Contents

Foreword, by Jerry Jennings vii

Preface: Interdependent Thinking xiii
Arthur L. Costa and Pat Wilson O’Leary

Acknowledgments xix

Introduction: Thinking Interdependently—A Human Survival Mechanism 1
Pat Wolfe

PART I: INTERDEPENDENT THINKING IN LIFE SETTINGS 9

1. Creating and Influencing Momentum:
The Challenges and Power of Adults
Thinking Interdependently 11
Jerry Jennings

2. Efficient Thinking with Architectural Teams 17
Peter Saucerman

3. Thinking Together in Industry 30
James Heath

4. Knowing the Score:
Thinking Interdependently in the Orchestra 36
Virginia V. Baker, Elizabeth Baker, and William Baker

5. Thinking as a Team 42
Mark Jones
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>A Virtual Continuum for Thinking Interdependently</td>
<td>Bena Kallick and Marie Alcock</td>
<td>49</td>
</tr>
<tr>
<td>7.</td>
<td>Creating Communities of Thought: Skills, Tasks, and Practices</td>
<td>Laura Lipton and Bruce Wellman</td>
<td>61</td>
</tr>
<tr>
<td>8.</td>
<td>Creating Interdependent Thinking Among School Staff</td>
<td>William A. Sommers and Shirley M. Hord</td>
<td>69</td>
</tr>
<tr>
<td>9.</td>
<td>Developing Smart Groups</td>
<td>Robert J. Garmston</td>
<td>75</td>
</tr>
<tr>
<td>10.</td>
<td>Working Smarter, Not Harder: Building Interdependent Communities of Practice</td>
<td>Diane P. Zimmerman</td>
<td>84</td>
</tr>
<tr>
<td>11.</td>
<td>In the Company of School Leaders</td>
<td>Patricia Reeves</td>
<td>94</td>
</tr>
<tr>
<td>12.</td>
<td>Thinking Maps for Meetings of the Mind</td>
<td>David Hyerle and Larry Alper</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>Reflecting on Part II</td>
<td></td>
<td>115</td>
</tr>
</tbody>
</table>

**PART II: FACILITATION STRATEGIES FOR INTERDEPENDENT THINKING**

**PART III: FOSTERING DISPOSITIONS OF INTERDEPENDENT THOUGHT**
14. We Instead of Me: The Teacher’s Role in Engendering Interdependent Student Thinking 129
   Patricia A. Roy

15. We Think Better Together: Classroom Strategies for Interdependent Learning 140
   Jill Barton, Mary Burke, and Sabrina French

16. Theater: Celebrating Interdependent Thinking 149
   Sandra Brace

17. Thinking Interdependently: The Family as a Team 156
   Lauren A. Carner and Angela Iadavaia-Cox

18. The Seven Habits of Highly Interdependent Teachers 165
   Jeremy Little

19. Teaching the Dispositions of Interdependent Thought 176
   Arthur L. Costa and Pat Wilson O’Leary

Reflecting on Part III 200

About the Editors and Contributors 201

Index 208
INTRODUCTION

Thinking Interdependently—
A Human Survival Mechanism

Pat Wolfe

To keep your resolve, surround yourself with those who want you to succeed. The brain cannot do its job of protecting the body without contact with other people.

—Robert Ornstein & David Sobel, The Healing Brain

The conception of the thinker as alone rather than embedded within a human community has been a fundamental characteristic of Western science and philosophy for many years. This belief has changed radically as our knowledge and understanding of the brain have grown. This introductory chapter proposes to explain how working and thinking interdependently (in groups) is not only a desirable process but the key to our survival as a species.

NEUROPLASTICITY

The past 3 decades have produced a prodigious body of research about the structure and function of the human brain. Probably the most amazing information to come out of this research is that the brain is changed as it interacts with and is influenced by the environment. This concept is referred to as neuroplasticity. It wasn’t too many years ago that it was believed that the brain you are born with is the brain you are stuck with; that your genes are the main determinants of who you are and the environment plays a rather insignificant role. We now know that this is far from true; the environment, by means of the brain’s plasticity, plays a vital role in who we become. One example of this plasticity can be seen in the brains of persons born without sight. It was supposed that the brain cells designed to process vision in a
blind person would atrophy since they were not activated. Instead, it was discovered that the visual cells actually change their function and become cells that process auditory and tactile input. Numerous additional research findings validate the fact that the environment plays a major role in the sculpting of the brain.

An understanding of plasticity has led to an increased understanding of how the human brain has evolved and developed over millions of years. At the outset, it is critical to understand that the main purpose of the brain is survival. We have brains in order to keep the individual and the species alive. Those traits and behaviors which increase the probability of survival are selected and passed on to the next generation. A fast runner had a better chance of escaping from a saber-toothed tiger and living to produce progeny. The same is true of many other skills or traits. For example, good hunters or gatherers had a better chance of survival, and if they worked together with others, their chances were even better. Humans are relatively weak, with no fur or armor to protect them. Being a weak lone individual competing for scarce resources would certainly be a disadvantage. But you could double your strength by establishing cooperative agreements with some of your neighbors. Being a member of a group would then make survival more likely when resources were limited. It is easy to see how eventually the brains of our ancestors began to change from purely survival brains into social brains. Most scientists now agree that our social brains have been shaped by natural selection because being social enhances survival (Cozolino, 2006).

Further evidence to support the concept of the social brain comes from studies of very young children. In his book *Why We Cooperate*, Michael Tomasello (2009) makes a strong case for an innate capacity that children have for empathy and cooperation. He states that at an astonishingly early age, children begin to help one another and to share information. It appears that we are born ready to cooperate.

Given the brain’s plasticity, it is not surprising that it appears that living in larger and more complex social groups has resulted in larger brain regions. The development and increasing complexity of social life changed not only behaviors but the anatomy and circuitry of the brain as well. Daniel Goleman (2005), in his book *Emotional Intelligence*, explains that earlier thinking on what allowed humans to develop such large and intelligent brains focused on our ability to hold and make tools. In recent decades more proponents have been drawn to the brain’s role in the social life of the species—its role in survival and in raising children who survive into parenting age.

The brain regions that have undergone the most change are those capable of the emotion, reason, and intellect necessary to form relationships
and work collaboratively with others. (Size typically is considered an indicator of processing capacity.) This has been corroborated by research in the comparative anatomy of humans and other primates. For example, the amygdala, a brain region necessary for emotion and social interactions, demonstrates the impact of the environment on the brain. A 2011 study by researchers (Bickert et al.) determined that humans with larger and more complex social networks had larger amygdala volume. The neocortex (the outer layer of cells covering the brain) is another area that expanded as humans became more involved in larger social groups (Cozolino, 2006). Various parts of the neocortex are designated for language, thinking abstractly, problem solving, and interpreting social information, areas necessary for success in navigating our increasingly complex social environment. In primate studies, it has been found that the more members of a band in a species, the larger the neocortex relative to the rest of the brain (Sawaguchi & Kudo, 1990). However, the social brain (with its proportionately larger neocortex) became the most highly evolved in humans who developed the highest degree of social prowess.

**MIRROR NEURONS**

Another group of neural structures called *mirror neurons* appear to play an important role in the workings of the social brain. These neurons reflect an action we observe in someone else, causing us to mimic the action or have the impulse to do so (Goleman, 2006). For example, when you observe someone yawning, it often causes you to yawn. The same is true of smiling. These hard-wired mirror neurons also allow us to “read” the feelings of others and resonate with those feelings. Our minds are not independent, separate, and isolated, but are continually interacting with the minds of others. Psychiatrist Daniel Stern (2004) believes that as these mirror neurons bridge brains, they create a pathway that allows us to engage in powerful interaction.

A deficit of the social brain, whether genetic or the result of brain trauma or surgery, often results in the inability to form relationships or have a productive social life. This can be observed in autistic individuals, who often are not equipped with the skills to read the feelings of others and have difficulty empathizing or socializing with them. The well-known case of Phineas Gage is a tragic example of the loss of social skills that occurs with damage to the frontal cortex. While Gage was working with explosives on a railroad crew, a steel rod accidentally exploded through his frontal lobe. Amazingly, he survived but his personality changed. He previously had been well liked and had worked well with the rest of the crew. After
The accident, he no longer related appropriately to others, lost his job, and died destitute and alone.

We have seen that certain behaviors increase the probability of survival. But what causes us to repeat these behaviors? Is it the knowledge that if we run faster we have a higher probability of escaping the wild beast, or are other factors involved? Knowledge alone is probably not enough of a reinforcer. Consider that most of us know that exercise and eating healthy foods are productive behaviors, but often that is not enough of an impetus to change our habits. Something else must be at play.

That “something else” is a hard-wired group of structures deep in the brain that rewards us for behaviors that increase our chances of survival. This primitive neurological system is referred to as the reward pathway, the pleasure center, or the natural reinforcement center. This system is composed of two main structures, the nucleus accumbens (NA) and the ventral tegmental area (VTA). As with all other brain systems, the neurons (brain cells) within these structures communicate with electrical and chemical signals.

An accident with a tamping iron made Phineas Gage history’s most famous brain-injury survivor (Twomey, 2010). To find out more about Phineas Gage, go to http://en.wikipedia.org/wiki/Phineas_Gage. Image courtesy of Jack and Beverly Wilgus.
at junctures called synapses. Electrical impulses (action potentials) cause neurons to release chemicals (neurotransmitters) into the synapse. The result is that the neuron receiving the chemical is activated.

**DOPAMINE: THE FEEL-GOOD NEUROTRANSMITTER**

There are several neurotransmitters released by the NA and VTA, but dopamine appears to be the primary activator of the pleasure center. Because the NA and VTA have projections to the conscious part of the cortex, we are able to be aware of the pleasurable sensation that dopamine produces. Dopamine says, “That feels good; do it again.” You probably have unknowingly experienced this effect. Think about how a delicious meal produced a pleasurable feeling or how you felt when someone smiled at you or complimented you on a job well done, or when you finally solved a difficult problem. You can thank dopamine! Why are you rewarded by these behaviors? It is because they increase your chances of survival. Is eating pleasurable? Yes, because if we didn’t eat, the species would die out. Have you heard of “runner’s high”? The effect is a dopamine reward for being a fast runner, another survival benefit. As we have seen, working well with others increases your chances of survival. Therefore, being complimented or smiled at, and collaboratively solving a problem can cause the activation of the reward pathway and increase the probability that you will engage in these behaviors again.

**SURVIVAL AND SOCIAL COOPERATION**

Validation of the neural basis for social cooperation comes from neuroscientists at Emory University. They found in their research that the act of helping another person triggers activity in the reward pathway, producing the same sort of pleasure as gratifying a personal desire (Rilling et al., 2002).

As mentioned at the start of this chapter, we are beginning to understand that thinking interdependently (with another person or group of persons) is more than just another strategy to use in classrooms; it has survival benefits as well. In addition, it appears that thinking interdependently increases student understanding and retention of concepts. For example, if I have just read or heard information new to me, I may think I understand it. However, when I am asked to teach it to a partner or discuss it with a group of my peers, several things may occur. I may find I didn’t understand as well as I thought and through group interaction I may get my misconceptions corrected. Or perhaps I will come to a better understanding when I hear
others’ perceptions of the information. An added benefit is I will literally strengthen the synapses between brain cells holding the memory of the discussion, thereby increasing the probability of retaining the information.

**SURVIVAL AND THE SCHOOL’S ROLE**

Traditional educational methods generally have not focused on cooperation and collaboration. Individual accomplishment and competition with others for grades are often the norm. As the understanding of the importance of working with others has increased, schools are beginning to look for ways to help students develop needed social skills. One process that is gaining momentum is social emotional learning (SEL). Its main goal is learning life skills such as how to recognize one’s emotions and manage one’s feelings, developing sympathy and empathy for others, maintaining positive relationships, and working constructively and ethically in a group. In our increasingly complex and interrelated society, these skills are becoming more essential. Certainly, learning to think interdependently fits well within the SEL process.

Another process or strategy for groupwork that includes interdependent thinking is cooperative learning. Studies of this method regularly report an increase in the engagement and active participation of students, which in turn increases student motivation, time on task, and retention of information. (See Chapter 13 by Judy Willis in this book.) It also improves cognitive reasoning and the ability to see from others’ perspectives (Munro, O’Brien, & Payton, 2006). Without the opportunity to work in groups, it is doubtful that these skills will develop to their fullest capacity.

**REFERENCES**


