Learning Radiology in an Integrated Problem-Based Learning (PBL) Curriculum.

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Background: The Faculty of Medicine (FoM) has been training health professions in Uganda since 1924. Five years ago, it decided to change the undergraduate curriculum from traditional to Problem Based Learning (PBL) and adopted the SPICES model. Radiology was integrated into the different courses throughout the 5 year program. The objective was to improve the implementation of the integration of Radiology in the integrated PBL curriculum.
Methods: This was a cross sectional descriptive study of radiologists and medical students using interviews and semi-structured questionnaires respectively.
Results: Radiologists' and students' perceptions and opinions on Radiology training were gathered. A Radiology training rationale was developed. Learning outcomes for Radiology were defined and learning formats were chosen. Learning materials were identified and strategies to improve the implementation were formulated.
Conclusions: This work has culminated into changes in Radiology integration in the curriculum and training at the FOM.

Introduction

Integration is the organization of teaching matter to interrelate or unify subjects frequently taught in separate academic courses or departments [1]. Integration in the medical curriculum dates back to1952 when the Case Western School of Medicine initiated what was said to be the most advanced medical curriculum by integrating the basic and clinical sciences focusing on organ system and featuring early patient encounters right from the first year. Now it is universally accepted [2]. However integration is not easily achieved and requires a lot of time and work in respect of planning, organization and execution[3].

The Faculty of Medicine (FoM), Makerere University is the oldest health professions training institution in East Africa. Five years ago as a result of a curriculum review, it decided to change the undergraduate training from traditional to Problem Based. It adopted the SPICES model (Student centered, problem based, integrated, community based, electives, Systematic)[4].

As a result of the review, radiology was integrated into the different courses in the medical curriculum which is five years. In the old curriculum radiology was taught as 2 courses in the 2nd and 4th years. Radiology is considered an important part of the curriculum. There is a need to address Uganda's radiology needs by training medical doctors that have good radiology skills considering that there is a shortage of Radiologists in the country. There are 30 radiologists for a population of 30 million people. Following the review the Radiologists realized that they could not rely on the old methods of training and so had to become innovative so as not to remain behind. This was also noted by Subramaniam in Australia[5]. In addition there is a need for the radiologists to be actively involved in training medical students if they are to influence their learning and be good role models so as to attract them to the profession later on.

This work set out to redesign the learning of Radiology in PBL curriculum and to improve the implementation of the integration of Radiology in the PBL curriculum. There is a need to ensure quality training by stimulating active learning in radiology and understanding of concepts. This involved formulating a rationale for the integrated Radiology training, defining the learning outcomes for Radiology by focusing on Ugandan needs, choosing active learning activities for these outcomes with focus on horizontal integration, sequencing the learning activities focusing on vertical integration.

Subjects and Methods

The Department of Radiology is one of the 23 departments at the FoM. There are 12 radiologists involved in the training of undergraduates. It also runs a Radiology post graduate program.The objective was to improve the implementation of the integration of Radiology in the integrated PBL curriculum.The study was a cross sectional descriptive study. The radiologists were interviewed to find out how they thought Radiology training should be conducted in the new curriculum. The radiologist ideas were collated in a short summary and conclusions were formulated and sent to them for validation. Semi-structured questions were administered to fourth and fifth year students.

Results

The radiologists agreed that the new curriculum was good (7/8) as students are responsible for their learning(5/8), are more involved in the process of learning(5/8), work collaboratively (4/8) and are stimulated to find information by using problems (5/8). They also thought it makes Radiology more relevant to patient management for the students (7/8). However they felt that the integration could not be easily achieved (5/8)and expressed the need to be more involved in the integration process (8/8). They felt that Radiology may loose identity in the curriculum and that some important concepts like physics, equipment, radiation safety and Radiotherapy were missing (5/8). Many (6/8) also felt that the student numbers were big and this strains the human resource when conducting small group learning. Despite this many thought that the PBL tutorials were an appropriate teaching tool and that students were motivated (5/8). Implementation was noted to be a challenge because there was a long chain of implementers through course coordinators and block coordinators before things got to the department.

The Radiologists(5/8) think that students aren't choosing radiology as a career because they don't get exposed to radiology enough for them to be interested in it. This was confirmed by the students who said there was limited exposure to radiology as a discipline `(N=82). A student wrote that " Radiology was treated as a good to know field as compared to other disciplines". Another wrote that "My interest in the discipline is not stimulated because there is little exposure to radiology". Only 15 students said they would take up radiology as a career. One Reported that he found it interesting, that it has a future because at the moment there are very few radiologists and that it is multi-disciplinary as well as a fast growing field.

All the 82 students and the 8 radiologists agreed that Radiology in the country was not getting adequate attention. They observed that the upcountry hospitals were not well equipped so students don't see its future. A student said "Radiology is an expensive discipline so I think it would be an expensive venture for me to go into private practice". one said Radiology is an unsafe environment to work in. The students (N=68) said that during their community placement exposure to Radiology was limited and the Radiology practice seemed to be limited to the big hospitals(N=60). They commented that Radiology did not seem to offer opportunities for career growth and advancement in Uganda (N=59). The students (N=27) said that there is little contact between the radiologist and the real patient and this would discourage them from taking Radiology as a future career.

The radiologists suggested that radiology should be made more visible in the curriculum and that there should be more interaction between the radiologists and the students for example by attending and participating in tutorials, seminars and grand rounds. This will help them to role model and impress the students that radiology is an interesting discipline. The students (N=54) and radiologists (6/8) suggested that more radiology and specifically images should be included in the tutorial problems.

Both groups recommended that an elective in radiology could attract students.

The radiologists proposed clinical radiology rounds, once a week on the wards in each of the 4 major 4th and 5th year rotations that is Surgery, Internal Medicine, Paediatrics, Obstetrics and Gynaecology. This would be worked out so that a radiologist would be allocated each semester to a discipline and for example every Friday afternoon, he/she would go through images on the wards. This would help the students to see many images during their time as students and would improve their pattern recognition as well as make the experience contextual.

A Radiologist would be nominated to be in charge of radiology undergraduate training and he/she would be the person responsible for making sure that the curriculum is followed so that things are not only on paper but actually happen. He /she would follow up on timetables and would work closely with the faculty education coordinator so that radiologists are involved in the planning.

The students proposed that lectures and seminars should supplement the other learning activities for the different courses in order to allow them meet the experts so as to fill up the gaps. The radiologists proposed that topics like radiation safety and Physics of Radiology could be given as lectures as they did not fit into other learning activities. Radiologists proposed that the skills lab could have a viewer where students could look at images from the archive.

A rationale for Radiology Training was developed as follows" A medical doctor should be able to apply the knowledge of radiology in the management of his patients. Radiology is intended to help the doctor investigate his patients so as to come to a diagnosis. This doctor in Uganda is likely to end up working in a place where there is no radiologist. The knowledge he/she would have acquired in radiology as an undergraduate would be a hallmark for patient management and improving the health of the community".

Learning outcomes for Radiology were developed. The students were expected to be able to:

1. identify normal radiological anatomy so as to recognize the abnormal
2. request for appropriate investigations
3. know the indications for investigations and their limitations
4. appreciate the radiology terminologies so as to interpret the radiology reports and use them for evidence based patient management
5. identify the different radiological and imaging investigations
6. know how to prepare patients for the basic examinations like Intravenous pyelogram and barium studies
7. know the basic Physics of Radiation, image formation, common artifacts and radiation safety
8. interpret basic radiological investigations like the Chest X-ray, Abdominal radiographs and Skeletal radiographs especially pertaining to the Ugandan context.
9. identify emergencies at basic radiological images
10. use a cost effective approach to imaging
11. relate clinical features, laboratory and radiological findings
12. recognize when referral to a radiologist is necessary.

It was agreed on that the following learning formats would be employed PBL tutorials, demonstrations, Seminars and conferences, Lectures, Skills lab, Radiological clinical (ward) rounds, Small group hands on interpretation sessions, Grand rounds and a Radiology Elective. Learning Materials are to be selected by a committee of radiologists at the beginning of every semester. The Radiologists recommended that all the radiology activities should be assessed and the results communicated to the course coordinators. During the session's feedback should be given to the students. Sequencing was agreed on and using the curriculum map, courses which had objectives pertinent to Radiology were identified.

Discussion

The Radiologists agreed that integration of Radiology in the curriculum was a good approach to training. There is evidence from Cognitive Psychology to show that the integration of knowledge

facilitates the storage and later retrieval of knowledge. It has also been noted to prepare students better for actual practice[6]. Integration also puts radiology in context and more problem based rather than discipline based.

The learning outcomes for Radiology training for medical students do not vary from region to region; this is evidenced by the similarities between the objectives for Uganda, Australia and New Zealand[7]. However when it comes to the specific topics these may vary depending on the location, for example in Uganda HIV and Tuberculosis would feature more prominently. Both areas identified the value of students observing certain radiological procedures. The radiologists in Uganda think this is important for the students to understand what their patients are in for so as to prepare them and explain to them the procedures. Subramaniam argues that the ability to select the most appropriate and cost effective radiological investigation is important because most are expensive and so care must be taken to use the most cost effective approach for achieving the desired goal in patient management [5]. This is particularly important in a developing country like Uganda and the radiologists in Uganda agreed with him.

It has been noted that an effective radiology education program has the advantage of giving the radiologist an opportunity to teach future medical professionals and influence their future practice and it also enables the department to attract the top performers to take up a career in Radiology. It has also been said that if Radiology is learnt in context as happens in a PBL approach, it will be effectively approached and practiced [5]. For example a patient with a pneumothorax or cardiac failure will be used as the focus of learning and this would show the relevance of Radiology in patient management. This is the approach that is used during radiology exposure sessions and rounds and is carried out on the wards. These enable the students to see many imaging results as to improve the pattern recognition abilities[8].

Clarity of purpose has been noted to be important in learning that is why learning outcomes for the students have been formulated so that they can learn to perceive and accept the relevance of the learning activities in relation to the large task of learning Radiology. It is also hoped that having formulated overall learning outcomes for the students will help support the students in developing ownership of the overall problem or task. Survey et al emphasise the role of a stimulus for learning, in which case the objectives given out to the students to help them study and later come up with their own learning objectives in the small group radiology sessions will act as stimulus and organisers for learning[8].

Encoding specificity has been defined as learning in a situation that resembles the situation in which the knowledge will be applied. In this case, by incorporating Radiology into the problems and also for radiologists to conduct rounds where images are seen alongside the patient will favour encoding specificity. It will also encourage elaboration [9]. So by using problems that have Radiology in them in the tutorials and using the small group discussions the students will work collaboratively, practice activation of prior knowledge, exchange and critically discuss acquired new information. All this enhances acquisition, retention and use of new knowledge. At the same time it will vary the situation in which learning occurs [10].

Conclusion

Improvement of the implementation of the integration of radiology into the PBL curriculum is an ongoing process that depends on the commitment of the radiologists and other faculty members to implement the proposals and suggestions in this article. Strengthening the Radiology component of the curriculum is hoped to help improve the delivery of health services in Uganda.

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References

1. Harden RM, Sowden S, Dunn WR: Educational strategies in curriculum development: The SPICES model. Medical Education 1984, 18, 284-297.
2. Grant, J. Asme Principles of Curriculum Design 2006 (No. 0 904473). www.library.auckland.ac.nz/subjects/med/course-pages/clined712.htm
3. Dahle LO, Brynhildsen J, Behrbohm Fallsberg M, Rundquist I., Hammar M: Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linköping, Sweden. Medical Teacher 2002, 24(3), 280-285.
4. Dent JA, Harden, RM: Section 1 Curriculum development (2 ed.). Eddinbrough: Elsevier Churchill Livingstone 2006.
5. Subramaniam, RM: Problem - based learning: concept theories, effectiveness and application to radiology teaching. Australasian Radiology 2006, 50, 339-336.
6. Regehr AJ, Norman GR: Adult Learning, Objectivity and other Self - evident Un truths. Advances in Health Sciences Education 2002, 7(2), 81-160.
7. Subramaniam R, Scally P, Tress B: Medical Student Radiology Training: What are the Objectives for Contemporary Medical Practice? Academic Radiology 2003, 10(3), 295-300.
8. Savery JR, Duffy Thomas M: Problem Based learning: An instructional model and its constructivist framework. Bloomington: Indiana University 2001.
9. Schmidt H: Problem -based learning: Rationale and description. Medical Education 1983, 17, 11-16.
10. Dent, JA, Hesketh, EA: Developing the teaching instinct. 13: how to teach in the clinical skills centre. Medical Teacher 2004, 26(3), 96-105.