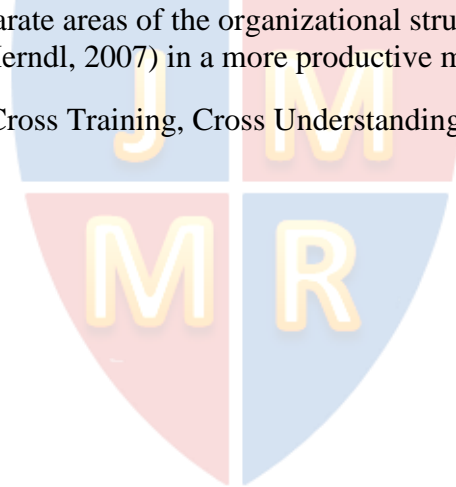# Managing cross-understanding: An extension of cross training

Bradley S. Wesner
Sam Houston State University

ABSTRACT

This paper will focus on the ways cross training practices impact and lead to cross understanding, perspective taking, enhanced interpersonal relationships, and greater organizational understanding within organizational settings. The literature surrounding cross training is centered largely around ideas of efficiency and task management and tends to focus on the practice and techniques used when creating a cross trained organization (Ebeling & Lee, 1994; Kaeter, 1993; Slomp & Molleman, 2002); however, most research fails to look at other communication aspects which are enhanced when workers are given the opportunity to cross train. This paper identifies four byproducts of cross training which seem to enhance overall organizational function and show potential for relationship enhancement and conflict management throughout the organization. Further, the results cited here give some clues to the way in which organizations may productively address boundary items, items of common interest between parties found in disparate areas of the organizational structure, (Gal, 2008; Star & Griesemer, 1989; Wilson & Herndl, 2007) in a more productive method.

Keywords: Boundary Items, Cross Training, Cross Understanding, Knowledge Management

INTRODUCTION

The virtues of cross training for organizations, particularly those surrounding ideas of production, have long been extolled with cross training historically focused on increasing worker flexibility and preventing production delays when specialized individuals were unable to attend work (Slomp & Molleman, 2002) resulting in reduced costs stemming from absenteeism (Molleman, 2005). Secondary to the concept of avoiding production delays is the notion that cross trained workers can demonstrate greater flexibility and develop a broader skill set with continued exposure to different types of jobs (Kaeter, 1993).

Due to exposure to varied job types cross training has been shown to enhance workers' overall understanding of the manufacturing process (Ebeling & Lee, 1994; Kaeter, 1993; Slomp & Molleman, 2002). This enhanced understanding of the product and the manufacturing process was noted to aid workers in recognizing errors in manufacturing that took place prior to their involvement on the assembly line. Due to their exposure to processes further up the line and their resultant knowledge of what should have been done, workers demonstrated the capability of recognizing and correcting errors and positively enhanced overall quality control efforts (Molleman, 2005). Research has also noted that cross trained employees also attained greater organizational understanding, demonstrating a better comprehension of how their individual role fit in the organizations processes (Bokhorst, Slomp, & Molleman, 2004; Jordan, Inman, & Blumenfeld, 2004; Sayin & Karabati, 2007; Slomp & Molleman, 2002). This broader organizational understanding was found to boost organizational morale and increase organizational performance with the concept of organizational understanding linked to greater levels of commitment to the company's mission by employees (Jordan et al., 2004).

To date the study of the way in which cross training of workers impacts their level of understanding across tasks has been limited. This paper will begin by reviewing studies which have investigated cross training and summarize the findings of those studies. The paper will then position the concept of cross understanding within a discussion of existing work on boundary items and knowledge management arguing that cross training is capable of creating enhanced understanding and perspective taking between employees. Finally a summary of recently conducted research will be presented which examines the linkage between cross training and cross understanding. This research contributes to existing scholarship by demonstrating: (1) the positive impact of cross understanding plays in enhancing perspective taking among employees and (2) the positive influence of cross understanding on decision making processes and intractable conflict reduction.

REVIEW OF LITERATURE

Cross Training: What are the Goals?

The vast majority of cross training research has concerned the study of dual resource constrained (DRC) systems (Bokhorst et al., 2004; Ebeling & Lee, 1994; Hottenstein & Bowman, 1998; Jordan et al., 2004; Kaeter, 1993; Park, 1991; Sayin & Karabati, 2007; Slomp & Molleman, 2002). DRC environments are defined as having more machines to run than there are humans to run them (Park, 1991), a situation which precludes running all machines at once. The constraints produced by the inadequate number of workers necessary to for use of all machines necessitate cross training, as individual workers must be able to move seamlessly from one

machine to another as necessary to fulfill the demands of production and complete the job at hand. In the DRC system, or job shop (Park, 1991; Slomp & Molleman, 2002), each individual is expected to perform multiple roles. The performance of multiple roles by a single employee establishes the first two criteria for successful cross training: (1) workers must be flexible enough to learn and perform multiple tasks for the DRC system to work and (2) workers must be able to learn and perform multiple tasks to provide redundancy when fellow workers are absent or otherwise unable to perform their normal roles (Molleman, 2005).

The DRC system focuses on the task level, and research in this area has largely been concerned with how efficiently workers can complete tasks outside their given specialty following cross training. For example, let us assume that a standard drill press operator is capable of drilling 500 holes in standardized materials per hour. A welder might be cross trained to run a drill press in the event that the drill press operator is absent or unable to perform the task and in doing so would now be qualified to drill holes in standardized materials as required. This training involves the removal of the welder from their normal duties so that he or she may be trained on the press. The determination of successful training rests entirely on the ability of the welder to drill holes in material at a rate which is determined acceptable, typically as close to the 500 hole per hour mark of the drill press operator as possible (Ebeling & Lee, 1994; Kaeter, 1993; Hottenstein & Bowman, 1998; Park, 1991).

As noted earlier, the secondary goal of cross training process is to enhance the worker's understanding of the overall manufacturing process (Ebeling & Lee, 1994; Kaeter, 1993; Slomp & Molleman, 2002), yet little DRC work is dedicated exclusively to the concept. Still, some research has indicated that such understanding is essential to enhance job quality overall. One such example is the Toyota job processing model (Kaeter, 1993). Toyota determined that whe each person on an assembly line knew what was taking place further up the line, and why, efficiency increased and fewer errors resulted. In this scenario the person midway down an assembly line would have an understanding of every process that had taken place on the line up to the point that he or she received the part. If something was not done correctly the worker then had the capacity to recognize the problem and have it corrected. Additional research on this process has noted two significant benefits of this knowledge: (1) the cross trained employee would be able to correct the problem and prevent wasted time and, if properly implemented, (2) failure rate should approach zero by the time that the part reaches the end of the line (Bokhorst et al., 2004). Other companies have since added the Toyota model to their methods of production and similar successes and gains in efficiency and error reduction have been observed (Kaeter, 1993).

Cross Training: How Much Do We Need?

Significant efforts have been made to determine how to cross train efficiently with researchers attempting to determine what processes are most efficient in cross training and, in some cases, whether it is worth pursuing at all. These studies focus on two areas: (1) how many people need to be cross trained to produce maximum efficiency and (2) how many jobs can people remember how to do after training exposure (Bokhorst et al., 2004; Hottenstein & Bowman, 1998; Jordan et al., 2004; Marks, Sabella, Burke, & Zaccaro, 2002; Slomp & Molleman, 2002).

The first area concerns how many people must be cross trained, as some research has found a positive relationship between cross training and enhanced worker efficiency across role

performance (Bokhorst et al., 2004; Ebeling & Lee, 1994; Hottenstein & Bowman, 1998; Jordan et al., 2004; Park, 1991; Sayin & Karabati, 2007; Slomp & Molleman, 2002). In an effort to capitalize on the noted efficiency increase, researchers then set about determining how much cross training was necessary and determined that while some cross training was good, more was not necessarily better. Researchers noted diminishing returns as the number of people who were cross trained was increased noting that when one person in a small unit was cross trained improvements in efficiency were noted, but the improvements noted for when cross training one member of a unit were not noted when additional members were subsequently trained (Jordan et al., 2004; Park, 1991; Slomp & Molleman, 2002). The contrasting views led to the emergence of three models. The first model suggests that no one be cross trained. The second model (total cross training) proposes everyone in a given team or unit be completely trained on all other jobs in the unit (Safizadeh, Ritzman, Sharma, & Wood, 1996; Sayin & Karabati, 2007; Slomp & Molleman, 2002; Sy, Beach, & D'Annunzio, 2005). The third model posits that only certain members of teams need to be cross trained (chaining) where some members of the team or workgroup function as single task specialists while others become capable of taking on other tasks other than their own (Jordan et al., 2004).

Research has noted that the greatest efficiency is noted when a single individual from a work group is cross trained, thus compelling weight can be given to the concept of chaining (Jordan et al., 2004). Chaining allows for one individual in the group to be cross trained with one other group. The diagram below (Appendix A) outlines what the process might look like with circles representing worker units and squares representing task types. The solid black line represents the primary task assignment for each work group. The dotted lines represent the cross trained task. In this situation, regardless of how many people are in the working units, only one person is cross trained (or cross chained in this case) to an alternative task. The remaining individuals within any work unit remain working entirely in specialty tasks (Jordan et al., 2004).

Chaining also provides a solution for the second area of significant constraint to maximization cross training potential, worker's capacity to retain information. Research has indicated that many workers show limited thresholds of retention when faced with multiple training situations on multiple tasks (Hottenstein & Bowman, 1998; Hoyt & Matuszek, 2001; Jordan et al., 2004; Park, 1991; Slomp & Molleman, 2002). The chaining model shows potential to solve this problem efficiently as the members who are cross trained are only responsible for retention of one task outside their specialty thus avoiding task information overload and resultant confusion. Further, this model provides that non cross trained workers would not be required to learn a second task at all. Additionally, once the organization accepts the fact that some members demonstrate a greater capacity for training retention across multiple task areas, the organization may then begin to identify and select for training only individuals demonstrating the greatest threshold of retention for multiple task roles thus eliminating the problem of training individuals who will not retain information after cross training and are unable to perform backup rolls when called upon (Jordan et al., 2004; Park, 1991; Slomp & Molleman, 2002).

From Cross Training to Cross-understanding

To this point in this paper, the research presented has sought to understand how cross training may prove effective in promoting efficiency through redundancy and has helped to identify how much cross training must be done to maintain that efficiency. Still, the research performed to date leaves some room for additional theorization. While cross training produces workers which are capable of performing tasks other than their own, only a small amount of

existing literature largely attempts to detail the impact of cross training on creating a greater overall understanding of the manufacturing process (Kaeter, 1993), particularly with respect to the often studied DRC system, and the organizational structure as a whole. Secondly, the research surrounding cross training is almost entirely focused on production at the factory floor level with little attention paid to decision making processes and team interactions among cross trained people in white collar roles.

Further, some scholarship has noted potential implications for further research in cross training which have arisen from their research in knowledge management and decision making. One such study focused on qualitative interviews associated with three engineering groups involved in computer memory production. The study noted a lack of understanding across group lines among white collar decision making members finding that in these situations groups of experts bring unique knowledge to the process and engage in deliberation to satisfy needs specific only to their own area of interest and with seemingly little regard for, or understanding of, the needs of others in the group (Kim & King, 2004).

Research has also noted that within individual groups the work results also tend to be difficult to evaluate by the workers themselves due to an almost total lack of expert knowledge outside of their personal area of expertise (Alvesson, 1993). It appears that this lack of understanding may be at least partially brought about by a lack of knowledge and position exchange during group processes. For example when considering Kim and King's (2004) work on three separate engineering groups, those three groups represented three unique expertise areas (design, process, and integration) all of which were present and working together in the study. For proper coordination to take place Kim and King note that the parties needed to have a shared exchange of knowledge and the lack of this shared exchange was eventually identified as the root cause for the coordination problems noted.

Kim and King (2004) found that the three engineering groups all identified with the larger mission for their department, that of expediting production processes and correcting impediments to that production. This broad level statement of purpose was easy for each group to identify with, yet the heterogeneity of the individual group's purposes proved problematic in facilitating that overarching goal. The members of the various teams lacked a holistic understanding of the production process, specifically the contributions of teams other than their own required for successful management of engineering difficulties associated with production. Groups were also found to have little knowledge of what other group's needs or perspectives were, preventing effective perspective taking. Kim and King noted that each of the team members possessed unique knowledge making them part of the team yet allowing them to maintain autonomy over tasks performed by others. The scholars report that such knowledge intensive workers became highly protective of their own expertise and established boundaries around their teams to protect their knowledge from others. Kim and King found that this restriction of knowledge sharing results in teams that have no real understanding of what other teams defined by different expertise are doing, how they do it, or what their needs are.

The researchers also found that when the three teams were brought together to work and share ideas concerning a problem associated with production, conflicts erupted. The authors initially accepted this as part of such a process noting that the process of problem solving takes place through ongoing negotiations among the teams who frequently disagree on problem solving definitions and methodological approaches (Kim & King, 2004; Oser, Gualtieri, Cannon-Bowers, & Salas, 1999; Sternberg & Grigorenko, 2001). This framing, according to Kim and King (2004), appeared to lead to conflicts when significant ambiguity and a lack of established

procedures existed concerning who would be responsible for correcting major problems. When ambiguities and unclear procedural process presented each team would pass the buck of responsibility off to another team. Researchers noted here that under these conditions, the teams viewed the problem from their own perspective and would work vigorously not to have to share knowledge associated with their particular point of view or accept responsibility for the problem out of fear of a knowledge breach. In contrast to these complex issues, simple problems that lacked ambiguity and could be solved via established company procedures were found to be solved quickly, with limited conflict, and with much greater sharing of knowledge between groups.

Kim and King (2004) noted that during periods of ambiguity, each team rallied around itself and immediately took up positions against the other teams eventually leading to a process of deliberation and negotiation between teams. During this process, the various teams would often make assertions about the problem and who was at fault in an effort to pass the buck to others. For example, the design team would say that the problem with the system was related to integration, so the integration team should fix it. The integration team would then state that the real issue surrounding the problem stemmed from the processing team. The processing team would then pass the buck back to design. The authors noted two important factors concerning this process. (1) There was no limit to how long the buck passing process could go on, but it would continue until someone eventually took responsibility and solved the problem. And (2) given enough time each of the teams eventually admitted little or no real knowledge as to what the other teams actually did or who was really responsible.

The authors attribute the problem solving impediments noted, and inefficiencies associated with those impediments, to authority conflicts between the groups (Kim & King, 2004; Sternberg & Grigorenko, 2001), a common attribution for such problems (Bailey, 1999; Sternberg & Grigorenko, 2001). This paper argues that such literature overlooks a central communicative concept which may provide a solution to this conflict manifestation: in such group interactions knowledge is not being shared which could produce a more thorough understanding of the issue vis-à-vis creation of a shared understanding the perspectives and needs. This paper argues that if groups were in possession of knowledge of other groups in the interaction that was sufficient for them to take the perspective of others, conflict could be significantly reduced and efficiency of interactions improved. For the purposes of the remainder of this paper this type knowledge exchange leading to the ability to take the perspective of others will be referred to as cross understanding.

The opportunity presented by cross understanding has long been hinted at in literature with perhaps the most insightful work on the subject from Star and Griesemer and their work on boundary objects (Star & Griesemer, 1989). Their work centers around understanding how members of varied scientific teams work together on projects of common interest. For example, if we assume that a team of scientists from various disciplines have been brought together to examine a newly found dinosaur bone, several specialties could be interested. Paleontologists might be interested in establishing the nature of the species. Chemists might be concerned with chemical properties of the bone. Finally, archeologists could be concerned with the location where the bone was discovered and the resultant knowledge of other peoples in and around that location. Thus, three different groups might approach the same object with three different views on the object and subsequent interests in the object. Herein the bone would be considered by Star and Griesemer to constitute a boundary object as the item itself is not exclusive to one

group, and the groups themselves see the object in different ways and with different conceptualizations or how the object might prove to be of the greatest value.

One can envision the natural emergence of conflict surrounding such objects if the specified teams were composed of individuals with these varied perspectives, if for no other reason than the fact that each group wishes to bring their perspective to the study of the phenomena in question. This conflict emergence becomes particularly troubling in problem solving groups, as noted in what Kim and King (2004) find in their study of the three engineering groups. Each group viewed the problem in production from their independent frame producing a different view of the problem than the view experienced by others. Conflicts emerge due to the fact that each group's perception of how to solve the problem is different from the perception of the other groups in the interaction. Some studies of boundary items have also noted that there is little meaningful information exchange between varied groups working together concerning their perceptions and the needs arising from their individual frame of reference (Chubin, 1976; Lynch, Tryhorn, & Abramson, 2008; Star & Griesemer, 1989). The researchers note that this lack of information exchange effectively prevents interacting groups from understanding the needs of others and produces numerous opportunities for misunderstanding and misinterpretation eventually leading to conflict within the groups and possible fragmentation prior to goal attainment (Gal, 2008; Wilson, 2007).

To better understand the concept of boundary items, consider a visual representation (Appendix B). Imagine four groups: A, B, C, and D, and how they might perceive a boundary item. The four groups are represented via the four color coded circles labeled A, B, C, and D. The boundary item is represented by the quadrilateral located in the center. Each group's perimeter of control and interest is represented by the dotted line surrounding the group. The boundary item is intersected by each group's perimeter of control placing the boundary item in each group's boundary region. If we imagined ourselves in any one of the groups we would have a vastly different impression of the boundary item depending on which group we were in. As defined above, the viewpoint of each group toward the boundary item is the key to problems arising when all groups try to work together.

RATIONALE FOR STUDY

Achieving Cross-understanding

Facilitation of cross understanding between groups such as those described above poses a challenge. To facilitate such knowledge exchange requires more than simple conversation between the groups, and is complicated by the fact that the groups themselves may have an interest in protecting their knowledge and not sharing it with other groups. This lack of perspective taking make perspective taking difficult; inhibiting decision making and promoting conflict as a result (Alvesson, 1993; Barrick, Stewart, Neubert, & Mount, 1998; Kim & King, 2004).

Cross training of the groups may provide a solution capable of bringing about the necessary knowledge exchange for perspective taking to take place. While traditionally focused on the transfer of task specific skills (Bokhorst et al., 2004; Ebeling & Lee, 1994; Hottenstein & Bowman, 1998; Jordan et al., 2004; Park, 1991; Sayin & Karabati, 2007; Slomp & Molleman, 2002) this paper argues that cross training is capable of giving employees an understanding of

the needs and constraints faced by other positions, and that such cross understanding enables the employee to view issues from perspectives other than his/her own.

If cross understanding is a byproduct of cross training processes, the model of boundary items presented earlier (Appendix A) would change substantially as the parties in question would no longer be limited simply to looking at the boundary object through their own frame. Rather, they would now have the ability to view the object through multiple frames, and thus from multiple perspectives, via incorporated knowledge from cross training procedures. This, then, should result in greater communal understanding of needs and constraints of all parties who have interest intersections with the boundary item resulting in more cooperation and diminished conflict. This postulation leads to the following research question:

RQ1: What is the impact of cross training on cross understanding in the workplace?

METHODS

The study was exploratory in nature and utilized qualitative data from interviews with individuals who were members of a large state level government organization in which cross training of specific individuals via the chaining method had been successfully implemented to provide for task redundancy in case of absence and for eventual succession planning.

Participants

The participants were 20 individuals who were current employees of the organization from varied rolls and had participated in cross training as part of their continued training and education. This type of purposive sample was appropriate for the research question. Participants who were identified as having participated in cross training were allowed to self select for the study and represented a variety of job types and positions including service employees, customer service representatives, and management personnel. The cross section of experiences experienced by participants allowed participants to assess the effectiveness of cross training, identify potential problems, and assess overall impact on their daily work lives.

The organization was presented with the criteria for the study and solicited volunteers for interviews based on their previous inclusion in a cross training programs at various levels of the organization and their availability for extensive interviews. This was done deliberately so that the organization could aid in identification of suitable participants based on the training that those individuals had undergone, diversity in the positions that they held, and tenure with the organization. The researcher then contacted the participants and the organization via email and set up times and locations for interviews. Interviews were collected over three full days of interviewing at the organization in central Texas. Interviews were conducted in a private office which was isolated from the rest of the workplace. The participants were of a diverse makeup including a broad diversity of ethnic composition and equal numbers of males and females responding.

Interviews

All interviews were conducted face-to-face. The interviewer began by describing the purpose of the study, explained the criteria for the selection of the participant, explained the

nature of the interview process, and obtained permission for the interviews to be conducted and tape recorded. The interviewer then explained the voluntary nature of the interviews and informed the participant that they could elect to terminate the interview at any time. The shortest interview was 30 minutes, and the longest was just over 90 minutes with most interviews lasting approximately 50 minutes. The length of the interview was typically reflective of the conversational style of the participant. All 20 interviews were transcribed by the researcher and a private transcriptionist hired by the researcher.

The interviews followed a semi-structured format intended to inquire into the experiences that the individuals had encountered during and following cross training experiences. Initial questions surrounded the nature of those experiences, and participants were encouraged to describe experiences that they considered the most applicable to the success or failure of such teams (Charmaz, 2002). The original interview protocol was modified as necessary to capture nuanced information that developed during the interview itself and could not have been anticipated prior to the interview process (see Appendix A).

Data Analysis

In order to discuss respondent's relevant perceptions and explanations of perceptions interviews were used (Charmaz, 2002; Gummeson, 1991). Data was analyzed using thematic analysis to identify emergent themes and commonalities in responses (Gummeson, 1991). This allowed for identification and classification of themes based on produced thought units of the respondents.

Direct and indirect questions elicited information concerning cross training and the narratives associated with respondent's experiences. Questions about ineffective cross training and areas for improvement were equally as productive bringing forth responses which illustrated damaging themes and emergent ideas of the respondents on how to fix such situations. The information solicited shed light on the behaviors, attitudes, and processes that cross trained team members recognized as being effective in facilitating cross understanding.

A total of four themes emerged as byproducts of cross training with no preconceived categorization. Responses were then categorized via those four areas. A second coder was also asked to analyze the data and identify themes after being exposed to the relevant literature surrounding the study. Reconciliation of all four categories was quickly accomplished after the second coder completed analysis. By allowing another coder to review the data the confidence of the researcher's assessment of emergent themes was greatly enhanced. To further understanding, the themes emerging from the data will be discussed here in greater detail

The eventual goal of this investigation was to attain an understanding of how cross training impacts cross understanding in the workplace. Through the use of a grounded theoretical perspective, the existing theoretical accounts offered by researchers were compared with the narrative accounts and thematic analysis of cross trained participants in the organization. Comparison yielded insight into how cross training opportunities may lead to cross understanding and a better overall understanding of the mission of the organization as a whole. As presented below, it appears that the cross training process may build bridges that allow new perspective taking on boundary objects.

RESULTS

After applying grounded methodology to materials and determining that the point of saturation had been reached, a solid and coherent pattern emerged. The study revealed that participants immediately recognized that the organization's main goal was to provide for redundancy and succession planning, but upon further questioning participants also noted that cross training led to greater levels of understanding across the organizational structure, or as it has been called it here, cross understanding. The participants noted that as they moved to train in positions other than their own, crossing organizational and even disciplinary boundaries, they began to think differently about work processes via understanding of the constraints and pressures associated with other positions. The following responses from managers are indicative of the changes in cross understanding of employees. In these cases, managers who allowed subordinates to train with the manager for succession planning reported cross understanding enhancement:

> "Right now I've got a third one (employee) ready for something new (promotion) but there is nothing available for her right now, but I've got her going to meetings with me so she sees what goes on. She's learning my job and what goes with it. It gives her an understanding of what I do and what I have to do and why I make the decisions that I do. I know it does. She tells me."

> 'They're (my employees) more confident in themselves. They definitely have an appreciation for all that I do (since the training), and so they're even more willing to help. If I say, "Oh, I need you to take care of something," it's an immediate response now. I also have learned to appreciate that there were jobs that some of my people liked to do…wanted to do…I just never knew it. Through their training on my job, they understand me better, and I understand them better. We know what makes each other tick."

> "The understanding they gain helps I think because as a state agency we have um…um measures that we are required to meet by the state legislature, and some people never knew that before but now they're like, "this deadline is something that we really want to meet and this measure is an important measure for the organization." They now get that you have to meet so many deadlines or the legislature comes and looks at you and says what are you guys doing. They never understood before."

An additional byproduct of such cross understanding is perspective taking. Employees reported that as they began to develop a better understanding of the constraints and issues faced by others in other areas or levels of the organization they began to take those issues and positions into consideration while doing their own work. Two participants noted:

> "Things have changed since I started training with XXX (her boss) I'll go to XXX and say you know this is happening, you know, how would you handle it? What would you do? I'll go to him and ask about personnel issues and something going on in our group and ask him how does he think I should handle that or should I

just refer it to him, you know? So yes I don't think if I wasn't being groomed for that position that would I even bother with that part. But now, I have to try to see things his way. It helps me a lot even in my own job. We disagree less because I try to see things his way before I even bring it up."

"Oh yeah, that's really beneficial. It's beneficial because you have another person who is willing to help and helps to look at other things in ways you normally would not. Typically I've got the division director who is looking at the issues, problems, and concerns and of course I'm looking at them too, but It's good to have someone with another perspective, a fresh set of eyes, or someone that is not day to day into that particular function to take a look at it. XXX (a newly cross trained employee) does a real good job at that because she's young she's wanting to learn stuff as well, so that's really useful…Interestingly she doesn't come from a fire service background, so she hasn't been trained and educated in fire protection. So, a lot of what she brings is kind of the lay person's perspective if you will. Sometimes we are already in the box…thinking in the box…and sometimes it's hard for us to get out of it. Those of us who have been trained in fire protection which the division directors have been in this service for 25 yrs. When she trains under me, I learn to think of things from her perspective and I think she considers mine. This makes decision making better and easier."

"She (respondent's boss) realizes we all work together and if they know what we are doing that helps us all, and I know that because I've worked in a lot of different areas, and I can say, "Oh market conduct needs to know this because when they are doing their exams they look for it."   …we'll include anyone we think (of) in the agency that might have some interest. I know it because I have trained in their job and I can see things through their eyes. I just went to Kansas City for a conference and at the end I wrote out everything in bullet points of important things and sent it out to umpteen people within the organization. If you work with them, and you know their jobs, you know what they need."

Respondents noted that with cross understanding and resultant perspective taking, they also engaged in reflection after cross training. This reflection centered around the way that their newly established understanding of the constraints and positions of others and their experience with other areas of the organization impacted their understanding of the organization's overall mission and what the big picture of the organization looked like. One respondent noted:

"Early in my career I got assigned a couple of projects that were really cross divisional in nature, I mean like representatives of the entire agency working for an extended period on rather complex projects. In that process we were trained and educated about their jobs and what they did. Terrific opportunity, it gave me such an expanded view of what the overall mission...of how departments work together, the different functions and business needs and customer basis they serve…extraordinary. When you train and work with other divisions it gives you that. It lets you know what gives them problems and what they are good at. It

also gives you that big picture approach, you know? That larger understanding of what this place is all about."

Respondents also reported that as cross training continued and cross understanding and overall understanding of the organizational mission increased, they developed better and more fluid interpersonal relationships with others. These relationships were marked by fluid organizational processes assisted through understanding. Interestingly, respondents also pointed out that, as also noted in previous examples, conflict manifestation was significantly reduced. This phenomenon was evident in the observations of management and line employees:

"Yes. I don't know if they've verbalized it, but when I look at their behavior they really do…they're in each other's offices talking and when we have a new legislation, I don't have to say anything. They've already got the team leaders together saying, "We've got a new process because of this legislation and we've got to update the procedures manual." They work well together. I'm real lucky with that. If they have an issue they come to me but mostly they work well together, so I haven't had any, "such and such is not telling me anything." Some of that I was just real lucky that I had the people that were there but the fact that they understand each other has a lot to do with it. They fight less and they work to get along."

"We all loved the opportunity to get together and train each other so that we could do the project. The best part is that we all got to know about each other and what made our jobs work, you know? In the end, we really got along well. In fact, we got along so well that we still get together for lunch just to catch up even after the project is over. We like to keep track of how our positions and stuff are changing. Keeps us in the know. Keeps us connected."

DISCUSSION

The data collected in this study illuminates multiple byproducts of the cross training process. Though the investigated organization sought only to provide for issues of redundancy and succession planning, respondents indicated that they also developed in other ways, specifically the four ways described above. Reflecting back on existing literature presented earlier, the findings above may have application in approaching the boundary item phenomenon (Star & Griesemer, 1989) which has long challenged communication efforts in organizations and among interdisciplinary and transdisciplinary researchers. This study indicates that individuals who cross train begin to understand and then take the perspective of others with whom they train. Here the employees are looking at the same issue but now taking the perspective of other positions which they have been exposed to through the cross training process. When we consider this in the context of respondent's indications of greater understanding of the larger organizational mission and purpose it would appear that such training may act as a bridge in the gulf that currently exists between various professions and academic perspectives. The cross understanding and perspective taking noted here are what appear to be missing in the boundary item literature, and their absence causes problems experienced during integration efforts surrounding boundary items. The ability of individuals to understand a position other than their

own appears to facilitate more fluid interdisciplinary work less intractable conflict manifestation. Should cross training provide a mechanism to create such understanding and perspective taking, as evidenced in the results of this study, groups of varied disciplines may find integration and collaboration on a variety of issues with less unproductive conflict. Similarly, this finding may point the way for continued efforts at unraveling the communication difficulties between seemingly dissimilar organizations and even divisions within those organizations.

Further implications exist when one considers the interpersonal understanding that was described by respondents when considering their training experience. This was particularly salient when respondents considered succession planning and were allowed to train under their supervisors. In such situations, enhanced cross understanding led to enhanced relationships between the parties. While additional and more longitudinal studies would need to be conducted to determine the longevity of this enhanced relationship status, the fact that both supervisors and subordinates indicated higher levels of understanding and relationship enhancement may indicate that cross training has implications in producing increased harmony in supervisor/subordinate relationships and hints at implications for overall organizational conflict management.

A further interesting observation is that cross understanding via perspective taking appears to have the potential to reduce role and task ambiguity. As Kim and King (2004) note, when tasks and procedures are viewed as ambiguous employees have a tendency to pass the buck to others in the group. While not directly noted here quantities significant enough for saturation, some respondents did indicate that cross training led to a more clear understanding of group level tasks, and that this appeared to reduce social loafing. Further investigation of this phenomenon is needed in future research.

Finally, it should be noted that the data collected did not fully substantiate an efficiency relationship between chaining as a method of cross training and overall organizational efficiency with respect to cross understanding. This is perhaps indicative of the fact that most studies comparing cross training models have focused on the necessary amount of cross training to facilitate organizational redundancy only. However, in this study it appears on the surface that the more people who are exposed to positions other than their own, the greater impact that cross understanding might have. It should be noted here that more data collection is necessary to flesh out the impact of various cross training models on the cross understanding phenomenon, as data collected here is not yet sufficient to make broad claims. It does appear that, in light of the findings presented here, that such research may be beneficial.

CONCLUSION

The study of cross training and its implications to cross understanding has been somewhat overlooked in previous research. This may be primarily due to the fact that cross training has long been looked at as a functional endeavor for organizations in which the organization is simply seeking to provide for redundancy and eventual succession. The implications appear to be much more substantial, and suggest that cross training might one day be viewed not only as a functional tool but one which could provide psychological and communicative enhancements for the employees and management of the modern organization.

Cross training appears to demonstrate a unique byproduct of cross understanding and the subsequent ability of those trained to engage in greater amounts of perspective taking via that training and understanding. The respondents here indicate that this understanding has led to
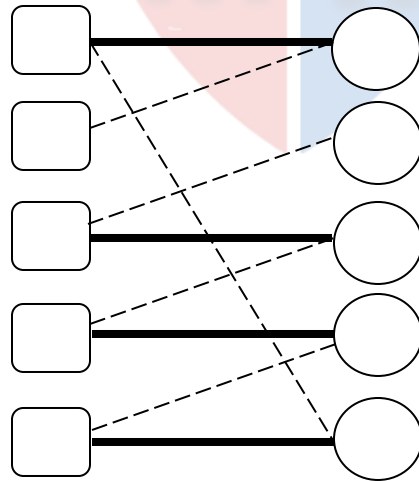
improved decision making processes which are subject to less conflict, and this provides the primary contribution of this work to the existing literature.

REFERENCES

Alvesson, M. (1993). Organizations as rhetoric: Knowledge-intensive firms and the struggle with ambiguity. *Journal of Management Studies*, *30*(6), 997–1015.

Bailey, D. E. (1999). Challenges of integration in semiconductor manufacturing firms. *IEEE Transactions on Engineering Management*, *46*(4), 417–428.

Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of Applied Psychology*, *83*(3), 377–391.

Bokhorst, J., Slomp, J., & Molleman, E. (2004). Development and evaluation of cross-training policies for manufacturing teams. *IIE Transactions*, *36*(10), 969-984. doi:10.1080/07408170490496209

Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis. In J. Holstein & J. Gubrium (Eds.), *Inside Interviewing: New lenses, new concerns* (pp. 675-694). Thousand Oaks, CA: Sage Publications.

Chubin, D. E. (1976). State of the Field The Conceptualization of Scientific Specialties*. *The Sociological Quarterly*, *17*(4), 448-476. doi:10.1111/j.1533-8525.1976.tb01715.x

Ebeling, A., & Lee, C. (1994). Cross-training effectiveness and profitability. *International Journal of Production Research*, *32*(12), 2843 - 2859. doi:10.1080/00207549408957104

Gal, U. (2008). *Boundary matters: The dynamics of boundary objects, information infrastructures, and organisational identities*. Case Western Reserve University, United States -- Ohio.

Gummeson, E. (1991). *Qualitative Methods in Management Research*. Newbury Park, CA: Sage Publications.

Hottenstein, M. P., & Bowman, S. A. (1998). Cross-training and worker flexibility: a review of DRC system research. *The Journal of High Technology Management Research*, *9*(2), 157–174.

Hoyt, J., & Matuszek, T. (2001). Testing the contribution of multi-skilled employees to the financial performance of high-tech organizations. *The Journal of High Technology Management Research*, *12*(2), 167-181. doi:10.1016/S1047-8310(01)00043-8

Jordan, W., Inman, R., & Blumenfeld, D. (2004). Chained cross-training of workers for robust performance. *IIE Transactions*, *36*(10), 953-967. doi:10.1080/07408170490487713

Kaeter, M. (1993). Cross-Training: The tactical view. *Training*, *30*(3), 35-39.

Kim, J., & King, J. (2004). Managing knowledge work: specialization and collaboration of engineering problem-solving. *Journal of Knowledge Management*, *8*(2), 53-63. doi:10.1108/13673270410529109

Lynch, A. H., Tryhorn, L., & Abramson, R. (2008). Working at the boundary: Facilitating interdisciplinarity in climate change adaptation research. *Bulletin of the American Meteorological Society*, *89*(2), 169-179. doi:10.1175/BAMS-89-2-169

Marks, M. A., Sabella, M. J., Burke, C. S., & Zaccaro, S. J. (2002). The impact of cross-training on team effectiveness. *Journal of Applied Psychology*, *87*(1), 3–13.

Molleman, E. (2005). Diversity in demographic characteristics, abilities and personality traits: Do faultlines affect team functioning? *Group Decision and Negotiation*, *14*(3), 173-193.

Oser, R. L., Gualtieri, J. W., Cannon-Bowers, J. A., & Salas, E. (1999). Training team problem solving skills: an event-based approach. *Computers in Human Behavior*, *15*(3-4), 441-462. doi:10.1016/S0747-5632(99)00031-X

Park, P. S. (1991). The examination of worker cross-training in a dual resource constrained job shop. *European Journal of Operational Research*, *52*(3), 291–299.

Safizadeh, M. H., Ritzman, L. P., Sharma, D., & Wood, C. (1996). An empirical analysis of the product-process matrix. *Management Science*, *42*(11), 1576–1591.

Sayin, S., & Karabati, S. (2007). Assigning cross-trained workers to departments: A two-stage optimization model to maximize utility and skill improvement. *European Journal of Operational Research*, *176*(3), 1643–1658.

Slomp, J., & Molleman, E. (2002). Cross-training policies and team performance. *International Journal of Production Research*, *40*(5), 1193-1219. doi:10.1080/00207540110098823

Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, *19*(3), 387-420.

Sternberg, R. J., & Grigorenko, E. (2001). *Environmental effects on cognitive abilities*. Psychology Press.

Sy, T., Beach, L., & D'Annunzio, L. S. (2005). Challenges and Strategies of Matrix Organizations. *Human Resource Planning*, *28*, 39.

Wilson, G., & Herndl, C. G. (2007). Boundary objects as rhetorical exigence: Knowledge mapping and interdisciplinary cooperation at the Los Alamos National Laboratory. *Journal of Business and Technical Communication*, *21*(2), 129.

APPENDIX A

APPENDIX B