Student centered learning strategies in higher education - scoping review and application to international learning collaboration

FINNISH NATIONAL AGENCY FOR EDUCATION

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Background

- The complexity of health care environments and interprofessional work requires health professional graduates to have high critical thinking skills (Clark & Hoffman 2019).
- Different types of pedagogical methods are essential for learning different types of theoretical, practical or psycho-social knowledge, skills and competences.
- Health care education is nowadays based on student-centred learning methods.
- One reason is that these methods seem to support the integration of theoretical knowledge and practical skills and help students to develop into proactive learners.

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Background

Student centered learning methods seem to produce

- Better-motivated and more satisfied students (Hung, Lam & Chow, 2020)
- Student engagement, empowerment and responsibility (Healy, Flint & Harrington, 2016)
- Deeper learning (Carrick, 2011)
- Better clinical reasoning skills (van Wyngaarden, Leech & Coetzee, 2019).

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The purpose of the project

- To summarize the evidence regarding the outcomes and benefits of student-centred learning strategies used in health care higher education institution settings
- To use this knowledge to create a pedagogic framework for an international learning project between Singapore Institute of Technology (SIT) and Metropolia University of Applied Sciences Finland (Metropolia).

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Methods

- **1st stage:** scoping review was performed during spring 2020 by using databases PubMed, Science Direct, CINAHL via EBSCO Host and OATD, a database of academic dissertations. The modified version of the STROBE v4 checklist for cohort, case control and cross-sectional studies was used for quality assessment of the selected studies.
- **2nd stage:** the knowledge was used to create a pedagogic framework for an international learning project between Singapore Institute of Technology (SIT) and Metropolia University of Applied Sciences Finland (Metropolia).

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Stage 1: the scoping review

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Results

Use of collaborative and inquiry-based learning strategies results

- Higher scores or otherwise improved performance (Makhoul et al, 2018; Rodríguez, Pérez, Núñez, Baños & Carrió, 2019; Carstensen, Kjaer, Möller & Bloksgaard, 2020) as well as effective learning (Naylor, 2011)
- However also studies that this effect was not observed (Mueller-Joseph & Nappo-Dattoma, 2013; Schoening et al, 2015)

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Results

The use of collaborative learning and inquiry-based learning was found to improve several types of skills

- clinical skills (Chang & Cui, 2018; Jackson, Bilich & Skuza, 2018; Männistö et al, 2020)
- communication and presentation skills (Naylor, 2011; Rodríguez et. al, 2019)
- holistic thinking and information synthesis skills (Ignacio & Chen, 2020; Naylor, 2011)
- critical thinking skills (Naylor, 2011; Rodríguez et. al, 2019; Schoening et al, 2015; Carstensen et al, 2020)
- independent learning skills (Mueller-Joseph & Nappo-Dattoma, 2013; Naylor, 2011, Rodríguez et al, 2019)
- interpersonal and interprofessional skills, (Chang & Cui, 2018; Jackson et al, 2018; Rodríguez et al, 2019)
- teamwork and collaboration skills (Jackson et al, 2018; Männistö et al, 2020; Naylor 2011) and creativity (Rodríguez et al, 2019).

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Stage 2: implementation of student centered learning methods to international learning collaboration

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Basic information of the Dosis-project

- Dosis-project has been realised as a part of Metropolia ICT and radiography students' Bachelor theses and Innovation studies in co-operation with Singapore Insitute of Technology (SIT) DP of Diagnostic radiography (DR), radiotherapy (RT) and ICT programmes.
- So far 18 Metropolia students and 9 SIT students have participated the project.
- New students are still enrolled because in this format we continue the project tills end of 2022.

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Objectives and actions in the project

The main objective of this project is to consolidate the cooperation between the partner institutions Metropolia and SIT in the field of health technology and especially in the field of *AI based solutions in dose management.*

Actions in the project

- Expert lectures about the basics of AI, use of AI in radiography and radiotherapy, academic writing and scoping review method
- Planning and work meetings online – since no opportunity to meet, also intensive days
- Collaborative writing scoping review articles about AI based dose management in radiography and radiotherapy

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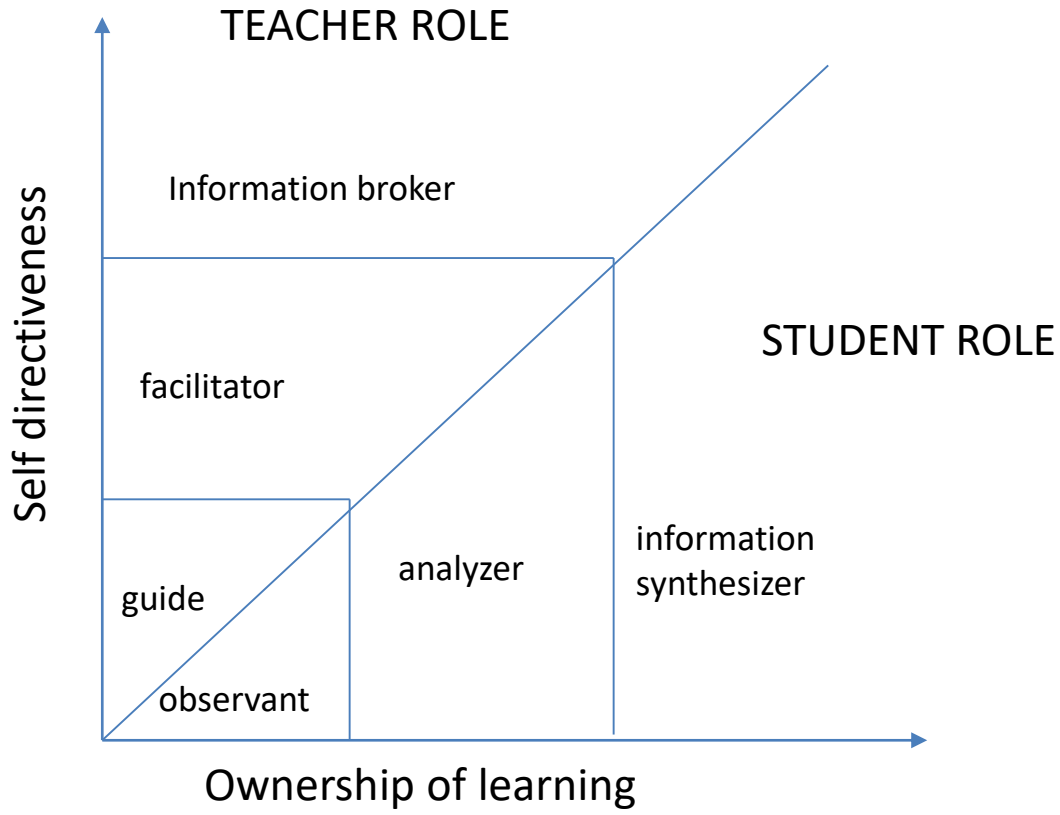
Implementing co-creative learning strategy to ’AI-based solutions in dose management’ (Dosis)- project



Co-creative pedagogy practiced in the project

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I The students´ choice for their learning goals
The students selected in groups their review topics

II Design of the learning in a way that it enables students becoming owners of their own learning process - Students work in groups via web conferencing tools, on site during intensive weeks in Finland and Singapore and participate online expert lectures

III Equal relationship and joint decision making between teachers and students – Teachers work in student groups as facilitators and co-authors

IV Important area of expertise being involved in the learning – Topic of the project ''Use of AI in diagnostic imaging and RT dose optimization'' is one of the Core competencies of diagnostic imaging and health technology curriculums

Co-creative learning in the project 4 pedagocic principles and how we realised them in practice in Dosis-project.

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Results of the implementation

- The students and professors have been very enhousiatic in producing peer reviewed scoping reviews.
- High quality outcomes from Bachelor level students!
- Both the students and professors have learned a lot about
- a) the use of AI in dg radiography and radiotherapy b) academic writing and scoping review methodology c) international co-operation and d) multiprofessional teamwork.

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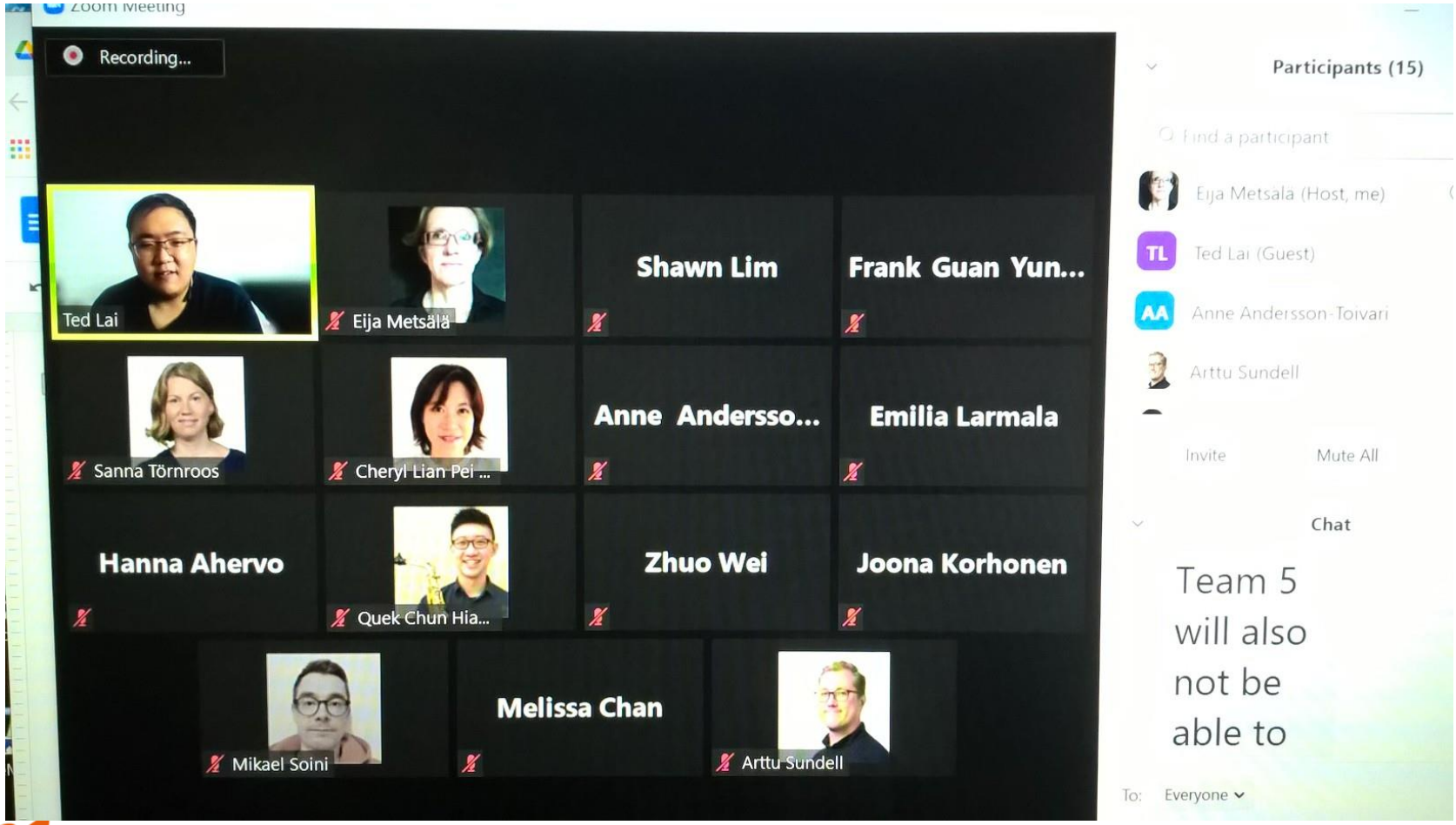
Covid-19 pandemia has posed some challenges



Solved by using Google Drive-platform, Zoom and other web-conferencing systems.

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American Journal of Nursing Studies

Research Article

Benefits and Outcomes of Student-Centred Learning Strategies in a Healthcare Higher Education Institution Setting - A Scoping Review

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Abstract

Objectives: The aim of this scoping review was to examine the evidence demonstrating the outcomes and benefits of student-centred learning strategies used in health care higher education institution settings.

Review method: PubMed, Science Direct, CINAHL via EBSCO Host and OATD dissertation databases were used in the search. The keywords used were co-creative learning, students as partners, collaborative learning, inquiry-based learning, cooperative inquiry and co-construction of knowledge. The modified version of the STROBE v4 checklist for cohort, case control and cross-sectional studies was used for quality assessment.

Results: Eleven full text articles using collaborative (n=9) and inquiry-based learning strategies (n=2) were selected for review. The results regarding measurable learning outcomes such as scores or proportion of students successfully completing the learning unit were inconclusive. However, with regard to qualitative studies, improvements in many kinds of generic and health care-specific skills and competencies were reported. Students were also satisfied with the use of student-centred methods, which was reflected in their reported motivation.

Conclusion: More high-quality research into the measurable outcomes of student-centred learning strategies is needed. However, these learning strategies seem to be useful in developing many of the skills and competencies needed for health care professions.

Keywords: Student-centred learning; Educational institution context; Health care students; Higher education institution

Contents lists available at ScienceDirect

Radiography

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Systematic Review

The use of deep learning towards dose optimization in low-dose computed tomography: A scoping review

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ABSTRACT

Introduction: Low-dose computed tomography tends to produce lower image quality than normal dose computed tomography (CT) although it can help to reduce radiation hazards of CT scanning. Research has shown that Artificial Intelligence (AI) technologies, especially deep learning can help enhance the image quality of low-dose CT by denoising images. This scoping review aims to create an overview on how AI technologies, especially deep learning, can be used in dose optimisation for low-dose CT.
Methods: Literature searches of ProQuest, PubMed, Cinahl, ScienceDirect, EbscoHost Ebook Collection and Ovid were carried out to find research articles published between the years 2015 and 2020. In addition, manual search was conducted in SweMed+, SwePub, NORA, Taylor & Francis Online and Medic.
Results: Following a systematic search process, the review comprised of 16 articles. Articles were organised according to the effects of the deep learning networks, e.g. image noise reduction, image restoration. Deep learning can be used in multiple ways to facilitate dose optimisation in low-dose CT. Most articles discuss image noise reduction in low-dose CT.
Conclusion: Deep learning can be used in the optimisation of patients' radiation dose. Nevertheless, the image quality is normally lower in low-dose CT (LDCT) than in regular-dose CT scans because of smaller radiation doses. With the help of deep learning, the image quality can be improved to equate the regular-dose computed tomography image quality.
Implications to practice: Lower dose may decrease patients' radiation risk but may affect the image quality of CT scans. Artificial intelligence technologies can be used to improve image quality in low-dose CT scans. Radiologists and radiographers should have proper education and knowledge about the techniques used.
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Radiation dosage and image quality with deep learning reconstruction techniques in CT imaging - A Scoping Review

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ABSTRACT

Purpose: Deep learning reconstruction (DLR) is a new Computed Tomography (CT) dose reduction strategy to optimise CT image reconstruction. We compared the impact of DLR on dose reduction, diagnostic accuracy and image quality with existing reconstruction techniques (hybrid IR, MBIR and FBP) in CT imaging.

Methods: A scoping review of literature between April 2016 and April 2020 was conducted, following the PRISMA-ScR guidelines, with data searched from MEDLINE/PubMed, Semantic Scholar, Google Scholar and SpringerLink databases. Review includes 9 articles.

Results: It seems that DLR techniques yield better image quality, with reduced image noise when done with reduced radiation dosages as compared to FBP, hybrid IR and MBIR techniques. The existing clinical CT studies also showed the superiority of using DLR techniques over other reconstruction techniques in terms of having significant improvements in both qualitative and quantitative aspects of CT image quality, by having reduced noise and improved diagnostic capabilities, allowing for better lesion detections.

Conclusion: DLR in CT have demonstrated potential in further dose management, yielding better CT image quality with reduced image noise.

Keywords: Computed tomography (CT), Deep learning reconstruction (DLR), Iterative reconstruction (IR)

INTRODUCTION

Computed tomography (CT) is a commonly used imaging modality and its usage has been rapidly increasing due to its strong diagnostic performance (den Harder et al. 2015). The growing popularity of CT as a diagnostic tool has raised concern about the risk of radiation-related carcinogenesis, prompting research in CT to focus on minimising radiation doses (Power et al. 2016). Throughout the years after the commercialised introduction of CT for clinical use, several approaches were made to reduce CT radiation dose (Power et al. 2016). One of such key methods was to determine the appropriate usage of CT scans by developing evidence-based guidelines and recommendations on when the benefits of a CT examination outweighs the risks (Furterer 2014). Other existing options involve concentrating on the optimisation of CT technical parameters (e.g tube current, tube voltage, pitch and reconstructed section thickness), utilisation of dual-energy CT and applying dose reduction technology (e.g. automatic tube current modulation) (Kerl et al. 2011; Li et al. 2011; Willemink et al. 2013).

In recent years, CT manufacturers have started to focus on developing a newer CT dose reduction strategy that revolves around optimisation of CT image reconstruction (Willemink et al.

Using Convolutional Neural Network in 3D Reconstruction from 2D Radiographs - A Scoping Review

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ABSTRACT

Aim: Using Convolutional Neural Network (CNN) in the process of reconstructing three-dimensional (3D) models from two-dimensional (2D) radiographs has been explored in recent years. In this review, we identify such articles and discuss clinical accuracy of results, time taken, and the remaining challenges for this AI development to be clinically applied.

Methods: A scoping review was conducted following the PRISMA-ScR framework using online databases (Semantic Scholar, Google Scholar, IEEE Xplore Digital Library, Springer Link and PubMed), filtered to include only recent (past 5 years) full-text peer-reviewed articles in English. Eight articles were selected.

Results: Authors proposed methods using CNN in the process of reconstructing 3D anatomical models from spine and lower limb 2D radiographs. Overall, the results were reported to have acceptable accuracy when compared to ground truth. The reconstruction processes were also fully-automated and had faster reconstruction times compared to other methods.

Conclusion: With CNN, fast and accurate 3D models can be reconstructed from 2D radiographs to aid in diagnosis and treatment planning of bone-related pathologies, providing a possible alternative to high radiation Computed Tomography (CT) imaging for certain procedures.

Keywords: Convolutional Neural Network, 2D radiographs, 3D reconstruction

INTRODUCTION

CT and Magnetic Resonance Imaging (MRI) are common radiological imaging procedures used to obtain patient-specific 3D reconstructions of anatomy to aid in diagnosis, surgical planning, treatment and follow-up of bone-related pathologies (Reyneke et al.. 2018). However, CT imaging can result in high levels of ionizing radiation for patients with conditions like scoliosis, that require scans over a large area for repetitive follow-ups (Levy et al.. 1996). This is a deterring factor due to possible biological effects e.g. cancer, especially for younger patients (Lin 2010). While MRI does not utilize ionizing radiation, there are other associated risks due to the use of a strong static magnetic field, gradient magnetic fields and radiofrequency pulses, and possibly contraindicated for patients with metallic fragments or implants, electronic implants, or tattoos, etc. (Dill 2007). MRI also has longer acquisition and processing times and is more frequently used to evaluate struc-

Conclusions

- The results of the scoping review suggested that using student centered learning approaches improves learning with respect to many generic and health care-specific skills and enhances student satisfaction and motivation.
- The experiences received from the Dosis-project where co-creative learning approach was implemented, this pedagogic framework seems to work very well also in international learning project, where there are students and professors from different professional and cultural backgrounds.

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Thank you for your attention!

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