

# Interprofessional Collaboration Among Physical Therapy, Speech-Language Pathology, and Engineering Faculty and Students to Address Global Pediatric Rehabilitation Needs: A Case Report

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**Background and Purpose.** The complexity of the health care workplace often transcends the expertise of a single knowledge domain. As a result, problem identification and resolution require collaboration to access the skills possessed by multiple disciplines. The purpose of this case report was to describe an interprofessional, experiential learning module that allowed 5 students in physical therapy and engineering to combine their knowledge with input from a speech-language pathologist to design, create, and deliver 2 low-cost communication devices to 4 children who were nonverbal and living at an orphanage in Ecuador.

**Case Description.** Three physical therapist students were participants in a capstone course, the “Physical Therapy Project,” which included an embedded alternative spring break involving travel to Ecuador. Two students in engineering

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were members of “Enabling Engineering,” a student group that provides to people with disabilities low-cost technology to assist with activities of daily living. A needs assessment conducted by the physical therapy faculty identified 3 children with cerebral palsy and 1 child with autism who would benefit from access to technology to address their communication deficits. Under the direction of 2 faculty members in engineering and physical therapy and a speech-language pathologist, the students in physical therapy and engineering collaborated in the design, development, and implementation of 2 communication devices. Students were provided with opportunities to reflect on their learning and experiences with the project. The global partner provided feedback on the effectiveness of the devices 1 month after implementation.

**Outcomes.** Incorporating knowledge from engineering, physical therapy, and speech-language pathology, the students used 3 dimensional printing to develop a low-technology communication button that provided voice output and allowed a child with autism to communicate basic needs to his caregivers. Three iPad tablets (Apple Inc, Cupertino, California) were customized with GoTalk NOW, a communication application, and a 3-dimensional printed case with a key guard. The iPad tablets were mounted to the children’s wheelchairs with the commercially available Magic Arm™ (Lake Forest, California). The students wrote reflections that revealed positive perceptions about interprofessional collaborative problem solving, interprofessional communication strategies, and focusing on the end user. Limited fluency in Spanish was identified as a concern. The global partner reported appreciation for the students’

active collaboration and problem-solving capabilities and noted that the iPad tablets provided an effective means of communication for the children who received them.

**Discussion and Conclusion.** An interprofessional education module allowed physical therapist students to collaborate with other disciplines, translate didactic knowledge to the field, and solve complex, real-world problems. Written reflection illuminated student learning and growth as a result of the process. Future work should focus on assessment of the long-term impact of collaborative efforts on student appreciation for different disciplines and strategies for creating teams that perform at a high level.

**Key Words:** Interprofessional education, International service learning, Pediatrics, Technology.

## BACKGROUND AND PURPOSE

Educators of health care practitioner students, including those in nursing,<sup>1,2</sup> occupational therapy,<sup>3,4</sup> medicine,<sup>2,5-7</sup> physical therapy,<sup>2,5,7-11</sup> and speech-language pathology,<sup>12</sup> realize that teamwork and collaboration are essential 21st-century skills required for providing high-quality patient care. However, the formal education of students in professional programs, including physical therapy,<sup>2,4</sup> engineering,<sup>13</sup> and speech-language pathology,<sup>12</sup> occurs in isolation from that of students in other disciplines. The importance of interprofessional collaboration in clinical practice was highlighted by an Institute of Medicine report in 1972.<sup>14</sup> More recently, a report from the Interprofessional Education Collaborative Expert Panel created a vision for interprofessional practice and education in an effort to promote safe, efficient, and high-quality patient-centered care.<sup>15</sup> For the purposes of this case report,

interprofessional education (IPE) in health care is achieved "... when two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes."<sup>16(p13)</sup> Interprofessional education is a planned experience that includes didactic instruction, a clinical experience in interprofessional care, or both for learners in more than 1 discipline.<sup>17</sup>

Unfortunately, many barriers and challenges affect the development of interprofessional course work in professional programs. Barriers include extremely dense curricula with rigid scheduling, professional requirements for accreditation, and limited interprofessional clinical education opportunities. Another challenge is that students and faculty may not fully appreciate the contributions of other disciplines because of limited knowledge about another profession's scope of practice. Further, authentic workplace problems are complex, multifaceted, and often ill-defined.<sup>18</sup> Undergraduate college students are novices and have difficulty translating classroom learning into practice when they face unique or unstable situations in the field.<sup>19</sup> In addition, the complexity of the workplace often transcends the expertise of a single knowledge domain. Problem identification and resolution require collaboration to access the expertise of multiple disciplines.

Innovative pedagogical models are needed to facilitate the development of sustainable IPE, and competencies are required for workplace success. Approaches can be structured to include people from a variety of disciplines who can collaborate to address real-world clinical problems. Models should include examination of student learning, transfer of knowledge, psychomotor skills, and sustained professional development. It is well established that the process of learning is continuous and grounded in the experiences of an individual.<sup>18</sup> Professional practice—especially in novices—can be enhanced when opportunities for reflection are included in the instructional approach.<sup>19</sup>

Communication between caregivers and children with moderate to severe motor impairments is a tremendous challenge. Children who are nonverbal because of disorders such as cerebral palsy (CP) or autism often benefit from the use of alternative communication approaches to overcome barriers to communication.<sup>20</sup> It has been estimated that 60% to 80% of children with CP at level IV or V on the Gross Motor Function Classification System (GMFCS) are nonverbal.<sup>21</sup> A core deficit for children with autism is comprehension of both verbal and nonverbal elements of language.<sup>22</sup> Children with limited speech may be relegated to "a passive role,

providing yes/no answers and acknowledgments of messages" during conversation with caretakers, family members, and peers.<sup>21(p150)</sup>

Augmentative and alternative communication (AAC) systems can complement limited verbal speech or enhance nonverbal communication strategies. Augmentative and alternative communication systems can include dedicated speech-generating devices. For example, an iPad (Apple Inc, Cupertino, California) or other tablet can be equipped with communication applications to provide voice or text output or can use photographs or icons to represent everyday activities, persons, actions, places, and objects. The effective use of AAC systems for day-to-day communication requires matching user abilities with available technology, especially if the intended user has significant impairment of motor control.

Customizing low-cost technological devices for communication to meet an individual client's needs requires the knowledge and abilities of 3 disciplines to ensure that all aspects of the problem are addressed. A speech-language pathologist is needed to assess a client's needs and to determine the client's language and cognitive abilities and the vocabulary necessary to communicate. An engineer is required to modify the technology to fit the specific requirements of the user, and a physical therapist (PT) is needed to optimize positioning to achieve the best functional outcomes and to identify the most reliable source of motor control to activate the device.

The 3 purposes of this case report were to describe an interprofessional, experiential learning approach that enabled 3 PT students and 2 mechanical engineer (ME) students to collaborate and integrate didactic instruction about pediatrics, engineering, physical therapy, and speech-language pathology to create 2 low-cost communication devices using 3-dimensional (3-D) printing for 4 children who were orphans, nonverbal, and living in Ecuador; to document the learning realized by the students involved in the project with respect to the roles of other disciplines, teamwork, and professional development; and to document feedback from the global partner regarding benefits and drawbacks of the partnership.

## CASE DESCRIPTION

### Local Setting

The educational context was a large urban institution in the United States whose philosophy incorporated practical, experience-based learning. Central to the philosophy was cooperative education, in which students alternat-

ed periods of classroom study with full-time employment related to career or personal interests. The Doctor of Physical Therapy curriculum was a 6-year entry-level program with 80 to 100 students matriculating annually. Students completed two 6-month cooperative education terms, 1 in the third year and 1 in the fourth year, during which they worked full time as physical therapy aides. Students also participated in a short-term service-learning opportunity within the local community in their third year. The sixth year comprised a 3-phase, 36-week (8 weeks/14 weeks/14 weeks) clinical education component.

"Physical Therapy Project" (PT Project) was a required, 1-year-long, 5-credit capstone course offered in the fifth year of the 6-year Doctor of Physical Therapy program. It provided all 80-100 PT students an opportunity to work with department faculty members on scholarship activities related to research, education, or service. One of the sections of PT Project, taught by 1 author (L.M.H.), included an embedded alternative spring break with a pediatric focus and involving travel to Ecuador to provide rehabilitation services to children with disabilities. Fifteen PT students were selected for participation by L.M.H. on the basis of Spanish language skills and interest in working in pediatrics and traveling abroad. Lodging was limited at the Ecuador site, restricting the numbers of participants to 15 students and 2 leaders.

The engineering curriculum was a 5-year program leading to a bachelor's degree. The curriculum allowed students to complete three 6-month cooperative education terms during which they were employed full time in industry related to mechanical engineering. "Enabling Engineering," managed by 1 author (W.M.), was a student organization focusing on the development of assistive technology for older people and people with disabilities. Student volunteers worked with design mentors to assess needs and build low-cost devices using engineering technologies. Enabling Engineering included weekly seminars on topics such as: physical and cognitive disabilities and the applicable engineering technologies. One author (S.H.V.) provided Enabling Engineering with consultation on physical therapy and opportunities to interact with consumer consultants from the community who had disabilities. Students heard first-hand accounts of the daily challenges people with disabilities experience and suggestions for technology solutions.

### International Setting

The international setting for the project was the For His Children (FHC) orphanage, with

locations in Quito and Latacunga, Ecuador.<sup>23</sup> This orphanage was chosen for the embedded experience because approximately 35% of the 50 child residents had moderate to severe disabilities and could benefit from rehabilitation services. Typical diagnoses included CP, Down syndrome, sensory integration disorders, autism, prematurity, and developmental delay. Faculty member L.M.H. had a strong relationship with FHC and, since 2007, had traveled there 8 times with PT students.

### Development of the Process

Faculty member L.M.H. (a PT) created an interprofessional experience for students in PT Project. Her 2 goals were to infuse realistic interprofessional collaboration into an existing course and to address complex, unmet pediatric rehabilitative and communication needs at FHC in Ecuador.

L.M.H. used an established educational model (Figure 1)<sup>11,24,25</sup> that included academic study about Ecuador, pediatric physical therapy, and a 9-day service-learning experience in Ecuador, during which the 15 PT students provided targeted physical therapy interventions under the supervision of licensed PTs. PT Project incorporated objectives identified by the Commission on

Accreditation in Physical Therapy Education<sup>26,27</sup> as being relevant to the development of professional core values, appropriate physical therapy interventions, and cultural competence (Appendix 1). L.M.H. provided the students with reading on cultural competence<sup>7,11,28,29</sup> and a cultural awareness activity.<sup>30</sup> Students completed the Inventory for Assessing the Process of Cultural Competence Among Healthcare Professionals—Student Version (IAPCC-SV)<sup>31</sup> before and after travel to account for changes in cultural competence due to in-country exposure. The IAPCC-SV is a reliable and valid instrument with good internal consistency (Cronbach alpha=.75) and good test-retest reliability [ICC(2,1)=.87].<sup>32</sup> Students completed written reflections before and after travel as well as an advocacy paper. These documents were used to assess outcomes and learning related to their participation in the project (Appendixes 2–4). Feedback was also gathered via a post-travel interview with the global partner to document benefits and drawbacks of the partnership (Appendix 5).

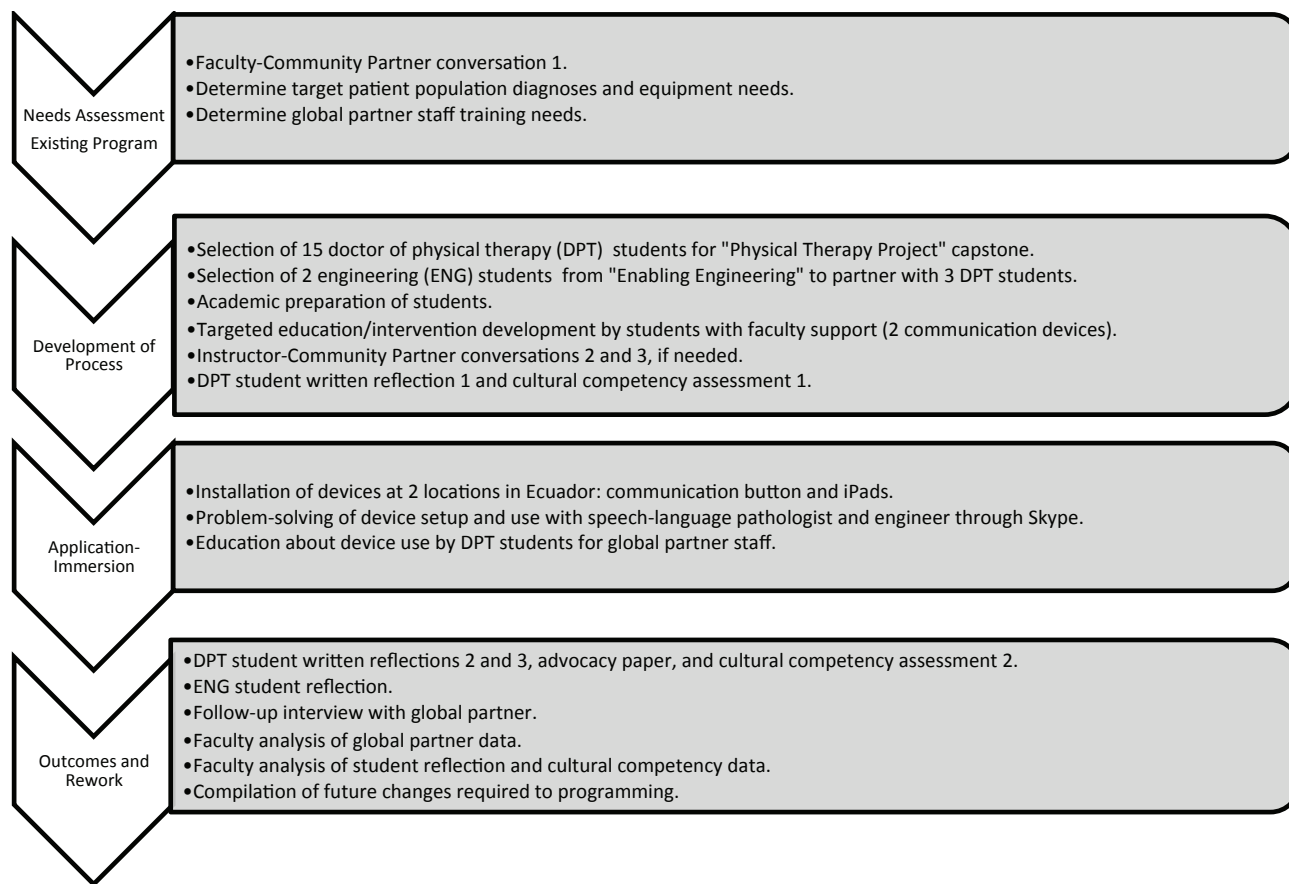
During the first semester of PT Project, L.M.H. conducted a needs assessment with the global partner via Skype<sup>33</sup> to gather information about the children's diagnoses and current rehabilitation needs. Four children

were identified as requiring technology solutions for communication deficits. As determined by the needs assessment, the project required interprofessional skills. L.M.H. sought assistance from J.M., an AAC specialist at Easter Seals. A peer faculty member in physical therapy (S.H.V.) introduced L.M.H. to a faculty member in mechanical engineering (W.M.). S.H.V. had been providing lectures to Enabling Engineering and consultation to students working on several technology-related projects for end users living in the local community. W.M. included the Ecuador communication project as an option for students in Enabling Engineering, and 2 ME students volunteered for the project.

### Application of the Process

Three children at FHC were diagnosed with CP by their pediatrician. All 3 communicated nonverbally and used wheelchairs for mobility. Their primary mode of communication involved a combination of nonsymbolic means, such as gestures, head nods to indicate "yes" and "no," and a few simple signs. One child was a 10-year-old boy with athetoid CP at level IV on the GMFCS. He could sit unsupported and ambulate for short distances with a posterior walker. He was right hand dominant and, while seated in his wheelchair,

**Figure 1. Conceptual Model of Interprofessional International Service-Learning<sup>11,24,25</sup>**



could independently reach and touch his iPad screen with fair accuracy. A second child was a 13-year-old girl with spastic quadriplegia at level V on the GMFCS. She could sit unsupported but was nonambulatory. She was right hand dominant and, while seated, could reach and touch her iPad screen with good accuracy. The third child was a 7-year-old boy with spastic quadriplegia at level V on the GMFCS. He could not sit unsupported, was nonambulatory, was left hand dominant, and could touch his iPad screen with fair accuracy. The fourth child was a 4-year-old boy diagnosed with autism by his pediatrician. He was nonverbal, had a low level of functioning, and possessed only partial vision in 1 eye. He was independent with ambulation but required constant redirection and assistance to remain on task.

Three of the 15 PT students elected to work with the 2 ME students on the technology team to address the identified communication challenges. W.M. and L.M.H. created a bridge between 2 existing courses and majors to facilitate the project. From the midpoint of the first semester through the middle of the second semester, the 5 students met weekly with the 2 faculty members for a total of 24 hours to collaboratively discuss, problem-solve, and explore viable solutions for the communication challenges.

The first challenge involved device abandonment, which occurs in nearly 70% of all cases of technology provision when devices have not been adequately modified to meet user needs.<sup>21</sup> Each of the 3 children had received iPad tablets with communication software from L.M.H. during a previous service trip, but the devices were not being used regularly for the intended purpose. They had been stored by the FHC caretakers to avoid damage by another child and were used infrequently by an educational tutor for academic rather than communication purposes with the children. Three causes for device abandonment were identified: there was no means to securely attach the iPad tablets to the children's wheelchairs, 2 children lacked the necessary fine motor control to effectively activate the hot buttons on the iPad screens, and the iPad tablets did not have a communication application in Spanish.

The goal of the interprofessional team was to address the 3 aforementioned concerns using a technology solution. The first steps were to orient the students to the iPad technology and locate a new software application with a Spanish version. L.M.H. contacted J.M., the AAC specialist, who suggested the purchase of GoTalk NOW (Attainment Co, Inc, Verona, Wisconsin), which has a Spanish version. L.M.H. contacted the vendor, which

donated 5 copies: 3 for the iPad tablets in Ecuador and 2 for training purposes in the United States. J.M. provided for the students 2 separate training sessions on how to use the program and customize it for each child's vocabulary and daily schedule. Training also included discussions on how to support the use of the device for communication purposes rather than academic instruction.

Next, the group problem solved how to attach the iPad to each child's wheelchair. The ME students discussed the option of creating an external case using a combination of AutoCAD (Autodesk Inc, San Rafael, California) and 3-D printing. Three-dimensional printing is a process for making 3-D solid objects from a digital file. A desired 3-D object is created using a computer-aided design program such as AutoCAD. Then, using the original AutoCAD design, a printer horizontally adds successive layers of plastic or other material to create the 3-D object.<sup>34</sup> The cases were designed to protect the iPad tablets from damage. To address the fine-motor concerns, the ME students mitered out of transparent acrylic plastic custom key guards with a limited number of openings to direct the child's finger to the desired "hot button." The final problem involved a means to stabilize the iPad tablets on the children's wheelchairs so that they would be readily accessible as well as stable enough to permit reliable activation of the hot button. The team chose the commercially available Magic Arm (Lake Forest,

California) to securely mount the iPad tablets to the wheelchairs.

The child with autism had a different challenge. He was intellectually challenged and nonverbal and became easily frustrated with his inability to communicate his needs to his caregivers. He required a device to express basic needs. The team designed and constructed 2 communication buttons using AutoCAD and 3-D printing. Each was approximately 15 cm (6 in) wide, made of durable plastic, and hexagon-shaped, and had a textured push button surface that could be attached to the wall. Depression of the textured surface caused activation of a light-emitting diode and voice output. One button was set up to say, in Spanish, "outside," and the second was set up to say, "I need to use the bathroom."

To sustain the interventions, directions on device operation were created, translated into Spanish, and provided to the caregivers. L.M.H. supervised and shared an educational format for the directions provided.<sup>35</sup>

## OUTCOMES

During semester 2, 15 students and 2 faculty members spent 9 days over the March spring break in Ecuador. They lived together in housing located on the FHC campuses. The PT students installed the 2 communication buttons at 1 FHC location (Figure 2) and the iPad AAC systems on the wheelchairs of the 3 users at a second location (Figure 3). The

Figure 2. Communication Button



**Figure 3. Alternative and Augmentative Communication System With iPad, Magic Arm, 3-Dimensional Printed Case, and Key Guard**



devices were positioned on the wheelchairs in the area of the most reliable motor control for each child. The PT team used Skype with J.M. once during the trip to collaborate and problem-solve a technical issue with the iPad tablets. At the request of W.M., pictures of all devices installed were sent via e-mail for his review and comment. By the end of the week, all 3 iPad users were operating their devices independently. The buttons designed for the child with autism were installed, but he will not use them until later in the year, when a volunteer expert in applied behavioral analysis will arrive at the orphanage to work part time for 1 year. She will assist the child in learning how to use the device.

Two perspectives were used to assess the impact of the IPE module and the perception of the effectiveness of the interventions (communication devices). The entire group of PT students on the trip took part in the assessment of cultural competence and advocacy as well as reflection on the trip as a whole; the 2 ME students and the 3 PT students who worked with them completed an additional reflection about the IPE experience (Appendix 6). Community partner perspectives were gleaned from data obtained through interviews conducted by L.M.H. with the volunteer coordinator and the PT at FHC. Interviews were conducted over the phone and through email exchanges.

### Student Perspectives

The PT and ME students all identified 4 positive outcomes related to the interprofessional experience, and the PT students all shared an area of concern. The first positive outcome was appreciation for collaboration with another discipline. Comments from these student reflections supported this statement (sources of quotations follow quotations in parentheses):

*Through working with other disciplines on this project, I learned the importance of being open-minded and hearing all input before putting a plan into action. [W]e needed to take into consideration what was realistic and feasible in terms of building the actual products. This was a valuable lesson for us as future physical therapists. In the ever-growing health care field, we need to work with and communicate with other providers to ensure the greatest quality of care for our patients. Having experience with these other disciplines so early ... will definitely be beneficial to all of us going forward in our careers. (PT student 1 [PT1])*

*I believe that getting to work directly with students in the PT department on this project made the greatest impact on me. I saw firsthand how helpful people with knowledge of other disciplines can*

*be and I could use that knowledge to design a button that was much better for the children than the basic button we were originally planning on creating before we got important information from the PT. (ME student 2 [ME2])*

The second positive outcome was the satisfaction students experienced with their ability to solve problems in the users' own environment, even though resources were extremely limited.

*... the troubleshooting aspect of this project was the most beneficial part of this experience. In an ideal world, we could just take the buttons and cases, implement them in the orphanages, and everything would work. Staying up with the team late at night to work out all the little kinks in the projects to make them as useful for the children as possible was truly rewarding. It brought us closer as a team and gave us an even bigger sense of accomplishment once everything was implemented. (PT1)*

The third positive outcome was the students' realization that they had to seek a common ground with other disciplines to effectively share ideas. They also learned the importance of sharing their thoughts in simplistic, nontechnical language to make the ideas understandable to the other discipline as well as the volunteers and staff at FHC.

*... we had to communicate our design and information with people who were not engineers, so we needed to use less technical language in our communications [while] mak[ing]sure that no meaning was lost, which is a very important skill to practice. In the same sense, we needed to understand what the PT students were telling us, so finding common ways to explain our disciplines was extremely important for everyone. (ME2)*

*In the ever-growing health care field, we need to work with and communicate with other providers to ensure the greatest quality of care for our patients. Having experience with these other disciplines so early in our education will definitely be beneficial ... going forward in our careers. (PT1)*

The fourth and final benefit noted by the students was the importance of designing a product with the end user in mind. In the engineering curriculum, ME students were not explicitly taught to focus on the end user.

*Working with PT and Speech rather than just a group of engineers was an*

*excellent opportunity. It allowed me to stretch my perspective and increase my awareness of the user. This project allowed me to learn user-focused design outside of classes. In the engineering curriculum, the user is never the focus but rather [the focus is on] the efficiency/power/price of the system. (ME2)*

*Working with the PT students helped us gain information on how the end user would interact with the product and certain design features that would be good and bad. The PT students were able to provide invaluable advice and information about the end user and how we could design our product to be the most compatible with their lifestyle .... (ME1)*

*A child who had dealt with communication disabilities for her entire life was suddenly able to answer questions and joke back and forth with the other children. This to me was an unforgettable experience. We put the tools in her hands to improve her quality of life—that's amazing. (PT2)*

Although no concerns were documented by the 5 students in relation to IPE, a problematic area, noted by the 3 PT students before travel, was the inability to speak Spanish fluently.

*One of my greatest fears about the trip is the language barrier. I am afraid that we will have a lot of difficulty in troubleshooting questions or concerns that the [children's caregivers] may have. (PT3)*

*[The patient] and I had 2 significant barriers to our communication, the use of an iPad and speaking 2 different languages. Even though we could have become frustrated, we figured out how to work together. Patience was more valuable than any physical therapy knowledge. (PT2)*

Another concern was related to working with a pediatric population, which was unfamiliar to this particular student.

*This trip challenged me to work with 2 patient populations I have limited experiences with—the pediatric population and the Spanish-speaking population. To manage these challenges, I worked with other students and the professor when things were unclear. (PT2)*

### Global Partner Perspectives

The global partner valued the students' active collaboration and problem-solving capabil-

ity and noted that the iPad tablets provided an effective means of communication for the children who received them. As noted by the PT at FHC:

*What impresses me most is [the students'] active collaboration during their visit. They are not daunted by problems or obstacles, and they demonstrate such a giving spirit toward our special children. They truly want to help, and it is so obvious. Even though their visits are short, they are a united group of people with 1 interest toward a professional goal. They apply their scientific knowledge and proven techniques to the issues our children face. (PT at FHC)*

*This year's team was 1 of the most helpful that has ever come down. We made great progress as far as postural care in many of the children and also with the communication system that the children use (iPad tablets). The ideas were enormously helpful and improved the usage of the iPad tablets. (PT at FHC)*

The volunteer coordinator at FHC indicated that the iPad tablets opened a "whole new world" for the 3 children because they use them to communicate on a daily basis. She indicated that, because of the training provided by the team that traveled to Ecuador, the children's teacher now uses the iPad tablets for communication purposes. One unanticipated benefit of this work was that the 3 children who communicate with their iPad tablets can participate in a summer project conducted at FHC by a volunteer from Writopia Lab.<sup>36</sup> Writopia (New York, New York) is an organization that empowers children from both advantaged areas and areas with few resources to create original written work and share their stories with the world. The 3 children with iPad tablets can participate in writing short stories about their lives.

### DISCUSSION AND CONCLUSION

The interprofessional, experiential learning approach was designed to enable 3 PT and 2 ME students to collaborate and integrate didactic instruction about pediatrics, engineering, physical therapy, and speech-language pathology to address complex unmet communication needs. The outcome of PT Project was the design, fabrication, and installation of 2 communication devices for 4 children who were nonverbal. PT Project objectives included Commission on Accreditation in Physical Therapy Education criteria<sup>26,27</sup> related to cultural competence, interprofessional collaboration, patient education, fabrication of devices and equipment,

advocacy, and leadership in community and volunteer services (Appendix 1). Course objectives pertaining to cultural competence and advocacy were measured through administration of the IAPCC-SV<sup>31</sup> and 3 reflection assignments (Appendixes 2–4). An additional reflection assignment (Appendix 6) enabled both PT and ME students to document their experiences while working as an interprofessional team to address a complex health problem in a global setting.<sup>18,19</sup>

All students documented the importance of being open-minded and willing to collaborate with others to address a common goal. Students in both disciplines realized that the success of the project required the expertise of more than 1 profession. Students acknowledged that the skill of communicating in nontechnical language was critical to the success of the current project and for their future professional careers. Research on team-based learning has identified the elements critical for team success: team members believing that their roles are important to the team, open communication, autonomy, and equality of resources.<sup>37</sup> Barriers within educational institutions make achieving interdisciplinary education difficult. Success requires commitment to the concept from departments and colleges, preestablished mutually agreeable meeting times, a sense of community, adequate physical space, technology, and solid community relationships.<sup>17</sup> The faculty involved in the current project managed these barriers by meeting with the student group at mutually agreeable times outside regularly scheduled class periods. Space and technology were available through W.M.'s engineering laboratory, and L.M.H. had an established relationship with a global partner.

Inclusion of stakeholder feedback on the process and review of the academic-community partnership illuminated learning and mutual benefits that empowered the global partner and strengthened and sustained the relationship.<sup>38,39</sup>

Recommendations for improvement in the educational module included adding strategies for formally teaching and assessing the impact of the collaborative effort on student appreciation for different disciplines. The team worked well together, and research has shown that interprofessional experiences change student perspectives in the short term.<sup>1,2,4,17</sup> Research that examines the impact of IPE longitudinally—in which students first understand their own professional identity and then gain an understanding of the roles of other professionals on the health care team—is needed.<sup>40</sup>

Although many benefits were recognized by both the students and the community

partner as a result of the IPE model described in this case report, there were limitations. The first concerned the faculty time commitment needed to ensure that the students worked effectively together and possessed the knowledge and resources required for addressing a community partner technology-based need. However, although time and effort were most intense at project outset, once the students were oriented, they were self-directed in most of their efforts. Another limitation was the inability of the speech-language pathologist to travel to Ecuador in 2015. Her expertise in AAC was critical to the team's success. To address this limitation, J.M. accompanied the team in 2016. Future funding efforts are under way to enable ME students involved in the project to travel with the team in 2017.

The literature supports structuring IPE to include an experiential component as a recommended approach for preparing health care students to collaborate as members of future interprofessional teams.<sup>14-17,41</sup> Contemporary medical issues that require effective, patient-centered, timely, efficient, and equitable health care are most effectively managed by interprofessional teams.<sup>5,14,15</sup> Training future health care providers to work in such teams may result in improved health care outcomes for patients.<sup>17</sup> A trend in health professions education is to provide opportunities for students to study and work abroad.<sup>41-43</sup> The American Physical Therapy Association unequivocally supports the inclusion of global educational opportunities, such as international service-learning or clinical education opportunities, to facilitate cultural awareness in PT students.<sup>10,26,27</sup> Western medicine has a place in regions with demonstrated health care needs, but care must be taken to provide rehabilitation services that are "culturally relevant, holistic, accessible, sustainable, and responsive."<sup>44(p65)</sup>

This case report describes an example of an IPE module that may be adopted by other PT programs. Innovative and alternative educational models that allow for the authentic transfer of didactic knowledge and interprofessional awareness to the field are needed.<sup>15-17,41</sup> Future study on the impact of IPE on student learning could involve larger, multisite studies that include measures for collecting data that capture student learning and global partner end user satisfaction. The IPE model described in this case report included opportunities for student reflection on the experience and feedback from the community partner. In its first year of operation, the IPE model appeared to offer benefits for the end user as well as PT and ME students. Interprofessional education can help prepare students to work collaboratively with oth-

ers in diverse disciplines in both local and international communities. It can also demonstrate how important interprofessional collaboration is for addressing health care needs and why it is a skill desired by employers for health care professionals in the 21st-century workforce.

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**Appendix 1. CAPTE Criteria<sup>26,27</sup> Serving as Learning Objectives for Physical Therapy Project<sup>a</sup>**

Old CAPTE Criteria <sup>26</sup>	New CAPTE Criteria <sup>27</sup>
CC-5.8 Exhibit caring, compassion, and empathy in providing services to patients/clients.	7D5 Practice in a manner consistent with the core values of APTA.
CC-5.11 Demonstrate professional behavior in all interactions with patients/clients, family members, caregivers, other health care providers, students, other consumers, and payers.	7D5 Practice in a manner consistent with the core values of APTA.
CC-5.17 Expressively and receptively communicate in a <i>culturally competent</i> manner with patients/clients, family members, caregivers, practitioners, interdisciplinary team members, consumers, payers, and policymakers.	7D7 Communicate effectively with all stakeholders, including patients/clients, family members, caregivers, practitioners, interprofessional team members, consumers, payers, and policymakers.
CC-5.18 Identify, respect, and act with consideration for patients'/ clients' differences, values, preferences, and expressed needs in all professional activities.	7D8 Identify, respect, and act with consideration for patients'/ clients' differences, values, preferences, and expressed needs in all professional activities.
CC-5.26 Effectively educate others using culturally appropriate teaching methods that are commensurate with the needs of the learner.	7D12 Effectively educate others using teaching methods that are commensurate with the needs of the learner, including participation in the clinical education of students.
CC-5.41 Provide effective culturally competent instruction to patients/ clients and others to achieve goals and outcomes.	7D12 Effectively educate others using teaching methods that are commensurate with the needs of the learner, including participation in the clinical education of students.
CC-5.30 Examine patients/clients by selecting and administering culturally appropriate and age-related tests and measures.	7D19 Select and competently administer tests and measures appropriate to the patient's age, diagnosis, and health status.
CC-5.34 Collaborate with patients/clients, family members, payers, other professionals, and other individuals to determine a plan of care that is acceptable, realistic, culturally competent, and patient centered.	7D39 Participate in patient-centered interprofessional collaborative practice.
CC-5.39 Provide physical therapy interventions to achieve patient/ client goals and outcomes. Interventions include: (a) therapeutic exercise; (b) functional training in self-care and home management; (e) prescription, application and, as appropriate, fabrication of devices and equipment.	7D27 Competently perform physical therapy interventions to achieve patient/client goals and outcomes. Interventions include: (b) assistive technology (prescription, application and, as appropriate, fabrication or modification); (d) functional training in self-care and in domestic, education, work, community, social, and civic life.
CC-5.46 Collect data from the selected outcome measures in a manner that supports accurate analysis of individual patient/client outcomes.	7D31 Assess patient outcomes, including the use of appropriate standardized tests and measures that address impairments, functional status, and participation.
CC-5.50 Provide <i>culturally competent</i> physical therapy services for prevention, health promotion, fitness, and wellness to individuals, groups, and communities.	7D28 Manage the delivery of the plan of care that is consistent with professional obligations, interprofessional collaborations, and administrative policies and procedures of the practice environment.
CC-5.51 Promote health and quality of life by providing information on health.	7D27 Competently perform physical therapy interventions to achieve patient/client goals and outcomes. Interventions include: (b) assistive technology (prescription, application and, as appropriate, fabrication or modification); (d) functional training in self-care and in domestic, education, work, community, social, and civic life.
CC-5.64 Advocate for the health and wellness needs of society.	7D14 Advocate for the profession and the health care needs of society through legislative and political processes.
CC-5.65 Participate and show leadership in community organizations and volunteer service.	7D13 Participate in professional and community organizations that provide opportunities for volunteerism, advocacy, and leadership.

<sup>a</sup>Abbreviations: CAPTE, Commission on Accreditation in Physical Therapy Education; APTA, American Physical Therapy Association.

## Appendix 2. Pretrip Reflection: Physical Therapist Student

1. What motivated you to travel to Ecuador? What do you expect to **personally** gain from the experience? Please describe.
2. What are your greatest fears or trepidations before travel? Can you explain why these issues are fears for you and what strategies you might have for managing them?
3. What do you perceive to be your role in the group of 15 students who are traveling to Ecuador? How do you see yourself and your special gifts contributing to the success of the group?
4. How would you describe cultural sensitivity? What does it mean to you?
5. How might your preparation for the trip to Ecuador affect your professional identity formation? In particular, think about the 7 physical therapist core values (accountability, altruism, compassion and caring, excellence, integrity, professional duty, and social responsibility).
6. How might your work in Ecuador affect your future as a physical therapist? Please describe.

## Appendix 3. Posttrip Reflection: Physical Therapist Student

1. Did the trip to Ecuador affect your professional role formation? In particular, think about the 7 physical therapist core values (accountability, altruism, compassion and caring, excellence, integrity, professional duty, and social responsibility). Please describe.
2. What did you perceive to be your role in the group of students who traveled to Ecuador? How did you see yourself and your special gifts contributing to the success of the group?
3. What did you gain from the experience? Was what you gained different from your expectations pretrip? If so, please describe.
4. How might your work in Ecuador affect your future as a physical therapist?
5. Other comments.

## Appendix 4. Advocacy Paper: Physical Therapist Student

1. Provide a picture of the child you advocated for during our work at For His Children.
2. Please identify the child and his or her diagnoses, developmental concerns, and social or behavioral complications.
3. Describe why you chose this child. What drew you to him or her?
4. What did you do as a physical therapist student with the child?
  - a. Treatment
  - b. Advocacy
  - c. Application of classroom knowledge and principles or cooperative education experience
5. What did you learn from the experience?
  - a. Medically
  - b. Personally
6. How might you apply what you learned during this experience to future patients/situations encountered in the clinic?

### **Appendix 5. Partnership Interview**

The interview is designed to improve partnership between For His Children (FHC) and the student physical therapist team. Please answer the following questions to the best of your ability. Thank you for your thoughtful responses.

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1. What is your position at FHC?
2. How many years have you worked at FHC?
3. In the years that you have worked at FHC, how many times have you interacted with the student physical therapist team?
4. Please describe how you have interacted with the students.
5. From your perspective, what are the benefits or the impacts of the alliance between FHC and the student physical therapist team?
6. How would you describe the students' abilities to culturally interact with the community of FHC?
7. What factors do you believe have contributed to the success of this alliance?
8. Please describe or identify any burden that the student physical therapist team placed on FHC.
9. What factors are important for creating and maintaining a successful relationship between FHC and the student physical therapist team?
10. What suggestions do you have for maintaining or fortifying this alliance?

### **Appendix 6. Postproject Reflection: All Students**

1. As a result of working on the iPad/communication button project, what did you learn about working with other disciplines (physical therapy, mechanical engineering, and speech-language pathology)? Please describe.
2. What element of working on this project made the greatest impact on you as a student, person, or future professional? Please describe.
3. Other comments.