How could AI be used in postgraduate radiology training?

Jennifer Curle[1], Vicki Dale[2] and Susan Jamieson[2]
1 NHS Greater Glasgow and Clyde, 2 University of Glasgow

INTRODUCTION

Artificial intelligence (AI) tools and products are increasingly being used in radiology to improve image quality, aid diagnosis, prioritise reporting and optimise workflow[1]. In the UK there is increasing clinical demand for imaging and consequently for radiology reporting time[2]. Postgraduate radiology training in the UK is an apprenticeship style model with heavy involvement of consultant radiologists. AI could potentially decrease the training burden on radiologist thus freeing time for reporting. Increased inhouse reporting could reduce costs. The project aimed to synthesise and critique empirical evidence on how AI is being used in Health Professions' Education (HPE) and how these examples can be translated into postgraduate radiology training in the UK.

METHODS

A critical narrative review of the scientific and education literature focussing on primary research involving AI and health professions' education was performed. Four subject databases were searched. Results were single screened by title, abstract and full text then critically appraised using the CASP tool[3].

RESULTS

Eleven papers from 2021-2024 were reviewed. These were categorised as; AI used for educational content creation (n=6), personalised learning (n=2), assessment of clinical skills (n=1), assessment of text created by students (n=1) and assessment of text created by educators (n=1). These are summarised in table 1.

DISCUSSION

Statistically-significant results were obtained by two groups using AI tools to assist with caries detection on x-rays by undergraduate dental students[4,8]. This approach could be adapted for postgraduate radiology training. An AI tool could be created and used to assist with detection of features on x-rays by trainees. There are commercial products which do this, but not with an educational aim. These would need adapted for the relevant environment. Cai et al[5] showed fewer complications and increased trainee confidence when using AI-labelled imaging to assist with training of postgraduate anaesthetic trainees in ultrasound-guided nerve block procedures. Again, this could be adapted for postgraduate radiology training. Firstly, for diagnostic purposes, an AI tool could be used for labelling anatomical structures on ultrasound. This would assist novice trainees in gaining basic ultrasound skills. Similar to Cai et al[5], their approach could be used to assist radiology trainees develop ultrasound-guided procedural skills such as biopsy and drainage techniques. Johnsson et al[12] successfully used an AI system to assess the technical proficiency of participants performing an ultrasound-guided CVS procedure. This could be transferred to assessment of the procedural skills associated with radiology. However, this system did not give feedback for improvement or give a holistic impression. Currently, the benefit over traditional expert assessment is doubtful.

Bond et al[13] developed a tool to assess free text, in this case, to score medical student patient notes. The scoring tool was developed to pick up key phrases. There was no statistically- significant difference in scores between faculty raters, non-faculty raters and the AI tool. Given every piece of imaging looked at by a radiologist results in creation of a written report, this approach has potential utility. In training, a bank of reported images could be created. An AI tool could compare a trainee report with the actual consultant report. This would require an intensive training period as the tool would need trained for every different study. This is a significant limitation. For this to be achieved in a pragmatic manner, collaboration would be needed at a regional if not national level.

Ruberto et al[10] used an AI tool to tailor a simulation scenario based on cognitive load. Simulation scenarios are not part of radiology training: however, altering training intensity based on cognitive load is a concept which could be applied to radiology training. It could be paired with text analysis as described above to provide a personalised set of imaging studies to report based on cognitive load.

Several studies are not uniquely transferable to the radiology environment, but show some promise in the general HPE arena. For example, personalisation of instructional strategy based on learning preference, use of an AI tutor system and analysis of free-text of WBPAs[6,10,14].

CONCLUSION

Overall, results were not generalisable because of the limited quality of the reviewed studies. Per the CASP tool, 4 studies were moderate quality and 7 poor quality. Promising areas which could transfer to radiology training were use of AI tools which label images to assist with learning and analysis of text to assist with review of trainee reports.

Future research on the use of AI in HPE should focus on robust study design and conduct with multi-professional input. Consideration should be given to the epistemological beliefs of the researchers.

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Table 1 General characteristics of the included papers

*CASP scores out of 20. Score: ≤15 low quality, 16-19 moderate quality, 20 high quality
CNN convolutional neural network, ML machine learning, DNN deep neural network, NLP natural language processing

Authors (year)	Country	Participants	Type of AI	Methodology	CASP score*	Premise
Educational content creation						
Ayan et al (2024)[4]	Turkey	Undergraduate dental students	CNN	Quantitative	13	Comparing ability of dental students to assess caries following conventional training versus training with an AI application
Cai et al (2022)[5]	China	Postgraduate anaesthesia trainees	CNN	Quantitative	16	Comparing success of popliteal nerve block and complications following usual training versus training with AI-labelled images
Sanchez-Gonzalez et al (2023)[6]	USA	1st year medical students	Generative AI	Quantitative	12	Comparing test scores of students who accessed a standard Powerpoint presentation with those who also had access to an AI tutor in a flipped classroom environment
Sardesai et al (2024)[7]	UK	Postgraduate anaesthesia trainees and anaesthetic consultants	Generative AI	Quantitative	8	Survey of trainees and consultants regarding effectiveness of consultation with AI-created simulated patient
Schropp et al (2024)[8]	Denmark	Undergraduate dental students	ML (probably CNN but not stated)	Quantitative	14	Comparing ability of dental students to assess caries following conventional training versus training with an AI application
Waikel et al (2023)[9]	USA	Postgraduate paediatric trainees	Generative AI	Quantitative	18	Using AI-generated images to improve detection of rare genetic conditions
Personalised learning						
Ruberto et al (2021)[10]	Canada	Emergency department-medical students, trainee doctors and attendings (consultant equivalent)	DNN	Mixed methods	13	Gauging participant response to using a new AI-created simulation tool which adjusts in complexity according to physiological markers of cognitive load
Shoaib et al (2024)[11]	Malaysia	Undergraduate dental students	ML	Quantitative	13	Using an AI model to match 'student learning style' with instructional style
Assessment of clinical skills						
Johnsson et al (2023)[12]	Denmark	Medical students, obstetrics and gynaecology trainees, foetal medicine experts (consultants)	CNN	Quantitative	16	Comparing assessment of procedural skill by experts versus AI
Assessment of text created by students						
Bond et al (2023)[13]	USA	Medical students	NLP and ML	Quantitative	16	Using an AI tool to score text created by students and comparing that with scoring by faculty
Assessment of text created by educators						
Yilmaz et al (2022)[14]	Canada	Emergency medicine assessors	NLP	Quantitative	15	Using NLP to analyse written feedback in order to determine competency

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