Dialogue During Team Problem Solving Using Visual Representation Boundary Objects: A Case Study

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DIALOGUE DURING TEAM PROBLEM SOLVING USING VISUAL REPRESENTATION
BOUNDARY OBJECTS: A CASE STUDY

By

Julie M. Webb

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DIALOGUE DURING TEAM PROBLEM SOLVING USING VISUAL REPRESENTATION
BOUNDARY OBJECTS: A CASE STUDY

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By

Julie M. Webb
DEDICATION

This dissertation is dedicated to my husband, Jeremy W. Webb, for his encouragement of me pursuing my dreams. And to my daughter Natalie, may she make all her dreams come true.
ACKNOWLEDGEMENTS

I will always be grateful to Dr. Rod Githens for not only advising me during my doctoral journey but for also having the vision and fortitude to create a doctoral program at University of the Pacific in Sacramento. Without you this dissertation would not exist. I thank you.

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I thank my family for the encouragement I received while I pursued my degree. Thank you to my husband, Jeremy, for understanding and supporting my lifelong dream of pursuing a doctoral degree. I thank my daughter, Natalie, who sacrificed time with me while I pursued my studies. I hope I’ve made you proud. I thank my mother and father for their lifelong dedication to my education and for making time away from my family a little easier.

Finally, I wish to thank the members of my cohort, especially Marla, Rebecca, and John for taking this journey with me. I consider each of you life-long friends.
Organizations benefit from the knowledge held by individual members as well as knowledge that is shared among those members. In order for knowledge to co-develop between members, and to spread, organizations must provide opportunities for members to collaborate. Organizational teams sometimes require assistance with interpersonal communication, establishing consensus, and sharing knowledge when collaborating. Group facilitators can offer guidance and intervene when teams need support. In addition, teams can find support through the use of visual representation boundary objects (VRBOs) to build trust, improve communication, increase cooperation, and share ideas. This study explores how knowledge is shared between team members and uncovers the importance of social interaction during the co-development of shared knowledge. The role that group facilitators play in team collaboration is highlighted. The results of the study indicate that a positive relationship exists between the use of a VRBO and the development of shared knowledge amongst a team. Patterns emerged from the findings that reveal a structure to the team’s collective meaning making that constitutes an underlying theory of action. The author examines the benefits of using VRBOs for teams and organizations including improved collaboration and communication.
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LIST OF ABBREVIATIONS

IRB  Institutional Review Board
PLC  Professional Learning Community
VRBO visual representation boundary object
CHAPTER 1: INTRODUCTION

Maria is eager to join a team of colleagues to generate solutions to a system-wide problem in her organization. Although many ideas are shared, Maria is frustrated by the disorganized nature of the collaboration. She engages in unproductive discussions with colleagues and recognizes that, after much deliberation, a viable solution has not presented itself. She longs for a way to help her team find common ground and communicate effectively so her organization can tackle the challenges that lie ahead.

Maria’s experience is not an uncommon one. Unproductive meetings waste time and money, and can leave employees feeling frustrated and annoyed. Organizations should strive to hold collaborative meetings with engaged colleagues who communicate clearly and effectively. The ability to collaborate and communicate effectively at work is a critical skill for professionals in all fields. In a recent survey, 86% of professionals reported that a lack of collaboration or poor communication was to blame for failures in the workplace (Fierce, Inc., 2011). Organizations have challenging problems to solve and those problems require productive collaboration and communication. In a global economy that is more connected now than ever before, collaboration among diverse individuals and organizations is a necessity. Individuals need to have effective communication skills in order to collaborate successfully. These skills include the ability to present complex information clearly and engage in discussions in which they express their own ideas, build and elaborate on others’ ideas, and synthesize meaning. Effective
communication allows collaboration to take place and for new solutions to come to the forefront.

This inquiry focused on how a team built group meaning through dialogue using a visual representation boundary object (VRBO) assisted by a group facilitator. A VRBO is an interactive chart that teams can use to combine individual ideas into shared thinking and consensus. For example, a team from a university’s student affairs office may decide to map out the anticipated participant experience during a new format for freshman orientation. They discuss the steps in the participant journey and negotiate ideas with one another. When their ideas align, team members illustrate the steps and label them with terms and descriptions that capture the group’s discussion (Figure 1). For a chart to be considered a VRBO participants need to be able to edit and revise it as needed, and participants should see their contributions represented through text and graphics. VRBOs show how ideas are interdependent and help teams collaborate effectively, even when members hold different positions or have different experiences. A chart that was made before the meeting, or made during the meeting to graphically record the event, would not qualify as a VRBO.
The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of VRBOs during team problem solving. The knowledge the researcher gained from this study may offer new insight into how verbal interactions influence team thinking and problem solving. A qualitative case study approach was used to observe a collaborative team at a single point in time as they worked to solve a problem in their organization. The case study design allowed the researcher to uncover the dynamic interactions between participants and the patterns that emerged in the language used to share ideas and build group knowledge through the use of a VRBO. The participating team was made
up of professional colleagues in a public high school in Northern California. The team was comprised of four individuals with approximately one year of experience working together in a collaborative capacity. This team was brought together in order to generate system-wide solutions for the implementation of Professional Learning Communities (PLCs) in the upcoming academic year. A group facilitator also participated in the study.

The remainder of this introductory chapter features background information, the context of the study, the problem of practice, and the purpose of the study. Also included are the study’s research questions, the significance of the research, and a brief discussion of the conceptual framework that positions the study. The chapter concludes with the definition of terms, the assumptions and limitations, and a summary of the chapter.

**Background**

Research has shown that visual representations can be used to improve team collaboration and communication in organizations. Visual representations are drawings, graphics, and physical artifacts that communicate a shared understanding of a team in a particular context. Visual representations can be used as boundary objects by collaborative teams in order to facilitate collaboration and communication. A VRBO is an image that shows an idea’s interdependency across a system and is one that all participants can revise (Black & Andersen, 2012; Star & Griesemer, 1989). It is a representation that helps individuals collaborate effectively across a boundary, such as a difference in knowledge or training (Black, 2013).
Visual thinking is the ability to interpret and create visual representations. It is a type of thinking that promotes creativity, ideation, and critical thinking and has been shown to strengthen communication skills (Moeller, Cutler, Fiedler, & Weier, 2013). Visual representations can convey a more concrete meaning of a concept than words alone, and as a result can accelerate understanding (Cyrs, 1997). Visual representations used as boundary objects, by contrast, can be concrete and abstract simultaneously because they convey information and ideas that can be both specific to a situation yet also generalizable across contexts (Star & Griesemer, 1989).

An example of a VRBO is a graphic representation of the process of the launch of a new product by a technology company. The graphic representation could be a large poster that includes information in words and images that describes the new product and the timeline for its release to the public. Several teams within the technology company contributed to design of the product launch poster, so there is a shared understanding of what the poster depicts. Yet different teams also draw their own interpretations about the meaning and significance of the poster. For example, the engineering team is concerned about the poster’s production timeline that indicates important design and manufacturing deadlines that guide the engineers. By contrast, the sales team is focused on the features that will be added to the new product because this information will be critical in the team’s communication with customers. The flexibility inherent in VRBOs allows communication and coherence across unique organizations (Star & Griesemer, 1989).

Boundary objects were first described by Star and Griesemer in 1989, and the use of visual representations as tools for collaboration and communication have been
well documented since 1987 when Willyard and McClees featured the roadmapping process used by Motorola in the 1970s. However, much of the research that has been conducted on the use of VRBOs for collaboration and communication has occurred over the last 10 years. Researchers have taken an interest in how VRBOs can be used as a tool for helping organizations improve teamwork for the purposes of innovation and creative problem solving. Additionally, researchers have studied the relationship between VRBOs and communication among diverse groups, though more research is needed in this area.

It is through verbal communication that teams develop socially shared cognition, or collective knowledge created through the interactions between group members (Thompson, 1998). As individuals verbally express their thoughts and ideas to the group, they attempt to transfer their knowledge to other individuals on the team, and then to the group itself (Zajonc & Adelmann, 1987). VRBOs can help teams solidify their collective knowledge and build consensus (Dow et al., 2012; Kerr, Phaal, & Probert, 2012; Simonse, Hultink, & Buijs, 2015). In addition, group facilitators influence how teams develop and share knowledge by their interactions with team members (Azadegan & Kolfschoten, 2014). Group facilitators can help team members work together effectively (Offner, Kramer, & Winter, 1996: Oxley, Dzindolet, & Paulus, 1996) including keeping groups focused on achieving goals (Adla, Zarate, & Soubie, 2011) and designing experiences that foster cooperation (Paul, Seetharaman, Samarah, & Mykytyn, 2004).
Problem of Practice and Purpose Statement

Problem of Practice

Professionals today are expected to solve challenging problems by successfully collaborating with diverse individuals. In order to collaborate well, professionals must be able to communicate effectively within and across teams so that understanding is conveyed clearly across a system. Team members and contexts are dynamic, so professionals need to understand and use tools that can help any team collaborate and communicate effectively so that they can productively solve problems.

Research on VRBOs has focused on a few key areas in the last 20 years. The literature describes traits of VRBOs that make them valuable tools for organizations. VRBOs that adhere to principles of the visual arts, such as color, line, and space, can be highly effective communication devices (Kerr & Phaal, 2015). The best VRBOs use visual structures that communicate the purpose of the tool, such as a roadmap that combines goal setting with clear timelines for achievement (Blackwell, Phaal, Eppler, & Crilly, 2008). VRBOs need to be visually simple and consistent so that comprehension isn’t compromised (Andersen & Richardson, 1997).

Another area researchers have focused on is the purpose of VRBOs and how they function within and across systems. VRBOs are designed to improve system coherence through the use of systems thinking (Black, 2013; Carlile, 2002; Kerr et al., 2012; Moeller et al., 2013). They help eliminate barriers to knowledge sharing which makes them ideal for innovation and problem solving (Carlile, 2002). They help individuals in an organization tackle challenging, complex problems (Black &
Andersen, 2012) by unifying diverse groups under a common goal (Tyler, Valek, & Rowland, 2005).

The literature is clear that VRBOs facilitate collaboration in several ways, including avoiding and resolving conflict (Eppler & Hoffmann, 2012), reaching consensus (Dow et al., 2012; Kerr et al., 2012; Simonse, Hultink, & Buijs, 2015), and building and maintaining trust among participants (Black & Andersen, 2012). Researchers have also studied how team communication is affected by the use of VRBOs. VRBOs can be effective communication tools for sharing new ideas as well as for conveying unified agreements to individuals outside the team (Kerr & Phaal, 2015; Kerr et al., 2012). Teams that use VRBOs develop a shared meaning while working on complex problems (Kerr et al., 2012; Simonse et al., 2015).

There is limited research that analyzes language use between participants using VRBOs. Carlile (2002) observed that VRBOs help distinct teams within an engineering firm to establish a common language and not only transfer, but also transform, knowledge across the organization. Research has also revealed that team members who use VRBOs generate more ideas because other members build upon the ideas of their teammates (Kerr et al., 2012). Kerr et al. (2012) documented a team’s use of a roadmap and noted that the articulation phase of the process included visual and textual contributions from the team with a verbal overlay that was used to synthesize information and convert it into a more digestible form. This verbal overlay has been largely neglected in the literature in favor of the visual representation of ideas. This study draws attention to the verbal overlay aspect of VRBO use in order to better understand the verbal exchanges that occur between participants, how those
exchanges relate to the resulting visual product, and how collective meaning is generated. Collective meaning, also referred to as group meaning, is meaning that is shared among specific group members. For example, the meaning shared between members of an engineering team regarding a new product under development or the meaning shared between a group of teachers regarding student literacy assessment data.

**Purpose Statement**

The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of VRBOs during team problem solving.

**Research Questions**

The research questions guiding this case study are:

- **Q1**: How does individual meaning influence group meaning, as measured by verbal communication during group problem solving and consensus?

- **Q2**: Are there detectable patterns in the group’s verbal layer of dialogue before, during, and after consensus as measured by agreement on the final VRBO?

- **Q3**: What is the relationship between individuals’ verbal communication and group meaning as measured by the resulting VRBO at the conclusion of group problem solving and consensus?

**Significance of the Study**

Organizations depend on the success of their teams to solve challenging problems and provide innovative solutions, but not all teams function effectively. Productive communication and collaboration within teams are necessary to maintain the health and prosperity of organizations. VRBOs are a unique tool that teams can use to improve the likelihood of successful cooperation and problem solving.
Research over the last 20 years has primarily focused on the outcomes of team collaborations that make use of VRBOs. Some literature does draw attention to the verbal communication that occurs when teams engage with VRBOs, but upon further examination the researcher found little information regarding the details of those exchanges. This aspect of VRBO use is important, for it is in these exchanges that individuals have the opportunity to draw on their own cognition, as well as that of their teammates (Hinsz, Tindale, & Vollrath, 1997), and teams can share, fortify, and synthesize this cognition for the benefit of the entire organization (Nonaka, 1994). There is a gap in the research regarding the verbal layer of interactions between group members during team collaboration and the subsequent relationship between this discourse, group meaning, and the resulting VRBO. Group facilitators, as well as team members, could benefit from an examination of the patterns of language that emerge during team problem solving with VRBOs because there may be indicators of divergent ideas, knowledge transfer, and consensus building that influence the team’s success.

**Definition of Terms**

**Collaboration.** The action taken by a group of autonomous stakeholders in an interactive, problem-solving process using shared rules, norms, and structures (Wood & Gray, 1991).

**Collective Meaning.** Meaning that is shared among specific group members (Zajonc & Adelmann, 1987), also referred to as group meaning.

**Communication.** “[T]he process of people sharing thoughts, ideas, and feelings with each other in commonly understandable ways” (Hamilton, 2013).
**Discourse.** Dialogue between two or more individuals carried out in direct interaction (Resnick, 1991).

**Explicit Knowledge.** Knowledge that is “uttered and captured in drawings and writing” (Nonaka & Von Krogh, 2009).

**Externalization.** The process of knowledge conversion from tacit knowledge to explicit knowledge (Nonaka & Von Krogh, 2009); this process is important for the transfer of knowledge from a single individual to a group or beyond.

**Group Facilitator.** An individual who acts as an impartial process guide balancing participation and results to help groups become more effective (International Association of Facilitators, n.d.).

**Interpersonal Meaning.** Meaning that emerges in a specific conversation (Zajonc & Adelmann, 1987).

**Knowledge.** “Knowledge is a justified true belief” (Nonaka & Von Krogh, 2009).

**Private Meaning.** Meaning held by a particular individual (Zajonc & Adelmann, 1987).

**Socially Shared Cognition.** Cognition as a social process in which the social context plays an integral part in its development (Resnick, 1991).

**Tacit Knowledge.** Knowledge that is “unarticulated and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb” (Nonaka & Von Krogh, 2009).

**Visual Representation Boundary Object.** A revisable image that shows an idea’s interdependency across a system (Black & Andersen, 2012; Star & Griesemer, 1989); A representation that helps individuals collaborate effectively across a
boundary, such as a difference in knowledge or training (Black, 2013); A living document that “forges the links between the differing stakeholders and communicates their shared viewpoints” (Kerr et al., 2012).

Assumptions and Limitations

The researcher was intrigued by VRBOs and team communication and collaboration in part because she is an experienced group facilitator, and therefore she brought certain assumptions to this study. The researcher assumed that she could remain a knowledgeable observer during the team collaboration under study while another facilitator guided the group. The researcher has been influenced by similar studies in the literature and believes that VRBOs can have a positive influence on team communication, collaboration, and consensus building. Finally, she assumed that the participants in the study spoke and wrote freely and honestly regarding their ideas and interpretations during the study.

This study used a qualitative case study methodology and an instrumental design in order to uncover and analyze the language used by participants. An instrumental case study qualifies as a bounded system (Creswell, 2012; Merriam & Tisdell, 2016), in this case a single team within one organization. The small team size allowed the researcher to capture participant dialogue and analyze individual contributions. However, the small sample size places limitations on the generalizability of the data. The session’s two-hour time frame limited the amount of discourse that could occur during the session.

Participant attitudes, motivations, and degree of extroversion could affect the interactions of participants. A participant’s familiarity with the topic under
discussion could also influence the contributions they made during the session. The use of a group facilitator is an additional factor that must be taken into consideration. A group facilitator guided the discussion and could influence the pacing, engagement, and tone of the session. Finally, the type of VRBO could have an impact on team dialogue, group facilitation techniques, and the ideas generated by the participants. As in all case studies, the conditions present in this study were unique and cannot be duplicated. Therefore, the results are exclusive to this bounded system.

Summary

Collaboration and communication are essential to success in the workplace (Fierce, Inc., 2011). Organizations need teams that can work together to solve complex problems and share solutions across the system. VRBOs have the potential to assist individuals to communicate better when teams collaborate. VRBOs have been shown to be effective tools for sharing information amongst the team and with members of the organization outside of the team (Kerr & Phaal, 2015; Kerr et al., 2012). As team members interact with one another they transfer knowledge from the individual to the group (Zajonc & Adelmann, 1987) and build the team’s collective knowledge (Thompson, 1998). Teams that use VRBOs have been shown to generate more ideas than teams that don’t use them because VRBOs help teammates build off of each other’s ideas in a focused, visual way (Kerr et al., 2012). How team members verbally interact with one another while using a VRBO is a research area that is understudied in the literature. This study attempted to uncover the verbal layer that
exists during team collaboration while using a VRBO and a group facilitator to guide the process.

This study detailed the verbal interactions between group members and the development of collective meaning while a team collaborates using a VRBO and a group facilitator. Chapter 1 provided an introduction to this study and described the problem of practice, the purpose of the study, and the research questions that guided the work. Chapter 2 offers a review of the literature as it relates to the study’s concept map and conceptual framework including socially shared cognition, the transfer of knowledge from individuals to groups, and the role that VRBOs and facilitators play in group problem solving. Chapter 3 describes the methodology, design, participants, and context of the study.
CHAPTER 2: REVIEW OF LITERATURE

Introduction

The purpose of this study was to determine the relationship between visual representation boundary objects (VRBOs) and verbal communication and group meaning during team problem solving. This review focuses on four themes that emerged in the literature. These themes are: (a) the development of shared meaning; (b) the importance of social interaction in the development of shared meaning; (c) the role of group facilitators in the development of shared meaning and dialogue; and (d) the contributions of VRBOs in the development of shared meaning and communication. This review does not include research pertaining to the visual arts because the aesthetic aspect of visual representations is not under study, nor does it weigh in on debates of how best to conduct cognition research. The concept map in Figure 2 and the conceptual framework in Figure 3 show the interplay of ideas between shared meaning, dialogue, and VRBOs that inform this study.
The concept map in Figure 2 depicts the connections between the branches of research that influenced this study. Socially shared cognition represents the knowledge that groups develop collectively through individuals’ interactions with other members of the group (Thompson, 1998). This conversion of knowledge takes place through the transfer of tacit knowledge to explicit knowledge by individual group members (Nonaka, 1994; Nonaka & von Krogh, 2009). The transfer of knowledge helps move meaning making from the private (i.e. individual) level, to the interpersonal (i.e. partner) level, and finally to the collective (i.e. group) level (Zajonc & Adelmann, 1987). Knowledge transfer is not linear, however, because the
verbal communication by individuals, and the verbal interactions between group members, cause individuals to rethink and express their new thinking in an iterative process. As the group works together to develop shared knowledge the group facilitator has a special role to play. Group facilitators influence how knowledge is transferred within a group, and therefore how knowledge is developed, by the directions they give and the interactions they have during the facilitation (Azadegan & Kolfschoten, 2014). The group facilitator and the group members populate and interact with a VRBO to guide their conversations (Kerr & Phaal, 2015), to see their thinking (Black, 2013), and to build agreement as they develop shared knowledge (SimONSE et al., 2015).
The conceptual framework model shown in Figure 3 depicts the process groups engage in as they solve a problem in their organization using a VRBO. Individuals generate thoughts and share those thoughts through dialogic exchanges with other group members. These exchanges promote the process of externalization in which individuals convert their tacit knowledge to explicit knowledge through dialogue (Nonaka, 1994). Dialogic interactions promote meaning development back and forth along a continuum from private to interpersonal to collective meaning (Nonaka, 1994; Thompson, 1998). The group facilitator engages in meaning development with the
group by acting as an impartial coach whose purpose is to help the group achieve its goals (Azadegan & Kolfschoten, 2014). As collective meaning solidifies, the group members document their shared knowledge on the VRBO (Black & Andersen, 2012), creating a “visual discussion” (Boder, 2006). This interaction with the VRBO spurs more thinking and more dialogue (Black, 2013; Dow et al., 2012; Kerr et al., 2012; Tyler et al., 2005), with the process repeating itself until either the group agrees that consensus has been reached or the group facilitator provides different direction.

**Shared Knowledge**

Organizations rely on the knowledge of their members to conduct business, solve problems, and innovate (Grover & Davenport, 2001). Knowledgeable people have the ability to integrate information into the context of their experience, expertise, and judgment that allows for new ideas to flourish (Grover & Davenport, 2001). When teams share information they can establish a joint perspective, but this does not guarantee the development of innovative solutions. In many cases, shared knowledge is the exception not the rule (Levine, 2018). Team members’ mindset, level of trust, and collaborative approach all impact the efficacy of a group’s ability to share and distribute knowledge (Levine, 2018). If no new ideas are created or organized then only information has been shared, not knowledge (Boder, 2006). Shared knowledge, also known as collective intelligence, is the cornerstone of knowledge management in organizations (Boder, 2006; Nonaka, 2008). Shared knowledge is vital to the health of any organization for several reasons. Cultivating and transferring knowledge within and across organizations helps to save time and money, increase sales, and improve work quality (Boder, 2006). Experts within
organizations have a greater depth of knowledge than novices do (Olson & Rueter, 1987) and this expertise should be harnessed to the benefit of the organization as a whole. In order to spread knowledge across an organization knowledge sharing needs to occur at the systems level (Olson & Rueter, 1987). Indeed, knowledge is an integral part of the system itself (Boder, 2006; Olson & Rueter, 1987; Nonaka, 2008).

A system, or network, of knowledge is created through the interactions of individuals in varied contexts. Socially shared cognition is collective meaning which combines individual thinking with social exchange resulting in knowledge distributed among the group (Thompson, 1998). Research in socially shared cognition attempts to uncover how cognition is created by an interaction between the social context and the individuals who engage with one another in that context (Grover & Davenport, 2001; Nonaka & Konno, 1998; Thompson, 1998). Although the individuals in a group are themselves knowledge processors, the study of shared meaning focuses on the processing that occurs as a result of the interactions between group members (Thompson, 1998). Thompson (1998) asserts that social interaction among group members constitutes cognition itself.

The individual cognition of group members, however, is also a component of shared meaning (Thompson & Fine, 1999). Knowledge is fundamentally created by individuals, but organizational knowledge is created by amplifying and synthesizing the knowledge of individuals, thus establishing a knowledge network across the organization (Nonaka, 1994; 2008). Individuals maintain their own unique cognitive structures but have access to the cognition of other group members (Hinsz et al., 1997; Wegner, 1986), with the structural diversity of the group playing a part in the
group’s successful sharing of knowledge (Cummings, 2004). Interactions between group members help the team navigate between different kinds of meaning. Zajonc and Adelmann (1987) depict four types of meaning: (a) collective meaning is meaning that is shared among specific group members; (b) interpersonal meaning is meaning that emerges in a specific conversation; (c) private meaning is meaning held by a particular individual; (d) unconscious meaning is meaning that results from biological processes in the brain. When teams collaborate to develop new solutions to organizational challenges they can be observed engaging in Zajonc’s and Adelmann’s (1987) first three types of meaning.

Tacit Knowledge and Explicit Knowledge

As meaning transforms within a group different types of knowledge are exchanged. The tacit knowledge and explicit knowledge of individuals play important roles in how knowledge is created, shared, and synthesized in organizations. Tacit knowledge is unarticulated knowledge that is gained by the actions and experiences of individuals, and the individuals’ reflections on those actions and experiences, including knowledge gained by acting on intuition (Polanyi, 1968; 1974; Nonaka & von Krogh, 2009). An example of tacit knowledge is riding a bicycle. Explicit knowledge is articulated knowledge that is gained through visual representations, conversations, and writing (Polanyi, 1968; 1974; Nonaka & von Krogh, 2009). An example of explicit knowledge is knowing how to signal turning left while riding a bicycle.

Tacit and explicit knowledge exist along a continuum (Nonaka & von Krogh, 2009) on which one end lies tacit knowledge that cannot be articulated to explicit knowledge that is simple to convey. When individuals share their knowledge it moves
along the continuum from tacit to explicit. This is referred to as knowledge conversion (Nonaka, 1994; Nonaka & von Krogh, 2009). Knowledge conversion occurs as the result of knowledge articulation through language (Polanyi, 1974). This process is critical for knowledge management because if organizations wish to solve problems they must work to expand the knowledge of their teams beyond that which is held by individuals (Boder, 2006; Nonaka, 2008; Nonaka & von Krogh, 2009). Organizations gain more from the tacit knowledge of their members because it represents knowing at a deeper level through experiences over time. But this knowledge must be transformed into explicit knowledge in order for organizations to benefit from its true value and utility (Mughal, 2010; Nonaka, 2008).

Nonaka (1994) and Nonaka and Konno (1998) posit that there are patterns of interaction between tacit and explicit knowledge that represent how current knowledge is transformed into new knowledge. These patterns, or modes, include the conversion of the following types of knowledge: (a) tacit knowledge to tacit knowledge; (b) explicit knowledge to explicit knowledge; (c) tacit knowledge to explicit knowledge; (d) explicit knowledge to tacit knowledge (Nonaka, 1994; Nonaka & Konno, 1998). Each of these patterns plays an important role in an organization’s knowledge creation process (Nonaka, Byosiere, Borucki, & Konno, 1994). This study aims to better understand the third mode of knowledge creation, the conversion of tacit knowledge to explicit knowledge in a process called “externalization” (Nonaka, 1994; Nonaka & Konno, 1998).

Herschert, Nemati, and Steiger (2001) conducted an experiment to measure the potential outcomes of the externalization process. The researchers studied 238
undergraduate students at a public university as they viewed two films in which a university employee shared tacit knowledge regarding student registration. In one film the employee shared content in a free form narrative approach; in the other film content was shared using a structured protocol that was presented to the audience. Participants were divided into one of four groups so that researchers could analyze how successfully tacit knowledge was transformed into explicit knowledge. These groups asked students to recall information from either the free form film or the structured film, using either a free form response or a structured response. The researchers found that the manner of sharing tacit knowledge in the two films did not significantly affect the externalization process (Herschet et al., 2001). However, the manner in which participants expressed this tacit knowledge into explicit knowledge mattered a great deal. Participants who used a structured response approach performed significantly better than those who used a free form response, including outperforming other groups in recall of the main point, details, and richness of information from either film (Herschet et al., 2001).

The verbal communication process during group problem solving is vital for the externalization of tacit knowledge to explicit knowledge; this leads to incrementing knowledge within a group in which the outcome from one step acts as input for the next (Boder, 2006). According to Nonaka (1994; 2008), organizational learning theories have not often considered the externalization process, yet it is an important one for leaders and managers to understand because it is a common method of knowledge creation in organizations. In order to build shared knowledge leaders must attend to different aspects of collective intelligence including the exchange of
individuals' knowledge, the articulation of individuals’ perspectives while working toward a coherent solution, and the maintenance of a team culture that promotes positive interactions and accepts alternative points of view (Boder, 2006; Smith, 2001). Brown and Duguid (2000) describe tacit and explicit knowledge in terms of a tension that exists between the two. Brown and Duguid identify tacit knowledge as practice, or how work is actually accomplished in an organization. On the other hand, they identify explicit knowledge as process, or how work is formally organized within an organization. In other words, a gap exists between what people think they do and what they really do (Brown & Duguid, 2000). The challenge for organizational leaders is to strike a balance between tacit and explicit knowledge so that innovation can be fostered (practice) as well as furthered (process) throughout the system (Brown & Duguid, 2000).

**Social Interaction**

New knowledge is created, and meaning is socially shared, when groups use interpersonal understanding to transfer knowledge (Nonaka, 1994; Thompson & Fine, 1999). Social interaction drives the generation of collective meaning; individuals interact with one another to diverge, converge, and maintain original ideas due to these interactions (Ickes & Gonzalez, 1994). Organizational knowledge is generated through interactions between tacit and explicit knowledge, transferring through continuous dialogue (Nonaka, 1994). Face-to-face dialogue allows individuals to share ideas, confront assumptions, test hypotheses, and co-develop new ideas (Thompson, 1998). Dialogue spurs social interaction, which ultimately constitutes cognition (Thompson, 1998). The social interactions among group members play a vital role in
the creation of shared knowledge, yet there are many ways in which these interactions fail to bring about the solutions the team is working toward. Groups are confronted with issues stemming from politics, dynamics, personalities, historical practices, and differences in languages, cultures, and mental models, among others. These issues play a role in the group’s ultimate success. In addition, group members can interrupt group communication (Nijstad, 2000) and hold back from sharing their thoughts due to fear of judgment (Camacho & Paulus, 1995; Larey & Paulus, 1995; Paulus & Dzindolet, 1993; Paulus et al., 1996). They also allow personal expectations to play a part in their interpretations of group success (Azadegan & Kolfschoten, 2014).

Groups can improve their likelihood of successful knowledge conversion by attending to the quality of their social interactions (Boder, 2006). The use of tools such as VRBOs can support these interactions because they build shared understandings (Kerr et al., 2012), help teams find common ground (Black & Andersen, 2012) and help them reach consensus (Dow et al., 2012; Kerr et al., 2012; Simonse et al., 2015).

**Group Facilitation**

Group facilitators are an additional support that teams can use to improve interactions and outcomes. Group facilitators work with teams to achieve the goals they set for themselves by monitoring and motivating the interactions and behaviors of group members. Groups that work without facilitation can experience significant problems that interfere with their success. For example, Kameda, Ohtsubo, and Takezawa (1997) found that group members gain influence during consensus when
they share more information in common with other group members. This finding puts individuals with diverse experience and viewpoints at a disadvantage and may jeopardize the group’s ability to innovate. Similarly, how strong an individual’s preferences are is related to how closely they resemble the preferences of other group members (Davis, 1996). This finding indicates that group members will more strongly prefer ideas or solutions that others in the group also favor, which can lead to fewer new ideas and rapid acceleration through the convergence process. Groups can benefit from the experience and expertise of a group facilitator to address these challenges.

Group facilitators can support team discussions by maintaining the team’s train of thought. Nijstad (2000) found that group members interrupt one another during conversations, which hinders the development of ideas that could benefit the group. Significant interruptions and disjointed conversations can be detrimental to a group because members view the success of their collaboration not just in terms of the difference between the intended goal and the actual outcome, but also on whether or not their personal expectations were met (Azadegan & Kolfschoten, 2014). Group facilitators can support individuals in realizing their expectations in ways that support the team as a whole.

In order to collaborate effectively, groups need more than a goal and a process to follow; they also need a facilitator to offer guidance, maintain effort, and intervene when necessary (Azadegan & Kolfschoten, 2014). Group facilitators juggle many different responsibilities while managing a group (Schuman, 2005) including group dynamics, politics, interaction, and cooperation (Azadegan & Kolfschoten,
There is an interaction effect that occurs between the facilitator and the group, meaning that there is a reciprocal relationship between the two (Azadegan & Kolfschoten, 2014).

The synergy between facilitator and group exists in part because of the skills and abilities of the facilitator. The International Association of Facilitators (n.d.) outlines six categories of competencies for expert facilitators: (a) Create collaborative client relationships; (b) Plan appropriate group processes; (c) Create and sustain a participatory environment; (d) Guide group to appropriate and useful outcomes; (e) Build and maintain professional knowledge; and (f) Model positive professional attitude. These competencies allow facilitators to bring out the best in the groups with which they work. Researchers further articulate this expertise by noting that facilitators structure group work to focus on goals and correct course if groups deviate from those goals (Adla et al., 2011). Facilitators design activities for the team to engage in to foster cooperation and focus on the purpose of the collaboration (Paul et al., 2004), including framing problems in different ways (Coskun, Paulus, Brown, & Sherwood, 2000).

Even with the facilitator’s adept skill, the success of the collaboration also depends on the quality of the group’s collaborative effort (Azadegan & Kolfschoten, 2014). When groups do not work together effectively, negative behaviors can impede progress. Sometimes facilitators work to help teams avoid social loafing that occurs when individuals sit back and let other members of the group put forth the effort (Latané, Williams, & Harkins, 1979). Common wisdom dictates that goals will be achieved easier through group effort. In reality, when many team members work
together some of them work less hard than they should (Latané et al., 1979). This is a group dynamic that facilitators should be aware of because it can sometimes lead to negative feelings and interactions among group members. Other times individual group members hold back their thoughts instead of presenting them to the group because they are apprehensive about negative evaluation by group members (Camacho & Paulus, 1995; Larey & Paulus, 1995; Paulus & Dzindolet, 1993). This issue can be mitigated by a group facilitator (Offner et al., 1996; Oxley et al., 1996).

An area that may be difficult for a group facilitator to monitor is the giving and receiving of shared information within a group. Group members prefer to exchange shared information (Wittenbaum, Hubbell, & Zuckerman, 1999) and focus on shared information at the expense of unshared information (Stasser & Titus, 1985). When groups share information it is sometimes known as information pooling (Stasser & Titus, 1985). Groups can make more informed decisions when pooling information versus acting individually (Stasser & Titus, 1985). However, when groups make decisions, they don’t share or integrate information as much as they should in order to make the best decisions possible (van Ginkel, Tindale, & van Knippenberg, 2009). This singular focus on information the group already has in common contributes to the group’s failure to unmask hidden information, which could lead to early consensus (Azadegan & Kolfschoten, 2014) at the expense of the exchange of valuable information (van Ginkel & van Knippenberg, 2008; van Ginkel et al., 2009).

By contrast, groups that discuss their unshared information show improved decision quality when given time to reach consensus (Winquist & Larson, 1998). van Ginkel et al., (2009) conducted a study involving 252 university students in the
Midwest of the United States. The participants were randomly assigned to groups of three to participate in team decision making discussions in which team members each held unique information that was vital to the task at hand. The findings of the study indicate that when teams engage in reflection on their task they are more likely to share information with one another, and when groups understand the importance of sharing knowledge they ultimately make better decisions (van Ginkel et al., 2009). Most of the time, when groups work collaboratively to make decisions they are operating with knowledge they bring with them to the discussion, not with information provided to them by researchers. The tacit knowledge group members bring is based on a process of action and reflection that can then be described and shared with the group (Nonaka & von Krogh, 2009). In this way, tacit knowledge provides the basis for explicit knowledge sharing (Sun, 1997).

When group facilitators work with teams to make decisions they should pay attention to the expression of shared and unshared information so that collective knowledge can develop within the team. Facilitators can make note of which group members dominate the discussion, be aware of agreement developing too quickly, and work to foster the development of divergent ideas. VRBOs can assist facilitators and teams with these challenges. VRBOs have been shown to aid participants in generating more divergent ideas (Dow et al., 2012; Kerr et al., 2012) which then leads other members to make associations with those ideas, resulting in even more ideas up for consideration (Kerr et al., 2012). In this way, VRBOs can be valuable tools for the development and distribution of knowledge within a group.
Visual Representation Boundary Objects

Communication

The dialogue that occurs between group members is a key component in the development of collective knowledge, which is generated during problem solving situations (Boder, 2006; Nonaka, 1994). A team’s knowledge that is generated during externalization must be solidified in order for it to be shared and internalized by the broader organization, and VRBOs help teams to solidify this knowledge through improvements of communication (Kerr & Phaal, 2015), effective collaboration among diverse groups (Tyler et al., 2005), connections between ideas (Black, 2013), and improved system coherence (Black, 2013; Carlile, 2002; Kerr et al., 2012; Moeller et al., 2013). The dialogue that participants engage in while using VRBOs is important for achieving a common view of the problem under discussion (Simonse et al., 2015). The verbal communication that occurs during team interactions with VRBOs is an area that is underrepresented in the literature on VRBOs, team problem solving, and innovation. Analysis of this “verbal overlay” may offer rich insights into what team members are thinking, how their thinking coalesces with others in the group, and the relationship between these kinds of thinking and the use of VRBOs (Kerr et al., 2012).

VRBOs are valuable tools that collaborative teams can employ when problem solving. VRBOs that follow graphic design principles, such as the effective use of color, line, and space, can be powerful communication tools within and across organizations (Kerr & Phaal, 2015). One such VRBO that is commonly used for strategy planning and alignment is the roadmap. A roadmap is “an extended look at the future of a chosen field of inquiry composed from the collective knowledge and
imagination of the brightest drivers of change in that field” (Galvin, 1998). Originally referred to as “technology roadmapping”, the roadmapping process was developed in the 1970s at Motorola (Willyard & McClees, 1987). Roadmaps are excellent examples of VRBOs because they combine purpose with a visual structure that clearly communicates that purpose (Blackwell, Phaal, Eppler, & Crilly, 2008). A team might choose to use a roadmap to plan for a new product, a new sales strategy, or any other new initiative that is interrelated with other parts of the organization and oriented toward a time-based goal. However, VRBOs such as roadmaps need to be visually consistent and simple if they are to be understood (Andersen & Richardson, 1997), because not only do those team members who design them need to be clear about what they represent, so do the stakeholders who view them outside of the context in which they were created.

Beyond visual consistency and simplicity, VRBOs need to be concrete representations of ideas, show how those ideas are interdependent across an organization, and be flexible and iterative in nature so that improvements can be made (Black, 2013). These criteria make VRBOs useful to organizations because they help their members tackle complex, challenging problems that don’t offer obvious solutions (Black & Andersen, 2012). Organizations, especially large entities, can house many different teams that hold specialized knowledge that is vital to the success of the organization. This specialized knowledge can be a barrier to innovation because it can be difficult for that knowledge to translate across the different functions of the organization (Carlile, 2002). VRBOs can help knowledge and ideas spread throughout organizations because they require participants to employ systems
thinking during their generation and can lead to improved system coherence (Black, 2013; Carlile, 2002; Kerr et al., 2012; Moeller et al., 2013). Participants come to realize that they can have a correct, yet partial, view of the situation, and VRBOs can help them see where their viewpoint fits in the larger context (Black, 2013). VRBOs help establish an infrastructure for sharing and transforming knowledge that helps teams manage knowledge coherently across a system (Carlile, 2002).

Collaboration

An additional consideration for improving system coherence is the level of trust that exists between members of an organization. Black and Andersen (2012) suggest that trust is a prerequisite for the successful use of VRBOs. These two researchers reviewed case studies and conducted action research in which they observed diverse groups tackle complex social problems (Black & Andersen, 2012). Their results lead them to claim that even more trusting relationships are built when groups experience success early on in their collaborations (Black & Andersen, 2012). Additional benefits to team culture are present in the literature. Tyler et al. (2005) found that diverse groups can effectively work together when teams engage with VRBOs during graphic facilitation sessions. Graphic facilitators distill the ideas that emerge from a group discussion into large visual images, thus creating a graphic recording that can serve as a VRBO. In a study that included 10 graphic facilitators working with 400 religious and spiritual leaders representing 70 countries and more than 35 different languages, graphic facilitation and the resulting graphic recordings assisted participants in acknowledging and representing all voices during challenging conversations (Tyler et al., 2005). The purpose of the events was to generate solutions to four social
imperatives: (a) providing all people access to drinking water; (b) eliminating debt; (c) supporting refugees; and (d) overcoming violence perpetrated in the name of religion (Tyler et al., 2005). The use of graphics also allowed participants to correct any discrepancies in the VRBO, such as language and symbols specific to a particular group, which maintained the cultural sensitivity the facilitators desired (Tyler et al., 2005).

VRBOs are valuable in that they help participants remain objective and reflective at the same time. VRBOs make the difficult issues under discussion less personal than when participants use speech alone because people can “see what they say” (Black & Andersen, 2012; Boder, 2006) and their focus shifts from themselves, to a small group, and finally to the organization as a whole (Tyler et al., 2005). Black (2013) synthesized research regarding VRBOs to uncover specific practices for their use during group collaboration and concluded that, much like agreed upon norms of collaboration, VRBOs can assist groups to maintain momentum, to keep the conversation moving forward, and they can be a reminder to participants of previous agreements they made as a team.

Dow et al. (2012) conducted a study in which 84 participants worked in pairs to create visual online advertisements for a non-profit organization. Pairs were randomly assigned to one of three research conditions: (a) the partners each generated and shared multiple visual prototypes; (b) the partners each generated multiple visual prototypes but only shared one prototype with one another; (c) the partners each generated and shared only one visual prototype (Dow et al., 2012). Their research revealed that partners who shared multiple visual prototypes with each
other took more turns speaking together, shared more ideas, created the best final advertisements, and reported an increase in rapport compared to the partnerships that shared only one visual prototype (Dow et al., 2012). This is evidence of the importance of using VRBOs during team collaboration because teams that speak more often tend to share more explicit knowledge, and the sharing of explicit knowledge can lead to the expression of tacit knowledge between team members. Therefore, VRBOs can contribute to the cultivation of socially shared cognition among group members.

In addition to VRBOs, narrative boundary objects have also been found to positively influence organizational culture. Innovation narratives are stories about innovation efforts that are told within organizations and function as boundary objects that symbolize organizational values, share information, and inspire new ideas (Bartel & Garud, 2009). In a review of the literature, Bartel and Garud (2009) assert that the use of multiple narrative boundary objects creates a cultural infrastructure that fosters innovation. Narrative boundary objects are not bound by time or space, so their ability to articulate past, present, and future innovations help organizations sustain a culture of innovation (Bartel & Garud, 2009). Furthermore, VRBOs help teams communicate with one another and with the greater organization, which helps to spread shared knowledge at the individual and systems levels (Boder, 2006; Thompson, 1998).

In order to assist individuals and teams to communicate effectively, group facilitators can be employed. The facilitated use of VRBOs has been found to make conversations between diverse participants more accessible because people can
witness their ideas being acknowledged and reinforced while also seeing how those ideas connect to the ideas of others and to the system itself (Boder, 2006; Tyler et al., 2005). In this way, VRBOs can make team communication more engaging and dynamic (Tyler et al., 2005). As participants work together to craft VRBOs they help all voices to be heard, acknowledged, and valued (Tyler et al., 2005).

**Shared Meaning**

VRBOs can function as communication tools within teams as well as organizations (Kerr & Phaal, 2015; Kerr et al., 2012). Kerr et al. (2012) outlined three phases of the roadmapping process that demonstrate how central communication is in the generation and use of VRBOs. During the first phase of roadmapping, team members communicate their ideas with the group and make associations with the ideas offered by other group members in order to generate still more ideas (Kerr et al., 2012). During the second phase, participants further articulate their ideas using verbal descriptions and visual representations to explain the thinking shared in phase one (Kerr et al., 2012). The final phase of the process involves sharing the roadmap with stakeholders, in which the roadmap becomes a VRBO that allows viewers to co-construct meaning and communicate across the system (Kerr et al., 2012).

Not only can VRBOs reinforce common messages across an organization, they are also effective when organizations look to engage key decision makers because they can reduce barriers that often prevent acceptance of new ideas and innovations (Kerr & Phaal, 2015). VRBOs can also engage participants because they can serve as a call to action for all stakeholders in an organization (Kerr et al., 2012). VRBOs are tools for promoting dialogue between stakeholders because they communicate shared
perspectives and lead to those stakeholders mobilizing action for positive change (Kerr et al., 2012).

The use of VRBOs can help teams develop shared meaning while working on challenging problems (Kerr et al., 2012; Simonse et al., 2015). In a yearlong ethnographic study, Carlile (2002) conducted fieldwork observations and conversations with employees at a mid-sized engineering firm in order to capture how employees use VRBOs to share knowledge within and across different functions of the company. He discovered that VRBOs help teams establish a common language with which to communicate to solve problems (Carlile, 2002). Carlile (2002) asserts that knowledge isn’t just transferred between team members through the use of VRBOs, but knowledge is also transformed as both parties contribute their ideas and experience. He cautions, however, that in order for VRBOs to remain effective communication tools they must be adapted in order to stay relevant as people, problems, and contexts change (Carlile, 2002).

Problem Solving

Studies have shown that VRBOs help groups solve complex problems because they facilitate teamwork and cooperation (Black, 2013; Black & Andersen, 2012; Carlile, 2002; Eppler & Hoffmann, 2012). Roadmaps are examples of VRBOs that are particularly useful problem solving tools. Roadmaps employ clear, visual structures that depict the path forward to achieve a team objective (Blackwell et al., 2008). Roadmaps help teams articulate goals and plan a process for achieving those goals (Kerr & Phaal, 2015). They show how the strategies and resources available in an
organization can be integrated and aligned to support the new future envisioned by the team (Kerr & Phaal, 2015).

In addition to outlining plans and setting goals, VRBOs have been shown to improve collaboration and help teams avoid conflict (Eppler & Hoffmann, 2012). VRBOs can also be used as tools to aid in conflict resolution. VRBOs display ideas offered by conflicting groups and these visual depictions help participants see the dependencies between their ideas, even when those ideas represent different perspectives (Black & Andersen, 2012). A shared focus in which interdependence of ideas is featured starts to build small, incremental agreements between groups that build trust in the process and in one another (Black & Andersen, 2012). The fact that VRBOs are living documents that invite revision and iteration means that conflicting groups can use them to keep conversations moving and ideas flowing, which creates more opportunities for agreement and unity (Black & Andersen, 2012). It is important to note that while VRBOs can unite diverse teams, expert facilitation to help teams resolve conflict is also necessary (Black & Andersen, 2012; Tyler et al., 2005). Skilled facilitators employ deep listening, cultural sensitivity, and an understanding of group dynamics as additional tools for conflict resolution purposes (Tyler et al., 2005).

VRBOs have the power to bring people together for a greater purpose. The dialogue that participants engage in while using VRBOs is important for achieving a common view of the problem under discussion (Simonse et al., 2015). Teams that make use of VRBOs develop a unified approach to problem solving (Simonse et al., 2015) and build common understandings (Kerr et al., 2012). VRBOs help groups find common ground (Black & Andersen, 2012) and build consensus (Dow et al., 2012; Kerr
et al., 2012; Simonse et al., 2015), which are key to tackling the complex challenges we all face.

Limitations of These Studies

Blackwell et al. (2008) collaborated with international leaders and information design specialists with expertise in the use of roadmaps as VRBOs, and they agreed that roadmaps that are cluttered and overloaded with information are not as effective as those that are clear and concise. Likewise, roadmaps that lack a logical scheme lead to compromised communication (Blackwell et al., 2008). This study included sophisticated methods of data collection and analysis including dendrogram representations of expert consensus, hierarchical cluster analysis, similarity matrices, and normalized multi-dimensional scaling, among others (Blackwell et al., 2008). But in the end, the findings rest on the experience and opinions of the practitioners selected for participation, and a replication of this study could yield different results. For example, practitioners from different industries may have experience with VRBOs that are organized differently, and have far more text and graphics, than those in the study conducted by Blackwell et al. (2008), yet these VRBOs may yield positive results in those contexts. Also, practitioners likely have different styles and personalities that influence their opinions on what constitute successful VRBOs.

Visual representations do not always positively influence a team’s ability to innovate. Goldman, Kabayadondo, Royalty, Carroll, and Roth (2014) observed the innovation process of two triad teams of undergraduates enrolled in a design thinking course. The teams struggled with communication even though they made use of visual representations during the design process (Goldman et al., 2014). In this case,
the visuals were not used as VRBOs to bridge the communication and comprehension gaps between teammates, which may have had implications for the teams’ outcomes (Goldman et al., 2014). The teams were small in size and number, and consisted of design students with little experience working together. In addition, the evidence collected in this study focused on the teams’ verbal and physical interactions and not their use of VRBOs. These factors may have influenced the participants’ use of visual representations.

**Summary**

This chapter constitutes a review of the relevant literature regarding verbal communication, group meaning, and VRBOs. It explored four themes that emerged from the literature: (a) the development of shared meaning; (b) the importance of social interaction in the development of shared meaning; (c) the role of group facilitators in the development of shared meaning and dialogue; and (d) the contributions of VRBOs in the development of shared meaning and communication. It also explained the conceptual framework which combines theories of the conversion process of tacit to explicit knowledge called externalization (Nonaka, 1994), the creation of knowledge through dialogic interaction along the meaning making continuum (Nonaka, 1994; Thompson, 1998), the use of VRBOs to solidify shared knowledge (Black & Andersen, 2012), and the iterative nature of this process (Black, 2013; Dow et al., 2012; Kerr et al., 2012; Tyler et al., 2005). Further study is needed to determine the language use of individuals and teams using VRBOs in different contexts due to a gap that exists in the current literature. The next chapter outlines
this specific study, which sought to determine if a relationship exists between VRBOs and verbal communication and group meaning during group problem solving.
CHAPTER 3: METHODOLOGY

Introduction

There is limited research that analyzes language use by and between participants using a visual representation boundary object (VRBO). The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of VRBOs during team problem solving.

Research Questions

The research questions guiding this case study are:

- Q1: How does individual meaning influence interactional meaning, as measured by verbal communication during group problem solving and consensus?
- Q2: Are there detectable patterns in the group’s verbal layer of dialogue before, during, and after consensus as measured by agreement on the final VRBO?
- Q3: What is the relationship between individuals’ verbal communication and group meaning as measured by the resulting VRBO at the conclusion of group problem solving and consensus?

This chapter begins with an explanation of the methodology and research design. It also describes the participants in the study and the context in which the participants were observed. The chapter explains the measures and procedures used for data collection and analysis. The trustworthiness of the findings is addressed, as well as the ethical considerations. The chapter concludes with an overview of the limitations of the study.

Description of Methodology

This study employed a qualitative design, which encompasses several characteristics: (a) a focus on process, understanding, and meaning; (b) the
researcher as collector and analyzer of data; (c) an inductive process; and (d) a
descriptive product (Merriam & Tisdell, 2016). To address the research questions in
this study, a case study approach was utilized in order to describe the language use
and interactions of one team during engagement with a VRBO. A case study is “an in-
depth exploration of a bounded system based on extensive data collection” (Creswell,
2012). It is defined by the bounded system, otherwise known as the unit of analysis,
not the focus of the study (Merriam & Tisdell, 2016). In this research inquiry the unit
of analysis is a team of four participants working in a public high school, and one
group facilitator. This research study examines the individual meaning, collective
meaning, and the discourse and interactions between team members participating in
a collaborative problem-solving endeavor. It differs from a true ethnographic design
because the development of a cultural theme over time is not the focus (Creswell,
2012). This case study is an instrumental case study because the researcher seeks to
illuminate the language use among team members engaged with a VRBO (Creswell,
2012) and maintain a “holistic and real-world perspective” (Yin, 2014) as an outside
observer of team collaboration.

In this case study, qualitative data were collected that explored the connection
between a VRBO, and verbal communication and group meaning among team
members. The data were analyzed for common patterns and themes to gain insight
into the discourse moves made by participants and the relationships between those
moves and individual and group meaning. Language use and interactions among
participants are social in nature. Therefore, qualitative research methods are ideally
suited for an examination of a team’s engagement with a VRBO.
**Site description.** This study took place on the campus of a public high school located in Northern California. To protect the identity of the school and its employees, the participating organization is referred to only as “the high school” when required in this study. All participants in this study are employees of the high school.

The researcher initially approached the principal of the high school through electronic mail. The researcher and the principal are former colleagues who previously worked together at a different school. After several exchanges through electronic mail the researcher extended an invitation to participate in the study. The principal agreed to approach her administrative team to gauge willingness to participate and the researcher sent a formal invitation to individuals on the team through electronic mail.

**Site access.** Access to the site initially included obtaining approval from the principal of the high school who oversees the participating team. The principal procured a conference room in which the observation took place. The observation was custom designed by the researcher, group facilitator, and team leader as a problem-solving meeting to support the team as they ideated around the implementation of Professional Learning Communities (PLCs). The researcher signed in at the school office upon entering the site and signed out upon exiting to comply with the school’s security policy.
Methods

The methods of data collection used in this qualitative case study included: (a) field notes, (b) artifact review, (c) and written interviews. All data were gathered from members of the participating team at the company.

Field notes. Observations of the participants during team collaborations were a critical data collection method for this study. Observation is a data collection method in which the researcher gathers data from a firsthand encounter by observing participants where the phenomenon of study occurs (Creswell, 2012; Merriam & Tisdell, 2016). The observation was conducted on site in an office conference room for a 2-hour duration. The researcher observed the session in person and the observation was video and audio recorded in order to capture the exact language used by participants and when that language was used during the session. A structure for Field Notes was developed to assist in the collection of data (Appendix A). The researcher was able to capture evidence of discourse between participants by viewing the video and audio recording of the session. Field notes were taken during the observations that captured the researcher’s thoughts and reflections to complement the video and audio recordings. Field notes are the written account of an observation (Merriam & Tisdell, 2016).

Artifact review. Artifacts can be valuable sources of data in a qualitative study (Creswell, 2012). Artifacts are usually documents or physical objects that are a natural part of the research setting and are not as intrusive as other data collection methods such as observations and interviews (Merriam & Tisdell, 2016). The artifact collected in this study was the VRBO that the team created during the collaborative
session. The VRBO was analyzed using the Artifact Review Protocol (Appendix B) to note the content and language documented by the team. The data that resulted from the VRBO were compared to the discourse evidence from the video and audio recorded observation, as well as the written interview data, to unearth relationships between the VRBO, and verbal communication and group meaning among team members.

**Written Interviews.** Qualitative interviews consist of the researcher asking open-ended questions and recording the answers (Creswell, 2012). In this study, the researcher conducted written interviews with participants during the video and audio recorded session. The group facilitator paused at three pre-determined intervals in order for participants to answer written interview questions. Written interviews were used because they allowed the researcher to collect the private thoughts of individuals close to when they occurred during the case study (Creswell & Poth, 2018; Merriam & Tisdell, 2016). The written interviews included questions that were designed to prompt participants to reflect on the discussion thus far and to consider what could be shared to move the discussion forward (Appendix C).

**Participants**

This case study focused on the use of a VRBO during collaborative problem solving and the discourse and collective meaning that resulted from its use. Consequently, it was necessary to locate an organization that encourages its employees to regularly engage in collaborative problem solving. The researcher conducted purposeful sampling in the selection of the site and the study’s participants. Specifically, a maximum variation sampling approach was chosen in
order to study the multiple perspectives of the participants (Creswell, 2012) and increase the potential for readers to apply the findings to their own situations (Merriam & Tisdell, 2016). Requirements for participation in this study were a team composition that included professional adults who are members of an existing team within an organization. Since the inquiry centered on team collaboration, it was necessary that the participating team have a minimum of six months experience working together in a collaborative capacity.

Participants in this inquiry were employees at a public high school in Northern California. In all, four team members agreed to participate as subjects in the study, in addition to an external group facilitator. Subjects in the study included one woman and three men ranging from 37 years to 52 years of age. The ethnicities of the subjects included three individuals of Caucasian decent, and one individual of Latino decent. Participants have worked at the school for an average of 3 years and have collaborated as a project team for approximately one year.

Data Collection

The data collection process occurred during one afternoon session and took place on site in the office conference room. The written interviews occurred at predetermined intervals during the observation. Participants responded in writing to demographic questions, then engaged in discussion, responded to the first set of interview questions, engaged in further discussion, responded to the second set of interview questions, engaged in further discussion, and responded to the final set of interview questions. Participants responded in writing to the interview questions using laptops in the office conference room. Interview questions were located on a
Google form that participants typed in and sent to the researcher’s university Google account.

Audio from the recorded observations was transcribed verbatim first using an online transcription service, then edited by hand for accuracy. The transcriptions were used to analyze data, to develop a coding system, and to identify emerging relationships and themes. To protect the identity of participants and the company, pseudonyms were used on all transcriptions, as well as field notes and the notes taken using the Observation Protocol, Interview Protocol, and Artifact Review Protocol.

**Data Analysis**

Both deductive and inductive approaches were used to analyze the data that emerged in this case study. The discourse data that resulted from the team collaboration session were video and audio recorded, then transcribed. The transcription of participant discourse was analyzed using a deductive approach to determine the conversation skills participants used during the group discussion and engagement with the VRBO. Conversations skills were sorted into four categories: (a) creating - proposing new ideas to the group; (b) clarifying - prompting one another to make ideas clearer as well as self-recognition of when clarification is needed; (c) fortifying - supporting ideas with evidence and explaining that evidence; and (d) negotiating - testing and strengthening one another’s ideas by challenging them with counterexamples or other ideas that compete with them (Zwiers, O’Hara, & Pritchard, 2014). Each verbal contribution made by participants was labeled with one or more of these categories.
Next, an inductive approach was used to determine themes that were present in the content of the messages conveyed by participants. First, the transcription was divided by intervals (i.e., prior to first written interview, between first and second written interview, between second and final written interview). Next, the data were organized using a timeline that identified the existing themes and when they occurred during the team discussion. Similarly, the themes that emerged from the written interviews were layered onto this timeline. The timeline was then compared to the conversation skills that participants used to convey meaning during the discussion. The resulting VRBO was analyzed using a deductive approach to determine the collective meaning that was generated from the team collaboration session.

Using a combination of deductive and inductive approaches, the researcher reviewed the entire data set and made notes regarding the categories, themes, and patterns that emerged. Google cloud-based software tools were used in order to store, organize, and code the descriptive data that emerged from the data collection process. The researcher chose Google software tools for this task because they offered a no-cost solution for storing data beyond text and transcriptions to include data gleaned from graphics and audio and video sources (Creswell, 2012), which were all present in this case study.

The descriptions of the context in the researcher’s field notes, the evidence of participant discourse in the video and audio recordings, and the written interview results combined to create a portrait of the events that transpired in this case study. Multiple perspectives were sought from the various data collection methods to
provide several points of view from different sources in order to validate patterns and themes.

**Stages of Data Collection**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctoral committee proposal review &amp; approval</td>
<td>December 2018</td>
</tr>
<tr>
<td>IRB certification</td>
<td>April 2019</td>
</tr>
<tr>
<td>Recruitment of participants</td>
<td>April 2019</td>
</tr>
<tr>
<td>Field research - participant team observation</td>
<td>May 2019</td>
</tr>
<tr>
<td>Data analysis</td>
<td>July 2019</td>
</tr>
<tr>
<td>Report findings</td>
<td>August 2019</td>
</tr>
<tr>
<td>Revisions/editing</td>
<td>September 2019</td>
</tr>
<tr>
<td>Defense</td>
<td>October 2019</td>
</tr>
</tbody>
</table>

**Trustworthiness**

Several steps were taken to establish trustworthiness in this study. First, several different data collection methods were employed including: (a) field notes, (b) artifact review, (c) and written interviews. The data from these unique sources were triangulated in order to determine the validity of the results. Triangulation is a strategy for strengthening the internal validity of a study (Merriam & Tisdell, 2015). The evidence gathered from the observation field notes, as well as the input from the participants gathered from the written interviews, was analyzed and compared.
The researcher also employed a respondent validation process in order to validate the data collected and prevent biased interpretations. Participants were asked to verify the accuracy of the VRBO created during the study as it related to the group’s discussion.

Researchers who choose to conduct a similar study can rely on the design and protocols of this study to guide their work toward comparable results. However, due to the nature of case study design as a bounded system, the results of future studies will depend on the factors presented by the case such as the participants, site, and VRBO, among many others.

**Ethical Considerations**

It was necessary to obtain Institutional Review Board (IRB) approval due to the fact that human subjects were used in this study. The IRB insures that ethical practices were enacted in this study, thus protecting the participants in the process. The researcher made every effort to respect the participants’ rights and privacy. Participation in the study was voluntary and the researcher gained permission from each participant to analyze and report individual contributions to the study through an invitational letter sent by electronic mail. The participants also granted the researcher permission to video and audio record the observations and collect written interviews conducted in this study.

Due to the small number of participants in this case study, individual responses and data were handled carefully with respect to privacy and confidentiality. The participants were informed that their individual contributions would remain
anonymous and would not be directly reported to the organization. Participants were assigned pseudonyms in order to conceal their identities and maintain their privacy.

Study Limitations

This qualitative case study is limited in scope due to several factors. First, the study focuses on one team of four participants in a single organization. Second, participants were observed and interviewed on a single day. Finally, the team engaged with one type of VRBO. Although the data generated significant findings, the results are bound to a particular team, context, and point in time. Additional research should be conducted to substantiate the claims made in this study and to gain further insight into the relationship between VRBOs and verbal communication and group meaning among team members.

Summary

The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of VRBOs during team problem solving. A case study research design was used to capture the authentic language use and interaction among participants during one observation session. This study featured four subjects from varied backgrounds and age groups who regularly work together in a public high school in Northern California. Data were collected using video and audio recorded observations, field notes, artifact reviews, and written interviews with participants. Data analysis methods were described in this chapter, as were the ethical considerations and limitations of this study.

Results of this study could have implications for team processes, collaborative skills, shared knowledge, and discussion patterns among team members. This insight
could help teams reflect on their use of productive conversation, consider how individuals could best share their knowledge and expertise, and plan for future facilitation and collaboration.
CHAPTER 4: FINDINGS

Introduction

This chapter discusses the findings of the research conducted in this case study. It begins with a reiteration of the study’s purpose which is followed by the study’s research questions. The chapter concludes with the findings and results based on data collected using field notes, video and audio recordings, written interviews, and artifact review.

Purpose Statement

The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of Visual Representation Boundary Objects (VRBOs) during team problem solving.

Research Questions

The research questions guiding this case study are:

- Q1: How does individual meaning influence interactional meaning, as measured by verbal communication during group problem solving and consensus?
- Q2: Are there detectable patterns in the group’s verbal layer of dialogue before, during, and after consensus as measured by agreement on the final VRBO?
- Q3: What is the relationship between individuals’ verbal communication and group meaning as measured by the resulting VRBO at the conclusion of group problem solving and consensus?

Description of Context

The study was conducted at a public high school in Northern California in the office conference room on campus. The researcher’s field notes indicated that the room included a large conference table in the center as well as bookshelves and
cupboards along two walls, and the remaining two walls made of windows. The room housed office equipment and professional books, and is primarily used for small group meetings and professional learning sessions. Additional equipment and materials used in the study were temporarily available in the room including an LDC projector, a projection screen, chart paper, markers, and sticky notes. Video recording technology was also set up to capture audio and video data for the study. The conference room included space for the researcher, the group facilitator, and four employees to participate in the study. The employees included the school principal and three vice principals, making up the administrative team for the campus.

The participants pre-selected the topic of focus for the session: Implementation of a Professional Learning Community (PLC). The participants chose this topic because they are interested in establishing a PLC structure throughout the school with the goal of improving teaching and learning. The researcher sought input from the school principal and the group facilitator, and used this information to plan the 90 minute collaborative session. The researcher had two goals for this session including: 1) conducting the dissertation study; and 2) creating a beneficial experience for the participants using a topic of importance to the team.

The session was organized into eight brief sections and was designed to encourage discussion among participants (see Figure 4). The session began with a welcome and overview by the researcher. The group facilitator lead the remainder of the session with the role of providing directions for each activity, prompting idea generation, encouraging group discussion, and charting contributions by the participants. In the Discovery activity participants reflected on past practice with
PLCs including observations they’ve made, things they’ve learned, and obstacles they’ve faced. Next came the Ideation activity in which participants generated new ideas and opportunities for implementing PLCs on their campus. In the Opportunities activity the facilitator participated very little in the group discussion in order to allow participants to consider the ideas generated up to that point, combine and synthesize those ideas, and collaboratively select the best ideas to craft into solutions for implementation. Finally, in the Solutions activity, participants plotted the chosen solutions onto a VRBO considering the effort each solutions would likely take to implement, and predicting the potential impact of each solution.

The participants were directed by the researcher and the group facilitator to complete three written interviews at predetermined intervals during the session, including at the conclusion of the Discovery activity, the Ideation and Opportunities activities, and the Solutions activity. A break was also provided at the mid-point of the session (see Figure 4).
Figure 4. Ideation session design.
The researcher’s role during the session was to make introductions and explain the organization of the session. The researcher was also on hand to answer questions posed by participants and the group facilitator before, during, and after the session. The group facilitator’s role during the session was to guide participants through the session’s activities and remain neutral toward the participants’ comments, the session topic, and the content generated by participants.

The researcher recorded field notes, making observations and reflections during the session. The participants appeared thoughtful and engaged throughout the session, expressing their knowledge on the topic of PLC implementation and reflecting on successes and challenges of themselves as individuals and of the team as a whole. The group facilitator seemed to establish a positive rapport with the participants and the team appeared relaxed yet fully engaged in the discussion. Participants often injected humor into their verbal exchanges and appeared to contribute honest responses that expressed their regard for the session’s topic.

**Individual and Interactional Meaning**

This study aimed to uncover how meaning is transferred from individuals to the group through collaborative discourse. In other words, it endeavors to answer the question: How does what I think influence what we think? To answer this question, the language provided by individual participants in the written interviews was compared to the verbal communication detailed in the audio transcript. Participants were asked in the written interviews to individually articulate their thinking regarding which ideas they believed the team should make clearer, support with more information, and seriously consider as they worked toward consensus. Criteria were
used to determine the topics participants deemed most important: (a) The topic was considered by at least two participants; and (b) The topic appeared at least two times before, during, and after consensus.

Discussion Topics

Patterns emerged from the content of the written and oral language that revealed two topics deemed notable by participants: (a) shared definition and vision, and (b) teacher training and site visitations.

Shared definition and vision. The first topic is the importance of creating a shared definition and vision for PLCs at the school site. The comparison of participant language from written interviews and discourse is shown in Table 2. The written interviews were conducted anonymously and therefore do not assign ideas to specific participants. The transcript of team discourse does indicate specific speakers, though each of them has been assigned a first initial pseudonym.

The findings indicate that multiple participants generated ideas regarding creating a shared definition and vision for PLCs. Before consensus was reached, two participants indicated in the written interview that they were thinking about the need to create a shared definition of PLCs. This thinking was supported by two participants who brought up the same topic during the discussion. During consensus, one participant continued thinking about a shared definition as determined by the statements in the written interview, while the same two participants resurfaced the topic into the discussion. In the written interview conducted after consensus was reached, two participants reiterated the school’s need for a shared definition and vision of PLCs, along with a scope and sequence for implementation. At this point in
the session, three of the four participants discussed and ultimately agreed on the amount of effort and potential impact a shared definition and vision could have at the school site.

Table 2
Creating a Shared Definition and Vision

<table>
<thead>
<tr>
<th>Written Interviews</th>
<th>Discourse</th>
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</thead>
<tbody>
<tr>
<td>“Understanding how to create a shared definition of Professional Learning Communities.”</td>
<td>03:34 E: “...but we needed to come to a consensus as a whole staff, I think, that says, ‘This is why we’re here on this campus,’ and come up with that why we’re here, what’s our purpose? And it has to be around all students can learn, and however that morphs into an agreement, so that then, when we get in these kinds of discussions, we can say, ‘Okay, let’s take it back. Is this playing to our stated goal that we all agreed to?’ And if it’s not, then okay, then that needs to go, and if it is, then those that aren’t on-board need to get on board, and so we can kinda use that, but I’m not sure that we sold that piece before rolling this out. I think that we tried and we did some things, but I don’t know that we got everybody on board or we all talked about this thing, and this is what it’s about. This is our focus.”</td>
</tr>
<tr>
<td>“Creating a shared definition and agreement on how the information will be messaged.”</td>
<td>11:16 P: “Right now, I don’t think you can go bigger until you actually hone in and refine the definition in our own practice. So I think it needs to be that shared understanding before we merge with other schools.”</td>
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<tr>
<td>“I believe that we, the admin team, should get on the same page on the process of PLC’s before rolling it out to the staff.”</td>
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(Table 2 Continued)

<table>
<thead>
<tr>
<th>Written Interviews</th>
<th>Discourse</th>
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<tbody>
<tr>
<td><strong>During Consensus</strong></td>
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<tr>
<td>“Shared definition, understanding and messaging of the expectations around PLC’s.”</td>
<td>31:30 P: “Okay. So, I’ll go first. One of my ideas is a solution is we absolutely have to have a shared definition as an administrative team, shared expectations and shared messaging. Do you think that that’s an opportunity?”</td>
</tr>
<tr>
<td>“Having the staff create the shared definition of PLC and what it would look like at [our school].”</td>
<td>32:55 P: “No, we need to, as an administrative team, have a shared definition of what a PLC is, and agreements around, not only the messaging but the implementation.”</td>
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<tr>
<td></td>
<td>39:52 E: “We have to get them down to… Eventually, all students can learn, and if we get them to agree that all students can learn in our PLC time down the road they can’t say ‘Well, those students can’t do it.’ Well no, our vision says all kids can learn and we believe that, therefore, we can’t say they can’t learn. If they’re not learning, it’s our job in our PLC team to figure out, ‘How do we get these kids to learn? What are the best practices? What do we need to change as instructors with that group of students that didn’t understand that particular assessment?’ ”</td>
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<tr>
<td></td>
<td>40:34 P: “So creating a shared vision?”</td>
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<tr>
<td><strong>After Consensus</strong></td>
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<tr>
<td>“Shared vision and scope and sequence.”</td>
<td>50:18 E: “And creating a shared vision with all. Okay, so I think that’s high impact. But it’s quite an effort.”</td>
</tr>
<tr>
<td>“I believe that we should consider creating a scope and sequence along with a shared vision for all.”</td>
<td>50:26 P: “It’s a ton of effort.”</td>
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<td></td>
<td>50:27 D: “I agree. That’s huge.”</td>
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<tr>
<td></td>
<td>50:28 P: “It’s huge. We know what it’s like.”</td>
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<td></td>
<td>50:31 F: “Up in the clouds?”</td>
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<tr>
<td></td>
<td>50:32 D: “Yeah, it’s hard.”</td>
</tr>
<tr>
<td></td>
<td>50:33 E: “I mean, we might be up here.”</td>
</tr>
<tr>
<td></td>
<td>50:35 D: “Yeah…”</td>
</tr>
<tr>
<td></td>
<td>50:38 P: “Put it as high as you can.”</td>
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</tbody>
</table>
Teacher training and site visitations. The second topic indicated by participants is the importance of teacher training and site visitations for professional learning. The comparison of participant language from written interviews and discourse is shown in Table 3. As noted previously, the findings indicate that multiple participants generated ideas regarding professional learning in written interviews and in team discourse. Before consensus, one participant verbally indicated they were thinking about how to support teacher learning with an increase in feedback and sharing successes with other departments. This thinking was supported by a participant who brought up the need to increase learning and build trust among teachers into the conversation, while another participant contributed a personal example illustrating the positive impact that professional learning can have on climate and culture at the school. During consensus, three participants mentioned teacher training, teacher empowerment, and site visitations of successful PLCs in action. In further discussion, all four participants contributed their thinking on this topic and engaged in multiple exchanges during the discussion. After consensus was reached, one participant shared their thinking about professional learning for PLC success in the final written interview, while the entire team discussed and predicted the amount of effort and impact the topic might have for their staff.
<table>
<thead>
<tr>
<th>Written Interviews</th>
<th>Discourse</th>
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</thead>
<tbody>
<tr>
<td>“We should have more teacher feedback when they are working in their PLC. Just like students get support through their work, we need to support the teachers through theirs.”</td>
<td>09:16 E: “I think it’s, also obviously, an opportunity to increase learning, increase teaching, best practices, all those kinds of things as well. Hopefully increase trust among staff and between everyone on campus.”</td>
</tr>
<tr>
<td>“Share the success of other departments and how they are working to create success with our students.”</td>
<td>13:22 P: “And I think it’s actually opportunities to build positive climate and culture. I know, that I can speak personally when I was an elementary teacher back in the day, my scores went up significantly in my own practice.”</td>
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<td></td>
<td>13:36 F: “Did they, great.”</td>
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<td></td>
<td>13:37 P: “Ah-huh. And so I know that I felt better about myself that I was able to show on one measure, of a standardized achievement pretty phenomenal academic achievement. So I think I felt better. ‘Cause there’s one year I did not feel good. My response to literature was horrific, the scores, and I really had to refocus, on my own instructional practice. But I think the teachers would feel better about themselves. So I think it could have a positive impact on climate culture.”</td>
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<tr>
<td>Written Interviews</td>
<td>Discourse</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>“Teacher led implementation, visiting functioning PLC sites, working with the willing, and many others.”</td>
<td>18:40 D: “I would like to see more teacher led implementation.”</td>
</tr>
<tr>
<td>“Training for teachers is important. Sending the motivated teachers to training to come back. Train the trainers.”</td>
<td>18:48 F: “What might that look like?”</td>
</tr>
<tr>
<td>“Empower stronger faculty members.”</td>
<td>18:50 D: “Well, much like the committee that’s convened to solve ‘the issue of tardies’ I would love to see those passionate teachers that already operate at a high level really driving this.”</td>
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<td></td>
<td>19:43 E: “Well, I think those second, third ones are feeding into that. We get teachers the training and the release time and at conferences where they could get excited and allow them to come back and share what they learned, and how they’re using it in their teams and sharing the effective things that are happening amongst their teachers and in their curriculum because of the PLC.”</td>
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<td></td>
<td>20:15 P: “I think also embracing early adopters into it could help infiltrate the staff also teachers choose what they need in regards to maybe they’re gonna do a book study what they need ‘cause there’s money for that, as well. But getting them...And I think that’s kind of what you were saying.”</td>
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<tr>
<td></td>
<td>24:18 J: “Maybe allowing staff members to maybe visit other sites that have fully functional PLCs to be a part of that, see what it looks like, up and running.”</td>
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<td></td>
<td>24:46 P: “So, but I think it’s important to visit the PLCs at other school sites that are functioning at a high level of integrity and fidelity. But it would have to be with like demographics. Because that’s the mindset of some of our teachers, that ‘These kids, they can’t...’ so I think it’s more powerful to even go to one that actually has like demographics.”</td>
</tr>
<tr>
<td></td>
<td>25:29 E: “That’s fair. Fair enough, but I think by visiting other sites then I think that gives us an opportunity to implement that teachers, teaching teachers. ‘Cause when they go there they go with the understanding that, &quot;Come back and share with us what you learned.&quot; What are they doing well, and what are they... Why are they successful,</td>
</tr>
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</table>
Table 3 Continued

<table>
<thead>
<tr>
<th>Written Interviews</th>
<th>Discourse</th>
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<tbody>
<tr>
<td>what did you see? Versus three teachers go. And then they come back and then those three teachers saw it.”</td>
<td></td>
</tr>
<tr>
<td>34:50 D: “We've all been to conferences right? But site visits and classroom visits have always been the thing that's impacted me the most. Is when I go and visit a peer, or when I go visit another school. Because, you can see people down on the ground doing it. For me that's the most impactful. I don't know if we want to make that part of sort of a…”</td>
<td></td>
</tr>
<tr>
<td>35:11 J: “Sending the eager teachers to PLC training and then the other one is them coming back and doing training themselves. Because we always talk about the one that's doing the speaking is doing the learning.”</td>
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<tr>
<td>35:22 P:” Right.”</td>
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<tr>
<td>35:23 J: “So if they're then reinforcing the learning that they've been doing, they're teaching.”</td>
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<tr>
<td>35:28 P: “You've learned something from me. Talking does the learning.”</td>
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<tr>
<td>35:32 J: “Is that you?”</td>
<td></td>
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<tr>
<td>35:33 P:” I'm learning a lot.”</td>
<td></td>
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<tr>
<td>35:37 E: “So you're saying they share it with the staff.”</td>
<td></td>
</tr>
<tr>
<td>35:39 J: “Yeah.”</td>
<td></td>
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<tr>
<td>35:40 E: “Not just their PLC team.”</td>
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<tr>
<td>35:41 J: “Yeah, they come back and share with staff and then I mean then we can start…”</td>
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<tr>
<td>35:47 E: “I'm getting it now.”</td>
<td></td>
</tr>
<tr>
<td>Written Interviews</td>
<td>Discourse</td>
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<td>--------------------</td>
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</tr>
<tr>
<td>“Share training with staff in advance so they know what to expect and how to prepare for attending the training. Also, who would be going.”</td>
<td>46:54 D: “It's a starting point, you're right. Visiting functioning PLC site visits. What do we think of that?”</td>
</tr>
<tr>
<td>“Taking a team of staff members to another site to see how PLCs have been implemented and how they have impacted the site.”</td>
<td>47:00 P: “You're the most recent teacher here…”</td>
</tr>
<tr>
<td></td>
<td>47:02 D: “Yes.”</td>
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<tr>
<td></td>
<td>47:03 P: “And so, I think if you're saying that, that has a little bit more voice and power, 'cause I haven't been in the classroom in…”</td>
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<tr>
<td></td>
<td>47:09 D: “Yeah, I'd say it's pretty low effort. All you have to do is contact a site that's willing, coordinate it and get people to travel, but it can be very impactful, but not as impactful as the actual…”</td>
</tr>
<tr>
<td></td>
<td>47:22 J: “Work?”</td>
</tr>
<tr>
<td></td>
<td>47:23 D: “Work done here on the campus.”</td>
</tr>
<tr>
<td></td>
<td>47:25 J: “So, like right here?”</td>
</tr>
<tr>
<td></td>
<td>47:25 D: “Yeah.”</td>
</tr>
<tr>
<td></td>
<td>--------------------------------------------------------------</td>
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<tr>
<td></td>
<td>49:40 J: “Yeah, there's all these over here. This is sending eager teachers to PLC training. I don't know if that's impactful, but I don't think it's a lot of effort. It's…”</td>
</tr>
<tr>
<td></td>
<td>49:50 P: “No.”</td>
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<tr>
<td></td>
<td>49:50 J: “Reset the schedules.”</td>
</tr>
<tr>
<td></td>
<td>49:51 P: “Yeah, but I don't know that it's super impactful.”</td>
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<tr>
<td></td>
<td>49:53 E: “It's not on the line, I don't think.”</td>
</tr>
<tr>
<td></td>
<td>49:55 P: “It's not on the line, I agree.”</td>
</tr>
</tbody>
</table>
These findings reveal a connection between the thinking of individual participants (i.e., individual meaning) and the sharing of, and building upon, that thinking within the team (i.e., interactional meaning). The sustained focus on the two topics at various points during the session is evidence of this connection, as indicated by the time stamps next to participant dialogue and the written interviews conducted before, during, and after consensus. Furthermore, the inclusion of more participants engaged in discourse surrounding the topics during and after consensus indicates that participants’ thinking influenced team discourse, and the consensus established around this topic is evidence of the influence of team discourse on collective meaning.

This section, entitled Individual Meaning and Interactional Meaning, described the finding that the individual meaning participants generated on their own influenced the interactional meaning participants generated collectively. The next section describes the finding entitled Patterns in Dialogue.
Patterns of Dialogue

This study attempted to gain insights into the verbal layer of discourse while a group collaborated and worked toward consensus. In other words, it aims to answer the question: Are there patterns in the dialogue team members use to communicate with one another while they solve a problem? To answer this question, the discussion captured in the transcript, and the final VRBO, were coded using deductive and inductive approaches.

Conversation Skills

The audio recording of the session was transcribed and the comments were coded into conversation skills using a deductive approach to data analysis. The conversation skills included four categories: (a) creating - proposing new ideas to the group, (b) clarifying - prompting one another to make ideas clearer as well as self-recognition of when clarification is needed, (c) fortifying - supporting ideas with evidence and explaining that evidence, and (d) negotiating - testing and strengthening one another’s ideas by challenging them with counterexamples or other ideas that compete with them (Zwiers, O’Hara, & Pritchard, 2014). Each verbal contribution made by participants was sorted into one or more of these categories. Each conversation skill was assigned a unique color in order to visually distinguish the data and reveal visual patterns within the participant discourse. Figure 5 displays these patterns as well as the total quantity of the conversation moves. Language used for the purpose of creating was assigned the color pink, clarifying was assigned the color yellow, fortifying was assigned the color green, and negotiating was assigned the color blue. Language that didn’t fall into one of the four conversation skills
categories was assigned the color white. Language generated by the group facilitator was also coded by conversation skills using the same four colors, and in addition was marked in grey to distinguish it from language generated by participants.

When new ideas were shared by participants it was coded in the create category. In this study, new ideas were offered up throughout the session. These same ideas were distributed at the beginning, middle, and end of each consensus period. On average, participants engaged in the creation of ideas more often at the beginning of the session in the discovery activity than during other activities.

Participants used the clarification conversation skill most often during the session. Figure 5 indicates that clarifications were often positioned after other clarifications, resulting in wide bands of yellow appearing on the chart. Upon further analysis of the transcribed discourse, it became apparent that participants used clarification language more often to understand another participants’ ideas, rather than to clarify their own ideas to the group. Many of the clarifications were interjected by the group facilitator, with most of his overall language contributions falling into the clarification category.

Fortification behavior occurred throughout the session but appeared more often during and after consensus when participants engaged in more discussions with fellow participants versus with the facilitator. In fact, the facilitator only contributed one fortified statement during the entire session, and this statement was in response to an off-topic joke made by a participant. Sometimes participants fortified their own ideas to the group, but most often they fortified an idea posed by a fellow
participant. This behavior occurred most often during and after consensus was reached.

Participants negotiated ideas at different points during consensus with no apparent pattern detected. The group facilitator did not engage in any negotiating behavior during the entire session.

The facilitator’s conversation contributions are indicated in grey on Figure 5. The facilitator used create and clarify conversation skills almost exclusively throughout the session, with the exception of one instance in which he fortified a participant’s joke. The facilitator’s language changed over the course of the session, with more contributions occurring during the first half of the facilitation when he engaged participants in the discovery and ideation activities.
Figure 5. Patterns of conversation skills.
Professional Learning Communities Implementation Themes

In addition to categorizing the discourse into conversation skills, the language used both orally and in written interviews was analyzed using an inductive approach. During this analysis, the researcher focused on the content of the language produced, and the inductive approach revealed seven themes used during the session that relate to PLC implementation: (a) communication, (b) culture, (c) empowerment, (d) engagement, (e) operations, (f) research, and (g) resources.

Definition of themes. The themes that surfaced during the discussion were unique to this case study and referred specifically to the topic of PLC implementation. Included here are the identified themes, a definition of each theme in the context of this study, and an example of the theme in participant discourse.

Communication. The process of sharing the purpose of PLCs, the vision for PLCs at the school site, and the messaging that considers how information is shared among stakeholders. Example: “No, we need to, as an administrative team, have a shared definition of what a PLC is, and agreements around, not only the messaging but the implementation.”

Culture. The climate in which stakeholders operate, the trust established between stakeholders, and the mindset to make PLCs successful. Example: “I think it’s, also obviously, an opportunity to increase learning, increase teaching, best practices, all those kinds of things as well. Hopefully increase trust among staff and between everyone on campus.”

Empowerment. The agency, authority, and leadership stakeholders possess in order to establish and maintain PLCs. Example: “Sending the eager teachers to PLC
training and then the other one is them coming back and doing the training themselves. Because we always talk about the one that’s doing the speaking is doing the learning.”

**Engagement.** The level of participation, collaboration, and personal investment expressed by stakeholders in the PLCs. Example: “Well, I see the opportunity of if this is running successfully like we would all hope, that some of those resistant teachers will get pulled on board, because everybody else is doing it, and everybody else is enjoying it, everybody else is improving, everybody else’s student scores are increasing, the data is looking great, and they’re gonna wanna be a part of the success, and so I see that as an opportunity to pull some of those resistant teachers into the game.”

**Operations.** The facilitation of PLCs by stakeholders, the process for establishing and engaging in PLCs, and the implementation of PLCs at the school site. Example: “And so I think that’s a definite opportunity and also for the new teachers that come in, they can step into a system that’s developed and they can kind of say, “Here’s what we do, here’s how we do it.” And they can kind of step right in and be right on board and then have the opportunity to ask their questions in those collaborative times.”

**Research.** The gathering of information to establish and maintain PLCs, examples of successful PLCs in other schools, and cooperation with collaborators operating outside of the school site. Example: “Maybe allowing staff members to maybe visit other sites that have fully functional PLCs to be a part of that, see what it looks like, up and running.”
Resources. The time, money, and materials necessary to establish and maintain PLCs. Example: “The site plan was built by a really good principal and she went ahead and included a release time in the site plan. So that teachers can not only collaborate during the work day, which we know is extremely powerful, but also so that they could have subs and attend professional development around PLCs.”

Detectable patterns exist in the verbal layer with regard to the themes under discussion. Figure 6 depicts how often participant language contained the PLC implementation themes that emerged from inductive analysis. This information was further categorized by when the theme language occurred, specifically before, during, or after consensus. The language was also grouped and color coded by conversation skill. Language used for the purpose of creating was assigned the color pink; clarifying was assigned the color yellow; fortifying was assigned the color green; and negotiating was assigned the color blue.

Figure 6 reveals patterns of language use regarding the PLC implementation themes. The focus on PLC implementation themes increased on average when participants engaged in the creation of new ideas, from before consensus to after consensus. On the contrary, when participants used clarification language their focus on the themes decreased on average, from before consensus to after consensus. Participants’ inclusion of the themes when fortifying and negotiating ideas varied little on average during each portion of the session. However, during negotiation, participant language focused almost exclusively on the seven themes of PLC implementation.
These findings reveal patterns within the verbal layer of dialogue between participants during a problem solving session. The conversation skills participants used are evidence of these patterns, as indicated by the distribution, repetition, and frequency of occurrence.

This section, entitled Patterns of Dialogue, described the finding that patterns exist within a team’s verbal dialogue as they work together to solve a problem. The next section describes the finding entitled Communication, Meaning, and Visual Representation Boundary Objects.
Communication, Meaning, and Visual Representation Boundary Objects

This study attempted to uncover a connection between communication, meaning, and VRBOs. In other words, it strives to answer the question: How does what we say and think synthesize into a final product that represents our consensus? To answer this question, the resulting VRBO was compared to the transcribed discourse and the written interviews produced during the team collaboration.

*Figure 6.* Percentages of participant language containing professional learning community implementation themes by conversation skill.
Building the Visual Representation Boundary Object

The VRBO (see Figure 7) is designed to engage participants in determining the solutions the team wants to move forward, in collaborating to evaluate the potential effort the solution will take for the team to accomplish, and in predicting the degree of impact the solution could have upon implementation. Participants were directed by the group facilitator to document solutions on individual sticky notes, one solution per note. He then asked the team to discuss where to plot the sticky notes on the chart based on the amount of effort the solution was likely to require. If the team decided the solution requires a lot of effort, the team plotted the sticky note higher on the chart. If the team determined the solution requires less effort, they plotted the sticky note lower on the chart. For example, the solution “Surveying staff with support needed moving forward, needs assessment” was plotted near the bottom of the chart which reflects the team’s determination that this solution requires minimal effort to achieve.

Finally, the group facilitator directed the participants to consider the potential impact that each solution might have on the organization. Solutions that the team determined could be highly impactful were plotted on or closest to the center line. Conversely, solutions the team determined might be less impactful were plotted either to the left or right of the chart, farthest from the center line. For example, the solution “Provide specific and consistent time/opportunities to work on PLCs” was plotted on the center line indicating the team determined that this solution has the potential to be highly impactful to the school site.
The VRBO that resulted in this study was recreated by the researcher in a digital format to include the participants’ original language as well as the corresponding PLC implementation themes (see Figure 8).
Figure 7. Final visual representation boundary object.
Figure 8. Final visual representation boundary object including researcher analysis.
Recurrence of Professional Learning Communities Implementation Themes

Participants worked collaboratively to come to consensus around the solutions the team would enact to move toward their shared goal of PLC implementation. The written language generated by participants on each sticky note was analyzed for the seven PLC implementation themes embedded in the discourse and interviews using a deductive approach. The findings reveal that every solution generated on the VRBO addressed either one or two of the themes that emerged during the team discussion and in the written interviews (see Table 4).
### Table 4

**Solutions and Corresponding Professional Learning Community Implementation Themes**

<table>
<thead>
<tr>
<th>Team Generated Solutions</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a shared vision with all</td>
<td>Communication, Culture</td>
</tr>
<tr>
<td>Trained teachers do the training</td>
<td>Engagement, Empowerment</td>
</tr>
<tr>
<td>We as an administrative team create a shared definition of a PLC, implementation/expectations and messaging</td>
<td>Communication, Operations</td>
</tr>
<tr>
<td>Identify our teacher leaders as well as “the willing”</td>
<td>Operations, Research</td>
</tr>
<tr>
<td>Create a scope and sequence as an administrative team for implementation</td>
<td>Operations, Research</td>
</tr>
<tr>
<td>Provide specific and consistent time/opportunities to work on PLCs</td>
<td>Operations, Research</td>
</tr>
<tr>
<td>Develop common systems within the PLC process for understanding and accountability</td>
<td>Operations, Communication</td>
</tr>
<tr>
<td>Functioning PLC site visits</td>
<td>Research</td>
</tr>
<tr>
<td>Admin model PLC process</td>
<td>Operations, Culture</td>
</tr>
<tr>
<td>Sending eager teachers to PLC training</td>
<td>Empowerment, Research</td>
</tr>
<tr>
<td>Meeting teachers where they are in the process</td>
<td>Engagement</td>
</tr>
<tr>
<td>Surveying staff with support needed moving forward, needs assessment</td>
<td>Research</td>
</tr>
<tr>
<td>Everyone has a specific role within PLC</td>
<td>Operations, Engagement</td>
</tr>
<tr>
<td>Compensation for leadership role</td>
<td>Operations, Resources</td>
</tr>
</tbody>
</table>
Visual Representation Boundary Objects Criteria and Accuracy

In order for the chart used in the session to be considered a VRBO participants needed to be able to edit and revise it as necessary, and participants should be able to see their contributions represented. The chart the team created meets these criteria. Participant input regarding the accuracy of the resulting VRBO was sought in the last written interview conducted after consensus. The final question asked participants for their perspective regarding the VRBO the team built (see Table 5). The findings indicate that participants believe that the resulting VRBO accurately reflected the team’s discussion.

Table 5
Participant Perspectives on Resulting Visual Representation Boundary Object

<table>
<thead>
<tr>
<th>Final Written Interview Question</th>
<th>Participant Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the completed chart that resulted from today’s session accurately reflect the group’s discussion? Please explain.</td>
<td>“I believe so. We have had conversations in the past but this exercise has formalized and concretized many ideas.”</td>
</tr>
<tr>
<td></td>
<td>“I think we had a good discussion. Everyone brought forth their ideas and we took the time to hear each other as to what holds importance for the group and the individuals.”</td>
</tr>
<tr>
<td></td>
<td>“The group discussion was depicted accurately on the chart created.”</td>
</tr>
<tr>
<td></td>
<td>“Yes...it provided time/space for us to dialogue and agree upon the priorities for implementation. It felt like we had consensus and were able to narrow the focus.”</td>
</tr>
</tbody>
</table>
These findings reveal that a relationship exists between participants’ verbal communication and group meaning, and this relationship is reflected in the VRBO the team created. The team’s discourse included content that represents seven PLC implementation themes, and the team demonstrated consensus around these themes by including them on the chart they collaboratively built.

Summary

This chapter discussed the findings of the study including: (a) individual and interactional meaning; (b) patterns of dialogue; and (c) communication, meaning, and VRBOs. Additionally, seven PLC implementation themes were identified that emerged from the research: (a) communication, (b) culture, (c) empowerment, (d) engagement, (e) operations, (f) research, and (g) resources. The next chapter describes the influence the findings have on the recommendations in this study.
CHAPTER 5: DISCUSSION

Introduction

The purpose of this study was to determine the relationship between verbal communication and group meaning through the use of Visual Representation Boundary Objects (VRBOs) during team problem solving. This was accomplished with field research that employed the use of field notes, video and audio recordings, written interviews, and an artifact review. These data collection methods were used to provide the researcher with insight into how teams communicate ideas during collaboration and consensus building.

A case study was conducted to capture the dialogue between participants as they worked together to solve a problem. The researcher designed an ideation workshop around the participants’ self-selected topic of Professional Learning Communities (PLC) implementation that included the use of a VRBO, and a group facilitator lead the collaboration. This methodology enabled the researcher to analyze the discourse and exchange of ideas of a small group of colleagues in their workplace, and to study how knowledge is shared among teammates who regularly collaborate.

The findings from the study were consistent with those detailed in the review of literature in Chapter 2. The VRBO appeared to support participant interactions by building shared understandings (Kerr et al., 2012) and helping the team members find common ground (Black & Andersen, 2012). Team members reached consensus as demonstrated by the VRBO they created (Dow et al., 2012; Kerr et al., 2012; Simonse
et al., 2015) and transferred knowledge along the continuum from private, to interpersonal, to collective meaning (Zajonc & Adelmann, 1987). The group facilitator appeared to guide the team’s conversation in an impartial manner while keeping the conversation focused and productive (Azadegan & Kolfschoten, 2014; Paul, et al., 2004).

The development of shared knowledge is dependent upon the externalization process in which participants convert their tacit knowledge to explicit knowledge through discourse (Nonaka, 1994; Thompson, 1998). The dialogic interactions between participants, and the group facilitator, promoted meaning development along the continuum between tacit and explicit knowledge (Nonaka, 1994; Thompson, 1998). The analysis of the dialogic interactions between participants distinguishes this study from others that examine the use of VRBOs during team collaborations. Dialogic patterns emerged from the findings that indicate changes in conversation skills before, during, and after consensus in a problem solving discussion. Patterns were detected in the amount and frequency of particular conversation skills, and these patterns were likely influenced by the design of the ideation session. Likewise, the findings indicate that the session’s design appeared to influence the externalization process as participants were guided by activities that surfaced the use of conversation skills at various points during the collaboration. Additionally, the group facilitator appeared to assist team members in the transfer of knowledge with verbal prompts and by establishing a risk-taking climate.

The findings also revealed that group consensus was likely influenced by the content themes the team discussed. Seven PLC implementation themes were
identified that emerged from the research: (a) communication, (b) culture, (c) empowerment, (d) engagement, (e) operations, (f) research, and (g) resources. A surprising result in this study was that a structure to these themes appears to exist that represents the team’s theory of action for implementing PLCs. This thematic structure could have implications on the implementation process as the study’s participants move forward toward establishing PLCs at their site. The resulting VRBO could be used to communicate the team’s theory of action by enacting it as a reference point for additional stakeholders (Star, 2010; Sutter & Kieser, 2019) and could assist organizational leaders in coordinating efforts to implement PLCs (Sutter & Kieser, 2019).

In this chapter, the researcher draws conclusions from the study’s research questions and findings described in Chapter 4. The results from the study are discussed in the following section that answers each of the three research questions. Recommendations for teams using VRBOs follow the discussion, as do recommendations for further research. The chapter concludes with a summary of the study.

**Conclusions**

This study was focused on the connection between team discourse, the transfer of knowledge, and the use of VRBOs. The researcher attempted to uncover this connection with three research questions. Research Question 1 focused on how meaning converts from the individual to other members of a team through team discourse. Research Question 2 attempted to determine if patterns could be detected in the dialogue that team members exchanged as they worked toward consensus.
Research Question 3 focused on determining if a relationship exists between team communication, collective meaning, and the VRBO that results from those interactions. The researcher describes the results of the research questions and draws conclusions based on this information.

**Research Question 1: How does individual meaning influence interactional meaning, as measured by verbal communication during group problem solving and consensus?**

The results of this study indicate that the design of the ideation session itself supports the development of meaning along the continuum from private to interpersonal. The session was organized for the facilitator to first get ideas shared in the open and not necessarily built upon. This required participants to think on their own and the facilitator gave them time to do this individual meaning work. Because participants weren’t engaging with one another’s ideas using cross talk at this point in the session they had the opportunity to listen without distraction and consider how the ideas their teammates shared complemented or countered their own thinking. There was additional time built into the session design for participants to consider their own thinking about the topic when they completed the first written interview before reaching consensus. At that time participants articulated their thinking in writing, which might have supported them when they verbally articulated these same ideas to the group later on in the session.

The group facilitator appeared to play a role in the transfer of knowledge among participants by encouraging participation through verbal prompts. These prompts consisted mainly of questions and directions for creating new ideas and clarifying ideas that had been shared. The group facilitator aligned the prompts with
the purpose of each portion of the ideation session. For example, during the discovery and ideation activities he encouraged participants to share individual ideas while he recorded them on chart paper. The purpose of these activities was for participants to generate as many ideas as possible so that the group entertained a broad range of ideas and didn’t narrow the discussion too quickly to focus on a single idea. The group facilitator also asked participants to suspend judgment in order to keep ideas flowing and to maintain a positive climate so that all participants felt safe to share and take risks by proposing new and different ideas. The participants appeared to follow these norms and his directions as evidenced by the amount and variety of ideas that were generated and entertained during the discussion. The myriad of ideas shared appeared to be important for the externalization process to take place in which individuals convert their tacit knowledge to explicit knowledge. The session was designed to foster the externalization process early on during the collaboration, and the group facilitator assisted participants in engaging in this process.

The dynamics of the team in this case study likely influenced the transition from private to interpersonal meaning. The researcher observed synergy between participants during the session through what appeared to be collegial conversation, relaxed body language, interjections of humor, and listening to understand versus listening to simply reply. The reason for these actions by participants could be that the topic of PLC implementation was not a new one for this team, so past conversations that participants engaged in, and interactions had with one another and their colleagues, might have influenced the results of this study. The participants
brought up the topics of creating a shared definition and teacher training during the discovery and ideation portions of the session, respectively. It’s possible that the synergy and common experiences the participants had prior to the study caused these topics to resonate with fellow participants who then wrote about the idea in the first interview before consensus. These factors may also have influenced the sharing of meaning from private to interpersonal early on in the session.

The topics of a shared definition of PLCs and teacher training appeared to be important enough for individuals to not only be thinking about them but to share them with the team. The sustained focus on these topics during the discussion is evidence of the beginning stages of consensus. More participants joined in on the discussion around these topics, so knowledge transferred to other teammates. These topics were sustained throughout the process and ultimately made it onto the final VRBO. Therefore, it appears that the group’s collective meaning was influenced by the thoughts of individuals and the discourse process influenced the thinking of the rest of the group, thus allowing the opportunity for consensus to take place.

**Research Question 2: Are there detectable patterns in the group’s verbal layer of dialogue before, during, and after consensus as measured by agreement on the final VRBO?**

Once again, the session’s design and the team’s dynamics appear to have influenced the patterns of dialogue that emerged in this study. Participants shared more ideas during the beginning of the session than at the middle or end of the session. This could be because the session was designed to first surface ideas, then for the group to grapple with those ideas and shape them collectively. The design
also influenced the group facilitator’s behavior because he directed and encouraged participants to offer up ideas more often during the discovery and ideation activities.

Team dynamics also appear to have played a role in the team’s verbal layer of dialogue. The participants engaged the skills of clarifying ideas more often than other conversation skills. This suggests that this team was listening attentively to one another and were motivated to understand the ideas being shared. Sometimes participants would anticipate the need to clarify their own statement and would back up their initial thought with further details, examples, or stories to improve comprehension for their teammates. Most of the time, though, participants in this case study spent their time asking each other clarifying questions in order to better understand one another. This behavior likely had a positive influence on the team’s ability to reach consensus because their deliberate interaction with, and positive reception of, one another’s ideas appeared to maintain the relaxed climate and a steady focus on the topic of PLC implementation.

During the opportunities and solutions activities that occurred during and after consensus the participants fortified more ideas than when they were working with the facilitator earlier in the session. The session was designed to engage participants in sharing individual meaning early on, then to release the discussion to the team for them to engage in discourse around the ideas originally shared. This team appeared to take one another’s ideas seriously and fortified them by adding examples and information. In fact, participants in this study fortified each other’s ideas more often than they did their own. This could be a result of the team’s synergy and collegiality that the researcher observed during the session. The act of fortification is another
step toward consensus because in doing so the team members are validating each 
other’s ideas through externalization. At this point in the session meaning has moved 
from private, to interpersonal, and is becoming more collective.

In this case study the participants didn’t use negotiation conversation skills as 
often as other skills, and the facilitator didn’t use them at all. It seemed as though 
the facilitator was trying to remain neutral to the content under discussion, allowing 
participants to negotiate on their own without his direction or prompting. This team 
demonstrated synergy early in the ideation session by sharing similar individual 
meaning both orally and in writing. It’s possible that this synergy early on meant that 
the teammates didn’t need to negotiate meaning very often in order to reach 
consensus around the topic of PLC implementation.

A pattern within the group’s verbal layer that appears to be important to group 
consensus was the development of PLC implementation themes throughout the 
session. A deductive analysis of the content of the participants’ conversation 
revealed themes that consistently appeared in each activity of the session, in each 
written interview, and in the final VRBO. Considering that the themes survived the 
externalization process to ultimately populate the VRBO, the researcher has 
concluded that the agreed-upon themes are what represent consensus for this team, 
versus the individual ideas shared during the session. The individual ideas were 
altered during the discourse process through clarification, fortification, and 
negotiation. However, the themes that comprised these ideas didn’t waiver.

In addition to the development of themes, what emerged was a structure to 
those themes that appears to represent the team’s theory of action for PLC
implementation, as shown in Figure 9. Seven themes appeared consistently during the team’s discussion and the individual written interviews. However, upon further analysis the researcher uncovered categories and relationships between the themes based on the meaning that developed along the continuum from private, to interpersonal, to collective. For example, Figure 9 show the themes organized into three categories. The What category indicates that the team determined that changes in communication and culture are what need to take place for successful PLC implementation. The Who category represents the teachers for whom the team is implementing PLCs, and the themes of empowerment and engagement represent the actions that will influence their implementation process. Finally, the How category represents the steps the team needs to take to get the PLC implementation process started and to maintain it.

Furthermore, Figure 9 shows not only categories but the relationships between specific themes as communicated by this study’s participants. For instance, the themes of communication and climate have a cause and effect relationship in which the participants believed that by improving communication within and among teams an improved culture of trust would result. A similar belief emerged from the analysis of the team’s conversation regarding the themes of empowerment and engagement. Participants communicated the belief that if they can empower teachers through leadership opportunities that will result in greater engagement among all teachers. Finally, a third relationship appears to exist between the themes of operations, research, and resources. The study’s participants shared the belief that how they go
about the implementation process will be dependent upon the information they have available to them and the resources they put into use to establish PLCs.

**Figure 9.** Professional learning community implementation theme structure.
Research Question 3: What is the relationship between individuals’ verbal communication and group meaning as measured by the resulting VRBO at the conclusion of group problem solving and consensus?

In this study, the team reached consensus through discussion that focused on PLC implementation themes. The VRBO solidified consensus by acting as a physical representation of this agreement. Participants verbally shared knowledge from their individual perspectives and experiences through the externalization process during the session, with collective knowledge culminating on the final VRBO. When the participants documented their ideas on sticky notes, and plotted them on the VRBO, they could literally see the content they shared during the discussion and interacted with the content again by ranking its feasibility and predicting its level of impact. Through these additional layers of discussion participants could further revise their thinking and confirm consensus.

An aspect of the team’s collaboration that was visible on the VRBO were the themes that emerged during the discussion. By contrast, an aspect that was invisible were the conversation skills participants used to share knowledge and build consensus. These conversation skills were important, however, because they were necessary for verbal communication to occur, and verbal communication was key to the externalization process and the population of the VRBO. What ultimately surfaced on the VRBO was the content of the discussion, and the seven PLC implementation themes are a critical piece of that content because they represent the collective meaning of the group.

The team in this case study plans to continue the PLC implementation process at their site, and their ideas and details will likely change as the message is spread
and more participants are involved. What could fuse this work together and sustain it are the themes that endured throughout the discussion and appeared on the VRBO. If new ideas offered by new team members fit into the existing theme structure then it could be more likely that those new ideas are adopted into the fold and accepted by the group. New ideas that fall outside of the theme structure might be less likely to be accepted and adopted by the group. The VRBO is a communication tool that could be instrumental in sharing these themes and the group’s unified message, which could help new team members self-select and filter their ideas, possibly sharing new ones that align with the existing theme structure and therefore the team’s theory of action.

The specific VRBO that was created in this study could be a valuable tool for the participating team as they work toward PLC implementation. The team could organize the themes that emerged on the VRBO and place them in a logical sequence to create a draft of a PLC implementation plan. This approach could be beneficial because the focus isn’t only on the steps to be taken to implement PLCs but includes the theory of action that emerged as a product of the socially shared cognition of the team, thus articulating the “why” that’s driving the need for change. This plan, and the original VRBO, could be used for communicating the team’s shared beliefs through an established common language that can encourage members of the organization to take action for PLC implementation. The team featured in this study should be prepared to revise the VRBO and implementation plan as needed in order to accommodate additional perspectives and new information that arises through their use.
Recommendations

The researcher makes the following recommendations as a result of analyzing the findings, interpreting the results, and drawing conclusions based on this case study. Recommendations are made for teams that are considering the importance of verbal communication and knowledge sharing using VRBOs. Recommendations are also made regarding areas in which further research could reveal additional insights into the verbal layer of team consensus building using VRBOs.

Recommendations for Teams Using Visual Representation Boundary Objects

1. Use a group facilitator to encourage participation during team problem solving, even if the facilitator is a member of the team.

2. The group facilitator should use language that matches the purpose of the session and should prompt team members while remaining neutral, if possible. This can help establish a climate of trust and risk-taking that are important if new and better ideas are going to surface.

3. Design the problem solving session with the VRBO in mind, considering how it will be used during and after the session. Match the purpose of the VRBO with the purpose of the session and plan for how the team members should engage with the VRBO.

4. Group facilitators and other leaders should pay attention to team discourse for cues regarding the transfer of knowledge, the use of conversation skills, the emergence of content themes, and for signs of consensus.

5. Consider what other uses the VRBO could have for the project beyond the problem solving session itself, such as building an implementation plan or communicating with a wider audience of stakeholders. Expect that the VRBO will change over time as additional stakeholders add their own revisions.

Recommendations for Further Research

1. Conduct additional case studies and consider how the verbal layer differs in different contexts and for different purposes, including teams that consist of teachers and their students.

2. Consider other methods for analyzing team discourse that go beyond conversation skills. Plan studies in which participants are unaware that their
discourse is being analyzed and compare the findings to conditions in which participants are aware that their language use is being studied.

3. Research how a group facilitator’s language changes when the problem solving conditions change. For instance, compare facilitator language use when a team is having trouble reaching consensus to a case when consensus is easily reached.

4. Conduct research that follows the team into the implementation phase of their problem solving endeavor to examine the changes that take place to the VRBO, the conversations, the content themes, and the theory of action.

5. Analyze content themes that emerge during team discussions across different cases and examine their relationship to consensus building among teams. Attempt to determine if collective meaning is the same as reaching consensus.

Summary

This study was an opportunity to gain greater understanding about how teams work together to solve problems in their organizations. The review of the literature confirmed that VRBOs are valuable tools for assisting teams to communicate, collaborate, and reach consensus. This review also revealed a gap in the literature regarding our understanding of the verbal layer of dialogue that occurs during team collaboration and its connection to group meaning and VRBOs. The results of this study indicate that patterns exist in team discourse that influence the transfer of knowledge between participants and the VRBO that results from these interactions. This study also revealed a structure to the conversation themes that were present in the team discourse and VRBO that constitute an underlying theory of action.

The VRBO is an important part of the social context in which socially shared cognition is established because it captures one particular team’s thinking at one particular moment in time. Through the externalization process knowledge travels back and forth along the meaning continuum between private, interpersonal, and
collective. In this study what was private became interpersonal when participants expressed their thoughts to the group through dialogue. The team built upon private and interpersonal meaning that was shared during the externalization process using conversation skills. While team members clarified, fortified, and negotiated the ideas that were shared from private and interpersonal meaning, those ideas became collective meaning because members could help shape the ideas collaboratively.

VRBOs are dynamic tools that, through the externalization process, can blend the shared cognition of the original team with the private meaning of other individuals in the organization, thus continuing to build interpersonal and collective meaning. In this way, VRBOs can operate as metaphorical mirrors in which participants can see their thinking reflected back at them. This, combined with the externalization process for building collective meaning, can be a substitute for creating “buy in” among stakeholders.
REFERENCES

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APPENDIX A: FIELD NOTES

Observer:

Date:

Time:

Place:

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<thead>
<tr>
<th></th>
<th>Observations</th>
<th>Reflections</th>
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<td>Activities</td>
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Diagram of Observation Context:
APPENDIX B: ARTIFACT REVIEW PROTOCOL

Title:

Description:

Format:

Review Date:

Researcher’s Reflections:
APPENDIX C: INTERVIEW PROTOCOL

Project: Dialogue During Team Problem Solving Using Visual Representation Boundary Objects: A Case Study

Interviewer: Julie Webb

Open session by reminding the interviewees:

- Purpose of the study
- Potential length of the written interview
- What data is being collected
- Remind interviewee that all information is confidential and no real names will be included in the study
- Verify interviewee’s understanding of how to submit written interview answers

Interviewee:

Position of the interviewee:

Written Interview Questions: First and Second Set

Q1: Which ideas, if any, need to be clarified?
Q2: Which ideas, if any, should be supported with more information?
Q3: Which ideas, if any, should the team seriously consider?
Q4: What idea, if any, could you share next?

Written Interview Questions: Third Set

Q1: Which ideas, if any, need to be clarified?
Q2: Which ideas, if any, should be supported with more information?
Q3: Which ideas, if any, should the team seriously consider?
Q4: Does the completed chart that resulted from today’s session accurately reflect the group’s discussion?