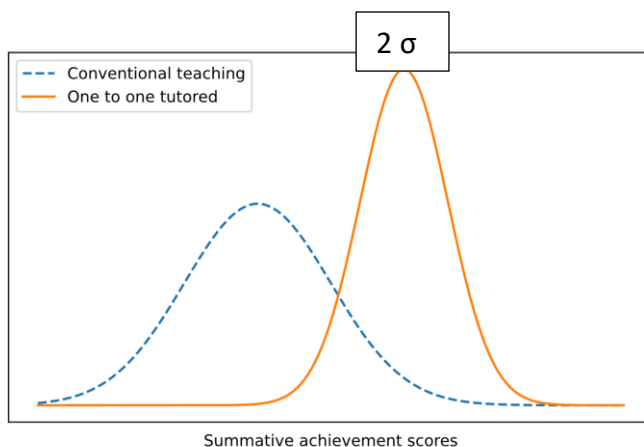
How can we avoid students using ChatGPT to cheat? Please answer short.



1. **Monitor Usage:** Use monitoring tools to track student interactions during tests or exams.
2. **Teach Ethics:** Encourage a culture of academic integrity and stress the importance of honest work.
3. **Design Open-Ended Questions:** Make assignments and tests that require critical thinking and unique responses, which are harder to cheat.
4. **Use Plagiarism Detection Tools:** Use software that checks student work for signs of plagiarism.
5. **Active Proctoring:** For online exams, consider using proctoring services to monitor students in real-time.

Taking into consideration how difficult is to avoid cheating because GPT-4 can answer open-ended questions and traditional Plagiarism Detection Tools are not updated, **GT** proposed the two unique ways to avoid cheating are Teaching Ethics and to ask good Open-Ended Questions.

Last point of PART I lecture was the **GP** question: "Can AI give every student a tutor?". This point was exemplified with the "*Bloom's 2 sigma problem*". *
The results of teaching when using one-to-one tutoring of students: "the average tutored student was above 98% of the students in the control class".



*(The Educational Psychologist Benjamin Bloom described the importance of "find methods of group instruction as effective as one-to-one tutoring". Two of his PhD students found that the average student tutored one-to-one using mastery learning techniques performed two standard deviations better than students educated in a classroom environment with one teacher to 30 students, with or without mastery learning. He quoted: "the average tutored student was above 98% of the students in the control class".).

The **GP** final note on AI (no comment):

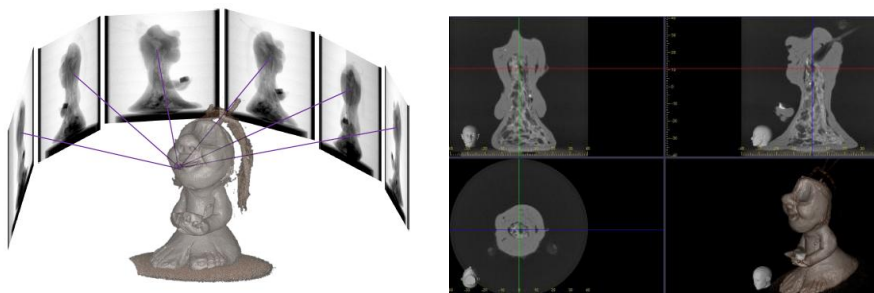


PART II –A LECTURE ABOUT CBCT

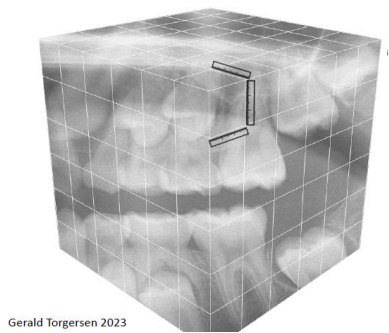
GP asked about the Cone Beam CT (CBCT) -experience of the audience. Answers: 34 “My clinic has CBCT and I use it for my patients”, 26 “I refer patients for external CBCT examinations”, 1 “I do not use CBCT”.

Basic technology of CBCT:

- Basically is a series of several hundreds «Cephs».
- Backprojection
- Each voxel reconstructed from all images



About the Voxels, resolution and measurements:



Gerald Torgersen 2023

Voxel size:	Larger	Smaller
Resolution	Lower	Higher
Image noise	Lower*	Higher*
Radiation dose	Lower*	Higher*
Storage size	Lower	Higher

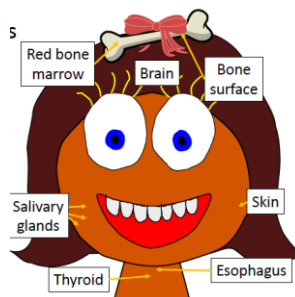
Artifacts on the CBCT images are anomalies or distortions in a medical image that are unrelated to the actual anatomy or pathology of the patient.

The most common artifacts in CBCT are: Movement, imperfections of equipment, objects (metal and other dense materials), and the physics of matter and radiation.

GP clarified that “effective dose” is the one used to quantify radiation health risk to the patient for a CBCT examination.

The effective dose is based:

- on radiation type
- on irradiated organs radiation sensitivity
- on radiation energy absorbed in those organs
- is measured in sievert (Sv) –mostly used μSv in dental examinations.

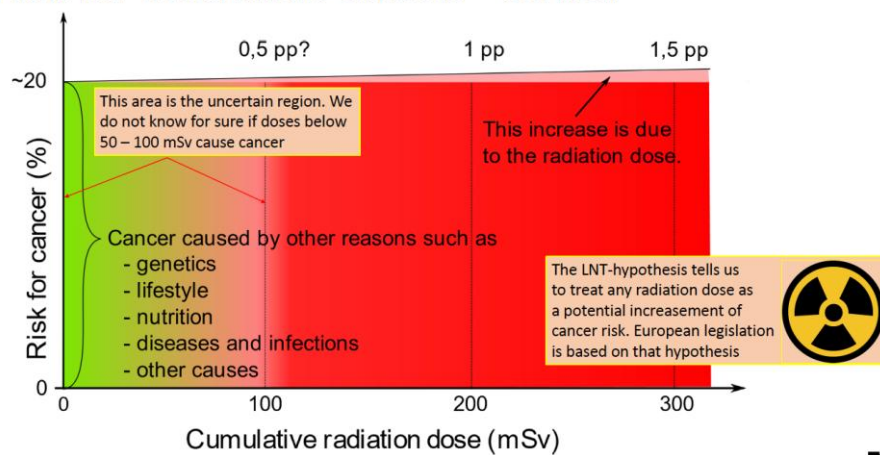


What is a stochastic process related to cancer due to radiation dose?

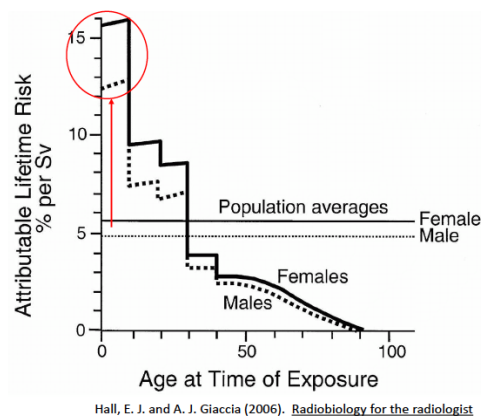
A stochastic process involves some response variable (cancer), that affect some individuals, some not varying randomly in some way over time.

GT emphasized the importance of taking into consideration the cumulative radiation dose.

Risk for stochastic effects - cancer

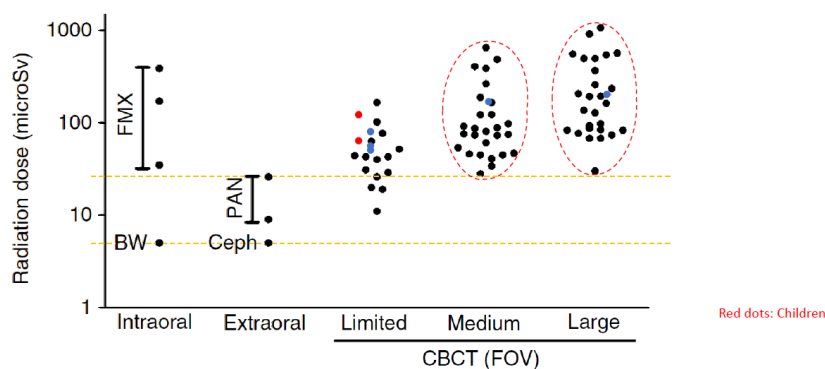


Specifically, the **radiation risk for children** – compared to adults that is three times higher.



And the **dose range for dental radiography:**

Note: Logarithmic scale



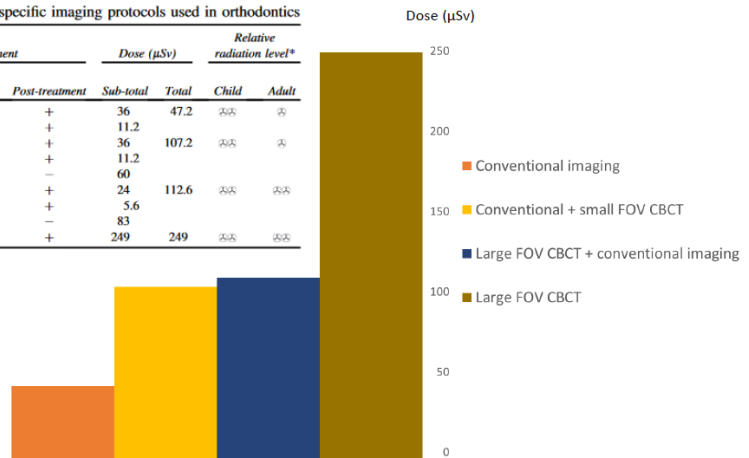
Main principles for radiation protection in medical care:

- **Justification:** The benefits of the examination outweigh the potential risks
- **Optimization:** Ensure that the minimum amount of radiation is used to produce an image of sufficient quality for accurate diagnosis or treatment
- **ALARA:** As Low As Reasonably Achievable

Radiation Risk Levels associated in Orthodontics

Table VI. Examples of the calculation of the RRL associated with specific imaging protocols used in orthodontics

Protocol	Modality	Stage of treatment			Dose (μSv)		Relative radiation level*	
		Initial diagnostic	Mid-treatment	Post-treatment	Sub-total	Total	Child	Adult
Conventional imaging	Panoramic ¹	+	+	+	36	47.2	25%	25%
	Lateral cephalogram ¹	+	—	+	11.2			
Conventional + small FOV CBCT	Panoramic ¹	+	+	+	36	107.2	25%	25%
	Lateral cephalogram ¹	+	—	+	11.2			
	Small FOV CBCT ⁵	+	—	—	60			
Large FOV CBCT + conventional imaging	Panoramic ¹	—	+	+	24	112.6	25%	25%
	Lateral cephalogram ¹	—	—	+	5.6			
	Large FOV CBCT ⁶	+	—	—	83			
	Large FOV CBCT ⁶	+	+	+	249	249	25%	25%



Source: Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and Maxillofacial Radiology, Oral Surg. Oral Med. Oral Pathol. Oral Radiol., 2013, <https://doi.org/10.1016/j.o000.2013.06.002>

Based on the effect on the head:

Site	Excess relative risk per 1 Gy (90 % CI)			
	Age at exposure group			
	0-9	10 - 19	20-39	40+
Brain	2.9 (0.8-5.5)	0.88 (0.28-1.78)	0.64 (<0-1.82)	<0 (<0-0.51)
Thyroid	1.5 (0.47-3.9)	1.2 (0.5-2.5)	0.46 (0.11-1.1)	0.31 (<0-0.92)
Other solid	1.65 (0.69-3.5)	NA	0.91 (0.50-1.4)	0.51 (0.14-1.1)
Skin	2.28 (0.04-7.8)	NA	1.7 (0.003-0.55)	0.01 (0.00-0.08)
Oral cavity			0.39 (0.11-0.76)	
Esophagus			0.52 (0.15-1.0)	

NB: 1 Gy ≈ 10 000 medium size CBCT examinations of about 100 mSv

Source: European Commission, Directorate-General for Energy, 'Radiosensitivity' of children –Health issues after radiation exposure at young age : EU Scientific Seminar 2020, Publications Office of the European Union, 2021, <https://data.europa.eu/doi/10.2833/769468>

As a conclusion:

The use of CBCT in orthodontics is of particular concern due to the **younger age** (and associated **higher cancer risk**) of patients undergoing orthodontic treatment.

Ruben Pauwels, Cone beam CT for dental and maxillofacial imaging: dose matters, *Radiation Protection Dosimetry*, 2015

Workshop. Group assignment –8 Groups

Groups 1 and 2:

- Use ChatGPT (or equivalent) LLM-model to solve a typical assignment from your institutions. How good is the answer? Evaluate critically.

The group presented searches for various topics. The answers were overall very good but the references referred to were made up most of the time. This led to a discussion on references that look real but are close to real in names, years and topic.

Groups 3 and 4:

- How can the use of SRS improve the teaching in your courses? Create some examples.

The group presented some ideas on how SRS could be used. They had tested various examples and found it useful.

Groups 5 and 6:

- How can you avoid student cheating by using ChatGPT (or equivalent) LLM-model? Can they use it in a fair way?

A discussion was held on the importance of letting the student reflect over given facts.

Groups 7 and 8:

- What does ChatGPT (or equivalent) LLM-model know about orthodontics at an undergraduate level?. Challenge the system and evaluate strengths and weaknesses.

The group had asked Chat GPT to create a Syllabus for undergraduate training in dentistry. The more precise the question to Chat GPT was written, the better the outcome was. They also had asked what orthodontics is and wanted a description for various readers. They found the Chat GPT very useful except for references that were often made up.