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A qualitative comparative survey of First Cycle radiography programmes in Europe and Japan

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Abstract *Purpose:* To qualitatively compare First Cycle Radiography programmes in Europe and Japan.
Methods: This qualitative survey was conducted via a series of case-studies of university-based radiography curricula in Europe and Japan.
Findings and conclusions: The main themes arising from the survey were that: (a) in Europe the freedom that most universities have in setting their own curricula and examinations means that in practice there is still a wide variability in curricula between and within states. On the other hand in Japan curricula are more uniform owing to central government guidelines regarding radiography education and a centrally administered national radiography examination. This means that student and worker mobility is much easier for Japanese radiographers. (b) in some countries in Europe principles of reporting and healthcare management are being expanded at the expense of the more technological aspects of radiography. Physical science competences on the other hand are considered highly in Japanese culture and form a major part of the curriculum. This may indicate that Japanese students would be in a much better position to cope with role developments linked to changes in imaging technology. Pragmatically oriented studies need to be carried out to determine ways in which radiographers can enhance their role without sacrificing their technological competences. The profession cannot afford to lose its technological expertise — it is neither in the interest of the profession itself and even less of the patient.

Introduction

Although several cross-national comparative studies have been conducted regarding higher education programmes, these have been typically conducted between states which

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have similar cultural, linguistic and educational contexts. Few studies have been made between states with totally different cultural backgrounds, such as Japan and states within Europe. Little is found regarding the Japanese higher education system in the English-language literature as only a small fraction of the research conducted by Japanese researchers is translated into English.[1] A thorough search of the literature for comparative studies involving the non-medical healthcare professions in fact produced only three articles in nursing.[2–4] In the case of radiography such comparative studies are totally absent. Although, the core competences of radiography are universal, emphasis varies between states and universities within states depending on factors such as local culture, approaches to role development, educational policies and legal frameworks.[5–7] The purpose of this study was to qualitatively compare undergraduate radiography programmes in European and Japanese universities (where radiography is known as 'radiological technology'). Comparative studies help us to appreciate what fellow professionals are doing in other parts of the world, to reflect on our own practices and to learn from the best practices of others. Comparative curriculum studies are essential to highlight novel themes that curriculum developers should consider. We also believe that, comparative studies are essential in an age of globalization as no profession can develop in isolation within the confines of its own country. The specific objectives of this qualitative study were theme generation, analysis and discussion. The study is delimited to undergraduate (First Cycle) radiography programmes.

The higher education contexts in Europe and Japan

There are three broad categories of universities in both Europe and Japan: traditional comprehensive universities, professional universities (in Europe increasingly called 'Universities of Applied Sciences') and specialised medical universities. Examples of traditional comprehensive universities in Europe are the University of Leeds (UK), University of Amsterdam (NL) and University of Pisa (IT). Examples in Japan are the Universities of Tokyo, Osaka, Nagoya and Tohoku which form part of the network of the so-called *national* universities. In Japan national universities are those which traditionally operated under the auspices of the Japanese Ministry of Education, Culture, Sports, Science and Technology (which is known in Japan as MEXT, an abbreviate form of the acronym MECSST). These universities are now operating under increased autonomy from MEXT.[8] Universities of Applied Sciences specialize in educating the newer professions. Examples in Europe are Fontys University of Applied Sciences (NL), University of Salford (UK) and Cologne University of Applied Sciences (DE). This type of university is also common in Japan among the so-called *public* and *private* universities. In Japan the term 'public university' refers to universities set up by prefectures or municipalities to cater for local needs (Japan is divided into 47 prefectures each of which is further divided into municipalities). Tokyo Metropolitan University, Akita Prefectural University and Sapporo City University are public universities. Private universities in Japan are by far the biggest category and run into hundreds. Specialised medical universities focus on medicine and the health sciences. Examples are Karolinska Institutet (SE), the Medical University of Vienna (AT) and the Medical University of Warsaw (PL) in Europe and Tokyo Medical and Dental University, Asahikawa Medical College and Hamamatsu University School of Medicine in Japan.

Degrees in radiography can be found in all three types of universities in the case of Europe. In Japan, however, radiography programmes are found only in traditional comprehensive and professional universities (e.g., Nagoya University a traditional comprehensive university and Tokyo Metropolitan University a professional university). Besides programmes in medicine and dentistry, specialised medical universities do include programmes in nursing but not radiological technology. Sometimes programmes are organized within small universities dedicated solely to the healthcare professions which however do not include medicine and dentistry (e.g., Gunma Prefectural College of Health Sciences, Kyoto College of Medical Science).

In Europe radiography departments within traditional comprehensive universities are organized under various types of faculties (Faculties of Medicine, Faculties of Health Science, Faculties of Science). In Japan, in the case of national universities, radiography programmes are usually organized within Schools/Departments of Health Sciences forming part of the Faculty of Medicine. This may indicate that in Japanese national universities radiography programmes are tightly linked to medicine. However in the case of universities which do not have a Faculty of Medicine (often private or public universities) radiography courses tend to be organized by other faculties (e.g., Faculty of Medical Technology, Teikyo University).

Many EU countries are reforming their educational frameworks to enhance cross-border recognition of academic degrees and promote the smooth exchange of students, educators and professionals. The most notable process in this regard is the construction of the European Higher Education Area (more popularly known as the 'Bologna Process').[9] The Bologna process aims to reform and harmonise programme structures in Europe[10] and is to be completed by 2010.[11] *Tuning* is a part of the Bologna Process, which focuses on the harmonization of learning outcome competences with the aim of facilitating student and worker mobility in Europe. *Tuning* aims to identify learning outcomes for generic (i.e., *Tuning* terminology for 'cross-professional') and subject-specific (*Tuning* terminology for 'profession-specific') competences.[12]

In the case of Japan, MEXT in 1991 published the 'Amendment of the Standards for the Establishment of Universities' in response to the need for reform of the education system and also for increasing international competitiveness. Two important aspects relevant to this study were a categorization of subjects into three broad subject areas namely 'fundamental subjects', 'basic specialised subjects' and 'specialised subjects', and the relaxation of criteria for credit calculation and course duration. 85% of universities in Japan implemented reformed curricula by 2006.[13] These amendments were legislated in order to enable universities to establish their own unique and flexible curricula which would satisfy increasing social demands and expectations. On the other hand, an unforeseen negative effect of the fact that universities are now freer to establish their own curricula, has been a tendency for traditional general subjects to be given less importance than specialised subjects. This seems to be adversely affecting student achievement not only in the traditional general subjects themselves but also in the specialised subjects as the former underpin the latter.[14]

Surveys of radiography education in Europe and Japan found in the literature

The Higher Education Network for Radiography in Europe (HENRE) is the Socrates thematic network implementing *Tuning* in radiography. HENRE aims to provide a forum for educational and professional organisations within radiography to discuss issues regarding the future professional development of radiographers on a European scale.[15] One of the first outputs of the research programme conducted by HENRE was a survey of existing radiography education programmes in Europe. The results of this survey are available online at the HENRE website (http://www.henre.co.uk/henre2/directory_h2.html). Forty-seven radiography institutes within 22 EU countries participated in the survey. Of particular importance to this study was the data concerning structure of credit award systems, structure of programmes, teaching and learning methods, assessment methods and curricular content. A weakness of the survey was that it tended to lean towards diagnostic radiography, whilst the therapeutic radiography component is weaker. The reason for this imbalance between the two streams of radiography could be because radiotherapy education had already been given due attention by ESTRO (www.estro.be). No equivalent survey has been identified in the Japanese literature.

Methodology

Qualitative methods are essential in studies which are fundamentally exploratory in nature, that is, when very little is known about the subject, as was the case of this study. The specific objectives of this comparative survey were theme generation, analysis and discussion and qualitative research is the most effective approach when one needs to uncover the range of themes relevant to a specific issue.[16] Qualitative research is inductive and thematic inferences are developed in cumulative increments based on the data acquired during each stage of the study.[16] The data was collected via a series of case-studies of radiography programmes at European and Japanese universities. Data collection was stopped when no new significant themes were emerging ('data saturation'). A qualitative case-study approach enabled an in-depth study and analysis of the radiography programmes at the selected universities.

Universities with radiography programmes in Europe and Japan were initially surveyed using the Internet. A total of 22 universities (16 from various countries in Europe and 6 from Japan) were then chosen. In qualitative research, data is not collected via randomized sampling but using purposeful sampling that is cases are chosen according to the purposes of the study. In the case of this study the purpose of the research was theme generation, hence cases were chosen according to whether they presented new themes or otherwise. Qualitative research has been criticized for its use of purposeful samples as opposed to random samples. However this type of criticism arises from a misconception of the main objective of this type of research — which is to uncover the range of themes relevant to an issue rather than the number of persons holding a particular thematic point of view. The criteria taken into consideration when choosing the European and Japanese radiography institutes included: type of university, type of Faculty, type of programme (separate and combined diagnostic/therapy), general course structure and course outcome competences. These criteria were used such that a diverse range of radiography programmes would be selected thus ensuring that a more comprehensive set of themes is detected. European radiography courses were chosen from different areas in Europe as we found that radiography education in Europe is at the moment still quite heterogeneous. Two national universities, two public universities and two private universities located in major cities in Japan were studied. Six universities were found to be sufficient in the case of Japan since for reasons discussed later on in this article there is a much higher level of homogeneity than in Europe.

The main data collection techniques in case-study research are document analysis, direct observation during on-site visits and interviews.[16] The data collection technique used in this study was document analysis. Course documents were obtained from university web-sites or when not available online via email from course leaders. Document analysis provided several advantages over other techniques for this particular study:

- Course documents are public documents and since they are expected to be seen by many people often represent data which has been given thoughtful attention by the authors.
- The technique is unobtrusive and avoids the biasing of responses or observations created by the researcher's presence during interviews and direct observations.
- As written evidence, documents save on transcribing time and expense.
- Finally course descriptions tend to follow similar formats making comparative studies much easier.

Data was collected with the help of a purposely designed theme collection instrument. The theme collection instrument was subdivided into 2 sections. The first section included information on the educational programme as a whole and on the context in which the programme is carried out i.e., country, city, name of university, type of university, name of programme, academic title awarded, duration, registration (i.e., whether the programme is approved for registration in the country), type of course (combined or separate diagnostic/therapeutic programmes), number of credits required for graduation, curriculum orientation, and programme structure. The second section was designed for collecting data on general curriculum content: imaging/therapeutic modalities studied, teaching methodology and methods of assessment. The curriculum content was classified under the following segments: Human Biology (anatomy, physiology, pathology), Biomedical Physics (devices, radiation protection, radiobiology, quality control, engineering, radiation chemistry, informatics), Protocol Design (imaging/therapeutic), Clinical Practice and Patient Care. This was done in order to be able to assess the importance given to the various segments of the curriculum. The number of credits assigned to each subject was also noted. The thematic sheet data was analyzed and relevant themes inferred from the data.

The methodological limitations of the study arose from limitations of the research design used. This study was conducted without direct on-site observations or interviews and based purely on documents publicly available from academic institutes. Such documents may sometimes not be totally complete or may not accurately describe the actual situation on the ground. To reduce the effect of the latter only universities with recently updated curricular documents were included in the sample. It is also acknowledged that although we believe that the sample was sufficient to supply most of the relevant themes, the inclusion of more universities would perhaps uncover further themes.

Results and discussion

The main themes arising from the data were the following:

Type of program

Combined diagnostic/therapeutic radiography programmes are the more common in Europe. Separate programmes for diagnostic and therapeutic radiography are mostly found in PT and UK (and those countries which for historical reasons follow UK educational models namely EI and MT). In Japan, Radiological Technology students have to pass a *national* radiological technologist examination for licensing purposes which is under the control of the Ministry of Health, Labour and Welfare (MHLW). The examination *includes both diagnostic and therapeutic* radiography. Since the primary educational goal of all radiography programmes in Japan is to educate students so that they will pass this centrally set national examination all radiography programmes in Japan are combined diagnostic/therapeutic.

Duration of study programme

The duration of study programmes in Europe varies between three (e.g., UK, NO, CZ) and 4 years (e.g., NL, EI, MT, PT). This is independent of whether they are separate diagnostic or therapeutic, or combined diagnostic/therapy programmes (e.g., separate three-year programmes in the UK, separate four-year programmes in EI, combined three-year programmes in CZ, combined four-year programmes in NL). All *university-based* undergraduate radiography courses are four-year programmes in Japan (non-university based programmes also exist, these are fewer in number and are of a three-year duration).

Structure of credit system

Most European universities now use the European Credit Transfer System (ECTS) in which one full-year of study is equivalent to 60 ECTS. The number of lecture hours per ECTS is variable (5—10). One credit in Japan involves 15—30 lecture hours (MEXT, School Education Law, Standards for Establishment of Universities, Article 21) and radiography students are generally required to obtain typically 124—136 such credits for graduation out of which 14 are in fundamental subjects, 30 in basic specialised subjects and 49 in specialised subjects. The rest of the credits can be chosen from a variety of options not necessarily related to radiography. Before the Amendment of the Standards for the Establishment of Universities, *all* lecture credits were of 30 contact hour duration. This lowering in the number of contact hours has affected two aspects of Japanese radiography education: educators have had to revise their teaching methodologies in order to maintain the necessary level of content whilst students are now expected to make up the shortfall through independent study.[17]

Determination of curricular content

In Europe therapeutic radiographers (also known as radiation therapists), medical physicists and radiotherapists (radiation oncologists) have worked together and on a European scale to produce endorsed guidelines for European core curricula for all three professions. This curriculum development programme has been carried out as part of the project ESQUIRE (**E**ducation, **S**cience and **QU**ality **A**ssurance for **R**adiotherapy) conducted by the European Society for Therapeutic Radiology and Oncology (ESTRO). It is important to note that, in the case of radiation therapists the project led to a European core curriculum.[18] Unfortunately the curriculum is not outcome competence based as required by *Tuning* but simply presents a syllabus (although there is a current initiative by ESTRO for this to be rectified). By comparison, the content of diagnostic radiography programmes is quite variable across Europe. This is probably owing to the fact that no Europe wide curriculum development project on the lines of ESTRO has been carried out. Only one such pan-European curriculum development study was found in the literature in the case of diagnostic radiography and this concerned only the physics component.[19] In their study the authors made a systematic study of diagnostic radiography curricular and role development documentation and the physics component of diagnostic radiography curricula in Europe and developed a structured inventory of physics elements-of-competences which underpin subject-specific competences in diagnostic radiography. It is to be noted that the inventory was developed in cooperation with HENRE and should form a good basis for a future European diagnostic radiography physics curriculum. It is hoped that the HENRE Tuning group would in future give more attention to the other segments of diagnostic radiography curricula. In Japan, the subject areas of the national examination for radiographers are determined centrally by the Ministry of Health, Labour and Welfare (MHLW) and the curriculum guideline is set by MEXT. This is in sharp contrast to European universities which have more leeway in determining curriculum content, albeit often within guidelines set by educational quality assurance authorities and professional and statutory regulatory bodies. The Medical Radiological Technologist law in Japan promulgated by the MHLW in 2003 introduced changes in examination subjects e.g., imaging engineering was separated from radiographic techniques and added new subjects e.g., MRI and Medical informatics. It also introduced changes reflecting the changing roles of radiological technologists e.g., technologists involving themselves in digital image management, PACS, or the physics—engineering aspects of radiography.[20] Subjects in the national examination for radiological technologists are listed in Table 1. The addition of new subjects to the national examination, reflected demands by hospital management, Japanese society and the developments of occupational standards in radiography.[20] The MEXT guideline for radiological technology curricula is shown in Table 2. However it should be noted that this guideline gives only loose descriptions of study areas and does not specify the study content in the particular areas.

Curriculum orientation

General curriculum philosophy at all universities in both Europe and Japan is to develop students' skills and knowledge in radiography and radiotherapy and their professional behaviour towards patients and other healthcare workers. However, the orientation is quite variable in Europe where universities tend to follow the local view regarding role development. For example in the case of diagnostic radiography, the UK orientation tends towards an increased emphasis on the reporting and healthcare management aspects of radiography at the expense of the technological (physical sciences) aspects. This is an unfortunate consequence of the restricted curriculum time available to curriculum planners. In other countries (e.g., DE, CZ) the technological aspect is more pronounced. In Japan the curriculum is in the norm much more physical sciences oriented as evidenced by the number of physics based questions in the national examination (see Table 3). Rich study contents in the physical sciences such as Fourier analysis (essential for an understanding of how image filtering can increase the efficacy of diagnostic images and why inappropriate filters can produce the converse effect), concepts of DQE and NEQ (essential for understanding the various sources of image noise and the relationship between noise and image quality) and basic solid state physics (required for an understanding of the strengths and limitations of digital detectors and their impact on image quality and patient dose, and also for understanding the use of thermoluminescence and solid state dosemeters) are included in the curriculum. A typical list of curriculum unit titles includes a high percentage of compulsory physical science based modules (see for example http://hes.met.nagoya-u.ac.jp/RT2/curriculum-e.html). In Europe, many physics curricula in many universities appear rudimentary by comparison. The specific reasons for this difference could not be identified with certainty in this study but Japanese society does value and hold in high esteem advanced technological competence. This may indicate that Japanese students would be in a much better position to cope with role developments linked to rapid changes in imaging device technology than some of their European counterparts. In Japan, there is currently a high demand for radiographers who also specialize in computer technology and medical information management. The trend towards the more technological aspects of radiography has is in fact been increasing in some universities for several years[17] and is still on the increase. For example, the Komazawa University, Department of Radiology Science, Faculty of Health Science, offers a four-year degree course in radiological technology which in addition to regular radiography content, offers options in studying digital imaging theory, image network technology and algorithms for medical image processing. Following the second year of the programme the student cohort is divided into two: diagnostic imaging science and image engineering science. In image engineering science, the programme aims to produce radiographers who can work with medical image networks and their management. The high interest in the technical aspects of radiography among radiological technologists in Japan is also evidenced by the fact that radiological technologists and medical physicists have launched a common journal to publish their work internationally. *Radiological Physics and Technology* (Springer) is the official English-language journal of the Japanese Society of Radiological Technology (http://www.jsrt.or.jp/web_data/nglish.html) and the Japan Society of Medical Physics (http://www.jsmp.org/english/index.html).

Overall programme structure

In Europe different types of programme structures are found. Some universities use a block system in which

Table 1 Subjects in the national radiological technologist examination in Japan (published by MHLW, in 2003, the division of subjects into disciplinary groups is hours).

Human biology	Biomedical physics		Protocol design
Anatomy	Radiation biology	Radiation safety control	Radiographic protocols
Physiology	Radiation physics	Medical imaging devices	Nuclear medicine protocols
Pathology	Radiation chemistry	Imaging engineering	Radiation therapy protocols
	Medical engineering	Medical informatics	
	Med. imaging instrumentation	Radiation measurement	

Table 2 Subject areas specific for radiography programmes in Japan (published by MEXT in 2000).

Subject areas		Credits	Learning outcomes
Fundamental Subjects	Scientific Perspectives, Human Life	14	Cultivate scientific and logical thinking, understanding of human nature, ability to adapt and be flexible, ability to make independent judgements and actions. Understand bioethics and human dignity. Cultivate the ability to cope with globalization and information age.
Basic Specialised Subjects	Human Structures, Functions and Diseases	12	Understand human structures, functions, diseases and other related topics. Understand public health and societies
	Basic and Radiological Science/ Technology	18	Cultivate basic knowledge and the ability to learn science and information technology related to healthcare, medicine and welfare. Cultivate basic knowledge necessary for the safe use of radiation in healthcare and medicine.
Specialised Subjects	Radiographic protocols	17	Understand imaging principles, mechanical structures, quality assurance, radiographic techniques, analysis and evaluation of images in XRI, CT, MRI and USI.
	Nuclear Medicine protocols	6	Understand imaging principles, structure of devices and quality assurance, and acquire clinical techniques and knowledge necessary for analysing and evaluating medical images in nuclear medicine.
	Radiotherapy protocols	6	Understand radiotherapy principles, structure of devices and quality assurance, and acquire clinical techniques and knowledge necessary for analysing and evaluating medical images in radiotherapy.
	Medical Image Information System	6	Understand theories for image acquisition, construction, analysis, evaluation and medical information network system
	Radiation Safety and Management	4	Understand the safe use of radiation and related regulations and laws as well as safe management of radiation in healthcare
	Clinical training	10	Cultivate radiographic techniques in clinical situations and understand radiology department management, patient care and responsibilities of radiographers as a part of a healthcare team
Total		93	

theoretical lectures, clinical training, tutorials and group discussions are combined. In such programmes special attention is given to clinical training which often starts at an early stage and frequently constitutes about 50% of the programme. Other programmes are divided into two parts: a *propedeuse* stage (the first year of the programme) and a *post-propedeuse* (the second, third and final years). Students must pass an examination at the end of the propedeuse stage in order to proceed to the *post-propedeuse*. The *propedeuse* stage may or may not involve clinical training. In Japan most programmes are divided into a first part (1—1.5 years) which includes learning of 'fundamental subjects' and 'basic specialised subjects'. This is a preparatory period providing students with a wide range of academic knowledge which is considered necessary for later radiography education and is equivalent to the *propedeuse* stage in Europe. Radiography education properly starts from the second semester of the second year. The module/block system was not used in the Japanese universities studied.

Table 3 Subject area question distribution in the 2008 national examination (exams are MCQ-based).

Subject area	Number of MCQ questions
Human Biology	34
Physical sciences	118
Diagnostic radiology protocols	27
Nuclear medicine protocols	11
Radiation therapy protocols	10
Total	200

Curriculum time allotted to the various subject areas of the curriculum

In Japan, curricular time allotted to each segment of the curriculum is quite uniform as most follow the guidelines from MEXT. Much greater variations were observed among European radiography programmes. Subjects in Human Biology are generally taught at a relatively early stage in both Europe and Japan and the orientation towards technology discussed earlier means that the percentage of physics based credits in Japanese curricula is much higher than in Europe. The number of credits allotted to imaging and therapeutic protocol design varies substantially between radiography programmes in Europe and is much higher than in Japan, although there are indications that in some universities in Europe students are simply expected to learn and follow protocols as opposed to acquiring an understanding of the principles of protocol design. Clinical training takes a larger fraction of curricula time in Europe than in Japan and it is usually spread throughout the programme. In Japan, much less emphasis is made on clinical training and it tends to be done at a late stage of the programme (in the third and fourth years). Patient Care involves subjects such as e.g., communication, interpersonal skills, psychology, inter-professional healthcare and sociology. Major fractions of curricula are allotted to such subjects in Europe. On the other hand, in Japan, this is considered as a minor part of radiography education and is often found within the elective component. This may indicate that awareness of the importance of such issues is higher in Europe than in Japan. The systematic application of the principles of inter-professional healthcare across a wide spectrum of disciplines is still not so well developed in most countries in Europe, nor is it in Japan. No surveys corresponding to that of HENRE have been found for Japan probably a result of the fact that the centrally determined curriculum tends to flatten major variations. For example, a survey of radiation safety education at radiography institutes in Japan found no significant differences.[21] In fact we did not detect major variations in the core subjects of radiography at the universities that we studied, however, a survey similar to the one conducted by HENRE would help a lot in uncovering the extent of homogeneity or otherwise of Japanese curricula in practice.

Teaching methodology

Teaching methodologies in radiography education generally include lecture, tutorial, seminar, clinical training, e-learning and PBL. The use of PBL is becoming more common in Europe but less so in Japan. This is further supported by the fact that we only found one article on the use of PBL in radiological technology education. This involved the use of information technology to address a radiation protection issue.[22]

Conclusion

The main conclusions of the study are that:

(a) In Europe the freedom that most universities have in setting their own curricula and examinations means that in practice there is still a wide variability in outcome learning competences between and within states notwithstanding the efforts of higher education quality assurance agencies in the individual states and those of HENRE to 'tune' such differences. On the other hand in Japan, radiography educational structures and curricula appear to be much more uniform owing to the centralised guidelines from MEXT and the nationally determined subject areas of the national examination from the MLHW. This means that student and worker mobility is in practice much easier for Japanese radiographers than for radiographers from the EU as universities and employers are more certain of what competences to expect from students from other universities and from new employees.

(b) In some universities in Europe principles of diagnostic reporting and healthcare management are being expanded at the expense of the more technological aspects of radiography. Physical science competences on the other hand are considered highly in Japanese culture and form a significant part of the curriculum. This may indicate that Japanese students would be in a much better position to cope with the rapid changes in imaging device technology than some of their European counterparts. This would be more so in the case of those graduates who have elected to specialize in areas such as image processing and medical image networks and their management. We regard this as an important issue for reflection by radiography curriculum planners in the EU and as a worthwhile area for further research. Pragmatically oriented studies need to be carried out to determine ways in which radiographers can enhance their role without sacrificing their technological competences. The profession cannot afford to lose its technological expertise — it is neither in the interest of the profession itself and even less of the patient.

The reasons for the more technological approach to diagnostic radiography education in Japan as opposed to the more reporting/management approach in some countries in Europe should also be investigated further. The specific reasons for this difference may be many. Examples include high esteem towards advanced technological competence within Japanese society, higher esteem for reporting/management in some countries in Europe, or simply economic drivers such as the presence of an undersupply or oversupply of radiologists or medical physicists.

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