



## **A Practical Jesuit Educational Model to Provide Better Service for Children with Disabilities**

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### **Abstract**

A multi-institutional program is described to provide educational experiences to undergraduate students in various disciplines through service-learning experiences in conducting human motion analysis (gait analysis). Multiple international partners provide follow-up service-learning experiences to students completing the course. The service component of the experience stresses the use of human motion analysis, a tool used to understand orthopaedic disabilities in children and to plan and monitor treatment strategies. Students contribute to these efforts during the service-learning portion of the course. The course is offered at Marquette University. Our outreach partners are located at Xavier Institute of Engineering, (Mumbai India), Club Noel Hospital/Silver Service Foundation (Cali Columbia), Philippine General Hospital (Manila Philippines), and Shriners Hospital for Children (Mexico City).

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## Description

We describe a multi-institutional program structured to provide educational experiences to undergraduate students in various disciplines using human motion analysis. This program was developed from international partnerships with other universities in the Philippines, India, and Mexico to support service outreach efforts offering motion analysis technology (Gait Analysis) to improve treatment and follow-up care of children with orthopedic and neuromuscular disabilities including cerebral palsy, clubfoot, limb deformities, spine bifida and spinal cord injury. The overarching goal of the program is to ensure high academic quality for undergraduate students through classroom and laboratory training followed by application experiences in a real-world environment of care.



**Figure 1:** Marquette University Service Learning Students and University of the Philippines-Manila College of Medicine Clinical Faculty in the Gait Laboratory at Philippine General Hospital

### **Type of experience (teaching, research)**

Through the program, the students receive classroom instruction and laboratory training before departing for a service-learning experience. The classroom experience is offered through an elective course (BIEN 4931 – Global Mobility, 2 semester hrs.) open to all students at Marquette University (see Appendix A – Course Syllabus). The service-learning experiences are offered at several established motion analysis laboratories (gait labs) located in Mexico City (Shriners

Hospitals for Children), Mumbai, India (Xavier Institute of Engineering) and Manila, Philippines (Philippine General Hospital).

### **Context in which it was carried out**

The course has been conducted for several years and is now included as part of the Public Health and Equity Minor at our university. The course introduces concepts of human motion analysis and describes how the technology can be applied to improve rehabilitative and orthopedic care for children and young adults with disabilities in international settings of need to address health disparities. Comprehensive background information is provided including a hands-on laboratory experience and a final practicum and demonstration. Learning outcomes include instruction in global health and equity teaching students to:

- Define and explain concepts of health disparity with a focus on gait and mobility,
- Analyze how specific factors (determinants) contribute to health disparity in gait and mobility, and
- Demonstrate the ability to apply multidisciplinary approaches from theory and experiential learning to develop public health solutions that improve health equity in gait and mobility.

Students have the option through the university Office of International Education to travel to one of the global outreach motion laboratories for a service-learning experience. While at the global laboratory, students are immersed in the care-giving laboratory environment, where they actively acquire and process patient data, observe the clinical decision-making process for patient care and follow-up, and conduct a research project of their own design.

### **Objectives and methodology**

The objectives of this multidisciplinary program (see Appendix A) are fourfold:

1. Introduce students to key concepts of Global Health and Equity with a goal of improving childhood mobility.
2. Introduce students to the field of quantitative motion analysis.
3. Introduce students to the application of motion analysis concepts for improved surgical planning, rehabilitative care, and research.

4. Provide a hands-on service-learning opportunity for an immersive experience in a global mobility laboratory.

Our first objective is to introduce students to key concepts of Global Health and Equity. This is done through classroom instruction, discussion, review of the Milwaukee Global Health Landscape Study (Milwaukee Global Health Consortium, 2020) and interactive use of the Robert Wood Johnson Webinar series on global health and equity (Robert Wood Johnson Foundation, 2020). At the culmination of this instruction, students learn to associate deficits with opportunities among the 17 Sustainable Development Goals (SDGs) of the United Nations (United Nations, 2015). Students learn to:

- Define and explain concepts of health disparity with a focus on gait and mobility,
- Analyze how specific factors (determinants) contribute to health disparity in gait and mobility, and
- Apply multidisciplinary approaches from theory and experiential learning to develop public health solutions that improve health equity in gait and mobility.

The second objective is to introduce students to the field of quantitative motion (gait) analysis. During this part of the course students are introduced to the technology of motion analysis and application of the technology to improve the care of individuals with disabilities in international settings. Students are introduced to the cyclical nature of gait and visual limitations in interpretation, gait technology and integration of concepts. This is followed by study of anatomic joint motion, forces, and muscle activity as well as the process of data acquisition, analysis, and interpretation. Students learn to:

- Define basic joint motion and muscle activity of the lower extremities during normal gait,
- Recognize key deficiencies in motion and muscle activity characteristic of pathology,
- Identify the key components of a quantitative motion analysis system including hardware and software, and
- Operate a motion analysis system to acquire, process and output data.

The third objective of the course is to introduce students to the application of motion analysis concepts for improved surgical planning, rehabilitative care and research. During this section of the course, students learn to compare and contrast normal and pathological gait patterns

(motion, forces and muscle activity). Case discussions and videos are used to compare pre- and post-operative gait patterns resulting from surgery and rehabilitation. Research findings are integrated to highlight the value and need for continued research in the field. Improved clinical decisions resulting from the use of quantitative gait analysis are emphasized. Students learn to:

- Define normal joint patterns at the hip, knee and ankle during gait,
- Identify and characterize pathological joint patterns during gait,
- Identify improvements in gait motion, joint forces and muscle patterns resulting from surgical correction and rehabilitation, and
- Recognize the value of quantitative motion analysis for improved surgical and rehabilitative planning.

The final objective is to provide service-learning opportunities in a global mobility laboratory. A unique feature of this course is that once completed, students have the option to travel to an outreach motion laboratory to observe patient care in the field while participating in routine data collection and research. During the outreach rotation, students gain new perspectives on the potential to improve global health/mobility as they consider challenges to implementation and opportunities for solution. During service-learning students learn to:

- Operate a motion analysis facility for clinical assessment of gait,
- Participate in the clinical decision-making process through case presentation and discussion,
- Gain first-hand experience of the impact of mobility restrictions in the outreach environments,
- Participate in clinical research, and
- Conduct an independent case study and presentation for critical review and analysis at the end of the rotation.

Methods of assessment in the class include two, in-class examinations and a final course practicum and demonstration (see Appendix B – Design Project Assignment). The practicum includes system setup, operation, successful subject test, data output and discourse on potential applications of the technology to improve Global Health & Equity in the context of mobility. Assessment during service-learning is based upon successful operation of the outreach

laboratory including patient preparation, system calibration, data acquisition and processing, and data output. A case study is conducted by the students during the outreach rotation in which they meet with their advisors to interpret case results and propose future direction in care (see Appendix C – Student-Led Case Study). Supervision of the outreach experience is provided by Marquette faculty as well as clinical colleagues at the outreach facility.

### **Results obtained**

The undergraduate course experience to date has received excellent evaluations from students. This year the course was offered for the third consecutive time with increasing enrollments. Enrolled students in the program to date have included students in the Liberal Arts, Health Sciences and Engineering curricula at Marquette, and several engineering graduate students. As part of the Global Health and Equity minor at Marquette, the course has gained broader visibility within the campus community. The course outreach in Mexico and Manila has attracted several groups of students wishing to participate. The addition of the outreach laboratory in Mumbai at Xavier Institute of Engineering has opened additional opportunities with a Jesuit partner for undergraduate exchanges and clinical research partnerships.



**Figure 2:** Gait Lab Inauguration, Xavier Institute of Engineering, Mumbai, India.

From a service perspective, the OREC outreach program has provided motion analysis services for pre-surgical planning, follow-up care and rehabilitation in areas of need over the past decade.

This vibrant service also ensures a relevant experience for undergraduate students participating in service-learning.



**Figure 3:** Pediatric Patient during Motion Analysis Session run by Marquette Students, Gait Laboratory at Philippine General Hospital.

### **Lessons learned**

One of the important lessons learned was that students should be introduced to outreach partners and opportunities early in the course (Simmons, 2019 & University of Pennsylvania, 2021). Over the past several years the course was increased to 2 semester hours to allow more time for the laboratory experience which occupies approximately 50% of the course. Feedback from the increased duration has been favorable and has allowed a more complex and realistic final project experience for students. Another lesson learned has been the need to introduce students early in the course to various motion analysis pathologies through presentation of video and data from actual cases. The value of presenting full case scenarios with pre- and post-treatment outcomes analysis is another lesson learned in the progression of the course development. Because so many students are interested in the service-learning opportunities, it also became apparent that there was a need to work with the Office of International Education very early in the semester to finalize and post travel requirements. Regarding the service-learning portion of the course, the need for several full-time faculty to participate with students

in the travel and on-site activities became quite apparent. We also identified a need for our partners at the outreach laboratories to serve as student mentors. A final lesson learned was the need for several days of rest and relaxation at the end of the rotation for students to enjoy their experiences and meet with new friends before returning home.

### **Opportunities for improvement**

Expansion of the classroom opportunities and more frequent rotations to outreach laboratories present opportunities for improvement. Offering the class every semester would increase the opportunity for more interested students to participate. Further expansion of the course from 2 to 3 sem. hours would also facilitate more learning, especially during the laboratory portion of the course. Another opportunity for improvement is an exchange program for undergraduate students at outreach institutions with Marquette University. From our experience with post-doctoral fellow exchanges, it is likely that an undergraduate exchange would be successful. Another opportunity is to provide additional undergraduate research opportunities based on the work done at the outreach laboratories. Having a motion analysis outreach laboratory in the developing world increases awareness among patients, physiotherapists, and caregivers of the intricacies in understanding movement. The outreach laboratory at Xavier Institute of Engineering is unique, as it is an engineering college with strong technical basis and also has collaboration with physiotherapy students to enhance knowledge of various gait pathologies as part of educational experiences.

The key to future success depends on successful establishment and collaboration with the outreach laboratories. Our group (OREC) will continue to find opportunities for further outreach, and strengthen the collaborative network that makes projects possible, while continuing to support clinical, educational, and research efforts at all current outreach locations.

### **Other alliances or partners with whom they collaborated in the experience (e.g. other universities, Jesuit institutions, other Jesuit apostolates and networks...)**

Our partners and alliances for collaboration include the following:

- Xavier Institute of Engineering, Mumbai, India



- Club Noel Hospital and the Silver Service Foundation, Cali, Columbia
- Philippine General Hospital, Manila, Philippines
- Shriners Hospital for Children, Mexico City

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