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Utilising ChatGPT to Enhance Radiation Protection Curricula for Health Sciences

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Background

Importance of Radiation Protection (RP) in healthcare

- Safeguarding of patients, carers and the public
- Occupational safety of healthcare professional (HCPs)
- Optimisation of practices/resources, sustainability

Why is continuing education in RP necessary?

- Evolving medical technology
- Guideline and regulatory updates
- Radiation risk awareness to enhance patient safety

Increasing use of AI in educational programs

- Adaptive AI-powered educational platforms
- Accessibility, guidance, support of educators/students
- Continuing and collaborative learning facilities

The emerging use of ChatGPT in education

- Enhanced searching for information
- Summaries of latest scientific findings and literature
- Interactive, personalised learning suggestions

Aim



To explore ChatGPT's capacity to provide useful suggestions for designing a lesson on RP in health sciences



To explore ChatGPT's capacity to generate customised learning scenarios for RP in health sciences



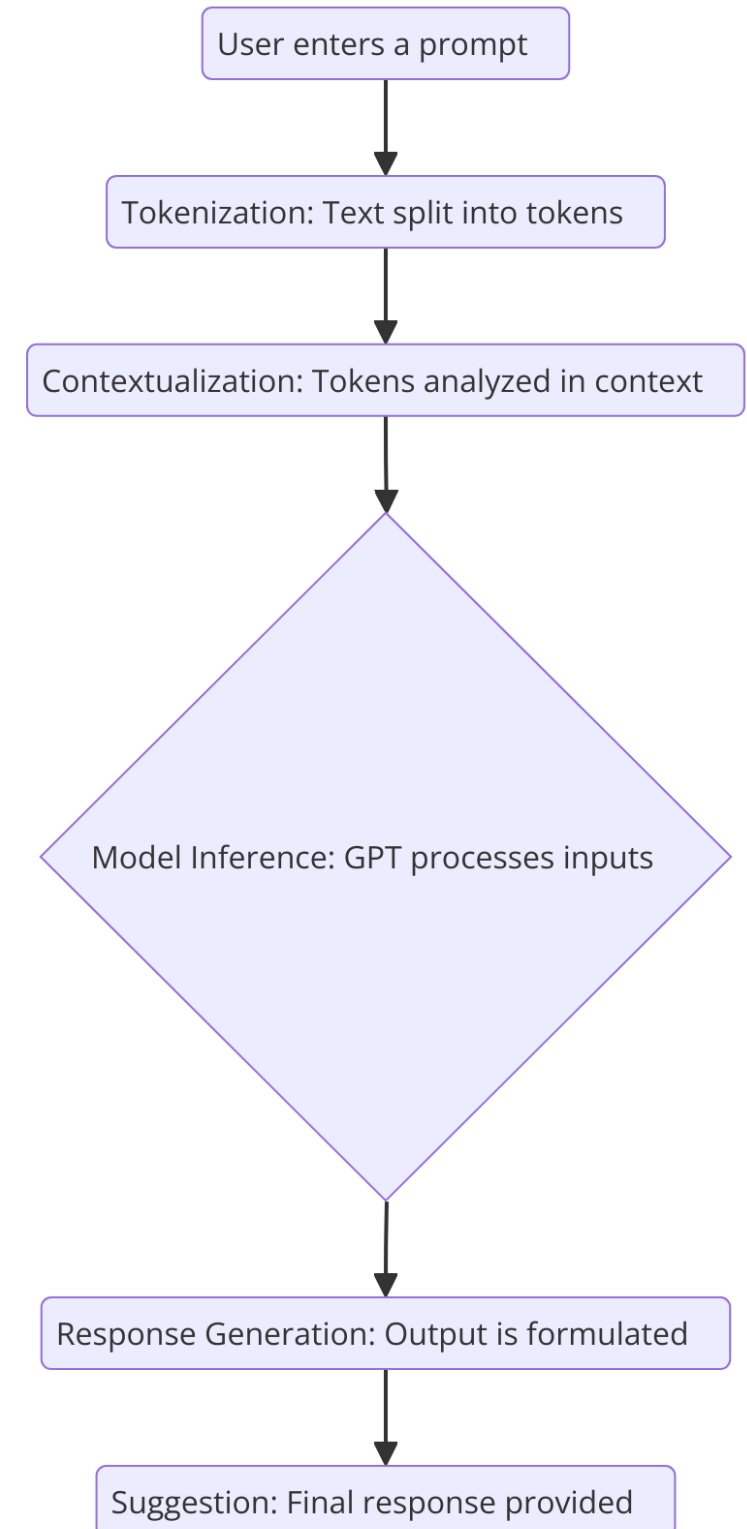
To explore ChatGPT's capacity to create drafts and search literature on RP for health sciences

Literature search in electronic databases

- PubMed, Scopus
- Search terms: “ChatGPT”, “radiation protection”, “education”, “curriculum”, “health sciences”

Use of ChatGPT for curriculum and content development

- ChatGPT-4o mini/ChatGPT-4o
- Import of specific and detailed prompts for curriculum enhancement suggestions
- Use different GPTs for each task



Scenario 1: Design of a Radiation Protection curriculum with “Curriculum Design” GPT

Input (prompt): Design a curriculum for radiation protection in radiography for undergraduate radiography students

Output 1 (suggestion for core objectives)

Core Objectives:

1. **Understanding Radiation Physics:**
 - Grasp the fundamental principles of radiation, including types, sources, and properties.
2. **Radiation Interaction and Effects:**
 - Comprehend how radiation interacts with matter, particularly human tissue, and understand the biological effects.
3. **Radiation Protection Principles:**
 - Learn the concepts of radiation safety, including ALARA (As Low As Reasonably Achievable), time, distance, and shielding.
4. **Regulatory Framework:**
 - Familiarize with national and international regulations governing radiation use in medical imaging.
5. **Practical Safety Measures:**
 - Develop skills in implementing safety protocols in clinical settings, including the use of protective equipment and dosimetry.
6. **Emergency Procedures:**
 - Prepare for handling radiation incidents or emergencies in a clinical environment.

Output 2 (suggestion for resources and materials)

Resources and Materials:

- **Textbooks:**
 - "Radiation Protection in Medical Radiography" by Mary Alice Statkiewicz Sherer et al.
 - "Radiologic Science for Technologists" by Stewart C. Bushong
- **Software:**
 - Dosimetry and simulation software such as RadCalc or PCXMC.
- **Online Resources:**
 - ICRP and WHO guidelines on radiation protection.
 - Access to radiography safety journals and articles.
- **Equipment:**
 - Radiation dosimeters, lead aprons, and thyroid shields for practical exercises.

Scenario 2: A real-world simulation scenario for interventional cardiology using ChatGPT

Input (prompt): Present a real-world simulation scenario about radiation protection in interventional cardiology

Output 1 (background, objectives, setting)



Creating a real-world simulation scenario for radiation protection in interventional cardiology involves integrating various aspects of the procedure, equipment, and safety protocols. Here's a detailed scenario:

Scenario: Radiation Protection in an Interventional Cardiology Procedure

Background:

You are an interventional cardiologist performing a percutaneous coronary intervention (PCI) in a busy hospital. The procedure involves using fluoroscopy to guide the placement of stents in a patient's coronary arteries.

Objectives:

1. **Minimize Radiation Exposure:** Ensure that radiation doses to the patient, medical staff, and yourself are as low as reasonably achievable (ALARA principle).
2. **Proper Use of Protective Equipment:** Use personal protective equipment (PPE) and shielding effectively.
3. **Optimize Procedure Technique:** Utilize techniques that reduce radiation exposure while maintaining diagnostic quality.

Setting:

- **Location:** Cardiac catheterization lab (cath lab).
- **Equipment:** Fluoroscopy machine, lead aprons, lead gloves, lead glasses, thyroid shields, and a ceiling-mounted lead shield.
- **Team:** Interventional cardiologist, radiologic technologist, nurse, and an anesthesiologist.

Output 2 (procedure steps)

Procedure Steps:

1. Pre-Procedure Preparation:

- **Review Patient History:** Understand the patient's medical history and the complexity of the procedure.
- **Positioning:** Ensure the patient is correctly positioned on the examination table.
- **Setup Shielding:** Place the ceiling-mounted lead shield to protect the team. Confirm that the lead apron, thyroid shield, and other PPE are in good condition and properly worn by the team.

2. During the Procedure:

- **Fluoroscopy Usage:** Limit the use of fluoroscopy by using it only when necessary. Use pulse fluoroscopy to reduce dose rates.
- **Technique:** Position the fluoroscopy machine to minimize the exposure to the patient's skin and staff. Utilize the collimator to restrict the x-ray beam to the area of interest.
- **Distance:** Maintain a safe distance from the x-ray source whenever possible. Use the protective barrier and stand behind it when not actively operating the equipment.

3. Monitoring and Communication:

- **Dose Monitoring:** Regularly check radiation dose indicators on the fluoroscopy machine. Ensure that cumulative dose levels are within safe limits.
- **Communication:** Maintain clear communication with the team about radiation exposure and procedural steps to minimize unnecessary exposure.

Scenario 3: Literature search using “ScholarAI” GPT

Input (prompt): Find original research papers published from 2020 onwards, where authors investigate healthcare professionals' knowledge about using lead aprons in radiological examinations

Output

Here are several original research papers published since 2020 investigating healthcare professionals' knowledge about the use of lead aprons and radiation safety during radiological examinations:

1. Assessment of Radiological Risk in the Operating Room

A study conducted in Sfax, Tunisia, highlighted that only 21.7% of healthcare workers wore lead aprons during intraoperative radiography, indicating gaps in knowledge and adherence to safety protocols regarding radiological protection (Haddar et al., 2024).

2. Knowledge of Radiation Hazards Among Healthcare Workers

Healthcare workers, particularly in operating rooms, displayed limited knowledge about ionizing radiation risks, with only 21.7% of respondents using lead aprons for protection during radiological procedures (Haddar et al., 2024).

3. Radiation Safety Knowledge in Urology Theatres

A UK-based survey found that 99.3% of healthcare professionals performing fluoroscopic procedures in urology used lead aprons, and 52.2% used thyroid shields, demonstrating moderate adherence to safety measures (Ong et al., 2021).

4. Use of Lead Aprons by Radiology Professionals

In this study, 67% of healthcare professionals knew they should wear lead aprons during radiological examinations, but only 62% implemented it correctly, revealing gaps in knowledge and proper use of personal protective equipment (Costa et al., 2023).

Corresponding links
to online articles

Scenario 4: Creating a quiz draft with ChatGPT

Input (prompt): Prepare a 5-question multiple-choice quiz about the stochastic and deterministic effects caused by ionising radiation

Output

Here's a 5-question multiple-choice quiz on the stochastic and deterministic effects caused by ionizing radiation:

1. Which of the following is a key characteristic of stochastic effects of ionizing radiation?

- A) Occurs only at high doses of radiation
- B) The severity increases with dose
- C) The probability of occurrence increases with dose
- D) Always results in immediate damage

2. Deterministic effects of ionizing radiation are characterized by:

- A) Occurring at any radiation dose, regardless of magnitude
- B) Having a threshold dose below which the effect does not occur
- C) Being random in nature
- D) Not depending on dose at all

Output

3. Which of the following is an example of a stochastic effect caused by ionizing radiation?

- A) Cataract formation
- B) Skin burns
- C) Cancer development
- D) Radiation sickness

4. Which statement best describes deterministic effects of ionizing radiation?

- A) They can occur at any radiation dose
- B) They occur after exposure to low doses of radiation
- C) They have a threshold dose, above which severity increases with dose
- D) They are not dose-dependent

5. Which of the following is true about stochastic effects of ionizing radiation?

- A) They are associated with a threshold dose
- B) They occur due to cumulative exposure over time
- C) The severity of the effect increases with dose
- D) The probability, but not the severity, increases with dose

Scenario 5: Search for YouTube videos with “Voxscript” GPT

Input (prompt): Can you find YouTube videos demonstrating scattered radiation during radiological procedures?

Output

Here are some YouTube videos related to scattered radiation during radiological procedures:

1. Effects of Radiation and Radiation Protection in Radiology (58:19)
 - Author: RadioGyan - Radiology Made Easy!
 - Overview of radiation effects and protection methods in radiology.
2. Control of Scattered Radiation (1) RADIOGRAPHIC EQUIPMENT (8:19)
 - Author: EPS: for the Radiographer
 - Discusses how scattered radiation impacts image quality and methods to control it.
3. Radiation Protection (Time, Distance, and Shielding) (4:50)
 - Author: How Radiology Works
 - Focuses on the basic principles of radiation protection.
4. Grids - X Ray Image Production (11:53)
 - Author: Clover Learning
 - Explains the use of grids in reducing scatter radiation during X-ray imaging.
5. Scatter Radiation Prevention with Ecolab's Drape Armour (1:27)
 - Author: Ecolab
 - Highlights the use of protective drapes to shield against scatter radiation.

These videos offer various insights into scatter radiation and protection methods in radiology.



Effects of Radiation and Radiation Protection in Radiology : ALL You

RadioGyan - Radiology Made Easy! • 2,9 χιλ. προβολές • πριν από 2 έτη



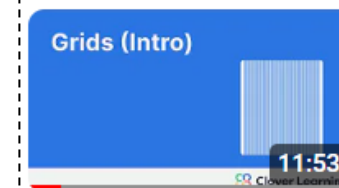
6. Control of Scattered Radiation(1) RADIOGRAPHIC EQUIPMENT

EPS: for the Radiographer • 7,5 χιλ. προβολές • πριν από 4 έτη



Radiation Protection (Time, Distance and Shielding)

How Radiology Works • 19 χιλ. προβολές • πριν από 2 έτη



Grids - X Ray Image production

Clover Learning • 13 χιλ. προβολές • πριν από 1 έτος



Scatter Radiation Prevention with Ecolab's Drape Armour

Ecolab • 1,5 χιλ. προβολές • πριν από 4 έτη

Conclusions

ChatGPT can enhance the process of developing or updating a Radiation Protection curriculum by...



...simplifying and explaining complex concepts and topics

ChatGPT can make mistakes. Check all information and ensure prompts (inputs) clarity for maximising accuracy in the output



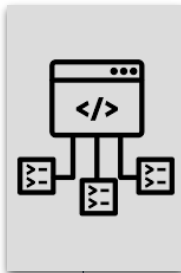
...facilitating research and generating information summaries

The initial curriculum assessment is crucial for identifying knowledge gaps and setting new learning objectives



...assisting in formulating relevant learning objectives using GPTs

The faculty recommendations and feedback are crucial to ensure that new content aligns with educational needs



...being incorporated in educational design frameworks

The academic board's final approval ensures that new or updated curricula meet quality assurance regulations

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