

1. Abstract

I PRO 309, or Human Orthotics and Prosthetics Education (H.O.P.E.), had the main purpose of creating educational material that can be used at Centro Don Bosco High School in Bogotá, Colombia, in order to help accredit the program as an International Society for Prosthetics and Orthotics (ISPO) Category III training program. The Category III program trains orthotists and prosthetists that will be able to fabricate devices to improve the quality of life for patients. To become familiar with the accreditation, previous semester's work in I PRO 309 was studied, as they had already created educational modules about things such as taking measurements, human development, and various pathologies. In order to create and further advance the educational material, the students of H.O.P.E. went to BioConcepts in Burr Ridge, Illinois, and fabricated orthoses that were then used to create PowerPoint presentations and informational pamphlets about treating the pathologies. Since the educational material is intended for use in Latin America, all PowerPoints and pamphlets were translated to Spanish.

Accrediting the program will allow the students to further their careers; after a student has received Category III certification from an accredited institution, the student can also receive a Category II certificate, with enough experience. A Category III practitioner cannot treat patients; by receiving the Category II certificate the practitioner will then be able to work directly with the patients and more patients can be treated in a shorter amount of time.

Most importantly, Centro Don Bosco has students who are interested in the program. The first class began in February of 2005 with 17 students. The impact these students have will be irreplaceable; in one year, the students will collectively produce over 200 orthotic and prosthetic devices. As a result, the first graduating class will affect a total of over 100,000 patients throughout their careers.

2. Background

There are over 45 million people living throughout Latin America (CIA World Fact Book, 2008). Approximately 250,000 of these people have unmet needs in the area of orthotic and prosthetic care. With an estimated 50 certified orthotic and prosthetic (O&P) practitioners and 1500 uncertified practitioners, these statistics show the need for additional accredited O&P technician programs in Latin America. Several institutions have joined to provide education and care to those in need; these institutions are listed below:

- Universidad de los Andes; Bogotá, Colombia
- La Escuela Colombiana de Rehabilitación; Bogotá, Colombia
- Centro Don Bosco, Bogotá; Colombia
- Laboratorio Gilete, Bogotá; Colombia
- Bioconcepts, Inc.; Burr Ridge, IL
- Dynamic Orthotics and Prosthetics; Houston, TX
- Children's Memorial Hospital; Chicago, IL

- Joliet Junior College Tech Prep Program; Joliet, IL
- Northwestern University Prosthetics and Orthotics Center; Chicago, IL
- Illinois Institute of Technology, Chicago, IL

In October of 2004 Centro Don Bosco (Bogotá, Colombia), Don Bosco University (San Salvador, El Salvador), and the Laboratorio Gilete (Bogotá, Colombia) signed an agreement to establish the first accredited O&P education program in Colombia. Since then, Centro Don Bosco has allotted 3500 square feet of space to the program, begun construction on classroom and laboratories in that space, and hired faculty and staff to support the program. Along with their vocational workspace, this allows for the classroom and manufacturing training required for a Category III program. Now that the program has been started there is a need to accredit the program by ISPO standards.

3. Objectives

As stated in the abstract, the primary objective of H.O.P.E. is the creation of educational material that can be used at Centro Don Bosco High School in Bogotá, Colombia, in order to help accredit the program as an ISPO Category III training program. Toward the accomplishment of this task, the secondary objectives have been broken down into two categories:

Overall Group Objectives:

- The development and production of several low cost handouts and brochures for the purposes of orthotics education.
- The translation of this material to Spanish.

Subgroup Objectives:

- To gain a cohesive understanding of pathologies related to the region to which they are assigned.
- The development and production of an Orthosis for their region which would be used to treat a pathology which they researched.
- The creation of a PowerPoint presentation which details their understanding.

4. Methodology

I PRO 309 students created educational PowerPoint modules to be used for the classroom portion of the educational program at Centro Don Bosco. Previous I PRO groups have focused on biomechanics, pathologies, common orthotic & prosthetic devices, and medical conditions. This semester, research was built upon information from previous I PRO groups but went on to include the process of fabricating actual orthotic devices. Three subgroups were created to research and compile the educational modules. Each subgroup (lower limb, upper limb, and spine) created their own modules and also created informative pamphlets on their specific areas of interest. These

educational modules were translated into Spanish so they can be used by the faculty and students at Joliet Junior College, as well as at Centro Don Bosco.

Each subgroup went to BioConcepts to attempt to fabricate at least one orthotic device related to their pathologies. Although not every group manufactured a completed orthotic device, they gained hands-on experience and insight on the steps needed to fabricate an effective orthosis. Each subgroup delegated their tasks and created a work breakdown structure that would allow the effective completion of the required tasks. IPRO 309, as a team, created a rough IPRO Day PowerPoint presentation. During the finalization process, the presentation was critiqued by the IPRO team as a whole and was changed based on accuracy, time restraints, and relevancy. This presentation was also translated to Spanish.

5. Team Structure and Assignments

The members were divided into the following sub-groups:

a) Lower Limb Breakdown Structure:

The Lower Limb sub-group focused on Blount's disease and Trauma and their objective was to create an educational module on how to manufacture orthoses for the treatment of these ailments. To accomplish this task, the individualized tasks in the sub-group were assigned as follows:

- Caleb Hallgren – *Political Science*
- Christine Kovacs – *Computer Science*
- Alexander Rial – *Mechanical and Aerospace Engineering*
- Chris Salgado – *Political Science*

By dividing the research in such a way, the subgroup effectively created an educational slideshow along with pamphlets that complimented the slideshow. Each person also provided background information on the condition such as causes, statistics, etc. The focus was on manufacturing an orthoses that would help in the treatment of Blount's disease and those affected by stroke.

b) Spine Breakdown Structure:

The Spine sub-group studied the causes and effects of Vertebral Compression Fractures due to Osteoporosis and their objective was to create educational modules on how to manufacture orthoses that would help people who are affected. The individual tasks were delegated as follows:

- Mrigank Bhatia – *Computer Engineering*
 - Causes of Vertebral Compression Fractures, Steps on how to manufacture an orthoses
- Manuel Castro – *Mechanical Engineering*
 - Translation of the material to Spanish, effects of Vertebral Compression Fractures
- Danielle Madere – *Biomedical Engineering*

- Finding information on orthoses that can be beneficial for people suffering from Vertebral Compression Fractures and their effects

For each section all group members were assigned specific information to research, similar to the way the research was divided for the initial module. To go along with each module a pamphlet was constructed providing an overview of the researched information.

c) Upper Limb Breakdown Structure:

The Upper Limb sub-group focused on the causes and effects of Brachial Palsy and how to fabricate an orthoses that can be helpful for people affected by it. They also created educational modules that provided steps on the manufacturing of the orthotic device. The individual tasks in the sub-group we designated as follows:

- Stephanie Fischer – *Computer Information Systems*
- Claude Anthony – *Psychology*
- Raymond Harris – *Biomedical Engineering*

In this way each sub-group member was able to learn about the very basics of Brachial Palsy: definition causes/risk factors, effects, and treatment, specifically orthotic treatment for physical effects and teach the other members of the team, namely the Lower Limb and Spine sub-groups about the effects of Brachial Palsy and the how the use of orthotic devices was proven to be useful in helping people affected by it.

In addition each sub-group went on a trip to BioConcepts with Professor Meade where they tried to put in practice what they had learnt about fabricating an orthoses.

In addition to research assignments, group members have been assigned an administrative task. The administrative tasks ensured timely deliveries, proper planning and adequate information media. The administrative tasks were as follows:

- Danielle Madere: *Project Manager*: The project manager oversees all of the operations as well as announces daily meeting agendas.
- Alexander Rial: *Secretary*: The secretary will take down minutes of the meetings, as well as post any deadlines that have been decided upon on iGroups.
- Mrigank Bhatia: *Webmaster*: The webmaster will create a website to make all educational materials available to the public in English and Spanish.
- Stephanie Fischer: *Vocabulary Manager*: The vocabulary manager will compile the pertinent vocabulary from each of the three subgroups into one easy-to-use note sheet.
- Manuel Castro: *Translation Manager*: The translation manager will translate all the pamphlets, presentation slides to Spanish.
- Caleb Hallgren: *Public Relations*: The public relations expert will create the logo for the group and help in presenting the midterm and final presentations.

- Christopher Salgado: *Field Trip Coordinator*: The field trip coordinator will be responsible for arranging field trips and working out schedules that would work best for everyone to meet outside class.
- Raymond Harris: *I PRO Day Coordinator*: The I PRO day coordinator will be the liaison with the I PRO office and be responsible for the group during I PRO day.
- Claude Anthony: *Work Schedule Expert*: The work schedule expert will be responsible for keeping track of deadlines of the deliverables.
- Christine Kovacs: *Ethical Compliance Coordinator*: The ethical compliance coordinator will ensure that all the work done in the I PRO does not violate the rights of the patients either here in USA or in Colombia.

To further ensure timely completion of all I PRO deliverables the subgroups reported the information requested by the Project Manager on the day that it was requested. This allowed and allowed the advisor and team to review the documents and request for any changes that were deemed necessary before submission.

6. Budget

The task of creating a budget was to price out the cost of the production of the orthotic devices and other expenses for the semester. In all, the group was approved \$1,250.00 according to the following:

		Requested	Approved	
EQUIPMENT	Joints	\$ 150.00		
	Lay on Design(s)	\$ 25.00		
	Electrical Tape	\$ 5.00		
	Metal Pipe	\$ 20.00		
	Foam Liner	\$ 75.00		
	Plaster	\$ 30.00		
	Polypropylene Sheet (s)	\$ 250.00		
	Rivets	\$ 25.00		
	Straps	\$ 20.00		
	Sub-Total	\$ 600.00		\$ 600.00

SERVICES	Group Apparell	\$ 200.00	
	Printing	\$ 100.00	
	Sub-Total	\$ 300.00	\$ 300.00
SUPPLIES	Office Supplies	\$ 50.00	
	Sub-Total	\$ 50.00	\$ 50.00
PATICIPANT SUPPORT	Product Testing	\$ 50.00	
	Sub-Total	\$ 50.00	\$ 50.00
TRAVEL & MEETINGS	Transportation	\$ 100.00	
	Admission Costs	\$ 50.00	
	Meals	\$ 100.00	
	Sub-Total	\$ 250.00	\$ 250.00
Total		\$ 1,250.00	\$1,250.00

7. Results

A. Research Findings and Resources

While we did not conduct any research, in order to accomplish anything in the team, we had to do our own research. This included information from books and websites as well as our personal experience and the professor's personal experiences. The list of resources is listed below.

B. Major Accomplishments

By the end of the semester, the team accomplished the following:

- Developed PowerPoint presentations about pathologies and how to create orthotic devices.
- Developed brochures for each individual subgroup.
- The material was translated into Spanish.
- Each subgroup made a trip to Bioconcepts, where they attempted to create their own orthotic device.

By accomplishing the above, we:

- Obtained relevant knowledge of 3 different types of orthotic devices specific to assigned ailments.

- Organized information into a manner in which it can be used to effectively teach and certify orthotic and prosthetic technicians.
- Used information to develop 3 different orthotic devices via the fabrication lab at BioConcepts.

C. Objectives Met and Ones That Were Not

Group Objective: Development and production of several handouts and brochures for the purposes of orthotics education.

Met/Not Met: MET

Why/Why Not: There is a vocabulary list as well as brochures and PowerPoint presentations from the subgroups.

Group Objective: Translation of these materials into Spanish.

Met/Not Met: MET

Why/Why Not: One of the team members is fluent in Spanish so he is translating the documents. Translation is very important to this IPRO because of its connection with Latin America.

Subgroup Objective: To gain a cohesive understanding of different pathologies related to each subgroup (Upper Limb, Lower Limb, and Spine).

Met/Not Met: MET

Why/Why Not: Each subgroup did a great deal of research on their pathology and turned it into a PowerPoint presentation and brochure.

Subgroup Objective: To develop a PowerPoint presentation detailing an understanding of our mission.

Met/Not Met: MET

Why/Why Not: Each subgroup has a PowerPoint presentation on their pathology as well as a PowerPoint related to the fabrication of a particular orthosis in their region.

Subgroup Objective: To create an orthosis/prosthesis for each subgroup using educational modules.

Met/Not Met: NOT MET

Why/Why Not: While each subgroup attempted to fabricate their own orthosis, not all of the subgroups finished the steps required. However, all of them made it at least quite a ways through the process and each group got a much better understanding of all the work put in to fabricate an orthosis.

D. Any ethical, moral, cultural, or scientific issues that occurred

See Code of Ethics

8. Obstacles

Our groups came across some obstacles when we were trying to accomplish tasks. We tried to account for individual differences; we tried to get people to do what they wanted to without taking away peoples' wants and needs. We attempted to break down

tasks to the best of our abilities; tasks were broken down into manageable proportions for each subgroup. Also, we assigned each subgroup to do research on their specific pathologies. We also made schedules; we based our schedules on the allowance of adequate time to finish tasks. Also, we monitored the official schedule of tasks daily. Adversity was dealt with when needed to; different team members took on more responsibility in time of need, we managed adversity by creating different strategies when needed, and we also did out of class research when needed.

There are things we could have done to resolve some of the problems. We could have been more preemptive in things like breaking down tasks, adversity, schedules, etc. What I meant is we could have looked ahead in facing obstacles before they became unmanageable (nothing really was that hard to finish on the due date, but we could have doubled or tripled tasks per day if we foresaw any possible “road bumps”).

I advise any future IPROs to be proactive in dealing with obstacles. Things like “breaking down tasks”, adversity and schedules could come back to “haunt” the group if they are not dealt with appropriately. I suggest bringing up anything that looks tricky to be dealt with at an earlier date.

9. Recommendations

The modules developed for this project thus far have focused on particular pathologies or pathological groups, with details in orthotic fabrication. There now exists, both as a result of the efforts of this IPRO and its previous semesters, and from the general medical community, a great deal of information on pathologies and treatments as well as information on specific orthotic fabrication. However, this body of knowledge does not fully encompass the goals of and requirements for ISPO category III certification. Therefore, it is the recommendation of this team that the next focus of this project should not only be on the less well documented aspects of Category III training, namely team skills, project participation and management, and communication, but also on the detailed fabrication of prosthetic devices.

10. References

- a. Orthotics and Prosthetics textbooks and provided by Professor Kevin Meade
- b. International Society for Prosthetics and Orthotics: <http://www.ispo.ws>
- c. MedicineNet, Inc.: www.medterms.com
- d. Hanger Orthopedic Group, Inc.: www.hanger.com
- e. U.S. National Library of Medicine: www.nlm.nih.gov
- f. Cincinnati Children's Hospital Medical Center: www.cincinnatichildrens.org
- g. Medtronic Sofamor Danek (Neuromuscular Scoliosis):
<http://www.iscoliosis.com/causes-neuromuscular.html>
- h. American Academy of Orthopaedic Surgeons:
<http://orthoinfo.aaos.org/topic.cfm?topic=a00232>
- i. Steve Harkins, Ph.D, Virginia Commonwealth University:
<http://www.people.vcu.edu/~swharkin/swHPages/glossary.htm#sectT>
- j. Wikipedia: http://en.wikipedia.org/wiki/List_of_medical_roots#O

- k. NeuroMuscular ORTHOTICS: <http://www.neuromuscular-orthotics.com.au/>

11. Resources

1. Kevin Meade, Ph.D., Clinical Orthotist
Professor of Mechanical Engineering, Illinois Institute of Technology
Graduate of the Orthotics Program at NUPOC
Ph.D. in Theoretical and Applied Mechanics, Northwestern University
M.S. in Applied Mathematics, Illinois Institute of Technology
B.S. in Mechanical and Aerospace Engineering, Illinois Institute of Technology

2. Martin Buckner, CPO
ABC Certified and Illinois Licensed Prosthetist/Orthotist
Adjunct Faculty of the Orthotic Prosthetic Technician Program at Joliet Junior College
Northwestern University Prosthetics-Orthotics Center certificate program
Member of the American Academy of Orthotics Prosthetics Fabrication Sciences Society

12. Acknowledgements

Professor Kevin Meade and the IPRO Department, IIT
Rehabilitation Institute of Chicago
Thomas M. Gavin, CO, and BioConcepts Orthotic Prosthetic Center