

**RSNA R&E Foundation Education Scholar Grant
Education Scholar Grant Application**

**Sergio Uribe, PhD, MS
Pontificia Universidad Catolica de Chile**

NOTE: Personal information for the applicant and other investigators has been removed from this sample application.

Title: Latin American MR e-learning Platform

Abstract:

The aim of this project is to develop a robust Magnetic Resonance Imaging (MRI) learning platform to offer a Graduate Certificate Program (Diploma) in MRI for MR technologists, residents, radiologists, and other medical doctors from Latin American countries.

MRI has had an explosive growth during the last years; however, knowledge about its fundamentals and its relation with the clinical findings is not always present. Indeed, training programs for MR technologists and radiology residents consider only a few MR lectures. This is mainly because of the busy academic and clinical workload. Furthermore, in Latin American countries, this situation is more exacerbated since there are only few people trained in MR who are able to teach the basic principles of this technique and there is a lack of teaching material in Spanish. All these reasons together with our motivation to spread the MR field in our region are the primary driving forces to build up this proposal. The goal of this project will be accomplished through the creation of MR e-learning materials that will be authored by various contributors including PhDs in physics or engineering, and experienced radiologists. The e-learning materials will be the base of a Latin American MR platform that will be then used to teach several topics of MRI. We will focus in developing lectures of the physical principles of MRI and its clinical applications; however we will emphasize those lectures that explain the association between imaging findings with MR sequences, as well as those lectures to optimize MR protocols.

The proposal will be implemented in two phases; the first will be the creation of the e-learning materials and the platform for supporting these lectures. The second phase will consist on using this platform for creating a Graduate Certificate Program in MR.

Percent of Time Dedicated to this Project:

The proposal project will be developed one year, and in the subsequent months we will use this platform to develop postgraduate academic degrees at different institutions in Latin America. I will dedicate 20% of my time to generate the materials required for the MR platform.

Priority Statement:

Over the last 6 years I have spent my working life developing and teaching MR in different university hospitals. Most of this work has been done in multidisciplinary teams, which has given me the opportunity to communicate ideas to people with different backgrounds, and to understand problems derived from several disciplines.

As can be seen in my biosketch, I have received several universities and governmental funding over the last years. My research has been focused on developing new methods for MR, as well as to translate those methods into the clinic, particularly in Cardiac MR.

Another important part of my job has been teaching MR to engineers, medical doctors, and also to MR technologists, which I have done in different countries in Latin America, such as Colombia, Ecuador, and Mexico. Several times, our group has been asked to give lectures in other countries; however, in some cases it has been impossible to give these courses because of the academic agenda.

From these experiences, and in addition to the limited MR lectures modules in the technologist and radiologist curriculum, I have realized the need of learning MR in a more appropriated way, particularly in our region. Therefore, I was delighted when I learned about this grant call from the RSNA and I immediately thought about applying for the Educational Scholar grant.

The Educational Scholar grant fits perfectly with my motivation of spreading the knowledge of MR in our region. Our goals for this project are two. The first one is to produce an MR platform of several e-learning materials. The content of these materials will include lectures, manuscripts, and tests that will be geared towards different levels of competences. The

second one is to use those materials for creating a Graduate Certificate Program in MR given by our University. Being an assistant professor at the Radiology Department and also working in the Biomedical Imaging Center is ideal, since there are many collaborators interested in participating in this proposal from both the Engineering and Medical schools within our and other universities. This can ensure that we can produce all the necessary contents for carrying out this project. All of my collaborators have Doctoral degrees in MR or they are experienced radiologists, and all of them have several years of experience given MR lectures.

Furthermore, our University has an excellent center for Internet learning, which is available to our group. This center has several projects for promoting continuous education through seminars, courses and diplomas in different areas, which are open to people from different countries in Latin America. Therefore this platform is perfect to achieve both objectives of this proposal.

I am very excited about the proposal describe in this document, since I believe it is an excellent opportunity to create a regional educational program of MR. It is my hope this grant will be funded, since it could be the base for creating further advanced MR lectures in specific topics, which can then be used for promoting higher degrees in MR, such as Fellowships in cardiovascular, body, neuro and muscle-skeletal.

Budget: (*Budget details have been removed from this sample*)

Project Timeframe: 7/1/2012 - 6/30/2013

Amount Requested: \$75,000

Complete Budget Justification

A. Personnel

Salary support:

UC Virtual and internet bandwidth for online lectures: \$20,000

PI Administrative tasks: \$ 4,000

PI and collaborators developing each MR module content (\$1,400 each - module content will include several power point presentations, recording lectures, manuscript materials, assessments and key point lectures. Total:

\$28,000

Student Assistant: \$ 5,500

B. Supplies

Computer and Desk Consumables: \$ 2,000

C. Other

Travel

(on site lectures and promotion of the MR e-learning Platform (three trips in Latin America): \$ 7,500

MR e-learning platform design: \$ 3,000

Diploma Organization: \$ 5,000

MR scanning time: 30 hours at \$300: Total: \$ 9,000

Total Project Cost: \$84,000

Funds provided by the Center for Biomedical Imaging: \$ 9,000

Total RSNA Project Cost: \$75,000

Other Investigators:

Name: Pablo Irrazaval

Role: He is a full professor of the department of Electrical Engineering with research and teaching expertise in Magnetic Resonance Imaging and other medical imaging modalities. He is the founder and director of the Biomedical Imaging Center. He is author of several publications, patents and a textbook. He has ample experience training people. He will contribute with lectures of the basic of MRI and will be responsible for the spectroscopy and perfusion modules.

Name: Francisco Cruz

Role: Academic abdominal radiologist, mainly ultrasound and CT and one of the founders of and actual Chairman of the Department of Radiology. He has been involved in teaching residents and fellows in the Body Imaging section for more than 30 years, member of the RSNA and AJR and past President of the Chilean Radiological Society. He has published various articles and book chapters in medical imaging and has been member or chair of several educational and clinical advisory committees. He is a renowned lecturer in abdominal imaging in Chile and has been a guest speaker and visiting professor in several countries in South America and in the University of British Columbia. He also has had leadership roles in radiology education promoting research and teaching within the Department of Radiology. He will serve as a mentor, supporter and provider for all the great variety of activities that projects of this kind requires.

Name: Steren Chabert

Role: Specialist in diffusion MRI and functional MRI, with particular experience in implementing functional MR in the context of Chilean public Hospitals. She has many years of experience in teaching biomedical imaging in general, and MR in particular, at an undergraduate and graduate level. She is currently head of the Biomedical Engineering Department and of the Master's program in Biomedical Engineering of the Universidad de Valparaiso, Chile. She will contribute with lectures for reviewing the physics of MRI, and will be responsible for developing the lectures of diffusion.

Name: Alvaro Huete

Role: Specialist in thoracic and abdominal imaging cardiothoracic imaging with ample experience as a lecturer both in Chile and abroad and has published 12 articles on diagnostic imaging in indexed peer-reviewed journals. He has active leadership roles in radiology education being the current residency program director at the Catholic University School of Medicine. He also is the coordinator of the abdominal imaging branch of the Chilean Society of Radiology. He will be responsible for producing the abdominal MR imaging module content.

Name: Luis Meneses

Role: Experienced interventional Radiologist. He is also an expert in the use of MR for assessing hemodynamics changes, and has published many papers and give lectures in different conferences. He will contribute with clinical lectures of the use of MRI for assessing flow and its clinical relevance.

Name: Alvaro Burdiles

Role: Specialist in musculoskeletal radiology (working both in diagnostic and interventional MSK radiology) and an experienced lecturer. After a MSK fellowship at University of Toronto he has been involved in radiology education at Universidad Católica de Chile (for residents and fellows), and in different cities across the nation as guest speaker or visiting professor. He has been a member of the directory of Sociedad Chilena de Radiología (SOCHRADI) in two different periods. Past Director of the Chilean Chapter of MSK Radiology. He will be responsible for producing the MSK imaging module content.

Name: Claudia Prieto

Role: Specialist in MR image reconstruction and an experienced lecturer and researcher. Her current research has a special focus on the investigation of novel techniques for under-sampled reconstruction and motion correction in MRI. She will contribute with lectures for reviewing the physics of MRI. She will be responsible for developing the lectures of fast imaging techniques and motion correction.

Name: Isidro Huete

Role: Academic neuroradiologist member of the ASNR and ASHNR, and a past program director and served as Chairman of the Department of Radiology until 2005. Presently is in charge of teaching the fundamentals of neuroradiology to radiology residents and also teaches residents of neurology and neurosurgery. He has been visiting professor in different South American universities and has published many articles and book chapters. He will be responsible for developing the Neuroradiology Imaging Module.

Name: Cristian Tejos

Role: Assistant professor at the Department of Electrical Engineering and faculty member of the Biomedical Imaging Center of the Pontificia Universidad Católica de Chile (PUC). He did an MSc degree in Signal Processing at PUC, an MSc degree in Biomedical Engineering at Imperial College London and a PhD degree in MRI and Image Processing at University of Cambridge UK. He has published several articles in the most important peer reviewed journal including Radiology, Magnetic Resonance in Medicine, Journal of Magnetic Resonance Imaging, IEEE Transactions in Medical Imaging, among others. His academic focus is in teaching and developing Magnetic Resonance Imaging and Image Processing. He will serve in this project to develop academic material in MRI physics and post processing.

Name: Coral de la Barra

Role: She has several degrees on computer sciences and design of e-learning courses, and many years of experience designing on line courses. She is the responsible for the development of educational software at Pontificia Universidad Catolica and she will support the organization of the MR e-learning platform.

Detailed Education Plan: (See Next Page)

Introduction:

During the Radiology residency and the training of medical Technologists several topics need to be reviewed, including the principles and applications of nuclear medicine, x-ray and computer tomography, ultrasound, and MRI, as well as other topics related to administrative tasks and research. In Latin America, the Radiology residency usually takes between 3 or 4 years. Except from Chile, the technologist career is usually a 2-year non-university degree. In addition to this, the clinical workload and the increasing demands for efficiency and productivity affects the quality of radiology education. Furthermore, most university hospitals in our region do not have a Medical Physics department, because there are only few people trained in this area. For all these reasons, the number of lectures is drastically reduced to a few modules during the training, which is focused firstly on the very basic aspects of the imaging technique, and then rapidly moves towards into clinical applications, which is usually taught by reviewing different clinical cases.

Although the lack of lectures affects across all imaging modalities, MRI is probably the most affected technique, since it is one of the most complex imaging technique, has several parameters that can affect image contrast and image quality and can be used for the diagnosis of several diseases in any part of the body. Additionally, there are not many experienced MRI physicists or engineers in our region who can teach MR to the medical community in an appropriated way, and it is more difficult to find people who can understand the needs of the technologists and radiologists. Therefore, knowledge about the physics of the technique and their relation with pathology is usually missing.

Consequently, most of the MR knowledge is learned when people start working in the field, either by self-learning methods and/or by acquiring (MR technologists) or reading (radiologists) the MR images. Although this method may work for some people, it lacks the advantages of a formal training are not exploited.

Although there are many MR electronic lectures available, there are a limited number of them in Spanish, and most of them are geared toward practicing radiologists. Furthermore, traditional e-learning lectures lack the interactivity between the teacher and the student and among students. However, nowadays with the use of advanced online learning tools, interactivity can be achieved and different e-learning materials can be produced, including manuscripts, video presentations and online real time courses among others.

Objectives: The aim of this project is to create an MR e-learning platform, which will be used for teaching MR in Latin America. The idea is to use this platform for creating a Graduate Certificate Program in MR given by the "Pontificia Universidad Catolica de Chile". Lecture modules will be authored by various contributors from our and other universities, from different disciplines including PhDs and experienced radiologists. The idea is to create an e-learning platform for an MRI training program. The lectures will emphasize not only the physics of MR or its clinical application, but also the relation between the specific sequence and the imaging findings. An advanced e-learning platform will be use to integrate all the material developed for teaching MR, for assessing the student, for interaction between the teacher and the learners and among co-learners. We will also carry out an assessment of the lectures, so that we can receive feedback and improve the materials that will be provided.

The primary outcome of this project will be to create a Graduate Certificate Program in MRI (Diploma in MRI), which will be open to the entire Latin American radiological community, including radiologists, MR technologists and other medical doctors. We will intent to launch the first version of the Diploma degree by the end of the project, which will include at least 100 hrs. of MR lectures.

Student Population: Residents in radiology, radiologists and other medical doctors as well as MR technologists from any Spanish speaking country will be served by the project. At the beginning of the second phase of the project we will carry out the e-learning activities within a select group of residents form our university. This will help us to receive feedback from the student and use their feedback to improve the MR platform before launching the Diploma degree.

Previous Experience: Dr. Sergio Uribe, the principal investigator of this project, is an expert in MR, in particular in Cardiovascular MR, and a well-known researcher and lecturer in this field. Over the last years he has made strong contacts with different companies, societies, and hospitals in different countries including, Spain, Ecuador, Peru, Argentina, Colombia and Mexico, where he has given several lectures and courses related to MRI. He has also been the director of different MRI courses in his university, giving lectures to both engineers and medical doctors.

The other faculties involved in this project are also well-known researchers and lecturers in MRI; all of them are faculty members of the Engineering or the Medical Schools. Faculty members are leaders in MRI in their respective areas of expertise, with several years of experience in teaching MRI and collaborating in multidisciplinary projects. Furthermore, all collaborators involved in this project share a passion for excellence in education and in particular in MRI.

Additionally, our university has a recognized electronic platform for developing on-line courses and graduate certificate degrees. They have several years of experience supporting faculties in web education for different disciplines. We will use their knowledge, experience and resources to build up an electronic Diploma in MRI.

Project Plans

Activities:

What specifically will be done to achieve the above objectives? How? Where? etc.

1. To develop multidisciplinary curriculum in MRI

The MR curriculum will include the physics of MRI, and an overview of different MR clinical applications organized in three different sections.

The first section will include a description of the physics of MRI and will cover in at least the following topics: basic of MRI, security, relaxation phenomena and magnetic resonance phenomena, basic sequences and their main applications,

spatial localization and k-space, fast imaging techniques, quantitative indexes of image quality and image protocol optimization.

The second section will include more advanced topics of MR such as, contrast agents, angiography, perfusion, diffusion, water fat Imaging, spectroscopy, functional MRI and MRI at High Fields. All lectures about the physics of MRI will involve several graphic or schematic examples so that the physics can be understood through the images.

In addition to the physics lectures, there will be a third section dedicated to review basic clinical applications in: neuroimaging, cardiovascular, Muscle skeletal and Body.

All lectures will be prepared by PhDs and experienced radiologists and will be composed of: paper materials prepared by our team, recorded lectures with Power Point presentations, key learning points, post lecture assessments. We will also try to carry out a few real time online lectures on some topics depending on the Internet bandwidth accessible by the students as well as onsite lectures and practical sessions on the MR scanner. There will be also a final assessment that would allow the learner to obtain his diploma in MR.

All lectures will be developed in a two way step, the first step will develop a general idea of the topic, and the second step will review more specific details of the technique with emphasis on the clinical application of MRI. This will allow the students to have firstly a basic concept of the topic, which will ensure us that he/she is ready to learn the details of the lecture.

2. To create the MR e-learning platform

For creating the MR e-learning portal we will use the UCvirtual platform of our University (<http://ucvirtual.uc.cl/>). This platform is intended to create learning programs through Internet. The objective of this platform is to enhance the knowledge of certain areas of interest by means of a dynamic and interactive educative process, which can be performed through small courses, seminars, and diplomas.

The UCvirtual platform has several tools that facilitate an online learning approach, including audio, images and animations. In addition to this, there are additional elements such as forums and Wiki pages that allow the interaction between the teacher students. Furthermore, the UCVirtual platform allows managing of the administrative tasks of the courses or diplomas.

The UCVirtual platform is based on the open source SAKAI software (<http://sakaiproject.org>), which is an educational software that has multiple functionalities of interaction between teachers, student, and allows managing different e-learning materials and assessments among others.

We will use the complete functionality of the UCVirtual portal to enhance the interaction between all participants of this project. Furthermore, each of them will be trained in the use of this software to upload the different MR e-learning materials.

3. To develop a Graduate Certificate Program: Diploma in MRI

Our University has a continuous education program that allows offering several courses and certificates in different disciplines. We will use this program to organize a Diploma in MRI that will be open to technologists, radiologists and other medical doctors interested in learning MRI.

The diploma will consist in at least 100 hrs. of education, which will be performed through the MR e-learning platform. We will study the possibility to make some lectures and practical lessons onsite depending on the learner availability. We will elaborate all the necessary documents for creating this certificate so that we could launch the first version of the Diploma by the end of this project.

Time Schedule:

Preliminary work

Since most of the contributors have already done several hours of teaching MR there are a substantial amount of lectures, primarily power point presentations and animations, which may be adapted to this project.

The UCVirtual Platform will allow us to save several hours of work of designing and developing a special platform for this project, since all the educational tools that we need are already included within the UCVirtual Platform.

A sampling lecture about the physics of MRI, including reading material and power point presentations are being developed. The idea is to use this template for the remaining physics lectures.

Phase 1. Preparing e-learning materials

1. Defining a comprehensive MR curriculum. At this stage we will define the topics that will be included in the Diploma, and the amount of time dedicated to each topic. This will be done within 1 month from the beginning of the project.

2. Development of the physics and clinical lectures, including manuscripts, power point presentations, and assessments. We will also obtain examples MR images that will be used during the lectures. We hope this will be done by December 2012.

3. Recording for the Power Point presentations and uploading the materials into the UCVirtual platform. This task will be complete by January 2013.

Phase 2.

1. Open the MR e-learning platform for the use of a small group of residents of our University. We will perform a small course of MR with specific topics to make a pilot study. This will start in March 2013 and will last for 3 months.

2. Obtain feedback about the functionality of the online MR e-learning portal from users and authors (June 2013).

3. Implements improvements (continuous).

3. Preparing all the necessary documents asked by the University for creating graduate certificate program in MR (June 2012).

4. Launching the first version of the Diploma. The registration will start in December 2012 and the lectures will start in March 2013.

Outcomes:

The MR e-learning materials will be available for free access to all residents in Latin American countries by December 2012. Residents will be able to complete lecture modules accordingly to his or her time. They will be able to go through the different topics of MRI according to a pre-defined virtual road map. They will be allowed to go through the different sections if the assessments of the previous lectures are successfully completed.

The main outcome of this proposal will be the creation of a Graduate Certificate in MR given by the Pontificia Universidad Catolica de Chile. This will be opened to MR technologists, residents, radiologists and other medical doctors from Latin American countries.

Evaluation

The first evaluation of the MR e-learning platform will be obtained during the pilot study to be carried out in a small group of radiology residents. This will serve us to improve lectures and the curriculum content. There will be approximately 15 residents that will use the platform to learn MR. In another group of 15 residents we will also perform the same MR lectures but on-site. At the end of the course there will be an assessment that will involve the 30 participant residents. Results of this test will be compared between the two groups to determine if the MR e-learning portal has the same or a superior impact of learning MRI than the traditional lectures.

At the end of this course, as well as at the end of the Diploma, there will be surveys to assess lectures satisfaction, and the ease-of-use of the MR e-learning platform.