KNOWLEDGE SHARING FOR COMMUNITY DEVELOPMENT: EDUCATIONAL BENEFITS AT THE COMMUNITY LEVEL THROUGH NETWORKS OF KNOWLEDGE FLOW AND COMMUNITIES OF PRACTICE

By

Emily Lample

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Professor Kimberly D. Bess

Professor James Fraser

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CD	Community Development
FUNDAEC	Fundación para la Aplicación y Enseñanza de las Ciencias
KS	Knowledge Sharing
PSA	Preparation for Social Action
SAT	Sistema de Aprendizaje Tutorial

CHAPTER I

INTRODUCTION

In recent decades, knowledge has received greater attention as an important part of development work, particularly at national and international levels (McGrath & King, 2004; Powell, 2006; World Bank, 1999). This has taken the form of increased consideration for information flow and learning, particularly between development organizations. As Powell (2006) points out, knowledge is central to development work because the development enterprise, rather than a mere provision of services, seeks positive change that results from things being done differently. Criticisms of the role of knowledge in development challenge tendencies for knowledge flow to be conceived of as a uni-directional transfer from wealthier nations and their development agencies to poorer nations (Chambers, 1997; McFarlane, 2006; McGrath & King, 2004; Mehta, 2001), for local/indigenous knowledge to be mischaracterized and disregarded (Agrawal, 1995; Chambers, 1997; Sillitoe, 2007), and for the nature of knowledge itself to be misrepresented as objective, universal, and unproblematic (McFarlane, 2006; Mehta, 2001). Several authors recommend increased communication between various sources of knowledge as a means to strengthen knowledge use in development (Leach & Scoones, 2006; Mato, 2004; Wilson, 2007).

While these discussions considered the role of knowledge in development at the national and international levels, less attention has been paid to the roles of knowledge and knowledge flow at the community level of development. Knowledge flow at the community level has been examined in the context of diffusion of innovation, but with a focus on

innovation at the expense of value afforded to local knowledge and practices (Rogers, 2003). The role of education, which is crucial in the spread of knowledge in a community, has been similarly under-appreciated. The present study intends to make a contribution towards this end by addressing issues of educational knowledge flow in the context of community development.

This study explores how education can encourage a flow of knowledge between students and community members that supports development at the community level. Drawing from the distinct theoretical lenses of network theory and Lave and Wenger's (1991) notion of communities of practice, it examines the case of a particular educational program, the Preparation for Social Action program (PSA) in Córdoba, Colombia, and investigates how the knowledge-sharing practices emerging from the program contribute to community development. Findings suggest that students draw what they learn in the program into their existing networks of communication, but also extend knowledge sharing beyond those networks through acts of service and research into local practices. As these knowledge exchanges intersect with existing communities of practice, where knowledge flow is denser and more closely connected to practice, they begin to shape the practice at a group, rather than individual, level.

CHAPTER II

REVIEW OF THE LITERATURE

Education for Community Development: The Benefits of Knowledge Sharing

Although education is considered to inherently benefit communities, explicit discussion of pathways for its benefits to community is less common in empirical research. Miller (1995) outlines three ways in which schools can contribute to community development: First, schools can serve as centers for community activity by housing facilities and hosting services for community benefit. Second, schools can promote the entrepreneurial development of students through projects to address identified local needs. These projects can sometimes give way to ongoing businesses. Third, schools can draw curricular content from the community setting, having students generate knowledge about their communities.

The three means for schools to affect community development identified by Miller resonate with larger trends in educational practice. The second and third options, in particular, connect to recommendations for service learning and youth civic engagement (Camino & Zeldin, 2002; Checkoway & Gutierrez, 2006; Stanton, Giles, & Cruz, 1999), place-based learning (Grunewald, 2003; Sobel, 2004), and social entrepreneurial education (Tracey & Phillips, 2007). While research in these areas, particularly civic engagement research, has identified many benefits of these sorts of educational approaches at the individual level, in terms of academic performance (Markus, Howard, & King, 1993; Ruiz-Mallén, Barraza, Bodenhorn, & Reyes-García, 2009; Shumer, 1994), identity development

(Yates & Youniss, 1998), personal awareness and sense of agency (Giles & Eyler, 1994; Hansen, Larson & Dworkin, 2003; Reinders & Youniss, 1998; Youniss, McLellan, & Yates, 1997), and sense of social responsibility and community belonging (Evans, 2007; McGuire & Gamble, 2006), there has been little consideration for benefits at the community level, beyond pro-social changes in individual students. This study takes up this issue by exploring potential benefits to the community of exchanges that take place between students and other community members on the basis of what they are learning—as students both investigate local practices and share what they learn in school with others.

Certain literature suggests that important knowledge-sharing may already take place in communities and can commonly be overlooked. Janzen (2008), for example, conducted an ethnographic study of the knowledge-sharing practices of a women's group in Uganda, finding that valuable sharing of knowledge takes place beyond what is captured by the focus of international development on women's education. While the women benefited from workshops organized by NGOs, they also experienced meaningful learning from exchanges with one another and with others in the community, from guest speakers at their meetings, workshops they organized themselves, and from observing others. Janzen suggested that the work of external organizations might have unintentional consequences in limiting the types and sources of knowledge that the women end up valuing.

Harris and Umpleby (2007) are two of a very limited number of researchers who have looked at exchanges between students and community members in terms of bidirectional knowledge flow. Through ethnographic studies of an elementary school and a high school in British Columbia, the authors identified a number of benefits of projects promoting knowledge exchanges between students and community members. Students enhanced their

appreciation of their own social, cultural, and geographic context and in some case developed a sense of their own ability to affect change. The participation of community members suggested the value they place on the involvement of young people in community affairs. According to Harris and Umpleby, these changes in community involvement might "begin a process of learning to stay" for students in the rural community rather than learning to leave (2008, p. 78).

The research of Janzen (2008) and Harris and Umpleby (2007) suggests the potential value of knowledge exchanges between students and other community members in benefiting the community. Further exploration of how knowledge sharing can contribute to community is warranted given the tendency in educational and youth development literature to focus on individual-level benefits to increased youth participation in the community. This study will undertake an initial investigation to examine the knowledge flow emerging from an educational program and examine how that flow benefits the community. In doing so, it will conceptualize the potential benefits of knowledge sharing from two distinct theoretical frameworks: from network theory and from Lave and Wenger's (1991) notion of communities of practice. From the former perspective, knowledge sharing can be understood as the mobilization of resources embedded in the network. From the latter point of view, knowledge sharing can be seen as contributing to the progress of communities of practices. These perspectives are discussed in greater depth in the next two sections.

Knowledge Sharing as Mobilizing Network Resources

The network theory perspective of knowledge flow rests on the notion of social capital. Social capital as a concept draws attention to the way that social relationships,

through individual ties or membership in a group, can be useful to an individual in providing access to means that facilitate the achievement of certain ends (Bourdieu, 1986; Coleman, 1988; Lin, 2001). Such utility can be found in access to material resources embedded in the network, such as a pickup truck, but also in access to information distributed across one's social network. The perspective of social capital as informational resources embedded in one's social network was most famously articulated in Grannovetter's (1973) argument that novel information, rather than being uniformly or randomly distributed across a person's network of contacts, tends to reside most frequently with acquaintances rather than close friends and family. This is because close friends, or strong ties, usually know one another well and often therefore have access to the same information, while weak ties act as the bridges over which innovative ideas and practices may cross to reach different groups of tightly-knit actors (Grannovetter, 1983).

Building on Grannovetter's argument, Burt (2004) suggested that access to information through weak ties translates into a greater likelihood of good ideas. He argued that those individuals connected via weak ties across tightly knit groups have more familiarity with diverse ways of thinking and behaving, and as such, have greater access to a variety of options from which they can choose and synthesize. In this way, Burt argues, the position of broker between groups is in itself a form of social capital. Brokerage can range from a simple awareness of interests and difficulties in another group to the transferal of best practices to the synthesis of knowledge and experience from the two groups toward the creation of something new.

Regarding the role of tie strength in knowledge sharing, organizational literature has a number of pertinent studies that add complexity to Grannovetter's initial argument. Several

studies suggest that knowledge may travel faster across weak ties when the knowledge is not complex—possibly because less time needs to be invested in the maintenance of social relations—but that strong ties facilitate the transfer of complex knowledge because those ties have a greater motivation to be of assistance, they give greater feedback by allowing for two-way conversation, and they respond to questions spread out over time (Hansen, 1999; Reagans & McEvily, 2003). The findings of Cross, Parker, Prusak, and Borgatti (2001) reiterate the importance of strong ties in knowledge sharing by identifying four features that distinguish effective knowledge-sharing relationships from ineffective ones: (1) the recipient has a good understanding of what the source knows and can thus gage when to turn to them; (2) the recipient has timely access to the source; (3) the source is willing to listen and engage in problem solving with the recipient rather than merely dump information; and (4) there is a certain degree of safety in the relationship between the source and the recipient that allows for learning and creativity. Each of these factors is more characteristic of strong ties, and suggests the value of close relationships in exchanges of knowledge.

Grannovetter's theory and the subsequent arguments of Burt and several organizational studies scholars point to the value of knowledge sharing as providing individuals with access to new information and ideas through their connections to others. Knowledge from this perspective is a collection of tangible resources embedded in a network of individuals and accessed by them through their social relationships. This perspective on knowledge and knowledge-sharing, while useful in many respects, assumes a static view of knowledge and is therefore less adequate for capturing the changes to ideas and understanding that can result from interactions around knowledge. The network perspective also tends to view knowledge as separate from action, as ideas that inform action rather than

being shaped and constituted by action. These concerns are addressed by Lave and Wenger's notion of situated learning in communities of practice.

Knowledge Sharing as Advancing Communities of Practice

In *Situated Learning: Legitimate Peripheral Participation* (1991), Lave and Wenger introduced a foundational perspective that shifted notions of learning away from cognitive processes to processes of social practice. Their perspective offers two major contributions to thinking about knowledge flow: the view of knowing as embedded in social practice and the concept of communities of practice. Together these suggest a particular manner of knowledge sharing between communities of practice.

According to this view, knowledge is rooted in social practice. It is not a possession stored in the mind, but rather entails developed competence in enterprises considered valuable (Wenger, 1999). It requires active participation in the world. From this perspective, knowledge sharing consists of more than passing along bits of information, it includes sharing pertinent skills and strategies for doing something, as well as deeper concepts and values that shape how an activity is carried out.

Knowledge sharing viewed from the perspective articulated by Lave and Wenger does not occur evenly or randomly across a population. Individuals are members of several communities of practice, where they and others are mutually engaged in a joint enterprise, drawing on a shared repertoire of routines, tools, vocabulary, and symbols (Wenger, 1999). This notion of communities of practice, as described by Wenger, includes families who together form a habitual way of life, small groups of work colleagues with connected day-to-

day practice, various configurations of students that arise formally or informally in schools, and self-identified special interest groups.

Knowledge sharing occurs within these and other communities of practice as those on the periphery legitimately participate in the practice and learn, thereby advancing toward fuller (more central) participation (Lave & Wenger, 1991). What is learned in this way includes both codified and tacit knowledge. Knowledge sharing can also occur between communities of practice as ideas and ways of doing things within one community are shaped by another. Wenger (1999) suggests that knowledge sharing between communities of practice can transpire through two types of connections: *boundary objects* (artifacts, documents, terms, concepts, etc.) shared across communities and *brokering*, the connections provided by people who share elements of practice across communities. According to Wenger, when both types are used, the likelihood of bridging practices is greater. Knowledge sharing across the boundaries of communities of practice can take place through discrete moments of exchange or through ongoing overlapping practices.

The notions of learning and knowledge as fundamentally social in nature, introduced by Lave and Wenger, give rise to a particular perspective of knowledge sharing as connected to practice, as rooted in endeavors of communities of practice, and as occurring through boundary spanning across communities of practice. Geographic communities can be seen from this perspective as constellations of communities of practice, related by their geographic proximity and resulting interactions (Wenger, 1999). Community development, then, relates to the progress of a number of interconnected communities of practice and can result from knowledge sharing between these communities of practice. Lave and Wenger's notion of communities of practice holds a great deal of potential in explaining the benefits of

knowledge sharing to community. Yet, while arguably most individuals belong to at least one community of practice, not all exchanges can be considered as taking place within or between communities of practice. In certain interactions, information or ideas may be swapped that do not directly relate to one individual's practice in a given community, connecting instead to separate interests or curiosities of the individual. The network perspective mentioned above is useful for capturing these exchanges and drawing attention to how different types of interpersonal relationships can differentially affect the exchanges that take place.

This study, then, draws from the two theoretical frameworks of network theory and Lave and Wenger's (1991) notion of communities of practice, to examine the potential benefits of knowledge sharing to community development. In doing so, it builds from a perspective of knowledge as rooted in practice, consisting of more than mere ideas and information. It considers important knowledge exchanges to take place both between communities of practice and between individuals outside of the context of their membership in communities of practice. For the purposes of this study, the potential of knowledge sharing will be explored through an examination of the PSA program in Córdoba, Colombia. The next section introduces the program as a particularly apt case by which to investigate the nature and benefits of education-based knowledge sharing.

The Preparation for Social Action Program: Knowledge for Development

The Preparation for Social Action (PSA) program is an educational option at the secondary level intended to support students' academic learning with an orientation toward developing their capacity to contribute to the progress of their communities. Through

presentations that introduce the program to communities via community meetings, the program targets young individuals with at least a primary education who are interested in furthering their studies and working for the benefit of their communities. The PSA program draws content from traditional disciplines in the physical and social sciences, mathematics, and communication, and encourages students to connect what they learn to local knowledge and practices. Service to the community is the organizing concept of the program, as each text integrates and organizes the content around concepts and activities that help students develop their capacity to work for their own progress and for the progress of their communities. Participants in the program are referred to by the designation "promoters of community well-being." Learning in the program occurs as small groups of students meet regularly to study and discuss workbook-style textbooks with the guidance of a trained tutor, and then apply those ideas in activities in the community. Each group of students is in this way a community of practice, according to Wenger's description, that is engaged in a joint enterprise of study and application in the community, drawing on a shared repertoire of routines, tools, vocabulary and symbols.

Knowledge sharing is promoted in the PSA program through activities in the texts that require students to investigate topics through discussions with community members, and others that encourage them to share what they are learning with others. The following passage from a textbook unit called "Health and Disease" gives insight into the view of knowledge sharing advanced by the PSA program:

> In order to perform the acts of service you considered in the previous lesson, you will need to be constantly engaged in acquiring knowledge. That knowledge is crucial to successful community service is obvious. What you need to reflect on at this point, however, is how to go about acquiring the knowledge you need to carry out your work in the community. The textbooks you study with us constitute one important source of such knowledge, but there are other sources of knowledge that influence your work, say, the books you read or the radio programs to which you listen. One very significant source you cannot ignore is the knowledge

> that the members of the community have about their own lives and about the world around them. (Arbab, 2010, p. 11)

The PSA program places the importance of acquiring knowledge in the context of aims of serving the community, and promotes appreciation for different sources of knowledge, emphasizing in particular the value of the knowledge of local community members. Later in the lesson, the point is further explained with the following statement: "Your studies with us should enable you to use the power of modern science to accomplish the tasks that are before you as promoters of community well being. But at the same time you should be respectful of traditional knowledge as an important source of the kind of insights you need to carry out your work effectively" (ibid., p. 12). The value placed on both modern science, to which students are introduced in the textbooks and other sources, and local knowledge, implies the value of an interaction between knowledge from these sources. Such exchanges aim to move beyond a debate between opposing ideas by orienting the concern for knowledge with the underlying goal of promoting well-being in the community.

The PSA program was piloted in Córdoba, Colombia in 2006, and since then has spread to a number of countries around the world, including Bolivia, Costa Rica, Zambia, Uganda, Kenya, India, and Papua New Guinea. An initiative of the *Fundación para la Aplicación y Enseñanza de las Ciencias* (FUNDAEC, Foundation for the Application and Teaching of the Sciences), the PSA program is one of several efforts contributing to the organization's overall goals of finding a more appropriate role for science, technology, and education in development (Arbab, 2000). PSA grew out of another secondary education program of FUNDAEC known as the SAT (*Sistema de Aprendizaje Tutorial,* Tutorial Learning System) program, an accredited six-year secondary program that has operated in Colombia and other countries in Latin America for over three decades. PSA and SAT share

similar content and the same methodology, though PSA does not seek accreditation and currently organizes its content for a duration of two to three years.

The academic research carried out on the SAT and PSA programs thus far highlight the social benefits of the programs. Murphy-Graham's in-depth study of the SAT program in Honduras suggested that the program has an important impact on the empowerment of women in terms of their participation in public life (2007), their gender consciousness (2008; 2009), and their role in intimate relationships (2010). Murphy-Graham's work drew attention to the ways that the benefits of study in the program appear to extend into the quality of one's relations with others and participation in the community in general. Honeyman's (2010) mixed-method study comparing the SAT program in Honduras to a conventional rural secondary program identified quantitative and qualitative differences between SAT students and their peers in terms of students' sense of social responsibility. Specifically, her findings showed that SAT students placed greater importance on developing positive personal qualities, attached greater value on establishing positive relationships with others, demonstrated a stronger orientation toward aiding others, and tended to articulate more specific positive changes in their relationships with friends, family, and neighbors as a result of their educational experience.

VanderDussen's (2009) study of the PSA program explored implications of service in learning for social change through interviews with tutors and coordinators of the program in Uganda. Among her findings, VanderDussen concluded that knowledge sharing is necessary for service learning to contribute to social change; the types of these knowledge exchanges may range from informal awareness-raising conversations to focused involvement in formal

decision-making. VanderDussen emphasized the perceived value of the content learning for preparing students to serve the community through knowledge exchanges:

> While all members of the community are considered as having some form of knowledge to contribute, the research participants suggest that understanding relevant knowledge through the content of the PSA program – for example, in business or agriculture – both helps them to serve effectively and to be seen by others as able to help through further sharing of knowledge. (VanderDussen, 2009, p. 140)

The content of what students learn in the program, then, better equips them engage in knowledge exchanges that benefit the community.

The findings of these authors highlight the social benefits of the SAT and PSA programs—characteristics that draw attention to the program as a compelling subject for exploring in more depth the means by which education can benefit the larger community. VanderDussen's conclusions about the importance of knowledge exchanges in shaping the program's social benefits, in particular, highlight the value of exploring the program's knowledge-sharing practices as a means for exploring the potential of education-based knowledge exchanges to lead to community benefits.

CHAPTER III

RESEARCH QUESTIONS

This study uses the Preparation for Social Action program in Colombia as a case through which to explore the potential for educational programs to contribute to community development by promoting an increased flow of knowledge in the community. Specifically, the study examines the following questions:

(1) What types of knowledge exchanges beneficial to community development emerge from students' study in the PSA program?
    a. What knowledge content is being shared between students and community members?
    b. With whom, specifically, are students exchanging knowledge?
    c. Does the knowledge content shared vary by whom students are sharing with? If so, how?

(2) How do the knowledge exchanges translate into benefits for the community?
    a. Along network paths?
    b. Between communities of practice?

CHAPTER IV

METHODS

Setting

The PSA program was first piloted in three communities in the department (province) of Córdoba, situated along Colombia's Atlantic coast. Córdoba's total population nears 1.5 million inhabitants (DANE, 2007). Its economy centers on agriculture and livestock. In comparison with the rest of Colombia, Córdoba has a larger indigenous population, higher rates of poverty, and lower rates of education. According to the latest census, 10.4% of the population of Córdoba was indigenous, compared to 3.4% nationally (DANE, 2007). In 2000, 69.4% of the population lived below the poverty line, in contrast to 59.8% nationally (Anaya-Narváez, date unspecified). The average total number of schooling years for adults in Córdoba ages 15 and higher was 6.4 in 2000, slightly below the national average of 7.3 and well below the average in the capital, Bogotá, of 9.4. The illiteracy rate of 16.5% in 2000 was double the national average of 8% (ibid.).

In recent decades, many regions of Colombia have seen ebbs and flows in levels of social and political violence. The department of Córdoba has been no different, and has in recent years experienced a rise in violence (Welch, 2010). During my brief visit to the region, one town I visited was under curfew as a result of recent episodes of "social cleansing" via public murders of social deviants, and a municipality near the other town I visited overthrew the mayor in a violent public protest.

Participants

At the time that I first collected data for this study in 2009, the PSA program had been in Córdoba for nearly three years. The three pilot PSA groups were finishing up their final texts and preparing for a graduation ceremony scheduled to take place a month after my departure. By that time, the program had grown considerably; there were a total of 15 PSA groups with nearly 200 students in the program. Most of the non-pilot groups had started roughly six months before my arrival, after a second wave of tutor training. For the purposes of this study, I chose to focus on the three pilot groups, with the idea that, being further along, they had greater experiences in talking to community members about what they were learning. While these groups started with 10-12 students in 2006, by the time of study, they ranged in size from 5 to 10 students. In interviews, students and tutors explained that several students had moved out of the region, over the course of three years, and others had found it difficult to balance their studies with other responsibilities. One student who participated in the study moved between localities in the region and was able to simply change PSA groups. Of the 21 total students in these three groups at the time of the study, 20 were able to participate in the research. For comparison, two newly formed groups, in two of these same three communities, were also invited to participate in the study. Through conversations with one of the groups during a class meeting, however, it was determined that participation would not make sense given that students collectively reported not yet having participated in knowledge sharing regarding the content of the program. From the other group, 6 of the 8 students who consistently attend were able to participate in the study.

The three communities where these groups are found differ in terms of ethnic make up, size and corresponding characteristics of infrastructure and educational opportunities.

The chart below describes each of the four PSA groups participating in the study in terms of the host community, its characteristics, and the proportion of students who participated in the study with network data and then follow up interviews. Each of the communities has been given a pseudonym. The two smaller communities, Lochi and El Alto, were located in a part of Cordoba home to individuals primarily of indigenous descent, while in the larger community, Tortuga, inhabitants were mostly of mixed indigenous, African, and European descent. As such, PSA students in the Lochi and El Alto were all of indigenous descent, while in Tortuga only one student was indigenous—a young man who moved from El Alto to Tortuga when he married.

Table 1. Participant Communities and Students

Community (Level of Group's Progress)	Characteristics of the Community	Proportion of PSA Students Participating in the Study	Gender Breakdown/ Age Range/	Number Interviews
Tortuga (nearly complete)	Pop: 20,000 inhabitants - Some paved roads, electricity, running water - Several educational options for primary and secondary school, plus a school of higher education	6/6	2 females, 4 males, from 17-48 years old	6
Lochi (nearly complete)	Pop: 4,000 inhabitants - Some paved roads, electricity, no running water - Primary schools and one secondary school	9/10	6 females, 3 males, from 18-28 years old	5
El Alto (nearly complete)	Pop: 250 inhabitants - Unpaved roads cannot be traveled after heavy rain, electricity, no running water - One primary school	5/5	4 females, 1 male, from 18-27 years old	4
El Alto (beginner)	Same as above	6/8	2 females, 4 males, from 12-16 years old	6
Totals		**26/29**	**14F, 12M**	**21**

Data Collection

Data collection in these communities combine social network data generated by students, interviews with students and tutors of the groups, two focus group discussions with students of the newest group and their tutor, interviews with community members, and participant observations of class sessions and knowledge-sharing activities. Drawing from Wicker's (1989) notion of "substantive theorizing" as a research approach, this study combines multiple methods to gain intimate familiarity with a particular process—that of

knowledge-sharing—and examine in its natural context. In contrast to a positivistic drive toward research products, substantive theorizing allows for openness, tentativeness in findings, and reorientation on the basis of critical reflection.

Network data was collected through an in-class activity with each PSA group, with the idea that inquiring about students' experiences of knowledge sharing through multiple methods would lend itself to better recall on the part of students and richer data in general. Inspired by Schiffer's (2007) "power mapping tool," I sought to utilize a visual map created by students to help them visualize and discuss the network of people with whom they discussed what they were learning. Each student was asked to produce two documents. Under my instruction, they individually (1) filled out a list of the people with whom they had discussed ideas related to the PSA program, including demographic information about these individuals, and (2) made representations of these networks using large paper, stickers and markers. The network representations that students produced used color-coded stickers to distinguish between individuals with whom they did assigned activities from the texts, and family members and others with whom they had discussed some aspect of the program informally. Where students located these stickers within three concentric circles indicated the frequency with which students spoke to these individuals in connection with the program. To create their ego network, I asked students to draw lines connecting themselves and all alters, as well as lines connecting alters who speak to one another regularly. An example of one student's constructed network is included below (Figure 1). An example of the chart that students filled out listing their alters is included in Appendix A.

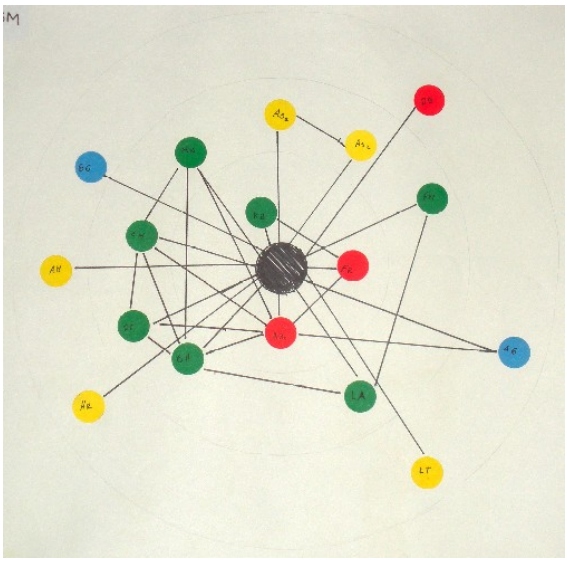

Figure 1: Example of One Student's Knowledge-Sharing Network

On the basis of students' networks, I carried out interviews with all students with whom an interview could be scheduled, either directly after the network activity or at another time convenient to the participant. Twenty-one out of 26 students were able to participate in interviews. I made particular effort to hold interviews with students in the largest and smallest communities in hopes of capturing greater diversity in the study. I asked students to explain their diagrams to me, and during the course of the conversation, I frequently pointed to a sticker and asked what they had discussed with that particular alter. I asked students follow-up questions on the basis of the experiences they shared, and asked about the benefits they perceived in participating in knowledge sharing activities. I also asked about how they thought others benefited from these experiences. A complete interview protocol for students is attached in Appendix B and a list of all interviewed students is included in Appendix C.

In addition to students, I interviewed each of the four tutors of the group individually (one of whom, Adriana, was also interviewed as a student), as well as seven members of the

community with whom students mentioned sharing knowledge. I asked tutors about experiences of the group and background information, and community members about their experiences of talking to students about what they were learning. Interviews with community members, as well as a few follow up interviews with students and a tutor were conducted on a return visit four months later. Complete interview protocol and a list of all non-student interview participants are included in Appendices B and C.

In addition to individual interviews, I carried out two focus group discussions with the newest El Alto group asking them to discuss their experiences regarding particular knowledge-sharing activities they had carried out individually and in groups. The reason for these focus group interviews was that these students were much younger than other students, and they themselves suggested that they would feel more comfortable discussing their experiences in a group. I also accompanied these students to visit two families for a project related to sorting trash, and accompanied students of the Tortuga group to visit a local baker and a local cheesemaker and ask about their waste management practices. Finally, I supplemented this data with an examination of the three text units mentioned most frequently in interviews: *Planting Crops, Transition to Agriculture,* and *Environmental Issues.*

Data Analysis

Answers to the research questions were pursued through a grounded theory approach that emerged from the networks of knowledge-sharing created and described by students. Following the grounded theory tradition, my analysis placed emphasis on "examining processes, placing the study of action central, and creating abstract interpretive understandings of the data" (Charmaz, 2006, p. 9). Students' network diagrams and their

interview explanations of the diagram were paired in what might be termed a qualitative approach to social network analysis (Hollstein, 2008).

The first step in understanding what the case study suggested about the potential for educational programs to use knowledge exchanges as a means of promoting community development was to get a sense of patterns of knowledge sharing across all of the participants in the study in three broad areas: (1) characteristics of students' knowledge sharing partners (2) circumstances leading to the exchange, and (3) characteristics of the exchange itself. In regards to the first area, the question of who was examined in terms of demographics (age range, education level, and occupation) and the individual's relationship to the student. Most of this information was included in the charts that students made for their networks, but it was supplemented with data that arose as students described their experiences. Under the second area, interview responses were analyzed for information about whether the exchange was the result of a class assignment or naturally emerging from context circumstances and student initiative. Motivations for selecting a particular person for an exchange were also analyzed from interviews. Interview analysis was triangulated with the sticker coding that students assigned each exchange partner in their network maps. For the third area, interview data was used to code each knowledge exchange as (1) being carried out individually by the student or in collaboration with other students and (2) promoting knowledge flow from the students to the community or from the community to the students. The placement of stickers on the network map by students was also used to code the frequency with which the exchanges took place between the student and the particular individual. This coding structure (captured in Table 2) was used to analyze each tie that students identified in their networks between themselves and the other individuals on their map (called 'alters' in the

language of social networks). This analysis was organized into a spreadsheet. From the spreadsheet, codes in alter characteristics and exchange characteristics were tallied to serve as a point of comparison for the patterns that were emerging from a process of coding the qualitative interview data.

Table 2. Coding Structure for Analysis of Each Tie

Who	How Exchanges Came about	Characteristics of Exchanges
Occupation - Filled in by student Age range - Child, youth, or adult Education level - Primary, secondary, tertiary Relationship to student - Family member (Y/N) - Relationship stated by student	Relationship to the text - Formally assigned or emerging from individual/group initiative Motivation for choosing the person - Identified by student New contact - An individual with whom the student began speaking as a result of the program, (Y/N) identified in interviews	Level of implementation - Individual student, small groups of students, or entire class Primary direction of flow - *Outward* from the student(s) to the community member(s), *inward* from the community member(s) to the student, or a combination of the two Frequency of interaction - Three levels identified to students as 'frequent exchanges' about program content, 'occasional exchanges,' and 'once'

After coding each network tie, the qualitative interview data was coded according to the types of knowledge and subject matters shared, the motivations and circumstances that led to the exchange, and the implications of the exchange for community development. For the three textbooks included in the study, each was examined to identify all of the exercises that explicitly instructed students to share or seek knowledge in the community and the information and activities that appeared to lend themselves to knowledge sharing. These

were coded in a spreadsheet according to the types of knowledge and subject matters shared, the direction of knowledge flow suggested, the level of student implementation intended by the text, how the exchange relates to the overarching aims of the text, and the possible implications for community development.

By examining and comparing (1) characteristics of each alter and exchange captured by student networks, (2) the students' interview descriptions of knowledge-sharing experiences in the program, and (3) the textbooks' use of knowledge sharing activities, I developed a grounded understanding of the types of knowledge exchanges that contribute to community development emerging from the PSA program.

To answer the second overarching question about how knowledge exchanges translate into benefits, I drew from the previous analysis coupled with additional coding of qualitative interview transcripts, focus group transcripts, and field notes. The qualitative coding led to thematic memos about patterns across cases as well as the development of several in-depth case studies of individual students' knowledge sharing practices. Patterns emerging across cases in interview and focus group descriptions were compared to the coding of alters and knowledge-sharing characteristics. Patterns in individual student cases were compared to the experiences described in other students' accounts. The themes emerging from both individual cases and across cases were analyzed from the perspective of both network theory and the idea of communities of practice.

CHAPTER V

FINDINGS

Students in the PSA program are called upon by their textbooks and by their tutors to investigate certain topics through conversations with members of the community and to share what they are learning with others. From their network maps and interviews, it is clear that students are also engaging in further knowledge sharing through their own initiative. The first section below examines patterns in students' experiences of knowledge sharing with regard to the characteristics of the exchange and the characteristics of alters in their networks. It ends by examining these patterns as evident in the cases of three students whose experiences will be central to understanding the potential community benefits of knowledge sharing, both from a network perspective and a community-of-practice perspective. The second section begins to answer the question about how knowledge sharing can translate into benefits for the community, by exploring how student exchanges with community members both enrich their existing networks of communication and extend those networks to include others. Drawing from descriptions of the three case study students and others, the section highlights how student knowledge-sharing activities put knowledge from diverse sources into contact, lead students to make practice-based recommendations to others, and facilitate discussion around values and fundamental concepts. The third section examines the benefits of knowledge sharing at the level of communities of practice, exploring how membership in multiple communities of practice shapes student practice within each community, and how the program encourages students to reach out to communities of practice of friends, family

members, and acquaintances and to reflect on their practice in light of certain ideas introduced by the program.

Networks of Knowledge Sharing in PSA

The networks of knowledge exchange that students represented in diagrams and described in interviews captured certain patterns in their knowledge-sharing behavior. The knowledge exchanges themselves were shaped by the content and conditions of each exchange. Particularly important to understanding the flow of knowledge along students' networks were the direction of knowledge flow and whether the activities were carried out individually in groups. With regard to alters in the students' networks, these were frequently family members or close communication partners of the students. Patterns in the networks set the stage for understanding the potential of knowledge sharing to contribute to the well-being of students' geographic communities. This section examines the characteristics of the knowledge exchanges and of the alters, and introduces the cases of three students whose experiences will be drawn on in greater depth in subsequent sections.

Characteristics of the knowledge exchange. The knowledge-sharing activities that students described were sometimes rooted in explicit instructions in the texts and sometimes emerged from the initiative of students and the tutor. They frequently related to agriculture and environmental protection, which were both covered in the program textbooks in ways that asked students to make connections between what they were learning and local practice. Knowledge exchanges also touched upon issues of mathematics and accounting, electricity, and what the PSA program is.

Two characteristics of the knowledge exchanges that students mentioned were important to shaping student networks of knowledge sharing: The first was whether the knowledge exchange was sparked by an *inward* movement of knowledge as students tried to learn from local knowledge and practice or by an *outward* movement of knowledge as students sought to share the benefits of what they were learning with others. This categorization only partially captures the content of the exchange, given that knowledge-sharing as understood by this study entails more than the transmission of information and ideas; it implies bi-directional communication and often entails the creation and modification of meaning for participants. Nonetheless, the question of direction gives some sense of the flow of knowledge within the community from a network perspective. The second characteristic important to the shape of students' networks was whether the knowledge-sharing activity was carried out individually by a single student or in groups with fellow students. This distinction was particularly important in affecting who students engaged as knowledge-sharing partners, as will be discussed below. Table 3 lists all of the instances of knowledge sharing mentioned by students, according to two variables important to the networks that emerged from students' experiences. Instances marked with an asterisk (*) were activities formally prescribed by the textbooks. As the table suggests, only a fraction of the total knowledge exchanges students described resulted from formal assignments in the textbook.

Table 3. Instances of Knowledge Sharing Mentioned by Students

	Inward	Outward
Carried Out Individually	• Asking farmers about farming practices* • Asking elders how transportation use to be* • Getting help from others on PSA homework • Discussing with others questions about values* • Asking mothers about the health of their children*	• Talking to others about the importance of caring for the environment* • Discussing with others what one is learning and doing in PSA • Inviting others to join PSA • Making suggestions to farmers about farming practices • Helping non-PSA students with their homework • Incorporating learned farming practices into farming w/ others • Helping others with accounting • Talking to others about other miscellaneous topics including hunting practices and electricity • Making suggestions to mothers about how to protect their children's health
Carried Out In Groups	• Asking small manufacturers about waste management practices* • Visiting a local farm to learn about plants and farming	• Sorting trash for neighbors and discussing trash sorting with them • Organizing a service project to fix a community road

* Activities formally assigned in the textbooks.

Characteristics of the alters. The question of whom students turned to in these exchanges varied according to the type of exchange (Table 4). The knowledge exchanges carried out by students in groups (or as a whole class) tended to involve individuals with more distant relationships to the students. Often students decided who to visit in group activities through discussions about who any of them knew who might be relevant to involve in the topic at hand. From this sort of planning, activities often involved friends, family, or acquaintances of one student, but someone who was a stranger to many others. Knowledge-sharing activities carried out in groups, then, were often ways for students to meet new

people and benefit from knowledge embedded in their local community that they might not otherwise be exposed to—knowledge about waste management in small manufacturing business, about local flora and about local agricultural practices, for example.

Table 4. Typical Knowledge-Sharing Partners by Knowledge-Sharing Type

	Inward	Outward
Carried Out Individually	Family members, friends, neighbors, acquaintances and occasionally, new contacts	Family members, friends, and neighbors
Carried Out in Groups	Neighbors, acquaintances and new contacts	Family members, friends, neighbors, and acquaintances

Activities that involved students sharing what they learned in an outward flow of knowledge, particularly when carried out individually, tended to rely heavily on the family members, close friends and neighbors, in contrast with activities that sought to draw on local knowledge and bring it inward. In these former cases, it may have been that topics related to students' study in PSA naturally emerged in conversations with frequent conversation partners or that students were more familiar with the lives of these individuals and had an idea about what might be interesting or relevant to them. Additionally, it is quite possible students felt more comfortable sharing about what they were learning with people they knew well.

Notably, family made up an important part of students' knowledge-sharing networks. Over forty percent of all of the alters in students' networks were family members of the students—parents (9%), siblings (9%), aunts and uncles (9%), cousins (10%), grandparents (2%), and other relatives (2%). More importantly, when the alters are differentiated according to how often students spoke to them about issues related to what they were learning in PSA (frequently, sometimes, or once), students disproportionately conversed with

family members repeatedly. Three-quarters of all alters identified as frequent partners were family members of the students (see Table 5). Students themselves remarked on the prevalence of family members in their networks, with comments such as, "My diagram is all family; there are only like two or three people that aren't relatives." They explained this with reasons such as "my family is who I have contact with most frequently since they are closer and know about what I am doing" and "my aunt is always interested in what we do, what we study, what use it serves us."

Table 5. Proportion of Family Members Represented in Students' KS Networks

Frequency of PSA-related discussion	Total number of ties (percentage of total)	Number who are family members (percentage of that frequency level)
Frequently	77 (25%)	58 (75%)
Sometimes	123 (39%)	60 (49%)
Once	114 (36%)	16 (14%)
Total	314	134 (43%)

Introduction to three cases. The discussion below about the benefits of education-based knowledge sharing to the community draws in particular from three PSA students, referred to here as Merly, Alvaro, and Jaime. Patterns in these students' knowledge-sharing networks and experiences are introduced here to illustrate the patterns identified above and set the stage for subsequent discussion regarding knowledge-sharing benefits. In the network diagrams below, red alters signify people with whom students already communicated and blue alters are new contacts. Triangles denote people visited by groups of PSA students, and all others are people contacted individually.

Case 1: Merly was 17 years old and about to finish her study of PSA in the town of Tortuga. As seen in her network diagram (Figure 2), over half (6 out of 11) of the contacts

with whom Merly discussed PSA-related topics were people with whom she already spoke frequently (marked in red): family members, teachers, classmates and neighbors. To these individuals, Merly often turned in investigative assignments, to ask for help on PSA homework, and to share what she learned in PSA. The five new contacts in her network (in blue) were all people Merly approached in order to gather more information about her community, as instructed by the textbook units "Environmental Issues" and "Planting Crops". As the triangles signal, most of these were people whom Merly met through group knowledge-sharing activities carried out by her PSA class as a group.

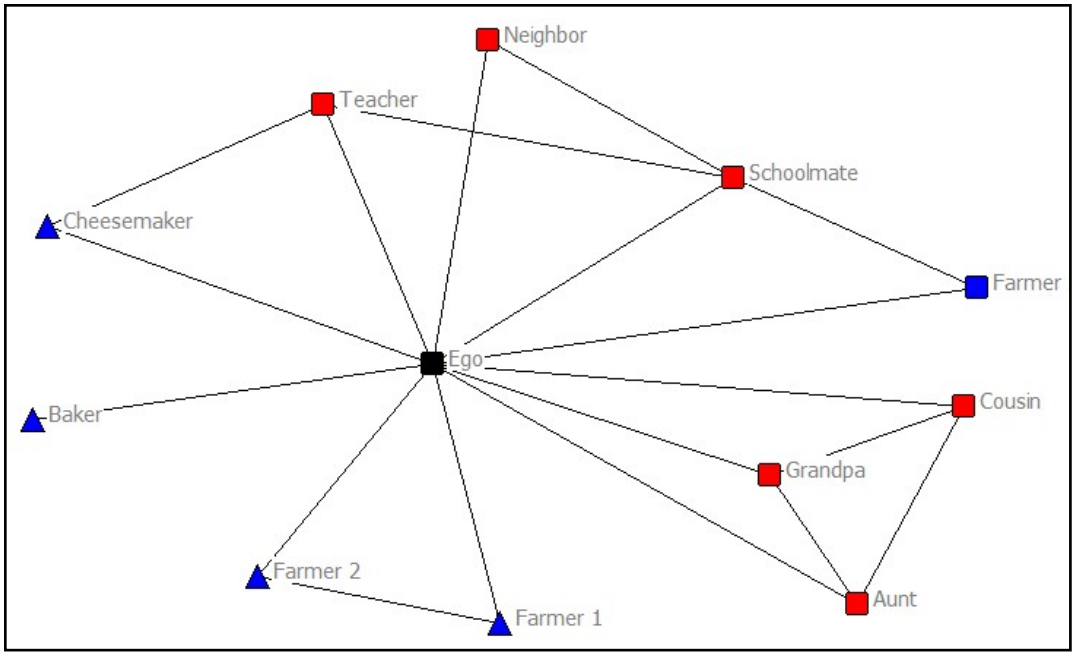

Figure 2. Merly's Network Diagram

Alvaro was a farmer in his early twenties finishing his PSA studies in the small village of El Alto. In Alvaro's network diagram (Figure 3), all of his alters were people with whom he already spoke frequently, as seen in red. Four out of Alvaro's twelve contacts were

family members. Also notable about Alvaro's network, in comparison to Merly's, is that it is quite dense. In other words, alters in Alvaro's network know each other and are in communication with one another. This is not surprising, given that Alvaro knew everyone in his 250-person village, and that his family members and close friends were farmers, members of his community of practice with whom he could discuss shared practices, which was not the case for Merly. Alvaro discussed farming practices back and forth with many friends and family members, putting into practice things he learned in PSA. With a few others, he shared other concepts pertinent to their interests.

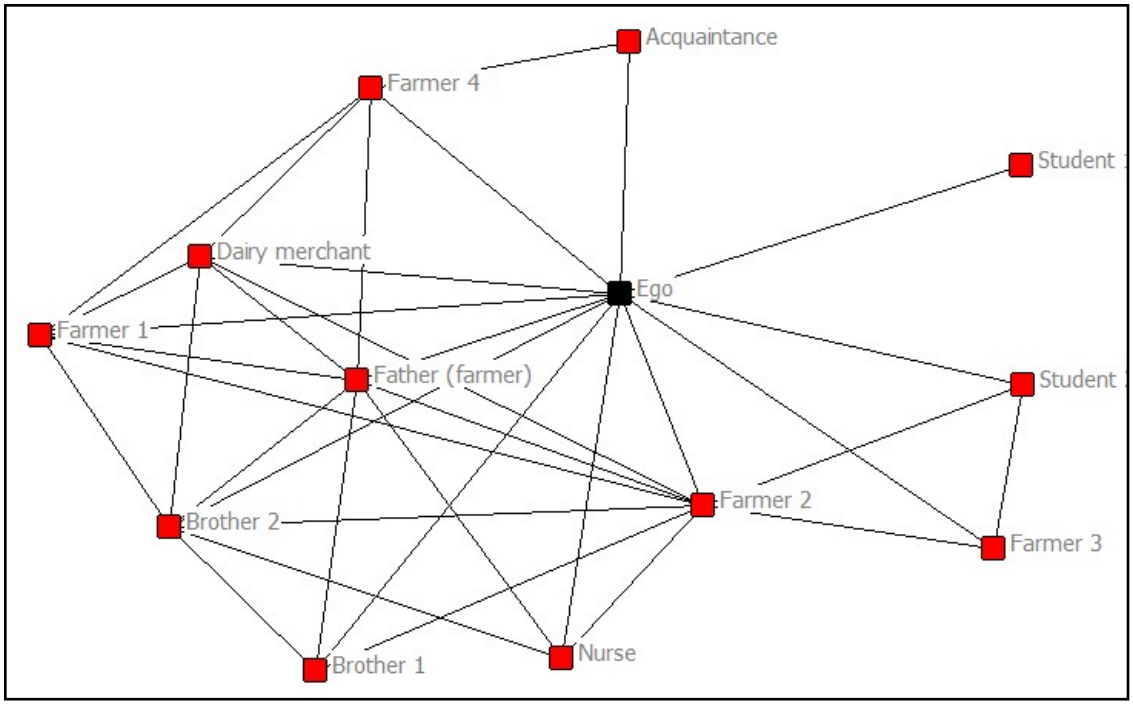

Figure 3. Alvaro's Network Diagram

Jaime was also in his early twenties and from El Alto, where he started studying PSA, although he moved to Tortuga and joined that PSA group one year prior to data collection for

this study. Like Alvaro, Jaime's network (Figure 4) is large, dense and contains many family members and close friends from El Alto. Like Merly's network diagram, Jaime's has a few new contacts with whom he connected through PSA practice activities, marked in blue. Nonetheless a majority (22 out of 25) of alters in Jaime's network were existing contacts. Interestingly, a large majority (specifically 16) of these were Jaime's relatives. He shared with family members and friends recommendations that might be helpful to their practice, and spoke to others about assorted topics.

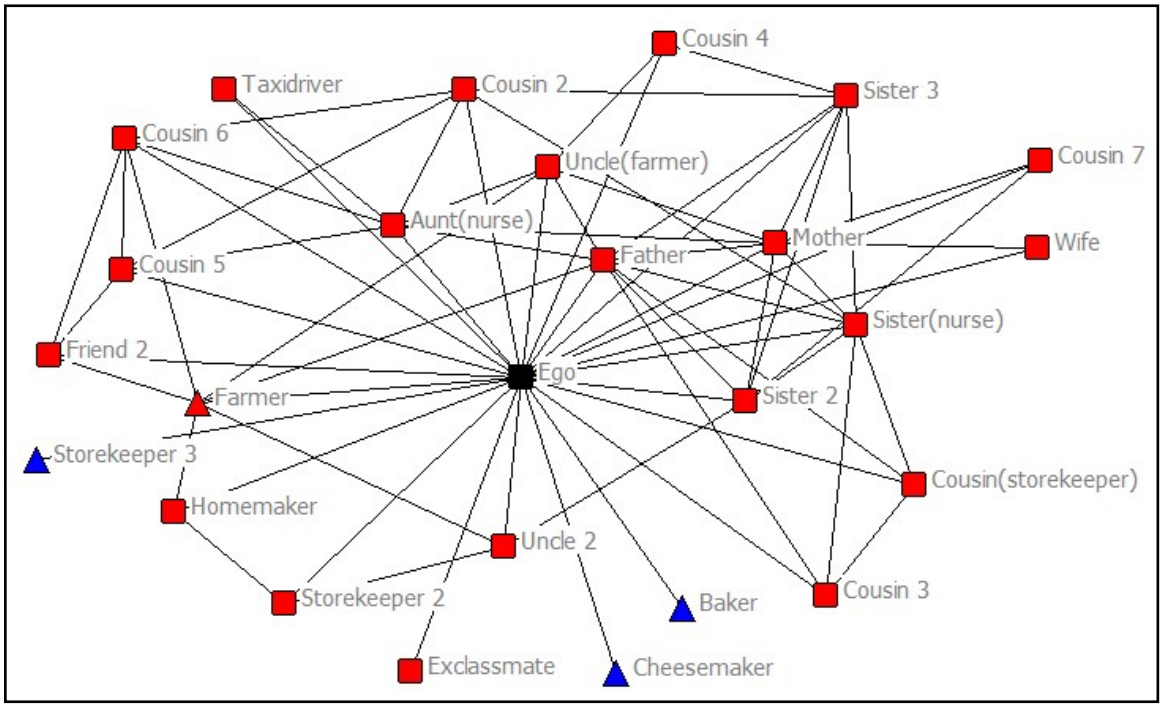

Figure 4. Jaime's Network Diagram

The networks created by Merly, Alvaro, and Jaime are illustrative of the patterns mentioned above. They draw heavily from students' previous contacts, particularly from family members. Most of the new contacts these students made resulted from group

activities prescribed by the textbooks and consisted of friends or family members of other students in their PSA group. In the next two sections, the experiences of Merly, Alvaro, Jaime, and other students will be used to provide insight into ways in which knowledge sharing can translate into benefits for the community.

Community Benefits through Network Enrichment and Extension

The network diagrams and interview descriptions that PSA students shared suggest two major means by which their knowledge-sharing efforts can translate into benefits for the community: first, learning in the PSA program encourages knowledge exchanges that enrich the flow of knowledge along existing paths of communication, through the introduction of relevant information and concepts, recommendations for practice, and discussions of foundational concepts and values; second, learning activities in the program also encourage an extension of students' networks of communication to include others with knowledge relevant to students' learning and others who may benefit from what they are learning. The paragraphs below will explore these benefits through students' own descriptions of their knowledge-sharing experiences.

Enriching existing networks. As mentioned in the previous section, most of the exchanges that students mentioned took place with people with whom they already spoke frequently, especially family members and neighbors. These interactions resulted both from activities prescribed in the texts and from students' own initiative. They were usually carried out by PSA students individually, through one-on-one encounters with family and friends. Students' accounts of their knowledge-sharing experiences suggest that these enrich existing networks of knowledge flow in three ways that benefit the community: (1) by putting

information and ideas from different sources into contact with one another; (2) through recommendations to improve practice; and (3) through discussions of values and fundamental concepts that deeply shape behavior and community participation. These three means of enriching existing networks of knowledge exchange to benefit the community are discussed in greater detail below, drawing in particular from the accounts of Merly, Alvaro, and Jaime.

At one level, the knowledge exchanges between students and community members can be said to enrich networks of communication by simply introducing new information and putting ideas from different sources in contact. This happened both through practice activities prescribed by the textbooks and as PSA students naturally brought what they were learning to bear on discussions and situations in which they engaged. Through knowledge sharing, students could supplement ideas in one space with additional information, practical applications of an idea, and further explanations of why something happened. Young students like Merly, who were studying PSA at the same time as regular schooling, used what they learned in PSA to complement what they were learning in school. Merly explained, "sometimes what they taught us in school was superficial, so we read and what we had in the [PSA] books… we had more detailed and broader information." She mentioned using what she learned in PSA to better explain the environmental damage caused by pollution and by certain adverse agricultural practices in homework assignments, and to figure out the steps to balance finances for accounting homework. She also used what she learned to help younger family members and neighbors with their homework. Similarly, Alvaro mentioned supplementing his farming knowledge with PSA concepts, using what he

learned in PSA to understand the reason why some seeds did not sprout in his farming experiences with his father.

Knowledge sharing also allowed students and their family and friends to examine a certain phenomenon from different perspectives and compare. For example, one student mentioned frequently putting what she learned in PSA about electricity into conversation with her uncle's experiential knowledge of electricity that resulted from his curiosity and experiments he conducted in his home. In other cases, the assignments in the texts instructing students to ask others about local practices led to discussion comparing the past and the present, or comparing local practices with other options. When, for example, one student asked her grandfather about how transportation used to be in her community, the conversation gave way to broader discussions of differences between circumstances today and back when he was young. She recounted:

> …My grandfather also told me that people lasted longer, that there wasn't as much pollution, as many chemicals, that now people have more illnesses, die earlier. Many cars, many chemicals… He told me that before people didn't pay as much attention to garbage, that they threw it wherever. I told him that now it's not like that, we have to classify garbage, collect it, have an adequate place in order to not damage the environment.

In the same focus group conversation where this student recounted the experience, one of her classmates highlighted this mutual exchange as one of the benefits of these sorts of investigation activities saying, "when we ask questions, they teach us and we teach them."

Exchanges such as these put knowledge from different sources into contact. This had the potential to benefit the community by, as Burt (2004) suggests, putting greater numbers of people in the community at risk of good ideas. The textbooks, drawing heavily from scientific knowledge but dealing with topics pertinent to everyday life, expose students to relevant new ideas, some of which reach the community and connect to local ideas and

experiences—both as relevant topics arise in everyday conversation, and as investigation practices create spaces for two-way exchanges to take place.

At a second level, the knowledge-sharing experiences that students mentioned enriched knowledge flow along existing channels of communication and benefited the community by introducing recommendations for practice relevant to life in the community. Students used what they were learning to recommend to others certain techniques and strategies for acting that fit their understanding of the needs of the community. With the study of the unit "Environmental Issues," for example, many students spoke to family members, neighbors, and friends about the importance of caring for the environment. Jaime and many other PSA students provided those around them with specific strategies for environmental care, including collecting trash in one place, not burning trash, sorting it, and using organic waste for compost. Alvaro and students who had farming relatives shared recommendations for agricultural practice, including ways to use organic fertilizer and insect repellant instead of chemicals, suggestions for crops that complement one another when grown together, recommendations for planting to minimize soil erosion, and ways of collecting and storing seeds for use next season. The recommendations students made often seemed to emerge naturally as a consequence of their learning in the program coupled with interactions with those around them. A student in Lochi described:

> We have a patio and my father is a farmer and all, so in some things we help each other and see what is in the book, and some of the mistakes that we see in practice we realize them in the book. {EL: For example?} The fertilizer and all of that. One day reading we realized that what he was doing was wrong, and he also read it and understood certain things. {EL: What was he doing?} The distance. The distance that he had one plant from another, this was something that was opposite, because of how the flow of water passed.

Several students mentioned making similar types of farming recommendations to family members. These recommendations come to the community, not from outside

interventionists, but from students and tutors indigenous to the region, sharing the same experiences and history.

Students' recommendations for practice were strengthened by providing reasons for them rooted explanations of physical phenomena. For example, according to one tutor, the students in El Alto tried to combat the tendency to cut down trees and burn the land when planting crops and met with certain success in helping to diminish the prevalence of the practice because they provided explanations for how it harmed the land. Jaime described explaining to his father the damage caused by chemical pesticides and how this led his father to start using a spray of ground hot pepper instead. In other cases, the recommendations for practice were further supported by collaborative action in carrying out the practice. For example, a student in Tortuga planted a small vegetable garden at his mother's house in the country. Students in El Alto started a compost pile in one student's home for all of their families and neighbors to use. In these cases, existing networks of knowledge flow were enriched not only by verbal recommendations and instructions, they were rooted in the students' own practical application of the ideas. Community members who participated in these activities alongside students benefited from a combination of theory and practice.

In addition to sharing relevant information and making recommendations for practice, a third way in which students' knowledge exchanges enriched communication with those they knew was through explicit discussions of fundamental values and notions that shape positive community membership. Certain activities in the textbooks explicitly asked students to discuss certain values questions with a certain number of people. In these cases, students turned exclusively to family members and trusted friends and neighbors to hold these discussions. In one example, Merly described asking her grandfather about the value of

animal and plant conservation. In his response, he shared a story from his own experience that highlighted particular values. Merly described the following:

> …Then he told me that when he worked at a milk company, he saw when the farmers would go to get milk they would take good care of the cows. And he used to ask, 'but why?' But the farmer got a lot of benefit from the cows, he took good care of them and he could sell them alive. Everything he got from them, milk, butter, cheese, it served him.

The discussion of values rooted in her grandfather's own experiences stayed with Merly enough for her to describe the experience in detail many months after it occurred. The assigned activities asking value questions opened spaces for family members and friends to share with students, through stories and personal reflections values that they held dear. They gave students the opportunity to compare ideas across individuals, noting similarities among those around them and taking what they found as beneficial in differences. About the significance of these types of exchanges, Merly shared: "The value is that one learns from each person because not everyone thinks the same, not everyone expresses the same thing, and some have a greater capacity to face a certain test, to put it like that." Through these conversations about values and other fundamental notions, both students and community members had the opportunity to reflect more deeply on their own views on fundamental topics such as the purpose of life and the relationship between human beings, animals and nature.

At the same time, the PSA program itself promotes certain pro-social values that can be considered to benefit the community. While various values can be gleaned from the program's textbooks, students, in their descriptions of their knowledge-sharing experiences, seemed to draw most heavily on the program's notions related to serving the community and caring for the environment. They often expressed these values when answering questions

about what the PSA program is and what they do in the program. In a few cases, particularly about caring for the land, students remarked that the practical advice they were sharing and the implied values resonated with community values and the way things used to be.

Thus, knowledge exchanges can enrich students' existing networks of communication with family members, friends, and neighbors in a manner beneficial to their communities. They put knowledge from different sources into contact, make practical recommendations about things others can do for the community, and bring discussions of values and fundamental concepts to the surface. These means of enriching networks take place to differing degrees in various types of exchanges, but are facilitated by the pre-existing relationship between students and these individuals. Along connections where information and ideas had previously flowed, relevant ideas and practical recommendations from PSA could naturally be brought to be bear. Between students and those they trust, values could be safely shared and considered.

Extending networks of knowledge flow. While many of the exchanges students described involved contacts that they already knew and communicated with, there were several experiences students mentioned that involved making contacts with new people. The knowledge sharing emerging from the PSA program provided impetus for students to extend their communication networks to include others with whom they previously had little contact. This happened in two ways: through investigative activities prescribed by the textbooks or planned by the class, and through service activities planned by the class or emerging from student initiative.

The case of Merly is illustrative of the first type. All of her five new contacts resulted from activities assigned in the textbooks to research community life. In Merly's case, as in

many others, the new contacts that students made in carrying out investigative activities resulted from carrying out the activity as a group. The people that the students visited together were individuals that one or more students knew and recommended that the class visit. Mrs. H, Merly's tutor, described the process of planning practice activities to interact with community members:

> Always before the practices we organized a survey [among the students]. We asked the participants who they knew that were people who could collaborate with us doing consultations. And they would say, 'Mrs. H, look, we can go to Mr. So-and-so and he can orient us.' And then we chose that person.

In this way, students extended their networks of knowledge-sharing contacts by interacting with the friends and family members of their classmates during group practices. Farmer 1 and Farmer 2 in Merly's network were the grandparents of two of her classmates. The cheesemaker and the baker were neighbors of her tutor.

The experiences of Fernando, a middle-aged motorcycle taxi driver and classmate of Merly, illustrate how service activities can lead students to exchange ideas with new people. Fernando's efforts to start a garden in a neighboring community for the benefit and learning of residents led him to make new connections with many of the residents of that 70-person village. Fernando explained:

> There were women, men, and children, all of the community, and I told them that what we were going to do is the practice of what I learned in theory. I am contributing the seeds, but what we grow won't be for me, I want it to stay in the community. The day that this bears fruit it stays here for you, everyone has a right to what is produced.

Fernando's knowledge-sharing interactions with community members in the garden led to other exchanges with them, including starting a literacy class for residents in the community as well. Through efforts aimed at service through applying and sharing what he had learned, Fernando extended his network of communication to include others who might benefit from his learning.

Both knowledge exchanges that led students to new contacts through investigative activities, and those that did so through service activities, extended benefits to the community in ways similar to the three ways of enriching existing networks mentioned above. In cases where new channels of communication were opened, new information and ideas were extended out to the community and brought in from the community, reaching beyond students' immediate circle of contacts to include information not available in their previous networks. For example, students learning about the complexity of waste management in PSA could see how these issues were addressed by a local baker and a local cheesemaker. Through activities of service, students were able to share recommendations for practice with others beyond their regular communication partners, with people in neighboring communities, as illustrated by Fernando's case. Discussions of values were also an integral part of exchanges. For example, in the visit to the cheesemaker, students and the tutor remarked that they were impacted by the man's strong concern for cleanliness in his facility.

The experiences of Merly, Alvaro, Jaime and other students highlight the potential for knowledge sharing to translate into community benefits through expanding student networks of communication and enriching existing networks with an additional flow of information and ideas, recommendations for practice, and explicit consideration of foundational values and concepts. The experiences of Alvaro and Jaime as discussed in the next section, illustrate how the flow of knowledge resulting from these experiences is not even, but instead shaped by membership in communities of practice.

Benefits of Knowledge Sharing as Brokerage between Communities of Practice

The benefits to the community that emerge from student-sparked knowledge sharing go beyond a greater flow of information between individuals in a network. In many cases, learning and knowledge are shaped by communities of practice, which are marked by mutually recognized ways of doing things, pre-existing values, concepts, and information. The sharing of ideas, practice-based recommendations, and values between communities of practice has different implications than sharing between individuals. These implications are explored below through two case studies, each of which illustrates a different means by which the benefits of student knowledge sharing occurs through communities of practice. In the first case, a single student, Alvaro, shares knowledge through his participation in multiple communities of practice. In the second case, Jaime uses his contacts in other communities of practice to try to influence practice in those communities. Both cases exemplify trends of sharing between communities of practice evident in the accounts of many other students, though with less clarity.

Multiple membership. The case of Alvaro, who was both a farmer and a PSA student in the small village of El Alto, highlights how membership in multiple communities of practice can lead to additional benefits of knowledge sharing. Alvaro's dual membership in both communities of practice produced more than an increased flow of information between his fellow farmers and his PSA books and classmates. His practice in each community shaped his participation in the other. This, in turn, had the potential to affect the practice in each community as a whole.

Alvaro began learning to farm from a young age, through legitimate peripheral participation in a community of farmers that included his father, his brothers, close friends

and other neighboring farmers. Sharing knowledge was an important part of learning within this community. Alvaro described: "Here… in the community there are other people who work in agriculture. They are my neighbors and friends and I share with them, also with my brothers." According to his own account, Alvaro was constantly interacting with members of this community, in particular his father. He described a back-and-forth exchange with his father, saying:

> Actually I have more contact with him [my dad], more communication with him because we live in the same house and we are always asking [each other questions], always sharing. He asks me and I respond, and in the same way, I ask him and he responds, and since he has a little more experience with things, I ask him and he knows how to give me a good response.

This frequent sharing of knowledge within the community of practice lent itself to the incorporation of relevant ideas from other communities of practice. One such community of practice was Alvaro's PSA group, with whom Alvaro spent about 15 hours a week studying. Together the group constituted a community whose practice and shared repertoire centered on studying textbooks, investigating local reality, and activities of service to the geographic community.

Alvaro's description of his knowledge-sharing experiences suggest that his participation in these two communities of practice influenced on another. His experiences of learning in the farming community of practice shaped his learning within the PSA program, as he actively made connections between the PSA texts and his own experiences. He described his learning in PSA as "more effective" because, "when it came time to study I already knew more or less how to do it, I had already been doing the practice of it much before seeing the book."

At the same time, PSA learning and practice affected Alvaro's farming learning and practice. One way this happened was through information that responded to questions that

arose in his farming practice. Although much of the farming content he studied in PSA was already familiar to him, Alvaro identified a few places where the textbooks clarified certain questions that had emerged from experience. For example, he explained:

> The story of the cotyledons was something that we didn't have before. When a seed was damaged, when sometimes one planted it and nothing sprouted, one would ask, 'why didn't it sprout?' Now after the study it was clearer to me.

As evident in this example, the information that Alvaro shared between communities of practice was shaped by his experience in each of the communities. Participating in both, Alvaro was more acutely aware of places where ideas from one community were relevant to the practice of the other.

Alvaro's PSA studies also affected his farming practice as he adopted and applied particular farming strategies from what he learned in PSA. He mentioned, for example, that his close friend and PSA classmate Juan[1] suggested that they use the strategies that they learned in PSA to grow corn on a new plot of land. As Juan and Alvaro incorporated elements of what they learned in PSA into their practice as farmers, changes in their practice at the periphery of the community of practice held potential to influence the rest of the community (Lave & Wenger, 1991). Their experiences using these techniques became part of the collective experience of the community; it could be referenced in conversations of community members and influence the practice of others in a diversity of ways.

Beyond information and practical applications, Alvaro's participation in these two communities of practice involved values considerations. The values that Alvaro highlighted as important within his farming community of practice—love of nature, beauty, sustainability through avoidance of chemicals and toxins—were values promoted by the textbooks as well.

[1] Juan moved out of El Alto to engage in service in another community just before this research project began and as such could not participate in the study.

It is not clear from Alvaro's account the extent to which values of one community shaped his perception of those in the other, but certainly the similarities between the two had a reinforcing effect. Other PSA students in El Alto remarked about how the values promoted in the agricultural practices recommended by PSA represented a return to values and practices that had previously been esteemed by the community, but were subsequently influenced by the introduction of new technologies.

The network diagram below (Figure 5) captures the flow of knowledge taking place in Alvaro's network of knowledge-sharing between communities of practice. Modified from the version above, Alvaro's network now includes his classmates in the PSA program. The diagram shows dense communication within the farming community of practice and the PSA group. Alvaro (Ego) and Juan (Farmer 2) are participants in both communities of practice, a condition that affords them the position of broker between the two communities (Wenger, 1999). The diagram also reveals dense communication between students of the PSA group and farmers. This reflects the many communication ties that exist within such a small village where many of the residents are in fact family members. One of Alvaro's PSA classmates is his sister, another is Juan's niece. Two of the farmers are his brothers, who are actually both studying education, although he mentions continuing to speak to them about farming. And one of the farmers is Juan's brother. The network diagram also draws attention to the existence of another relevant community of practice – the family. While Alvaro did not speak about knowledge sharing within the context of the activities that characterize the practice of families, such family decision-making, rituals or habits, the fact that he is engaged in dialogue regarding the program with so many of his family members is suggestive of the possibility.

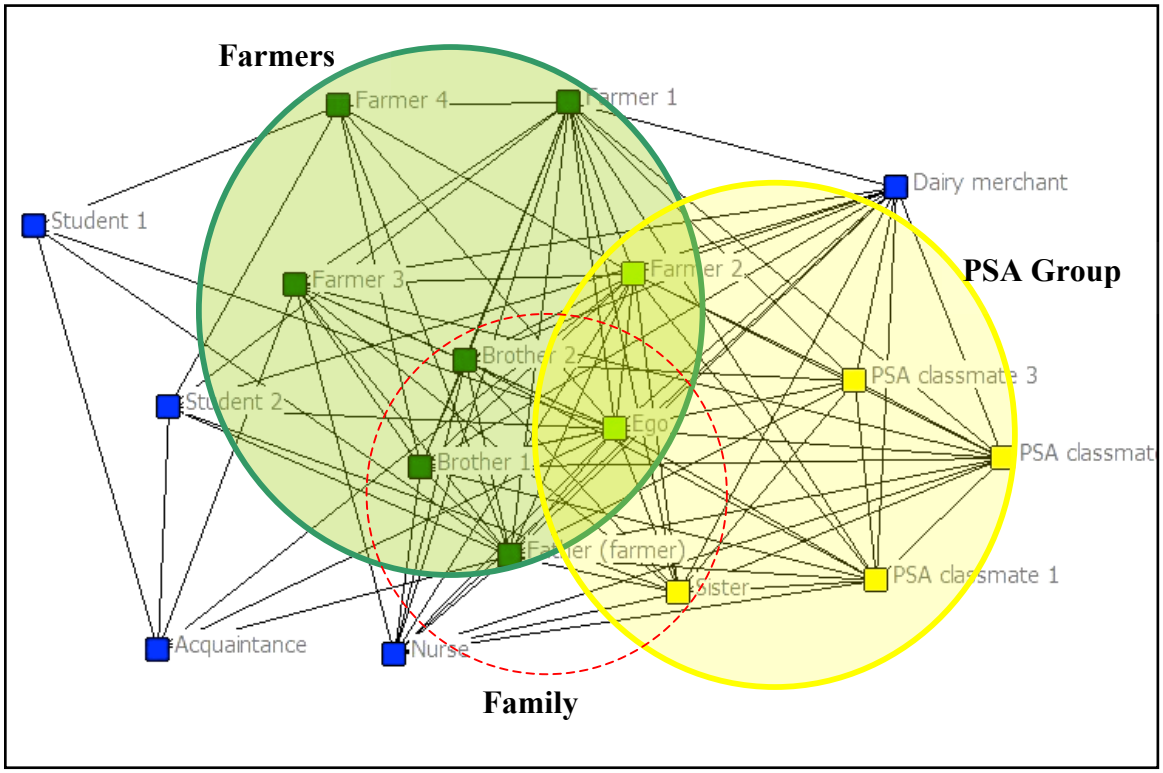

Figure 5. Alvaro's Network by Communities of Practice

The case of Alvaro provides one example of how, through membership in multiple communities of practice, knowledge sharing can occur naturally between the communities in a manner that goes beyond the spreading of ideas to the shaping of practice. Given higher levels of communication within the community about the practice in question (in Alvaro's case, farming), there seems to be a greater facility of ongoing, back-and-forth exchanges of information and ideas, such as the kind Alvaro describes having with his father. Information that is shared between communities would seem much more likely to touch upon issues of relevance to practice because both the student and the other person are engaged in the practice. Similarly, recommendations for practice that the student introduces are likely more deeply rooted in the practice itself.

Interactions with other communities of practice. According to Wenger (1999), individuals can have contact with knowledge from communities of practice to which they do not belong, through family members, friends, and others. This opens the door to knowledge-sharing benefiting a geographic community through students' interactions with other communities of practice. This is illustrated in the case of Jaime, the young adult student originally from El Alto who moved to Tortuga and continued his studies. While finishing the PSA program in Tortuga, Jaime began to work as a tutor of another PSA group. Like Fernando, who started a community garden with others, Jaime's account of knowledge-sharing placed emphasis on service to the community. Rather than examples of applying learning to his own practice, Jaime shared several examples of occasions where he used what he learned to encourage others to reflect and possibly change their practice. In these examples, Jaime drew from his learning and practice in the PSA program to influence other communities of practice—those where his family members and neighbors were participants. For example, he and other classmates in El Alto spoke to his father and several other farmers in the community about the harm caused by chemical insecticides and alternatives that could be used. He spoke to both his mother and his mother-in-law about waste management in their respective occupations, and took his PSA students to speak to the shopkeeper in front of the house where they meet to discuss the same issue.

The approach that Jaime described using in speaking to members of other communities of practice is suggestive of its potential to influence practice within these communities. The three key characteristics of that approach are captured in Jaime's account of speaking to his mom about her waste management practices. He explained:

> My aunt is a nurse, my mom is also a nurse. They used to give a lot of injections and vaccinations, and they would take them [the needles] and throw them on the floor like that, and the wind would take them. So we did a practice activity about the environment and I

> spoke to my mom since she had a mess of those things there, and I told her that this was very damaging to the environment, and why didn't she collect them in a bag, and when I went to visit I would take the bag to a nearby municipality where the garbage truck collected trash. So she spoke to my aunt and my aunt is doing the same thing.

First, in this description, it is evident that Jaime considered his conversations as an initial step in spreading ideas to others in the community of practice, through a sort of chain of knowledge flow. In the above account, he emphasizes at the beginning and end of the passage how the conversation with his mother influenced his aunt's practice as well. Similarly, in describing his experience speaking to farmers, he emphasized knowledge flow from his direct contacts to others in the community of practice, saying:

> There we spoke to about 6 people… They, then, have spoken to others with whom I almost never speak to… We did a practice activity about how to take better care of the land, and then those people did the same presentation that we did with them, with other people… My dad did it with two of his brothers and a few cousins from a different community, and my uncles spoke to others, like that, like a chain.

For Jaime, sharing knowledge from PSA creates a chain. The shared experiences and concerns of a community of practice lead those with whom he shares ideas to discuss them with others engaged in the same practice.

The second characteristic of Jaime's knowledge sharing to distinct communities of practice was his use of questions. Jaime took what he learned to others in the form of questions, rather than instructions, about their practice. To his mother he asked, "why didn't she collect [the needles] in a bag?" When asked what he and his students said to the shopkeeper they visited, Jaime explained:

> They were questions that were like how did he think that he could contribute to the improvement of the environment, and so he said that by not throwing trash in the street. And from there I think that he thought he wasn't doing anything [to contribute] and from there he started to collaborate.[2]

The result of the questions in this case was that the shopkeeper "felt bad and now he collects all of the garbage, he even takes it upon himself to collect it from across the street, and he

[2] In Spanish, the word "colaborar" means both to cooperate and to contribute to a cause.

throws it in black bags." Jaime's emphasis on asking questions suggests an approach that recognizes the capacity for critical thinking of the listeners and encourages them to reflect on how newly introduced ideas can apply to their own lives.

Third, Jaime's conversations with others related to their practice included practical ideas for things they might do to address the issues he raises in conversation. For example, he suggested to his mother that, since no garbage truck reaches their small village, he could take her discarded needles to town when he visits. The conversation with his father and other farmers included the idea of using ground hot pepper spray instead of chemical pesticides. Through practical ideas of actions they could take, in addition to information about what was harmful and why, Jaime facilitated the adoption of changes in behavior.

The diagram below (Figure 6) captures the flow of knowledge in Jaime's network to communities of practice to which he does not belong. Within the circle marking each community of practice, there are alters with whom Jaime speaks, and who therefore form part of his network, and there are individuals within the community with whom Jaime does not speak. These individuals are represented by light-colored squares. Though Jaime does not speak to them directly his accounts project that they too may be influenced by the ideas that he is sharing, given the high levels of communication and shared interests and practices of each given community. As the case of the storekeeper illustrates, a community of practice influenced by conversations with a PSA student need not be people holding the exact same occupation. While there are other storekeepers in Jaime's network, these live in El Alto and are not in contact with the purple storekeeper who lives near Jaime in Tortuga. The latter storekeeper's community of practice would instead involve others working in his store who could be influenced by his new ways of handling waste in and around the store. The farmers

and health care providers in the diagram would similarly not be all farmers and health care providers in the region, but those who work together and share ideas and ways of doing things.

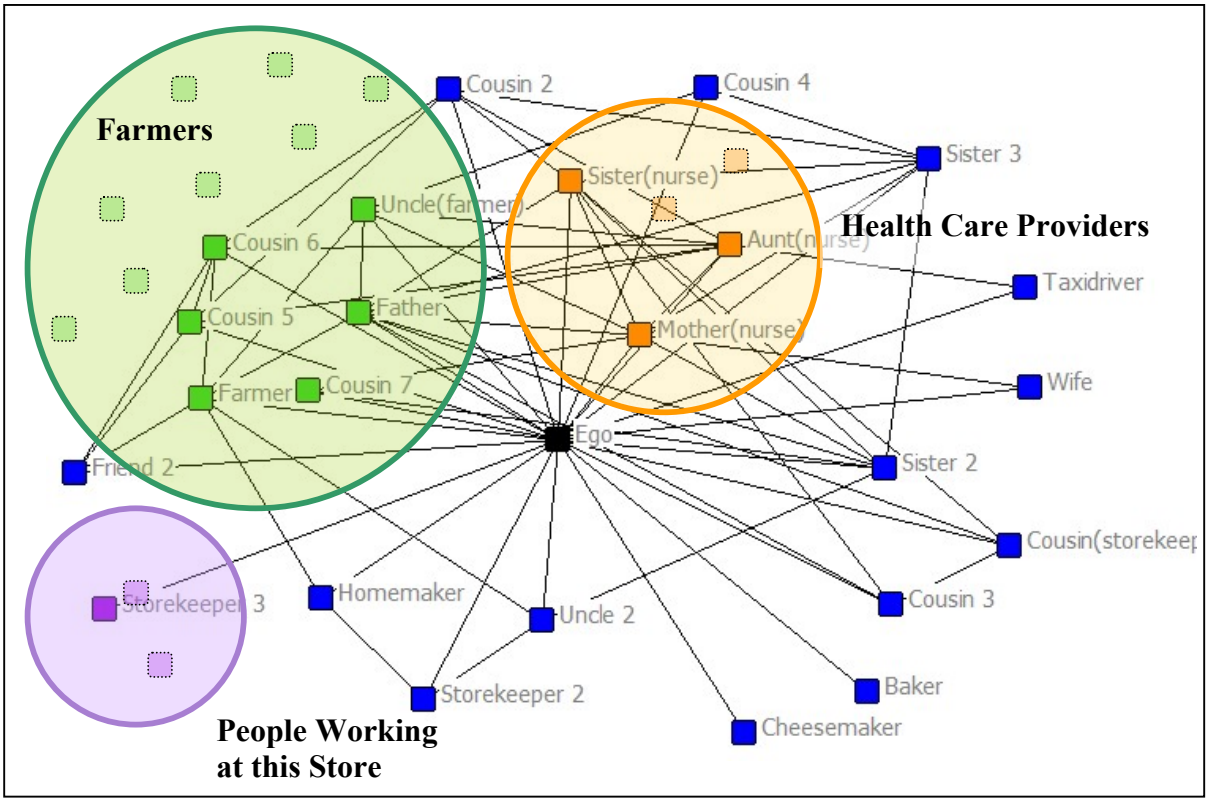

Figure 6. Jaime's Network by Communities of Practice

The knowledge sharing captured in Jaime's story was carried out specifically to influence practice in other communities of practice. Underlying Jaime's notion of contributing to the well-being of his geographic community is an implicit recognition that his friends, family members, and neighbors are engaged in occupational practices alongside others. He made connections between what he was learning in PSA and the practices of those around him, and he introduced these connections to others by posing questions to

encourage them to reflect on their own practice. These reflections, Jaime expected, could also influence other members of these individuals' communities of practice, as they in turn shared with others.

The cases of Jaime, Alvaro, Merly, and their classmates convey how the knowledge sharing promoted by educational programs can lead to benefits for community development. The content of the PSA program calls upon students to investigate community practices through conversations with others in the community and to share pertinent ideas with others through activities of service. At the same time, students individually and as a group engage in knowledge exchanges that go beyond the assignments in the textbooks, individually speaking to those around them about things they learn and planning additional group activities of investigation and service. These activities of knowledge sharing translate into benefits for the community as networks of knowledge exchange are enriched and extended. Through these conversations, ideas from different perspectives are put into conversation with one another, community members are exposed to concrete suggestions for ways to improve their practice, and students and community members can reflect on deeper values and notions that shape practice. At times, these conversations are best understood as ideas passing between individuals, while in other cases the exchanges are so closely related to group practice that they are best understood as exchanges between communities of practice. At the level of the students' geographic community, exchanges between individuals and communities of practice regarding relevant information, practice strategies, and fundamental concepts set the stage for community benefits as increased contact between ideas enhances the likelihood of good ideas and good practices. Students and community members become

more knowledgeable about workings in the community and possibilities for action, gaining opportunities to adopt or modify the ideas and practices of others.

CHAPTER VI

DISCUSSION AND CONCLUSIONS

The findings suggest that student knowledge-sharing activities can contribute to community development on two fronts: by increasing access to knowledge elements and their flow, and by forging a community of practice that interacts with and influences other communities of practice in the geographic community.

Information, insights into the workings of reality, and strategies for effective practice are diffused across a geographic community, across a nation, and across the planet. Through experiences in the PSA program, students draw from and find relevant the funds of knowledge of their families (Moll, Tapia, & Whitmore, 1993). They seek out the knowledge of others in their community that they are less familiar with, and through the guidance of their textbooks and tutors, they make connections between the two. Knowledge from both inside and outside of the classroom are considered relevant and related, facilitating the flow of knowledge between the them. Through their investigations, students gain a better sense of who in the community is knowledgeable about a given topic; they develop greater awareness of the location of knowledge resources in the community.

At the same time, the benefits of knowledge, particularly scientific knowledge, generated outside of the community can be brought to bear on community life. Valuing both scientific knowledge and locally generated insights and experience, students can share what they learn about scientific explanations of the needs of the soil and the delicate balance of the physical environment with others in the community in a complementary, rather than

antagonistic, manner. The PSA program, then, encourages both a flow of knowledge within the community, and a flow of knowledge into the community.

The PSA program facilitates this flow of knowledge through the creation of an entirely new community of practice that promotes sharing between individuals and communities of practice. The PSA group, as a community of practice, is characterized by a desire to learn about reality and make connections between textbook learning and students' local context. It is organized around an orientation toward service that involves both large planned activities and small informal exchanges with those nearby. The formal practices assigned by the textbooks help students develop the skills and habits of knowledge sharing, while the relevance of the content to their everyday lives facilitates naturally emerging sharing between students and those with whom they interact.

The diagram below (Figure 7) conveys a model for knowledge flow that contributes to community development, as promoted by the program. Within a given geographic community, student members of the PSA group community of practice promote an increased flow of knowledge in the community through membership in other communities of practice (represented by the green circle), through interactions with family members and close friends in other communities of practice (the orange circle) and through interactions with individuals in communities of practice more distant to their own realities (the purple circle). Ideas and experiences from these communities of practice interact with the ideas from the program itself, many of which come from outside of the geographic community. These other communities of practice also have knowledge flow interactions outside of the geographic community. The red circles signal families, which are themselves communities of practice, and at the same time serve as spaces for communities of practice to interact. Yet, not all

knowledge-sharing promoted by the program takes place in relation to individuals' engagement in activities that are defined by communities of practice. Some involve knowledge sharing around individuals' solitary practices or personal interests (represented by the blue squares).

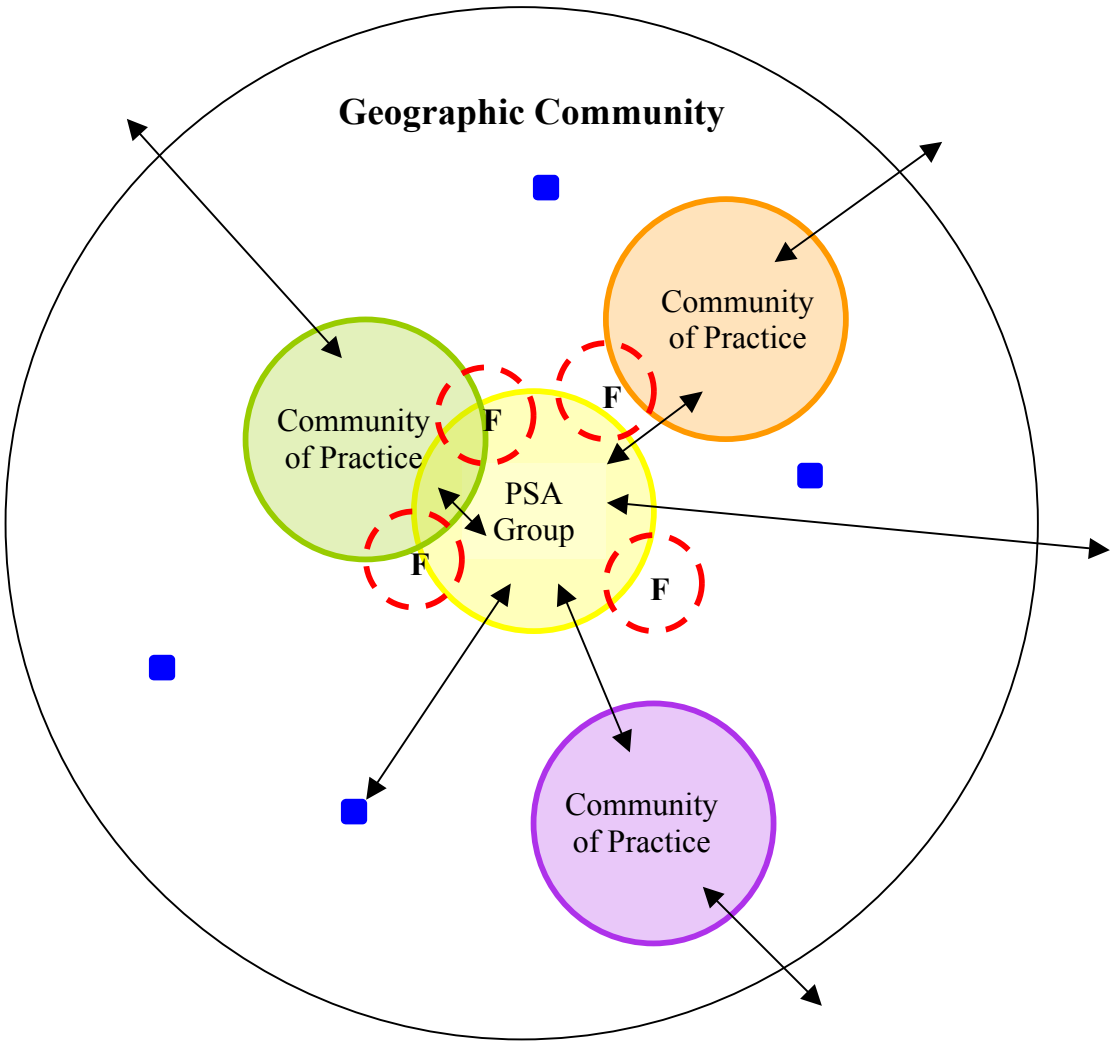

Figure 7. Knowledge Sharing for Community Development

The approach to community development highlighted in this model and exemplified by the PSA program offers a potential alterative to other roles ascribed to knowledge in efforts intended to contribute to the prosperity and development of communities. As Escobar (1995) points out, the international development enterprise was posited upon a conception of science and technology as main ingredients to be transferred to recipient populations incapable of adequately generating knowledge on their own. Such a framing of development assumed and reinforced disparities in access to knowledge and power between populations. At the same time, development science tended to translate a complex social reality in 'developing' countries into inscriptions in ways that embodied power relations and shaped possibilities for thinking and acting within development practice. Responses to some of these criticisms have tried to afford a greater role for local knowledge and participation, but have in practice discovered the complexities and potential for contradictions when the terms of development are still established by development workers (Chambers, 1997; Hickey & Mohan, 2005).

The role for knowledge in development considered in this study moves beyond the hierarchical considerations of uni-directional knowledge *transfer*, while not negating the likely benefits of knowledge that is not indigenous to a given community. This approach builds upon considerations that information, concepts, attitudes, values, and skills naturally flow within a population and between populations, and that good ideas are more likely when there is greater access to knowledge from different sources. Ultimately, the Preparation for Social Action program is part of an effort on the part of FUNDAEC to bring larger and larger segments of the world population into processes of acquiring, generating, and applying knowledge for the good of their communities towards the ends of greater social justice and

global prosperity. This study, which was carried out very early in the development of the program, has little to say about its long-term effects, but suggests that the potential exists for educational programs to promote an increased flow of knowledge in a community that both augments exposure to the fruits of science and enhances appreciation for local knowledge and resources.

CHAPTER VII

LIMITATIONS AND FUTURE RESEARCH

This paper has offered a preliminary exploration into the potential contributions of the knowledge sharing generated by educational programs to the well-being and development of communities. The study here was carried out with the participation of a small number of students from the pilot of a single program in Colombia, and analysis centered on students' accounts of interactions of the past couple years. As such, the study likely does not exhaust potential pathways by which knowledge sharing can contribute to community progress, and offers little insight into how disparate claims between students and community members are resolved. Further insights into the implications of an increased flow of knowledge within the community could benefit from greater exploration of the accounts of community members outside of the program with whom students interact, long-term attention to this program as its experiences and practices advance past the pilot stage, and investigations of other types of programs that encourage knowledge sharing and community development.

The study introduces a link between knowledge flows and community benefits that sets the stage for several arenas of future exploration. Further examination of the interactions of knowledge from different sources as they are described here holds the potential to offer insight into discussions of the relationship between scientific knowledge and local and indigenous knowledge, both within the context of science education and in debates on "development". Additionally, while the accounts of students here suggest that their knowledge-sharing efforts have influenced the practices of certain individuals in other

communities of practice, the question remains regarding the ways in which and the extent to which these changes in individuals influence their larger communities of practice. Such an inquiry might begin to answer a much larger question of how this sort of approach to community development, driven by increased exchange and application of knowledge from different sources, can generate potential benefits for geographic communities at a larger scale: To what extent does the program hold the potential to over time address issues such as poverty and limited opportunities for formal education that are faced across the region? What sorts of long-term effects does such a program have on the community? While exploration of these topics was beyond the scope of this study, the pursuit of such questions holds considerable promise for further elucidating the potential contributions of education to community development.

APPENDICES

Appendix A – Network Diagram Chart

Tablas para la identificación de miembros de las redes y sus características

	Nombre Completo	Inici[7]	Género	Edad (elige uno)	Profesión	Nivel de educación[8]	¿Familia?[9]	¿Con quién habla?[10]
1			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
2			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
3			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
4			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
5			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
6			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
7			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
8			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
9			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
10			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
11			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
12			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
13			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
14			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		
15			M / F	0-11, 12-18, 19+		Prim. / Second / Univ		

Mencione algunas de las maneras por las cuales usted contribuye al bienestar de su comunidad.

_____
_____
_____
_____
_____

[3] Para cada individuo, cree un conjunto único de "iniciales" para identificar el individuo en la representación dibujada de la red. Por ejemplo, se puede identificar a Manuel Sánchez con MS_1 y a Maria Suárez con MS_2

[4] Para cada individuo, identifique el nivel mas alto de educación que la persona ha alcanzado: educación primaria, educación secundaria, o educación universitaria

[5] ¿Es la persona un miembro de su familia? Si es que si, ¿qué es para usted? Escríbalo en este espacio.

[6] Para cada individuo, identifique con quien mas de la lista usted piensa que hablen.

[7] Para cada individuo, cree un conjunto único de "iniciales" para identificar el individuo en la representación dibujada de la red. Por ejemplo, se puede identificar a Manuel Sánchez con MS_1 y a Maria Suárez con MS_2

[8] Para cada individuo, identifique el nivel mas alto de educación que la persona ha alcanzado: educación primaria, educación secundaria, o educación universitaria

[9] ¿Es la persona un miembro de su familia? Si es que si, ¿qué es para usted? Escríbalo en este espacio.

[10] Para cada individuo, identifique con quien mas de la lista usted piensa que hablen.

Appendix B – Interview Protocols

Interview Protocol for Tutors (1-2 for each community):

- Please describe a little about the PSA program in this community.
    - How long has the program been here? How did it come to this community?
    - What distinguishes the PSA program from other educational opportunities in the region?
    - How long have you been working with the PSA program? How do you like it?
- Please describe a little about how students learn in the PSA program.
    - What are the main sources of their learning?
    - What role do other members of the community play in their learning process?
    - What do students learn about science in the program? How do you think they benefit from learning about science?
- Here is a list of several practice activities students have been asked to carry out in the units they have studied so far. Could you talk some about the experiences of your group carrying these practices out?
    - For each one, please explain how students organized to carry out the activity, with whom they carried out the activity, and where.
    - What, if any, do you feel were the benefits to students of participating in these activities? What were the benefits to community members?
    - Were there things you did a little differently than described in the unit? If so, what were they? What led you to do that?
- What, in general, do you think is the value of having students consult with other members of the community regarding what they are learning?

Interview Protocol for Case-Study Students

- Here is the network representation you created a couple weeks ago. Can you explain it to me?
    - Who are these stickers representing? What did you discuss with them?
    - Why did you put this person in this place?
    - How do you know that these people talk to each other?
    - How often do each of these people talk to one another? (Very often, sometimes, rarely)
    - Is anyone on your chart someone new that you met in doing the practices of the unit?
    - Is there anyone you wish you talked to more often? Is there anyone you haven't discussed the idea with, but with whom you would like to?
- Now I'd like to discuss with you some of your experiences in more detail. In some of the units of your program you are asked to investigate certain things by consulting other members of your community. On other occasions, you are asked to share some of what you learn with others. Here are examples of these activities from units that you have recently studied. Select a few of these activities that you remember carrying out. For each one, describe what happened.

    - Who did you talk to? How did you decide to talk to him/her/them? How do you know him/her/them? Have you ever talked to him/her/them before about other things?
    - What was discussed? Where did the exchange take place?
    - What did you benefit from the experience? What do you think s/he/they benefited from it?
    - Have you talked to them about other important issues since?
    - What do you think are the benefits of learning about science and discussing science topics with others in your community?

Interview Protocol for Community Members

- Student(s) [X] mentioned that he/she/they discussed <u>something about what he/she/they are learning in the PSA program</u> with you. Please tell me about that experience.
    - What did the student(s) ask you? What did you share with him/her/them? Did he/she/they share ideas with you? If so, what?
    - When did this happen? Where?
    - What do you feel you gain from the experience? What do you think he/she/they gained?
- Would you be interested in talking more with PSA students about <u>what they are learning</u>? Why?
- Since this occasion have you discussed other important ideas with PSA students? If yes, please describe it.
- What do you think is the value of discussing <u>such issues</u> with members of the community?
- What are good sources of learning about <u>these sorts of issues</u>?
- In order to get a more complete picture of networks of who people in the community discuss <u>important issues</u> with, could you tell me about who you discuss <u>these sorts of issues</u> with? Which of these people do you think discusses important ideas with one another?

Appendix C – List of All Interview Participants

Table C.1. Student interview participants in the study

Student	Age	Occupation	Community/Group
Merly	17	Student, PSA tutor	Tortuga
Elvira	20	PSA tutor	Tortuga
Alberto Jr.	16	Secondary student	Tortuga
Alberto Sr.	48	Carpenter	Tortuga
Fernando	45	Motorcycle taxi driver	Tortuga
Jaime	23	PSA tutor	Tortuga
Berta	18	Mother/homemaker	Lochi
Juana	25	Mother/homemaker	Lochi
Irina	adult	Mother, artesan, PSA tutor	Lochi
Marcos	28	Secondary student	Lochi
Alonso	20	PSA tutor	Lochi
Maria	22	Educator	El Alto, Group A
Adriana	27	PSA tutor	El Alto, Group A
Alvaro	adult	Farmer, educator	El Alto, Group A
Helena	18	Secondary student	El Alto, Group A
Jairo	16	Secondary student	El Alto, Group B
David	12	Secondary student	El Alto, Group B
Edgar	16	Secondary student, farmer	El Alto, Group B
Mariana	15	Secondary student	El Alto, Group B
Cecilia	14	Secondary student	El Alto, Group B
Mario	14	Secondary student	El Alto, Group B

Table C.2. Non-student interview participants

Name	Role	Community of Residence
Mrs. H	Tutor of Tortuga group	Tortuga
	Tutor of Lochi, PSA regional coordinator	Tortuga
Javier	Tutor of El Alto A, PSA coordinator	Lochi
Adriana	Tutor of El Alto B	El Alto
	Local baker	Tortuga
	Local cheesemaker	Tortuga
	Grandfather of student, retired	Tortuga
	Cousin of Tortuga student	Other community
	Father of student, farmer	El Alto
	Mother of student, health worker	El Alto
	Grandmother of student, homemaker	El Alto

REFERENCES

Agrawal, A. (1995). Dismantling the divide between indigenous knowledge and scientific knowledge. *Development and Change, 26,* 413-439.

Anaya-Narváez, A. Departamento de Córdoba información sociodemográfica. Retrieved March 15, 2010 from http://www.cordoba.gov.co/informacion_sociodemografica.html

Arbab, F. (2000). Promoting a discourse on science, religion, and development. In Harper, S. (Ed.) *The lab, the temple, and the market* (pp. 149-238). Ottowa, ON, Canada: International Development Research Centre.

_____. (2010). *Family health: Health and disease.* With Debbie Singh. Cali, Colombia: *Fundación para la Aplicación y Enseñanza de las Ciencias.* 1.1.1.P.P.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *The handbook of theory and research for sociology of education* (pp. 241-258). New York: Greenwood.

Burt, R.S. (2004). Structural holes and good ideas. *American Journal of Sociology, 110*(2), 349-399.

Camino, L. & Zeldin, S. (2002). From periphery to center: Pathways for youth civic engagement in the day-to-day life of communities. *Applied Developmental Science, 6*(4), 213-220.

Chambers, R. (1997). *Whose reality counts? Putting the first last.* London: ITDG publishing.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* London: Sage Publications.

Checkoway, B. N. & Gutierrez, L. M. (2006). *Youth participation and community change.* New York: Haworth Press.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*(1), 95-120.

Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2001). Knowing what we know: Supporting knowledge creation and sharing in social networks. *Organizational Dynamics, 30* (2), 100-120.

D.A.N.E. (2007). Colombia una nación multicultural: Su diversidad étnica. Retrieved May 20, 2010 from http://www.dane.gov.co/

Escobar, A. (1995). *Encountering development: The making and unmaking of the Third World.* Princeton, NJ: Princeton University Press.

Evans, S. D. (2007). Youth sense of community: Voice and power in community contexts. *Journal of Community Psychology, 35*(6), 693-709.

Giles Jr., D. E. & Eyler, J. (1994). The impact of a college community service laboratory on students' personal, social, and cognitive outcomes. *Journal of Adolescence, 17*, 327-339.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360-1396.

_____. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory, 1*, 201-233.

Grunewald, D. A. (2003). The best of both worlds: A critical pedagogy of place. *Educational Researcher, 32*(4), 3-12.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly, 44*, 82-111.

Hansen, D. M., Larson, R. W., Dworkin, J. B. (2003). What adolescents learn in organized youth activities: A survey of self-reported developmental experiences. *Journal of Research on Adolescence, 13*(1), 25-55.

Harris, C. E. & Umpleby, S. L. (2007). Students as community participants: Knowledge through engagement in the coastal context. In J. S. Lutz and B. Neis (Eds.) *Making and moving knowledge: Interdisciplinary and community-based research in a world on the edge* (pp. 64-84). Montreal: McGill-Queen's University Press.

Hickey, S. & Mohan, F. (2005). *Participation—From tyranny to transformation?: Exploring new approaches to participation in development*. London: Zed Books.

Hollstein, B. (2008, March). Qualitative methods in network analysis. Paper presentation at the Quantitative-Qualitative Interface in Social Network Analysis Seminar, University of Essex Colchester, UK.

Honeyman, C. (2010). Social responsibility and community development: Lessons from the Sistema de Aprendizaje Tutorial in Honduras. *International Journal of Educational Development, 30*, 599-613.

Janzen, M. D. (2008). The women of Agabaya: Education and post-development theory. *Canadian Journal of Education, 31*(1), 8 – 31.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Leach, M. & Scoones, I. (2006). *The slow race: Making technology work for the poor.* London: Demos.

Lin, N. (2001). *Social capital: A theory of social structure and action.* Cambridge: Cambridge University Press.

Markus, G. B., Howard, J. P., & King, D. C. (1993). Integrating community service and classroom instruction enhances learning: Results from an experiment. *Educational Evaluation and Policy Analysis, 15*(4), 410-419.

Mato, D. (2004). Communication for social change in Latin America: Contexts, theories, and experiences. *Development in Practice, 14*(5), 673-679.

McFarlane, C. (2006). Knowledge, learning and development: A post-rationalist approach. *Progress in Development Studies, 6*(4), 287 – 305.

McGrath, S. & King, K. (2004). Knowledge-based aid: A four-agency comparison study. *International Journal of Educational Development, 24*, 167-181.

McGuire, J. K. & Gamble, W. C. (2006). Community service for youth: The value of psychological engagement over number of hours spent. *Journal of Adolescence, 29*, 289 – 298.

Mehta, L. (2001). The World Bank and its emerging knowledge empire. *Human Organization, 60*(2), 189-196.

Miller, B. A. (1995). The role of rural schools in community development: Policy issues and implications. *Journal of Research in Rural Education, 11*(3), 163-172.

Moll, L.C., Tapia, J., & Whitmore, K. F. (1993). Living knowledge: The social distribution of cultural resources for thinking. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 139-163). Cambridge, UK: Cambridge University Press.

Murphy-Graham, E. (2010). And when she comes home? Education and women's empowerment in intimate relationships. *International Journal of Educational Development, 30,* 320-331.

_____. (2009). Constructing a new vision: Undoing gender through secondary education in Honduras. *International Review of Education, 55*(5/6), 503-521.

_____. (2008). Opening the black box: Women's empowerment and innovative secondary education in Honduras. Gender and Education, 20(1), 31-50.

_____. (2007). Promoting participation in public life through secondary education: Evidence from Honduras. *Prospect, 37*(1), 95-111.

Powell, M. (2006). Which knowledge? Whose reality? An overview of knowledge used in the development sector. *Development in Practice, 16*(6), 518 – 532.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly, 48*, 240-267.

Reinders, H. & Youniss, J. (2006). School-based required community service and civic development in adolescents. *Applied Developmental Science, 10*(1), 2-12.

Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.

Ruiz-Mallén, I., Barraza, L., Bodenhorn, B., Reyes-García, V. (2009). Evaluating the impact of an environmental education programme: An empirical study in Mexico. *Environmental Education Research, 15*, 371-387.

Schiffer, E. (2007). *The power mapping tool: A method for the empirical research of power relations.* Washington, DC: International Food Policy Research Institute.

Shumer, R. (1994). Community-based learning: Humanizing education. *Journal of Adolescence, 17,* 357-367.

Sillitoe, P. (2007). *Local science vs. global science: Approaches to indigenous knowledge in international development.* New York: Berghahn Books.

Sobel, D. (2004). *Place-based education: Connecting classrooms and communities.* Great Barrington, MA, USA: The Orion Society.

Stanton, T. K., Giles, D. E., & Cruz, N. I. (1999). *Service-learning: A movement's pioneers reflect on its origins, practice, and future.* San Francisco, CA: Jossey-Bass, Inc.

Tracey, P. & Phillips, N. (2007). The distinctive challenge of educating social entrepreneurs: A postscript and rejoinder to the special issue on entrepreneur. *Academy of Management Learning & Education, 6*, 2, 264-271.

VanderDussen, E. (2009). *"A Spirit of Service": Conceptualizing service in learning through the* Preparation for Social Action *(PSA) Program in Uganda*. Unpublished master's thesis, University of Toronto, Toronto, Ontario, Canada.

Wicker, A. W. (1989). Substantive theorizing. *American Journal of Community Psychology, 17*(2), 531-547.

Wilson, G. (2007). Knowledge, innovation and re-inventing technical assistance for development. *Progress in Development, 7*(3), 183-199.

Welch, T. (2010, October 19). Neo-paramilitary violence on the rise. *Colombia Reports.* Retrieved January 26, 2011, from http://colombiareports.com/colombia-news/news/12447-violence-in-cordoba.html

Wenger, J. (1999). *Communities of practice: Learning, meaning, and identity.* New York: Cambridge University Press.

World Bank (1999). *World development report 1998/99*. Washington, D. C.: Oxford University Press.

Yates, M., & Youniss, J. (1998). Community service and political identity development in adolescence. *Journal of Social Issues*, *54*(3), 495-512.

Youniss, J. McLellan, J. A., & Yates, M. (1997). What we know about engendering civic identity. *American Behavioral Scientist, 40*(5), 620-631.