Student Perspectives on Working in Interdisciplinary Teams to Implement mHealth

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STUDENT PERSPECTIVES ON WORKING IN
INTERDISCIPLINARY TEAMS TO IMPLEMENT MHEALTH

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Submitted to Brigham Young University in partial fulfillment
of graduation requirements for University Honors

College of Nursing
Brigham Young University
December 2018

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ABSTRACT

STUDENT PERSPECTIVES ON WORKING IN INTERDISCIPLINARY TEAMS TO IMPLEMENT MHEALTH

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Interprofessional education of students in healthcare professions can lead to positive outcomes for students that are unique in a university setting. The purpose of this thesis is to describe benefits and challenges students encounter when working with students of other majors. This study used a convenience sample of students working on a university project to implement mHealth. Participants responded to two surveys with quantitative and qualitative questions. Students reported greater appreciation for diversity, the necessity of communication skills, and self-awareness of their own responsibilities in a team.

Key Words: Interprofessional education, mHealth, students, interdisciplinary teamwork, communication
ACKNOWLEDGEMENTS

I would like to acknowledge the Brigham Young University College of Nursing for the continued support in completing the Honors program. Specifically, I would like to express gratitude and appreciation for Shelly Reed for serving as my advisor and kindly assisting me with all my questions and drafting. I would like to thank Deborah O. Himes for her contribution as my clinical instructor and Honors Coordinator. I would like to thank Katreena Merrill for guiding me to the ISVS and for serving on the thesis committee. I would also like to acknowledge Craig Nuttall for his assistance with the IRB application submission, and Neil Peterson for help with quantitative analysis and as my research professor. I would also like to acknowledge the BYU Ballard Center for Economic Self-Reliance and Norman Hill for the enthusiasm and support in completion of this thesis.

Finally, I would like to thank my husband, Tevin, for all the time spent supporting me in my academic and career goals.
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Student Perspectives on Working in Interdisciplinary Teams to Implement mHealth

Historically, each discipline within the healthcare system lacked collaboration with other disciplines and tended to function independently in near isolation. This type of workplace behavior, also known as *silo mentality*, can lead to negative impacts on patients, such as localized decision-making that lacks perspective (Shockney, 2017). In an attempt to move away from silo mentality, the Institute of Medicine urged healthcare educators to integrate interprofessional education (IPE) into healthcare curricula (Margalit et al., 2009). Researchers reported that the implementation of IPE promotes patient-centered care (Buring et al., 2009). For example, Wakefield, Carlisle, Hall, and Attree (2009) discovered that IPE created an environment that fostered greater patient safety. Other benefits included improved patient-centered communication, reduction of clinical errors in the Emergency Department, and improved clinical outcomes for clients with diabetes (Murdoch et al., 2017; Reeves et al., 2013). Accordingly, researchers and educators have responded by developing, implementing, and analyzing programs to improve IPE (Margalit et al., 2009).

Although transitioning from silo mentality has been a focus in healthcare, IPE may also benefit other disciplines that require teamwork when problem solving. For example, business management requires interdisciplinary problem solving. Within a business, different departments such as finance, accounting, and human resources work together to accomplish the firm’s goals. Research has shown that breaking down silos in a business can increase teamwork, communication, and customer relations (Willcock, 2014). In summary, the avoidance of silo mentality in business can lead to greater outcomes.
Depending on the industry, a business may also require teamwork with members of other industries, such as the management of a pharmaceutical company working in partnership with hospital administrators and doctors. In recognition of the importance of interdisciplinary teamwork, the Marriott School of Business at Brigham Young University founded the Ballard Center for Economic Self-Reliance to organize students who work together to discover and implement successful solutions to world problems. In the process, students find greater meaning to their lives through educational experiences. Through the Ballard Center, students participate in research-based, social innovation projects that promote self-reflection and moral awareness. For example, one project at the Ballard Center is called the Y-Prize Competition. The Y-Prize Competition is an annual competition containing several divisions requiring student teams to distribute different products to benefit people in poverty. Students can win prize money from the Ballard Center to fund their projects. The competition begins in September each year, and continues throughout the following academic year. Students select their team members but are encouraged to select members from different majors and backgrounds. This diversity of knowledge brings depth and expertise that a group with silo mentality would find difficult to experience.

In the 2017-2018 academic year, the Y-Prize Competition included the Maternal Health Challenge, a competition requiring teams to use mHealth, or mobile health, in a developing nation. The Ballard Center focused on the concern for maternal and newborn mortality in developing nations because of recent research. In 2015, Wang and Hong reported that based upon data from the 2010 Cambodia Demographic and Health Survey, 40% of Cambodian women did not receive skilled care during antenatal, natal, and postnatal periods. The Ballard Center presented the problems of maternal and newborn
mortality to student teams and challenged them to find solutions using an approved company’s mHealth technology.

**Literature Review**

**mHealth Implementation and Effectiveness**

The World Health Organization defines mHealth, or *mobile health*, as healthcare that includes the use of mobile phones and/or other wireless technologies (Park, 2016). The purpose of these mobile technologies is to use phone calls, short message service (SMS), and/or mobile phone apps to increase communication between healthcare providers and patients.

The implementation of mHealth solutions in developing nations primarily consists of community health workers using cell phones with the mHealth mobile app during a visit with a pregnant mother. Typically, the mHealth mobile app contains several different features, including the abilities to create appointments, track healthcare provider visits, set reminders, and call clinics or hospitals. Additionally, the mobile app could contain simple diagnostic trees. The purpose of the diagnostic tree is to determine the next course of action for the mother. For example, when prompted by commands on the phone screen, a community health worker could input information such as temperature, heart rate, blood pressure, other signs and symptoms, etc. Then the app alerts the worker that the mother needs to call the doctor, go to the hospital, or proceed in another direction. The primary purpose for the mHealth app is to increase and improve communication between a local clinic or hospital and a geographically isolated mother.

Although mHealth appears to be a solution for improving maternal and newborn care, research results vary as to its effectiveness. Research on the implementation of mHealth programs is expanding. In a systematic review by Chen, Chai, Dong, Niu, and
Zhang (2018), researchers discovered increasing numbers of research papers on mHealth in recent years. Some of these research papers indicated improved communication between expecting mothers and healthcare workers, while other research showed no significant effects of communication. This review indicated that SMS is used more frequently in developing countries than in industrialized nations, and SMS has been helpful in the prevention of certain maternal and newborn communicable diseases and childhood disease management (Chen et al., 2018). Furthermore, researchers Watterson, Walsh, and Madeka (2015) concluded that using SMS to communicate with mothers throughout their pregnancy seemed promising. However, they also concluded that research results have not yet supported these claims. Another systematic review by Ilozumba et al. (2018) highlighted the sustained interest in mHealth for maternal and newborn care but noted the lack of clarity in the goals of intervention implementation. In conclusion, despite an increasing interest in mHealth research, the benefits of mHealth remain inconclusive.

**Student Perspectives on IPE**

Due to the increased integration of IPE in healthcare education curricula, research articles on student perspectives on IPE has also been increasing. First, research has been conducted on students from a variety of disciplines. For example, Lumague et al. (2006) explored the perspectives of nine students studying different specialty including nursing, occupational therapy, physiotherapy, medicine, social work, pharmacy, and speech pathology. Additionally, research has explored the effects of IPE, including effects on students. Reeves, Fletcher, Barr, et al. (2016) reviewed multiple studies on the effects of IPE and reported findings on student outcomes. Students mentioned more positive than negative outcomes, and common positive outcomes included the generation and
maintenance of positive views of IPE, personal enjoyment, and improvement in teamwork knowledge and skills (Reeves et al., 2016).

Additionally, in the past five years, researchers have implemented a variety of methods to identify student perspectives. Many research studies used qualitative data collection and analysis, and some studies used a mixed-methods study design. For example, one method was to interview students who participated in an IPE activity or program (Mellor, Cottrell, & Moran, 2013). Other researchers focused on a pre- and post-survey design that assessed students’ perspectives before and after IPE intervention (Jutte, Brown, & Reynolds, 2016). A third method was to evaluate a reflective essay written by students after IPE (van Wyk & de Beer, 2017). Using these different methods, researchers have identified student perspectives on IPE. Although commonly used, the methodology of self-assessment is considered a weak measure of significant change (Reeves et al., 2016). While there are studies that used both quantitative and qualitative data analysis and collection, there remains a need for a stronger use of quantitative data analysis.

**Gaps in the Literature**

Although there is an abundance of research on mHealth and growing research on student perspectives on IPE, there are gaps in the literature concerning interdisciplinary teamwork, interdisciplinary maternal healthcare, and student perspectives. In a recent systematic review, researchers Davies, Fletcher, and Reeves (2016) discovered very few research articles on IPE in maternity services. This contrasts with the abundant research on IPE in other healthcare professions. In addition, there was minimal research conducted on student perspectives of IPE as it relates to interdisciplinary teamwork. More specifically, there is a lack of research on the implementation of mHealth solutions.
Research articles on interdisciplinary teams and the implementation of mHealth are sparse, but existent. One such article was about a student interdisciplinary team that created an app to improve maternal and newborn health. Lessons learned included the value of communication, openness, flexibility, respect, and appreciation and the barriers of time constraints on collaboration (Hudson et al., 2017). A second article by Recio, García-Hernández, Luque and Salas-Morera (2016) concluded that the increase in mHealth research papers indicated a growing interest in mHealth for health science and computer science fields, but also indicated that there was limited understanding of the impact of interdisciplinary teamwork on healthcare practices.

In conclusion, there is a scant amount of research regarding the effects and results of mHealth products and minimal evidence on the effect of an interdisciplinary team implementing mHealth. Therefore, the goal of this thesis is to integrate both topics of student perspectives of IPE and mHealth implementation using a mixed-methods study design.

Methods

The methods of this thesis consisted of online survey development, data collection, and analysis of survey responses. Both quantitative and qualitative methods were used for this research. Quantitative data was collected using a validated scale, and qualitative data was collected from students’ responses to an open-ended questionnaire. The Brigham Young University (BYU) Institutional Review Board approved this study in June 2018.

Data Collection Tool

The Interprofessional Socialization and Valuing Scale (ISVS) developed by King, Shaw, Orchard, and Miller in 2010 measures teamwork and collaboration. The ISVS is a
validated instrument that contains 24 items in three categories: “Ability to work with others,” “Value in working with others,” and “Comfort in working with others.” The items are rated on a scale of one to seven, with one being “Not at all” to seven being “To a very great extent.” Higher scores on the scale indicate stronger ability, comfort, and value of working with others. The ISVS also includes the answer option “Not Applicable” (King et al., 2010). The only modification made to the ISVS in this study was the introduction to the scale in the post-implementation survey. The introduction was clarified to also refer to the period after the student’s in-country project implementation.

The ISVS and open-ended questions were administered using Qualtrics data analysis software and were used to develop and test the pilot survey. The survey was pilot tested on a group of BYU students who participated in another division of the Y-Prize Competition. Fourteen out of 20 students responded to the pilot study. Pilot study participants were not included in the final analysis. Additional questions included in the pilot study but not the final questionnaire asked how long it took to complete the Qualtrics version of the survey and for feedback about how to improve the questions. Students commented that the survey took an average of 6-10 minutes. Some students skipped questions or responded to open-ended questions with one-word answers. Feedback from the Qualtrics pilot survey was used to improve the final two surveys to be sent out to the study participants. A minimum word count was created for the open-ended questions, and participants would be required to answer each question before continuing on to the next question.

Qualitative data was obtained for the study by the creation of open-ended questions and one closed-ended question. There were four open-ended questions in the
pre-departure survey, and five open-ended questions in the post-implementation survey. General topics of the questions included reasons for participating in the competition, perceived benefits and challenges, lessons learned, and future application (see Appendix B).

Data Collection

Participant Selection. Subjects were participants in the Y-Prize Competition Maternal Health Challenge division, which is a competition independent of this research study. The subject population was a convenience sample of 17 students ages 20-25 at BYU who participated in the Y-Prize Competition Maternal Health Challenge division. Data analysis included only participants who completed both a pre-departure survey and a post-implementation survey.

Survey Administration. The first survey titled “Student Perspectives Pre-departure Survey” was emailed using an anonymous link to student participants in August 2018. At the time of the pre-departure survey, participants had been working with their team members for six months to 11 months. Then the second survey titled “Student Perspectives Post-implementation Survey” was administered the following month in September 2018. Students were expected to implement their mHealth project within that month. Students had one week to respond by completing their surveys on a computer in a location of their choice. Although the survey links were emailed to known student emails, data remained anonymous by assigning random four-digit codes to each participant response in the pre-survey. In the post-implementation survey, students were required to enter the four-digit code in order to proceed with the survey. Data collection concluded automatically using a setting on the Qualtrics survey software.
Data Analysis

Quantitative data. Quantitative data analysis used both descriptive and inferential statistics. First, for the ISVS, any “Not Applicable” answer options from participants were given a “0” in analysis. Using the guidelines for the ISVS, descriptive statistics including means and standard deviations for each of the subscales were calculated using the Statistical Package for the Social Sciences (SPSS). Scores were calculated per scale, using questions 1–9 for ability, questions 10–18 for value, and questions 19–24 for comfort. Mean scores and standard deviations were calculated for each participant in each of the subscales to determine the variance in the individual responses and are presented in Table 1. Next, the SPSS software was used for inferential statistics to run a paired t-test. A paired t-test was used to evaluate a change in individual ISVS scores before and after the students’ project implementation.

Qualitative data. Three researchers analyzed qualitative data collected from student responses. Responses to each open-ended question were sorted and compiled into separate tables. Themes were identified by examining student responses to open-ended questions in both surveys. Responses were considered a theme if at least two or more students commented a similar idea, using exact wording or intended meaning. Responses by two or more students were recorded in the results. Finally, meaningful quotations for each theme under the perceived benefits and challenges were consolidated into additional separate tables (See Tables 3, 4, 5, 6.)

Results

In total, seven participants responded to both surveys. Two students responded only to the post-implementation survey, and those responses were not included in collection of qualitative data and statistical analysis. The majors represented by the
sample population included Business Management, Public Health, Physiology and Developmental Biology, Information Systems, Information Technology, and Neuroscience.

**Quantitative data analysis**

Descriptive statistics was used to analyze the mean scores and standard deviations of the sample. This resulted in the mean scores and standard deviations for “Ability to work with others” subscale in the pre-departure and post-implementation surveys as 6.36 ($SD \ 0.6073$) and 6.47 ($SD \ 0.5961$), respectively. Next, the mean scores and standard deviations for “Value in working with others” subscale in the pre-departure and post-implementation surveys were 6.59 ($SD \ 0.4264$) and 6.67 ($SD \ 0.4264$). Finally, the average mean scores and standard deviations for “Comfort in working with others” subscale in the pre-departure and post-implementation surveys were 6.11 ($SD \ 0.6152$) and 6.08 ($SD \ 0.5371$).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Significance of the Change in Scores for the Pre-departure and Post-implementation Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Ability</td>
<td>Pre</td>
</tr>
<tr>
<td></td>
<td>Post</td>
</tr>
<tr>
<td>Value</td>
<td>Pre</td>
</tr>
<tr>
<td></td>
<td>Post</td>
</tr>
<tr>
<td>Comfort</td>
<td>Pre</td>
</tr>
<tr>
<td></td>
<td>Post</td>
</tr>
</tbody>
</table>

Next, using inferential statistics, a paired samples t-test was conducted comparing the change in pre-departure and post-implementation surveys to potentially confirm significance. As indicated in Table 2, this analysis yielded no significant results, with values of 0.410 for ability, 0.755 for value, and 0.874 for comfort. None of the tests showed significance, indicating no change between the pre-departure and post-implementation scores on any of the ISVS subscales.
Table 2

<table>
<thead>
<tr>
<th>Paired t-test Comparison of Total Participant Pre-departure and Post-implementation ISVS Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
</tr>
<tr>
<td>Ability</td>
</tr>
<tr>
<td>Value</td>
</tr>
<tr>
<td>Comfort</td>
</tr>
</tbody>
</table>

Qualitative Data

Pre-departure Survey. In the pre-departure survey, the most common reason given for participating in the competition was to gain experience in teamwork. Other stated reasons included a specific desire to help others, passion for healthcare, leadership opportunity, and to win prize money offered by the Ballard Center for successful implementation. Student also expressed the desire to use the skills they had developed to tackle an interdisciplinary problem.

To the question, “How did you choose your team members?” students most commonly stated previous connections. These connections included previous friendships and participation in the same internship. Students also reported specifically choosing students who were in business, healthcare, and technology majors because they recognized the need for different skill sets. More specifically, students reported that students with a knowledge of technological skills was particularly beneficial for the implementation of mHealth. Other students reported that they chose students who could speak Portuguese because their team wanted to implement mHealth in a very specific country.

In regards to perceived benefits, most participants reported the benefit of learning from a different perspective or point of view when working with students from other
majors. According to these students, this positive outcome of different perspectives also helped provide balance in teamwork. Other benefits mentioned by students included personal enjoyment, increased breadth of knowledge, and increased networking.

Examples of responses are shown in Table 3.

Table 3
Pre-departure Survey Responses to Benefits of Working with Students in Other Majors

<table>
<thead>
<tr>
<th>Response category</th>
<th>Pre-survey example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different perspectives or points of view</td>
<td>“I love asking my team members about things...from a business point of view”</td>
</tr>
<tr>
<td></td>
<td>“Having a pre-law student on the team added another perspective and pair of eyes that could point out things that we overlooked”</td>
</tr>
<tr>
<td></td>
<td>“Helps our team to be more balanced and not so focused on one area”</td>
</tr>
<tr>
<td>Personal enjoyment</td>
<td>“Working with students of other majors . . . is the best part”</td>
</tr>
<tr>
<td></td>
<td>“I had so much fun working with students from other majors”</td>
</tr>
<tr>
<td>Increased breadth of knowledge</td>
<td>“While I was thinking of the more clinical aspects, others had much more knowledge about running it as a business, approaching the technology aspects, making connections with people in country”</td>
</tr>
<tr>
<td></td>
<td>“Students from other majors have skills and can answer questions immediately that I would otherwise have to do extensive research on”</td>
</tr>
<tr>
<td>Increased networking</td>
<td>“These students have different networks and can connect with different professionals faster than I can”</td>
</tr>
<tr>
<td></td>
<td>“Each major provided our team with more connections with faculty, organizations, and students within BYU”</td>
</tr>
</tbody>
</table>

Next, reported challenges included communication barriers, different perspectives, and project management skills. Two participants reported an absence of great challenges. Communication was the most frequently mentioned challenge, and students stated this barrier was a challenge for the speaker and the listener. Students recognized that perceived communication barriers required an open mind, listening skills, and the simplification of concepts. The challenge of specific project management skills
included setting expectations in the form of timelines and deadlines that all students understood and agreed upon. Select quotations are displayed in Table 4.

<table>
<thead>
<tr>
<th>Response category</th>
<th>Pre-survey example</th>
</tr>
</thead>
</table>
| Communication barrier      | “At times it is apparent that other people are totally unfamiliar with your field and explaining your reasoning for things is difficult”  
|                            | “We all have something to say because we see it differently, so we all have to listen intently to others.”  
|                            | “We like people that are like us . . . so sometimes it takes extra work to embrace and listen to other people’s ideas and concerns”  
|                            | “Must simplify things sometimes so we can understand concepts that are unfamiliar to us”                                                                                                                                                                                                                                                                                                                                 |
| Different perspectives     | “Seeing things from [another person’s] perspective is hard, that is why people don’t just do it naturally.”  
|                            | “You don’t completely understanding the reasoning of others.”                                                                                                                                                                                                                                                                                                                                                 |
| Project Management Skills  | “Problems mostly involved not clearly understanding the time that it would take for the application to be built or the amount of work that would be required to make changes once the application had been completed”  
|                            | “They might not know how to set a reasonable deadline.”                                                                                                                                                                                                                                                                                                                                                      |
| None                       | “I do not see great challenges”                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Post-implementation Survey.** The post-implementation survey results also indicated multiple perceived benefits and challenges to interdisciplinary teamwork. All participants responded that they met their own personal expectations for project implementation and working in an interdisciplinary team. Three students reported that this experience exceeded their expectations. Students reported that their satisfaction with the project was a result of becoming a better team member.

In this survey, students reported different ideas, specific aspects of collaboration, and unique solutions as benefits. These benefits more specifically included the appreciation of other students’ ability to do specific tasks, such as app development.
Other specific responses related to different ideas and unique solutions included more discussion and learning from each other. Generally, students focused more on the results of project implementation than in the pre-departure survey. Students focused less on the skill sets of other team members.

Table 5
Post-implementation Survey Responses to Benefits of Working with Students in Other Majors

<table>
<thead>
<tr>
<th>Response category</th>
<th>Post-survey example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different ideas</td>
<td>“We all had different ideas of how to get things done, and that always led to better outcomes”</td>
</tr>
<tr>
<td></td>
<td>“Ability of our team to overcome a wider variety of problems”</td>
</tr>
<tr>
<td></td>
<td>“More discussion and ideas concerning our implementation plan and interaction with our in-country partners”</td>
</tr>
<tr>
<td>Collaboration</td>
<td>“The rest of us can more easily collaborate and share responsibilities because we all know how to read, write, problem-solve, etc.”</td>
</tr>
<tr>
<td></td>
<td>“Other students had unique expertise”</td>
</tr>
<tr>
<td>Unique solutions</td>
<td>“Unique solutions that are often more practical, since they are the most streamlined tools that their skill set can offer”</td>
</tr>
</tbody>
</table>

The main challenges identified by the post-implementation survey were communication barriers, lack of understanding between team members, and unfair workload. For example, general understanding about another major or technology skills was lacking. Students reported that they could not determine other students’ competence in their area of study. Other misunderstandings arose from confusing or unclear explanations and disagreements between team members.

Students reported overcoming these challenges by improving communication, dividing general tasks among team members, and seeking to understand others’ expectations. More specifically, students reported overcoming communication barriers by removing jargon specific to their field of study in order to simplify concepts and improving listening skills. Some specific quotations are displayed in Table 6.
Table 6  
*Post-implementation Survey Responses to Challenges of Working with Students in Other Majors*

<table>
<thead>
<tr>
<th>Response category</th>
<th>Post- survey example</th>
</tr>
</thead>
</table>
| Communication barriers  | “Requires more effort to communication...I can’t resort to using jargon from my field that would be clear and precise to me”  
|                         | “We did not always agree with each other right off the bat”                                                   |
|                         | “Other majors do not understand how my idea works so [they] cannot see how to integrate their skills with the solution I offer...limits them from fully contributing, and vice versa”  
|                         | “No way to know of competence in the other field”                                                              |
|                         | “Sometimes they make things sound too easy, but actually it is not”                                             |
|                         | “I became discouraged with people in the industry not being clear about their expectations”                     |
| Lack of understanding   | “Difficult to share the workload at times...since our team did not all have the same skills”                   |
|                         | “I was unable to help team members that were overwhelmed with the work that they were doing”                   |
| Unfair workload         | “I did not see great challenges”                                                                             |
| None                    | “I did not see great challenges”                                                                             |

Students had three main responses to the question, “What did you learn by working with other students that you did not learn in other college settings?” All students responded that they were able to distinguish a difference between working in a team for an extracurricular activity and completing a group project for a grade. First, students noted that one real-life application as compared to class projects or assignments was the ability to assess the passion of another student over time. Second, students reported learning about the necessity and value of communication in teamwork. Third, students expressed deeper appreciation for other majors.

Finally, participants reported several ways they will apply what they learned from participating in a team to implement mHealth. The most common responses included improving future communication, embracing and appreciating other disciplines, and applying principles of teamwork to their profession. Specific responses included explaining expectations beforehand and personal skill sets. Personal skills sets reported
by students included project management skills, language skills, app designing skills, and technology skills.

**Discussion**

As reflected by high scores on the Interprofessional Socialization and Valuing Scale (ISVS), students value interprofessional teamwork and are generally confident in their ability and comfort in working in interprofessional teams. Our finding that students place high value on interdisciplinary teamwork is similar to findings of other studies. In Telford and Senior (2017), students also highly valued working with other professionals. Universally, in this study, students reported greater benefits than challenges and more positive experiences than negative experiences, similar to studies in Reeves, Fletcher, Barr, et al. (2016). Therefore, for these students, the ISVS subscale value may be independent of the effect of challenges.

The difference in the pre-departure and post-implementation survey scores were not statistically significant, however this finding can be partially attributed to initial high scores. This result is similar to another finding in Simko, Rhodes, McGinnis, and Fiedor (2017) where nursing students’ scores did not improve significantly from the pre-departure to post-implementation survey, with this finding attributed to students’ initial high scores. Additionally, students in this study had been working in their teams for several months before the administration of the pre-departure survey. It is possible that had the pre-departure survey scores may be different.

**Comfort Scores**

This study did not find that adverse outcomes significantly affected students’ comfort in working with others. In terms of comfort, students did not mention adverse emotional effects of interdisciplinary teamwork. One study by Telford and Senior (2017)
reported that students shared feelings of emotional apprehension or anxiety before participating in mandatory IPE settings. The lack of negative emotional impact in this study could be due to small numbers in the study, and because these students were allowed to choose their team members rather than to be placed on a team. This provides the possibility that perceived outcomes may be different if students have more autonomy to select team members in IPE or in choosing the type of project.

Additionally, there is inconclusive evidence that the requirements of implementing mHealth affected comfort scores. In the context of this study, mHealth implementation required knowledge and understanding of technology, and some students reported that they lacked technology skills. Students reported feeling appreciation for other students’ expertise in technology. Students commented that they wish they could have helped more, but they did not express feelings of inferiority to other students. This finding is different from Prentice, Engel, Taplay, and Stobbe (2015) where students participated in general IPE activities such as clinical simulations and workshops. These activities required general skills such as reading and writing. Nursing students reported feeling uncomfortable working with medical students because of perceived stratification in intelligence and skills, but medical students did not report similar discomfort (Prentice, Engel, Taplay, & Stobbe, 2015). However, findings from this study did not support that students experienced similar emotional discomfort because of perceived stratification in intelligence or skills because of differences in knowledge.

**Benefits of Interdisciplinary Teamwork**

Overall, students recognized value in others’ perspectives and ideas throughout the survey process by describing benefits of interdisciplinary teamwork. The benefit of a broadened perspective is consistent with several studies (Lumague et al., 2006; Margalit
et al., 2017; Mellor, Cottrell, & Moran (2013). Additionally, because students reported learning about communication throughout the project, improving communication may have contributed to the reported benefits of successful team project implementation, personal satisfaction with the project, and enjoyment of working with others. These findings of personal satisfaction and enjoyment were also captured in a previous study (Mellor, Cottrell, & Moran, 2013).

Self-Reflection. While other studies conducted on student perspectives focused on using various methods to identify outcomes, findings from this study also suggest the importance of self-reflection. Students may have improved their self-reflection abilities in this study. For instance, in the pre-departure survey, students identified the benefit of multiple perspectives. Then, in the post-implementation survey, students gave specific descriptions of this benefit, explaining that the different perspectives led to different ideas and unique solutions.

The difference in responses may be related to the administration of the two surveys. At the implementation of the first survey, participants were informed that they would be required to take two surveys; this likely allowed the students to have more time to reflect on their experiences in preparation for the second survey. Because all students reported that their expectations for working with others were met or exceeded, purposeful reflection after a project or group activity may have helped students to realize fulfillment of expectations. Furthermore, in the post-implementation survey, students could have been more cognizant of the impact of interdisciplinary teamwork on the final solution and consequently reported more benefits regarding results of successful mHealth implementation. Therefore, administering the first survey when teams initially formed may have provided different results.
This finding of the importance of self-reflection has not been explored in previous research on IPE and student perspectives. This study’s design to capture responses before and after project implementation was able to compare and contrast individual responses. In studies that used a single interview (Mellor, Cottrell, & Moran, 2013), reflective student essay (van Wyk & de Beer, 2017), or debriefing session (Hudson et al., 2017), a pre- and post- comparison could not be accomplished. Although researchers like Jutte, Brown, and Reynolds (2016) conducted the pre- and post- survey design, similar to the design of this study, they did not comment on a change in response quality over time. Furthermore, in Hudson et al. (2017), researchers also did not comment on the quality of student self-reflection after the course.

**Challenges of Working with Others**

Students reported learning how to overcome challenges. The impact of challenges was not seen on the post-implementation survey ability score. For example, students who reported communication challenges and how they resolved these communication issues also had high scores in ability. Furthermore, students did not express long-term discouragement or frustration with other team members or organizational constraints during the implementation of this project.

In comparison, other studies reported more organizational challenges. Logistical differences, such as the coordination of conflicting schedules, were emphasized as major challenges (Acquavita, Lewis, Aparicio, & Pecukonis, 2014; Hudson et al., 2017; Lumague et al., 2006). In these three studies, students participating in IPE were expected to create times outside of scheduled IPE interventions to complete a task or a project. In Acquavita, Lewis, Aparicio, and Pecukonis (2014), students participated in a semi-structured interview and completed a questionnaire about IPE. Because there was a lack
of an IPE intervention, students were assumed to have already previously encountered IPE as part of a university setting (Acquavita, Lewis, Aparicio, & Pecukonis, 2014). In Hudson et al. (2017), students were assigned to develop an mHealth app and had to schedule times to meet and coordinate team work. Finally, in Lumague et al. (2006) students had to also complete a group presentation on their own time. Because this was an extracurricular activity, students in this study had to independently coordinate schedules. However, the findings from this study suggest that the value of working with others was not inhibited by challenges such as conflicting schedules.

Communication. One major theme recognized was the necessity for communication. Communication was essential to alleviate knowledge deficits and to improve collaboration among team members. Moreover, communication was an important aspect of these students’ ability to work with others. Students recognized their inability to clearly and effectively share their opinions and listen to others affected their participation, just as their teammates’ inability to communicate affected teamwork. The necessity for increased or enhanced interpersonal communication is a consistent finding with other research studies (Hudson et al., 2017; Imafuku et al., 2018; Jutte, et al., 2016; Reeves et al., 2016; van Wyk & de Beer, 2017). When students in this study reported the need to improve their communication in the pre-departure survey, they also reported success and satisfaction in teamwork in the post-implementation survey. These findings are also consistent with Mellor, Cottrell and Moran (2013) where students reported communication as important and were successfully able to communicate and use interpersonal skills.

Technology Skills. Because the Maternal Health Challenge required the use of mHealth technology, students acknowledged that technology skills – such as computer
programming – were very valuable. This is a unique challenge in the context of implementing mHealth. Challenges associated with lack of technology skills are not frequently mentioned in other studies. Although students rated themselves high on the subscales of ability and comfort in teamwork, they also reported that lack of technology skills led to a misunderstanding of expectations and generalized feelings of incompetence. Due to their lack of technical skills, these students were limited in the mHealth app development. This finding is similar to Jutte, Brown, and Reynolds (2016), wherein students expressed frustration about the unequal division of labor related to skills different student possessed. Instead of learning app development skills like the students in Hudson et al. (2017), the students in this study relied on the skills of team members. After project implementation, students did not report learning technology skills, unlike a previous study that showed increased knowledge of other specialties (van Wyk & de Beer, 2017). Instead, students in this study reported gaining appreciation for students with technology skills. In summary, the added requirement of technology skills in this mHealth competition posed a challenge to some students that might not be present in other studies on student perspectives of IPE. However, this also provided the benefit of increased appreciation for other members of the team.

**Limitations**

One of the main limitations of this study was the small convenience sample, which may not be representative of a larger population. The small sample ultimately limited the ability of a paired samples t-test to indicate meaningful or significant results. In addition, the sample limited qualitative analysis, as there was not enough data to compare results across majors. Furthermore, students chose to participate in the Maternal Health Challenge, indicating they were initially open to working in an interdisciplinary
setting and willing to participate in this extracurricular activity. The results of this study may due to the specific sample and may not be applicable to students who are assigned, rather than who choose, to work with an interdisciplinary team.

Other limitations included the period between surveys and the minimum word count in the post-implementation survey. First, due to the brief period between surveys, approximately one month, students may have had limited time to see the impact of working in IPE teams. Therefore, scores may not significantly change in this short time period. Students may have reported different scores or more specific, concrete insights with a longer time period between surveys. Additionally, results may be different if the survey was administered in Fall 2017, when student teams had just formed. Second, there was no minimum word count for qualitative responses in the post-implementation survey. Consequently, some responses in the post-survey were only four words long. This possibly led to shorter responses, thus limiting qualitative data from the post-implementation survey.

**Conclusion**

Improving collaboration between disciplines and moving away from silo mentality can be a focus for all organizations, and not exclusively healthcare. Students in this study valued interdisciplinary teamwork and identified learning meaningful skills in settings outside of the classroom, specifically important team communication skills. Communication was essential when working with students from other majors. More research is needed on student perspectives using larger sample sizes over longer periods to identify the value of working in IPE teams.
References


doi:10.2273/ajpe.81.6.1


doi:10.17159/231-3833/1017/v47n2a6


Appendix A

Interprofessional Socialization and Valuing Scale (King, Shaw, Orchard & Miller, 2010)

At this point in time, based on my participation in interprofessional education activities and/or clinical practice...

1. I feel comfortable in accepting responsibility delegated to me within a team
2. I feel able to act as a fully collaborative member of the team
3. I have gained a better understanding of my own approach to care within an interprofessional team
4. I feel comfortable in being accountable for responsibilities I have taken on
5. I am comfortable engaging in shared decision making with clients
6. I am able to listen to other members of the team
7. I have gained a better understanding of the client’s involvement in decision making around their care
8. I feel comfortable clarifying misconceptions with other members of the team about the role of someone in my profession
9. I more highly value open and honest communication with team members
10. I have gained more realistic expectations of other professionals on a team
11. I have gained an enhanced awareness of the roles of other professionals on a team
12. I see myself as preferring to work on an interprofessional team
13. I have gained an appreciation for the benefits in interprofessional team work
14. I have gained greater appreciation of the importance of a team approach
15. I feel comfortable initiating discussions about sharing responsibility for client care
16. I have gained an appreciation for the importance of having the client and family as members of a team
17. I believe that interprofessional practice will give me the desire to remain in my profession
18. I believe that interprofessional practice is not a waste of time
19. I feel comfortable debating issues in a team
20. I am comfortable being the leader in a team situation
21. I feel confident in taking on different roles in a team (i.e., leader, participant)
22. I am able to share and exchange ideas in a team discussion
23. I feel comfortable speaking out within the team when others are not keeping the best interest of the client in mind
24. I believe that interprofessional practice is difficult to implement
Appendix B

Student Perspectives Pre-departure Survey

1. Why did you choose to participate in the Y-Prize competition?
2. How did you choose your team members?
3. What do you see as benefits to working with students from other majors (if any)?
4. What do you see as challenges to working with students from other majors (if any)?

Student Perspectives Post-implementation Survey

1. After implementing your team’s project, what benefits did you see to working with students from other majors (if any)?
2. After implementing your team’s project, what challenges did you see to working with students from other majors (if any)?
3. How did you overcome those challenges (if any)?
4. What did you learn by working with other students that you did not learn in other college settings?
5. Did you meet your personal expectations for participating in the Y-Prize competition?
6. How will you apply what you learned about working with students from other disciplines in the future?