Faith Integration Through Service-Learning in the Information Sciences

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ABSTRACT: *This paper demonstrates that the information sciences discipline offers significant opportunities for meaningful service-learning engagement. A secondary purpose of this paper is to document a biblical basis for service-learning in the information sciences discipline. The paper introduces a service-learning taxonomy that is well-suited for the information sciences discipline. This taxonomy outlines the activity and scope of service-learning opportunities available within the discipline, along with actual examples of service-learning projects conducted at Messiah College. Samples of student reflections on the impact of their service-learning experiences are also included in the paper.*

INTRODUCTION

The mission of Messiah College is to "educate men and women toward maturity of intellect, character, and Christian faith in preparation for lives of service, leadership, and reconciliation in church and society." The incorporation of the service-learning model into the course curriculum can greatly activate this mission. Even though there is a sound biblical basis for service-learning, this does not always translate into practical application — especially in the information sciences discipline (i.e., business information systems, computer science, computer engineering). The information sciences discipline, however, offers significant opportunities for engagement with non-profit organizations (NPOs). Such organizations often lack the expertise, resources, and time to leverage information technology to improve operational efficiency, effectiveness, and value. Furthermore, students in this discipline are in high demand and often command significant salaries in the commercial sector upon graduation (Ellis, 2006). By exposing students to the opportunities and rewards of using their information sciences skills for the benefit of NPOs, students will be more open to pursuing such opportunities upon graduation, either vocationally or as part of community citizenship.

This paper demonstrates that the information sciences discipline offers significant opportunities for meaningful service-learning engagement. Furthermore, this paper introduces a service-learning taxonomy that is well-suited for the information sciences discipline. This taxonomy outlines the activity and scope of service-learning opportunities available within the information sciences discipline. A secondary purpose of this paper is to document a biblical basis for service-learning in the information sciences discipline.

BACKGROUND AND RELATED WORK

Historically, service-learning in the academy has focused predominately outside of the information sciences (Droge, 1996). Adams (Adams, 2004) notes, "While service-learning is becoming more common in college curriculums, it is still noticeably absent from many computer science programs." Sanderson (Sanderson, 2003) indicates that "computer science is not very visible in the service-learning community." Of the more than 300 service-learning syllabi listed at the Campus Compact Web site (Campus, 2008), only five entries exist for computer science. However, service-learning models and projects in the information sciences have emerged over the past several years. A comprehensive review of the literature revealed that approximately 22 papers were

published on service-learning in the information sciences between 1999 and 2007. These papers are cited in the references section of this paper and are now summarized in the following sub-sections.

ORGANIZATIONAL MODELS FOR SERVICE-LEARNING IN THE INFORMATION SCIENCES

There are different organizational models for integrating service-learning into the information sciences. A panel session (Ferguson, 2006) outlined the opportunities and challenges for service-learning in the information sciences. The University of Notre Dame has an active service-learning program in the information sciences (Madey, 2005). This paper discusses the overall program structure, credit-bearing course options, grading, liability management, and team structure for their service-learning program. A number of service-learning projects done for regional NPOs are also highlighted in the paper. The projects have included the development of custom database and Web-based applications and providing professional services in the development of a strategic technology plan for a regional NPO.

Butler University began a service-learning program in 2001 (Linos, 2003 and Sorenson, 2005). Their effort began by joining the EPICS program (EPICS, 2008), a national service-learning organization that started at Purdue University in 1995 focused on the engineering discipline. The paper outlines the curriculum adjustments made to accommodate service-learning at Butler University. It also outlines the benefits of the program and challenges the program faces in the areas of project management, progress assessment, evaluation, long-term continuity, and funding. Finally, the paper highlights the SIA project, a Web-based application that aids middle school students in learning the Spanish language.

Southwest Missouri State University has developed guidelines for establishing a service-learning program in computer science (Sanderson, 2000 and Sanderson, 2003). The guidelines provide a definition of service-learning, briefly discuss the benefits of service-learning, outline the institutional and departmental support necessary for service-learning, and offer project selection and preparation guidelines.

NPOS AS A BASIS FOR SERVICE-LEARNING

Many of the service-learning projects to date in the information sciences involve the development of custom software or a Web site for a NPO. Schahczenski (Schahczenski, 2002) makes a good case for the fact that NPOs are an excellent source for service-learning projects in the information sciences. The paper illustrates how faculty and students at the University of Montana have effectively partnered with regional NPOs to complete service-learning projects. The projects have included Web databases for NPOs, membership databases for a local YMCA, a donations database for a local NPO, and a Web site for an NPO that publishes the voting records of legislators online. Similarly, a recent service-learning project at Trinity College (Ellis, 2007) involved students developing a disaster management system for managing disaster relief for an NPO. A recent project (Rosmaita, 2007) at Hamilton College focused on the development of a Web design course that incorporated service-learning. This was done by having students provide the professional service of reviewing the web sites of regional NPOs and recommending ways to improve the accessibility and usability of the sites. Similarly, an introductory computer science course at Wheaton College (MA) focused on the development of Web sites for regional NPOs (LeBlanc, 1999).

SERVICE-LEARNING IN SYSTEMS ANALYSIS AND DESIGN COURSES

Service-learning has also been integrated into systems analysis and design courses. For example, at Miami University (Ohio) a systems analysis and design course (Bishop-Clark, 2006) has focused on the development of Web-based educational software for a local elementary school. Similarly, Quinnipiac University has integrated service-learning into a systems analysis and design course (Saulnier, 2003). Projects have focused on developing custom applications to benefit the university such as campus housing assignment, scheduling, and e-commerce. In a related paper (Saulnier, 2005), an overview of the service-learning model at Quinnipiac University is defined and service-learning as a viable educational pedagogy is established. Various courses with a service-learning orientation at the undergraduate and graduate level in the information sciences are briefly described.

SERVICE-LEARNING IN SCHOOL DISTRICTS AND THE DIGITAL DIVIDE

School districts and the digital divide have also provided service-learning opportunities in the information sciences. For example, service-learning work done at Drake University focused on promoting the use of technology in the process of community engagement (Shulman, 2002). The focus of these projects has been on assessing "… the efficacy of service-learning interventions in the dissemina-

tion of information technology literacy beyond campus gates." The paper discusses a number of challenges related to service-learning in terms of students being able to cross the digital divide to teach basic computer literacy skills to senior citizens and youth. There are two service-learning courses at Saint Anselm College (Traynor, 2003). Students complete 20 hours of service as part of these courses. In the first course, computer applications, students teach senior citizens basic computer literacy skills. In turn, senior citizens interact with 3rd grade elementary school students via e-mail. In the second course, students may optionally participate in a service-learning project. Example projects for regional NPOs have included web sites, software evaluations and teaching basic computer skills. Franklin & Marshal College, a small liberal arts college (Adams, 2004), has a service-learning component in their introductory computer science class. Students spend 20 hours in a single semester teaching inmates at a local prison basic computer skills. Finally, a service-learning project at the University of South Florida focused on providing information technology (IT) support for school districts (Christensen, 2006).

SERVICE-LEARNING AND THE OPEN SOURCE MOVEMENT

Some efforts have focused on the use of the open source approach to software development (Feller, 2002) in service-learning projects. For example, a software engineering course at Ohio University (Liu, 2005) is focused on the development of a software process that can be used in one semester courses to develop custom open source software applications in a service-learning setting. Similar efforts on the use of open source software development have been taken at Trinity College (Ellis, 2007). The service-learning project documented in this effort involved the development of an open source disaster management system.

SERVICE-LEARNING IN THE FORM OF CAPSTONE COURSES

In some cases, service-learning has been implemented as part of a culminating or capstone course experience. For example, Mansfield University of Pennsylvania offers a two-course sequence in computer science as a capstone experience that allows students to engage in service-learning (Tan, 2005). Service-learning projects have included an employee tracking system and inventory control system for regional companies, a student accountability system for the University Provost Office, an ordering system for a local

company, a human resource Intranet for a regional bank, and a nursing home care plan system for a nursing home. Similarly, faculty at Grand Valley State University outlined a capstone project in Information Systems focused on community-based projects (Leidig, 2006). The information technology major at Washington & Jefferson College requires a service-learning capstone course (Hannon, 2006). To date, the service-learning projects at this school have focused on the youth in the area through a local community arts and cultural center. Projects have included training in the digital arts as well as Web design, global positioning systems, etc.

THE IMPACT OF SERVICE-LEARNING ON FACULTY

Much of the service-learning literature in the information sciences focuses on organizational models, student outcomes, and specific projects. However, Luther College has also identified the positive impact of service-learning on faculty (Jensen, 2007). The specific faculty benefits attributed to service-learning are "refreshment and development of technical skills, opportunities to learn and practice skills in new areas and enrichment of teaching practices." These lessons were based on a service-learning project focused on teaching basic computer skills to teachers and students in a secondary school in Tanzania.

SERVICE-LEARNING IN THE INFORMATION SCIENCES AT MESSIAH COLLEGE

The author and others at Messiah College have been actively involved in service-learning projects in the information sciences for the past several years. The Appendix of this paper summarizes the wide range of service-learning projects done in the information sciences at Messiah College. In addition, the author participated in a multi-year task force funded by the Lilly Foundation involving an interdisciplinary team of faculty focused on the definition of a service-learning taxonomy. This project was informative regarding the essence of service-learning as practiced in disciplines other than the information sciences. Collectively, these service-learning project experiences, as well as the interdisciplinary service-learning task force, provide the basis for the information sciences service-learning taxonomy defined herein.

SUMMARY

While the recent activity in service-learning in the information sciences discipline is encouraging, it is still substantially disproportionate to such projects in fields outside

of information sciences. Furthermore, no known service-learning taxonomy exists for the information sciences that outlines the breadth and depth of service-learning opportunities available to the discipline. Such a taxonomy is introduced later in this paper. The review of related work done herein proved invaluable in the creation of the service-learning taxonomy defined in this paper. Consequently, each of the various projects identified in the literature can be positioned in the taxonomy.

WHAT IS SERVICE-LEARNING IN THE INFORMATION SCIENCES?

At Messiah College, "service-learning is a pedagogical model which intentionally integrates academic learning with community service in a credit bearing academic course. Students participate in an *authentic service* activity which *meets needs identified by the community* (designed within the framework of a mutually beneficial relationship) and *critically reflect* on that activity. Thus, students gain a *deep understanding of course content,* a commitment to *socially responsible citizenship,* and develop skills and understandings needed to contribute to civic well-being." (*italics* added) (Messiah, 2007)

The critical elements of service-learning are content, service and reflection (Messiah, 2007). In the context of the information sciences, content can be focused on readings, visuals and class discussion that specifically relate service to the course objectives. A reading example could include excerpts from Bryant Myers' book, *Walking with the Poor* (Myers, 1999) or the book *A Shared Future* (Garred, 2006). Visuals could include video, photographs or experiences that offer the students an opportunity to learn more about the communities they will serve and how their work can potentially impact the communities. Class discussion is used to amplify the relevance of service to the course in discipline-specific ways. The author's experience is that service in the information sciences should be oriented toward specific projects that address significant information technology needs of NPOs. Such needs cover a wide range of activities spanning the development of information systems to the installation of a computer network (see Appendix). The range of service opportunities in the information sciences is discussed further later in this paper. The author's experience is that reflection in the information sciences should focus on guided journaling done by the students on topics that relate the student's service experience to Christian vocation, their personal faith journey, community outreach, and responsible stewardship with the resources which God has entrusted to them. Samples of

student reflections appear later in this paper.

The author's experience points to several key student benefits of service-learning in the information sciences. Student-reflection journals confirmed the significant benefits that service-learning offered them. A summary of the key student benefits follow:

- *Applied experience:* Many students in the information sciences long to engage in the process of solving practical problems with information technology (IT). Service-learning experiences allow students to practice problem solving with an actual customer and organization. Such experiences also provide students the chance to apply the technology they have learned about in theory but have not had the chance to apply in practice.

- *Ethics:* Service-learning experiences also allow students to address ethical issues such as software licensing, pricing and vendor claims of product functionality and performance. In addition, such experiences offer the opportunity for students to practice clear and honest communication with a customer.

- *Professionalism:* Students performing service-learning projects get to practice professionalism in the form of meeting planning, presentation development, project deadlines, and trade-off analysis.

- *Teams:* Students are given the opportunity to work in teams as they perform service-learning projects. This is a critical skill that students must develop as they transition from college into the workplace.

- *Project management:* Service-learning projects allow students to practice and develop project-management skills related to project planning, estimation, and scheduling as well as communication and coordination. In general, such projects allow for the development of key interpersonal skills students will need to succeed in the workplace.

- *Diversity:* Students often get to experience and see diversity as they work with NPOs. Diversity occurs as students interact with people who are different from themselves in terms of socio-economic status, race, ethnicity, and location around the world.

- *Adversity:* Students can also come to appreciate the adversity that comes with being poor, disabled, or uneducated as they work with the NPOs that minister to people from such groups.

- *Vocational exploration:* Service-learning projects offer students the opportunity to explore their vocation, both in terms of the different types of organizations and the func-

tional roles they would like to play within an organization.

- *Culminating experience:* Students often look at service-learning projects as the culminating or capstone project of their educational experience. These projects are often referenced to employers and others as a "rite of passage" into the workplace.

The author's experience indicates that NPOs also benefit from service-learning in the information sciences. Such projects improve the overall efficiency, effectiveness and value of NPOs. These projects lead to improved marketing, fund raising, communications, service quality, and increased capacity.

A BIBLICAL BASIS FOR SERVICE-LEARNING IN THE INFORMATION SCIENCES

It is important for students in the information sciences to understand the biblical emphasis on service as it relates to their discipline. From the author's experience, many students in the information sciences have the distinct impression that service happens in other disciplines, not in the information sciences. Some students have decided against entering the information sciences discipline, even though they were gifted in that area, because they felt that serving God was more readily done through a major outside of the information sciences. A proper biblical view of service via the information sciences can have a transformative impact on faculty and students as they begin to see their technology skills as part of God's provision to serve him.

A review of the existing literature reveals that a limited amount of work has been published on a biblical basis for service-learning. The literature that does exist in this area tends to focus on the importance of service-learning in the fulfillment of the mission of christian higher education. For example, the book by Heffner and Beversluis (Heffner, 2002) offers an interdisciplinary view of how service-learning is used to enhance the curriculum and connect with the community at Calvin College. The paper by Schaffer (Schaffer, 2004) seeks to make the connection between and the importance of service-learning in the fulfillment of the mission of Christian colleges and universities. This paper also presents data that suggests "Christian colleges and universities should implement service-learning as a means of furthering their faith-based mission through curriculum." While such writings are useful, they offer little biblical scripture to support and motivate the significance of service-learning.

In limited instances, papers have been written that offer a biblical basis for service-learning with respect to specific disciplines. For example, a biblical basis for service-learning is offered in the papers written by Green and others (Green,

2004a and Green, 2004b) for the field of engineering. Similarly, the work of Fowler, Neill, and Stovall (Fowler, 2006) provides a biblical basis for service-learning for the field of accounting.

The literature review revealed that existing scholarship in the area of service-learning focuses on the importance of service-learning in fulfilling the mission of a Christian college or university. In some limited cases, a biblical basis for service-learning has been offered for select disciplines. To date, however, a biblical basis for service-learning has not been established for the information sciences discipline. That is the purpose of this section of the paper.

A biblical basis for service-learning and service in the information sciences follows. In particular, God calls us to:

- *Minister globally to those in need:* God calls us to minister globally to those in need, whether they are around the corner or around the world. Isaiah 58:10 (NIV) states that "if you spend yourselves in behalf of the hungry and satisfy the needs of the oppressed, then your light will rise in the darkness, and your night will become like the noonday." Matthew 25:34-40 also calls us to minister to the physically and spiritually hungry, thirsty, lonely, unclothed, imprisoned and sick. Scripture says that "… whatever you did for one of the least of these brothers of mine, you did for me." Matthew 25:40 (NIV). Scripture also implores us to remember the poor (Galatians 2:10) and to carry each other's burdens (Galatians 6:2, James 1:27). Service-learning projects with NPOs in the information sciences provide an excellent opportunity for students to directly minister to those in need. In addition, projects in the information sciences indirectly contribute to those in need as such projects often lead to improved administrative efficiencies, improved organizational capacity, and improved fund-raising capabilities. This is strategic, as many NPOs spend a disproportional amount of time on administrative matters when they could be ministering to those in need. For example, World Vision International has found that 50% of frontline staff time is devoted to satisfying administrative requirements (World Vision, 2007). Thus, by developing information systems for NPOs, staff personnel are freed up to further minister to their constituents.

- *Focus on the eternal:* Degrees in the information sciences are among the most lucrative of all college degrees (Ellis, 2006). Students in such disciplines need to take heed to scripture that encourages us to focus on the eternal and not to "… store up for yourselves treasures on earth, where moth and rust destroy, and where

thieves break in and steal." Matthew 6:19 (NIV). Scripture instructs us that "… where your treasure is, there your heart will be also." Matthew 6:21 (NIV). An eternal focus means that we should "… become all things to all men so that by all possible means I might save some." 1 Corinthians 9:22 (NIV). 1 Timothy 6:18 (NIV) also commands the Christian to "… do good, to be rich in good deeds, and to be generous and willing to share." By doing so, we "… will lay up treasures for [our]selves …" 1 Timothy 6:19 (NIV). Service-learning projects in the information sciences offer students the unique opportunity to experience using their gifts for a purpose beyond themselves and to explore the issues related to the stewardship of their talents as it relates to eternity.

- *Work diligently and show love as unto the Lord:* God calls us to present ourselves as approved workers (2 Timothy 2:15). I Peter 4:10 (NIV) states that "Each one should use whatever gift he has received to serve others, faithfully administering God's grace in its various forms." Similarly, Romans 12:3-8 instructs us to serve him with our talents. Ephesians 4:28 (NIV) says that we are to do something useful with our own hands "… that we may have something to share with those in need." God calls us to use our gifts as an act of service to the Lord and to "share with God's people who are in need …" Romans 12:13 (NIV). In Matthew 22:36-40, God calls us to love our neighbors as ourselves. Colossians 3:23-24 (NIV) instructs us that "Whatever you do, work at it with all your heart, as working for the Lord, not for men, since you know that you will receive an inheritance from the Lord as a reward. It is the Lord Christ you are serving." Note that the previous verse says that we are to work "for the Lord, not for men." This verse is saying that every job is sacred in God's economy. This perspective is consistent with Luther's view on the role of vocation (Kleinhans, 2005) whereby "all work is God's work." Finally, Acts 20:35 (NIV) states that "our hard work … must help the weak, remembering the word of the Lord Jesus himself: 'It is more blessed to give than to receive.'" Students in the information sciences should be encouraged to work diligently and share their gifts with those in need as if doing so for the Lord.

- *Serve as an act of obedience:* Once students are exposed to the biblical call to minister globally to those in need, to focus on the eternal, to work diligently and to show love as unto the Lord, they should be encouraged to see service to others as an act of obedience to God. As Christians, James 1:22-25 calls us to be doers of the

word and not merely listeners. James 2:14-24 informs the Christian that faith and action go hand-in-hand. That is, as James 2:20 (NIV) says "… faith without deeds is useless." Students in the information sciences should be encouraged to see service as a proper response to what God has done for them and as an act of obedience and love to Jesus Christ.

A biblical view of service-learning should serve to motivate educators and students in their desire to serve God through their discipline. It should also inform students as they write their journal reflections on service in the information sciences as part of their service-learning experience.

A SERVICE-LEARNING TAXONOMY FOR THE INFORMATION SCIENCES

Having established a biblical basis for service-learning in the information sciences, a framework for service-learning in the context of the information sciences is needed. Many disciplines in the academy have embraced service-learning for some time (Droge, 1996 and Heffner, 2002). Several generic frameworks have been developed to help inform the academy about the forms of service-learning. For example, Musil developed a service-learning taxonomy and maturity model around levels of engagement and authenticity (Musil, 2003). As discussed earlier in this paper, service-learning in the information sciences is beginning to emerge. However, service-learning projects in the information sciences are still in their infancy and are still substantially disproportionate to such projects in fields outside of information sciences. Furthermore, no known service-learning taxonomy exists for the information sciences.

The service-learning taxonomy for the information sciences discipline defined in this paper should serve to inform those in the discipline about the range of opportunities available to engage in service-learning. This is an important contribution in a discipline where such a taxonomy has yet to emerge and relatively little service-learning engagement occurs. A service-learning taxonomy that delineates opportunities for service in the information sciences will serve to broaden the scope of service within the discipline as faculty and students become more aware of the vast array of possibilities for service-learning.

The information sciences service-learning taxonomy defined herein is based on actual service-learning experiences (see Appendix) performed in the information sciences discipline at Messiah College. The taxonomy itself is a two-dimensional space. The first dimension of the taxonomy is the activity type. An activity type defines a functional unit

work to be performed in the context of a service-learning engagement. Examples of activity types include training, professional services, and custom software development.

Table 1 follows and defines the activity types for service-learning in the information sciences. For each activity type, the table:

- defines the focus or nature of the activity type,
- outlines the level of engagement typically required on the part of faculty-student teams to perform this activity type,
- describes the key skills required to perform the activity type,
- provides an example of the activity type.

The second dimension of the taxonomy is scope. Scope defines the span of tasks completed in the context of a service-learning engagement. Examples of scope include research,

analysis, design, implementation, test, transition, and assessment. Table 2 defines the scope for service-learning.

Structurally, the service-learning taxonomy forms a matrix where the rows of the matrix are the activity types, the columns of the matrix define the range of scope and a specific service-learning engagement is placed in one or more cells of the matrix. Table 3 follows and depicts the full information sciences service-learning taxonomy. It has been populated with representative projects completed at Messiah College over the past several years. A project will span one or more columns depending on the scope of the project. For example, the "MS-Office for Area NPOs" training project involved designing, implementing, testing, and transitioning the training. Therefore, the entry for the project in the matrix spans the design, implement, test, and transition activities. The specific projects named and characterized in Table 3 are further described in the Appendix of this paper.

Table 1: Information Sciences Service-Learning Activity Types				
Activity Type	**Focus**	**Engagement Level**	**Key Skills**	**Example**
Training	Focuses on imparting knowledge or skill needed by the staff of NPO(s).	Low	Subject matter expertise (SME), training development	Microsoft Office training for NPOs
Professional Services	Focuses on providing expert advice on information sciences issues facing an NPO.	Medium	Problem solving, SME	Strategic IT Advisory Board for a NPO
Systems Selection	Focuses on defining the system needs of an NPO, identifying candidate solutions, evaluating identified solutions, recommending a solution, and transitioning the solution to an NPO.	High	Problem solving, consulting, product research and evaluation, product installation.	System analysis, selection, and installation of donor mgt. system for an NPO
Support/Help Desk	Focuses on providing customer support related to an application or system for NPO(s).	Medium	SME, listening, trouble-shooting.	Providing support for local area network for NPOs
Custom Development Projects	Focuses on the full life cycle development of a custom application for an NPO.	High	Software development, project management	Integration of bar code system with asset mgt. system
Product Development Projects	Focuses on the full life cycle development of a product application that is common to several NPO(s).	High	Software development, project and product management	Impact Assessment portal for NPOs

Table 2: Information Sciences Service-Learning Scope	
Scope	**Description**
Research	Spans the tasks of problem identification and concept definition.
Analysis	Spans the tasks of requirements discovery, documentation, and validation of a business process or system.
Design	Spans the tasks of architecture, database design, user interface design, communications design, workflow design, and report design.
Implementation	Spans the tasks of detailed design and implementation of a system.
Test	Spans the tasks of integration, system, and user acceptance test of a system.
Transition	Spans the tasks of installing a system and migrating from the old system to the new system.
Assessment	Spans the tasks of performance, usability, efficiency, effectiveness, and value/impact assessment of a system.

Table 3: Information Sciences Service-Learning Taxonomy with Sample Projects

Scope / Activity Type	Research	Analysis	Design	Implement	Test	Transition	Assessment
Training			MS-Office Training for Area NPOs				
Professional Services			Install LAN for CAPC				
Systems Selection		Research/Select Mgt. Information System for CAPC					
		Donor & Member Management System for MC					
Support/Help Desk							
Custom Development Projects	World Vision LEAP Impact Assessment Application						
	CURE Intl. Inventory Barcode System						
	Upper Allen Fire Dept. Purchase Order System						
	MC Summer Basketball Camp MIS						
Product Development Projects	Explore Impact Assessment Product						

STUDENT REFLECTIONS ON THE SIGNIFICANCE OF SERVICE-LEARNING IN THE INFORMATION SCIENCES

Perhaps the significance of service-learning in the information sciences can best be summarized by reading sample reflections from student journals from the World Vision LEAP project. One student wrote, "It still boggles me to think that I could participate in mission and humanitarian work by doing something I like to do: writing computer software." Another student wrote, "So not only is this a project I had fun working on, it's something that will be useful for spreading Christian love. This has really been an eye-opener to me, since I always had a hard time trying to reconcile my calling as a Christian with my passion for computer programming." The student continued, "… I realize more as time goes on that the experience has helped me mature in a profound way."

Some of the student reflections are deeply personal and demonstrate the spiritual impact of service-learning on students. One student wrote, "Sharing my time and energy on this project has really been about sharing my heart and soul with the poor in Africa and around the world. When I look at it from that perspective, it becomes one of the most important things I have ever been involved in." Still another student wrote, "This project is not just a graded assignment or a critical thinking exercise or a piece of software to add to someone's bottom line. It is an expression of love; of the love I share with Christ for those who have been abandoned by this world. I feel that God has called each and every one of us, computer scientists [alike], to use our skills and talents in creative ways as conduits for his love on this broken earth."

CONCLUSIONS AND FUTURE DIRECTIONS

The information sciences discipline affords numerous and unique opportunities for students to apply their gifts, skills and knowledge via service-learning. Although the application of service-learning is emerging within the information sciences discipline, the taxonomy defined in this paper serves as a helpful tool to encourage faculty to broaden the scope of service-learning within the discipline. It outlines the types of activities that can be pursued as service-learning such as training, professional services, systems selection, support/help desk, custom development projects, and product development projects. Furthermore, it outlines the scope of tasks that can be completed: research, analysis, design, implementation, test, transition, and assessment.

There are a number of important future directions for this work. First, the information sciences community would be well-served by a published collection of recent papers that document specific service-learning projects across the defined taxonomy. Secondly, it would be useful to develop specific models for promoting the practice of service-learning across local and global NPOs. This would include soliciting projects, assessing their feasibility, performing such projects and transitioning the results of such projects to organizations. Thirdly, more research needs to be done on the best way to develop products that serve the needs of multiple organizations in a service-learning setting. Such products offer enormous potential leverage as they may be useful to many organizations. In addition, more research needs to be done on models for the sustainability of projects and products developed in a service-learning context. Finally, research needs to be done on how to best measure the impact of service-learning in the information sciences on both the students and the organizations they serve.

ENDNOTES

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APPENDIX I
Case Study Applications of Service-Learning Taxonomy

Table 3 serves the dual purpose of depicting the overall service-learning taxonomy and listing sample service-learning projects completed by Messiah College faculty and students. This Appendix briefly describes each of the projects listed in Table 3.

- MS-Office Training for Area NPOs: This semi-annual event offers the staff of Central Pennsylvania NPOs the opportunity to receive training on Microsoft Office™. This project happens in BIS 230 (Computer Applications) under the direction of a faculty member. Students, however, design and deliver the training, and NPO participants complete a feedback questionnaire at the end of the training.

- Install LAN for CAPC: This project involved a student-faculty team performing the professional service of designing, implementing, and testing a local area network (LAN) for the Capital Area Pregnancy Center (CAPC) (www.capchelp.org). The team also transitioned the LAN to CAPC personnel so they could administer the LAN.

- Research/Select Management Information System for CAPC: This project occurred in the 2006 spring semester of BIS 412 (Systems Analysis & Design Applications), the BIS major capstone course. CAPC had a need for a Web-based distributed scheduling system to replace their manual scheduling method. The students formed a team under the direction of a faculty member and managed the complete life cycle spanning research through to testing and transitioning the application to CAPC staff. After extensive research and evaluation, the team selected the eKyros (www.ekyros.com) application, a Web-based pregnancy center management information system that included functionality far beyond distributed scheduling (client management, donor management, reporting, etc). The students also raised $2,000 so that CAPC could purchase the software. CAPC is fully operational with eKyros. The project is chronicled at http://joshuaeverhart.com/bis412/. Students completed reflection papers that demonstrated the significant impact the project had on them.

- Donor and Member Management System for Messiah College Collaboratory: The Messiah College Collaboratory for Strategic Partnerships and Applied Research had a need for a management information system to manage donors, volunteers, and members. This project was done in the 2007 spring semester of BIS 412. The students formed a team under the direction of a faculty member and managed the complete life cycle spanning research through to testing and transitioning the application to Collaboratory staff. After extensive research and evaluation, the team selected the CiviCRM open source application (www.civicrm.org), a Web-based constituent relationship management system designed specifically for NPOs. The project is chronicled at http://colloaboratory.messiah.edu/wiki/index.php/BIS-412.

- World Vision LEAP Impact Assessment Application: World Vision International (www.wvi.org) is the world's largest Christian relief and humanitarian organization with over 25,000 employees in 100+ countries. They had a need for a Web-based application for planning, designing, monitoring, and tracking the impact of field ministry activities based on their formalized approach to field ministry known as LEAP (Learning through Evaluation with Accountability and Planning). World Vision provided a grant to Messiah College for faculty and students to develop a prototype system to support the LEAP framework. This project has been ongoing since 2005 in CSC 333 (Database Applications) under the direction of a faculty member, where students form teams and research and develop new features of the LEAP system every year. In addition, the World Vision grant provides funding for faculty and work-study student stipends so that work can continue on the project during the summer months. The funding also provides support for travel to Africa and for the purchase of related computer equipment. The project is chronicled at www.leapmanager.org.

- CURE International Inventory Barcode System: CURE International (www.curenetcomm.org) is a Christian organization that provides medical equipment and related services to needy areas of the world. The organization had a database of all of its medical equipment but lacked the ability to track the equipment as it traveled throughout the world. In the 2004 spring semester of CSC 333, a four-person student team under the direction of a faculty member, researched, designed, implemented, tested, and transitioned the integration of a barcode tracking system from Symbol Technologies into the CURE International medical equipment database.

The project is chronicled at http://home.messiah.edu/~bnejmeh/CSC33304/cure/DbApps/index.htm.

• Upper Allen Fire Department Purchase Order System: A local volunteer fire department desired a purchase order system to better manage and track purchase orders. In the 2003 spring semester of CSC 333, a student-led team under the direction of a faculty member developed a Microsoft Access-based purchase order system custom application. This system has been utilized by the Upper Allen, Pa., Volunteer Fire Department since 2003. The project is chronicled at www.home.messiah.edu/~bnejmeh/csc333b/bb1176/.

• Messiah College Summer Basketball Camp MIS: Messiah College runs a significant summer basketball camp program for several hundred young people. The director of the camp desired a system to manage the complete camp from registration through to team assignment and bank account management. In the 2003 Spring semester of CSC333, a student-led team under the direction of a faculty member developed a Microsoft Access-based basketball camp management system. The system has been in use by the camp since 2003. The project is chronicled at www.home.messiah.edu/~bnejmeh/csc333a/nr1157/index.html.

• Explore Impact Assessment Product: Several non-government organizations (NGOs) have expressed interest in a Web-based field ministry impact assessment system similar to the World Vision LEAP system described above. A team of faculty and students are beginning to research and explore how the existing LEAP system could be generalized into a product so that multiple NPOs could use the same software.