GUIDED GROWTH

Educational and Behavioral Interventions for Children and Teens with Fetal Alcohol Spectrum Disorders and Early Trauma

ALSO BY IRA J. CHASNOFF, MD

Drug Use in Pregnancy: Mother and Child

Drugs, Alcohol, Pregnancy, and Parenting

Understanding the Drug-Exposed Child

The Nature of Nurture

Power Beyond Measure

Risk and Promise

Cause and Consequence

Mystery of Risk

INTERNATIONAL PRAISE FOR

GUIDED GROWTH

Educational and Behavioral Interventions for Children and Teens with Fetal Alcohol Spectrum Disorders and Early Trauma

***Guided Growth* reminds us of the importance of connecting with our students and building a foundation of trust. The interventions provided are exactly what we need to support students, get them ready to learn, and help them build resiliency.**

JUSTI GLAROS
Supervisor of Curriculum, Instruction & Assessment, Sharon City School District
Sharon, Pennsylvania

Dr. Chasnoff's and Dr. Powell's developmental approach to the challenges of children and youth affected by prenatal substance exposure and early trauma is a much-needed guide to navigate through the tasks of understanding risk and resiliency for these children, their parents, and their teachers. This book should be read by every teacher in America.

SID GARDNER
President, Children and Family Futures
California

This beautiful book, targeted to teachers, parents – anyone involved with guiding children and youth with FASD – fills a great gap in the literature addressing the education of children. Citing the most recent research, Drs. Chasnoff and Powell first explain how normal learning takes place and how the brain works and then explain what goes wrong in the brain affected by prenatal exposure to alcohol and postnatal trauma. In fact, many children prenatally exposed to drugs or alcohol have also been exposed to neglect or abuse. The authors explain how all these factors contribute to a state of permanent stress, which inhibits the development of social relations and academic learning. The second half of the book moves into providing strategies to improve behavior and effective learning, offering numerous examples with detailed analyses of what works and what does not. The final chapters will be of special interest to parents and teachers who aim to prevent problems before they occur and to promote better communication between parents and teachers. I highly recommend this book to anyone who works with children and youth who were prenatally exposed to alcohol.

DIANE BLACK, PH.D.
Chair, European FASD Alliance

As the parent of children with FASD, I find there is a real shortage of books that explain the roots of behavioural difficulties stemming from prenatal alcohol exposure and early trauma. *Guided Growth* does this admirably. The book guides the reader in an easy manner, explaining learning difficulties and behavioural challenges which result when brain development has been negatively impacted by prenatal exposure to alcohol or trauma during the early years. Real life classroom

situations, where complex and subtle learning difficulties and often misunderstood behaviours impact the child's learning, are explained. Bringing together a wealth of expert knowledge, this book provides step by step guidance in assisting the child learn and manage behaviours in class. A procedure to proactively enhance classroom learning and reduce behavioural difficulties is explained. Teachers will gain insight, knowledge and skills from this book that will be wide-reaching, assisting children with FASD and Early Years Trauma and beneficial to all children in a learning environment. This book is also recommended for parents along with professional staff involved in education: classroom support, special needs staff, educational psychologists and social work support staff will gain knowledge and advice from this book to assist them in understanding and facilitate working proactively with children and teens who have an FASD or who experienced early years' trauma.

EILEEN CALDER BA BSC
CEO FASD Scotland
Edinburgh, Scotland

Fetal exposure to noxious substances and early postnatal traumatic experiences have long- lasting effects on the growth and development of children and, ultimately, their ability to learn and be productive members of society. Early interventions are paramount in this regard, especially for fetal alcohol spectrum disorders, which often are not identified until early school age. *Guided Growth* displays the authors' deep understanding of brain development and the interventions needed to teach and guide children affected by substance exposure and early traumatic experiences. This wonderful book should be read by parents, teachers, psychologists, and medical and nursing professionals alike, as it demonstrates and outlines strategies to improve the outcomes and lives of children and families affected by substance abuse and trauma.

STEFAN MAXWELL, MD
Asst. Prof. Pediatrics, WVU School of Medicine
Charleston, West Virginia

***Guided Growth* is a valuable resource and guide for anyone who works with children. The information on research and practice was up to date, clear and easy to follow, which is vital given the complex topic it addresses. As an Education Consultant I will not only be referring this book to the districts and schools that I work with, but I will also use the information to inform my work around trauma and substance misuse.**

BIANCA IRIZARRY
State Education Resource Center
Connecticut

***Guided Growth* builds hope by providing a blueprint to work with children and youth with FASD and trauma who continuously fall through the gaps of our child welfare system. One of my favorite lines, among many, is "It is much easier to change the classroom environment than change the child." The book provides easy-to-understand interventions utilizing evidence-based research and case scenarios. It is a game changer and an essential read for anyone working in the child welfare, educational, or any other system that touches the lives of children and families.**

LEANNA LUKA-CONLEY
Deputy Commissioner of Adult, Children and Family Services
Chautauqua County Department of Health and Human Services
Chautauqua County, New York

Guided Growth **bridges the gap between research and practice in an elegant, practical and effective way. As a clinical psychologist working with children, adolescents and families affected by prenatal substance exposure, I found the interventions in this book realistic, practical and research-based while considering ecological and cultural factors at the same time. Through very helpful case studies, the book reinforces the concepts along with excellent visual displays of scientific information. The behavioral strategies portrayed in the book are best practices and can be implemented by anyone, giving them excellent clinical utility. The educational interventions focus on classroom environment and empower children and parents by bridging the home and school. This is one of the best books I have ever read about FASD and practical behavioral and educational interventions!!**

GOKCE ERGUN, PH.D
School of Professional Psychology, Wright State University
Dayton, Ohio

When parents and educators go through ongoing complex struggles with children, they may feel exhausted and desperate. Guided Growth infuses new energy, inspires hope, advances understanding, and provides practical strategies for addressing the everyday difficulties that occur at home and in the classroom when living and working with children who have experienced developmental trauma and exposure to alcohol during pregnancy. Guided Growth will give comfort and confidence to parents and teachers as they help children and enhance children's trust in the caring adults in their lives.

SHARONA DUCHNE
Adoption & Foster Wisdom, Academy for Parents & Professionals
Jerusalem, Israel

As a parent of a child with FASD and chief program officer for a clinic serving this population, Guided Growth is invaluable! A resource addressing both FASD and early trauma, so often co-existing, has been much needed in the field. Dr. Chasnoff's and Dr. Powell's wealth of knowledge and expertise, real-life examples, and user-friendly strategies make this the "go-to" guide and necessary reading for parents and educators alike!

MICHELLE STILLER BRADLEY, MA, CHIEF PROGRAM OFFICER
Hope RISING Clinic for prenatal substance exposure
Wonderland Child & Family Services
Seattle, Washington

Guided Growth **brings into focus the damage done to the fetus when exposed to alcohol and other drugs, providing a road map for collaboration between parents, health care agencies, and school systems. This book is a must-read for anyone interested in children's development and behavioral health.**

TARIQ M KHAN, MD, FAAP
Jamestown, New York

Guided Growth **is a must-read for teachers, counselors, and for parents who are raising a challenged child. The book is enlightening, empowering and encouraging. It is easy to "give up" on children with learning and behavioral challenges, or further frustrate them to the point of giving up on themselves. In this book, Ira Chasnoff and Ron Powell expertly bridge the gap from research to reality, providing strategies to help children with emotional dysregulation who so often disrupt classroom learning.** ***Guided Growth*** **enables us to think proactively,**

intervene strategically and help complex children succeed not only in learning, but in developing the self-worth essential for fulfillment in life.

MARIAN SOKOL, PHD
Executive Director, Children's Bereavement Center of South Texas
San Antonio, Texas

***Guided Growth* is grounded in science and translated into clear and practical guidance for parents, teachers, and clinicians who work with children affected by prenatal alcohol and drug exposure and whose lives have been complicated further by early childhood trauma. This book will have a significant impact on how we educate a very high-risk population of children and how we provide support to their families.**

KRISTIN GIST, PHD
Sr. Director, Developmental Services, Rady Children's Hospital
San Diego, California

Children who have been prenatally exposed to drugs and alcohol have complex needs that may require them to become involved in various systems. Some of these families become engaged in the child welfare, public health and court systems. As someone who has worked in the child welfare field and court system, a successful approach to meeting the needs of these families requires all of these systems to work collaboratively together. This book brings these perspectives together to create solution-based approaches to ensure the best outcomes for children and families.

KATHY THOMPSON
Iowa Children's Justice
Des Moines, Iowa

***Guided Growth* shares profound messages with such clarity that all readers will gain both the tools needed, and the motivation to use them in order to improve the learning needs of children impacted by prenatal alcohol exposure. If you love children and want them to make the world a better place, you'll want to read this book.**

SHERRELL HOLTSHOUSER RN MPH
Anchorage, Alaska

High praise for the authors of *Guided Growth* who have done nothing short of an amazing job in bridging research and actual case scenarios to produce solid information and successful strategies and tools for clinical practitioners, teachers, and parents seeking to understand and find success in working with children impacted by prenatal alcohol and drug exposure as well as adverse childhood experiences. *Guided Growth* strategies provide the read with both a vision and a clear path to create the hopeful possibilities and optimum opportunities that we seek for all children.

DEBORAH L. FRAZIER, CEO
National Healthy Start Association

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For more information about special discounts for bulk purchases or to book a live or online event, please contact NTI Upstream at www.ntiupstream.com/contactnti.

The names of children and families in clinical cases in this book have been changed to protect their identity.

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To the *Big Six*
Stav, Noam, Yuval, Yoni, Sadie, Ezra
You bring me joy every day.
IJC

To Jackie, who taught me that a single
caring and loving adult has the power
to transform the life of a child
from hard places and whose example
has inspired countless others
to believe that it is within their capacity
to be the one.
RJP

Contents

INTRODUCTION

A State of Paradox

We live and teach in a state of paradox: Risk and resiliency. Risk and protective factors. Risk and promise. These competing forces come at us from all directions, often coming to a head in the classroom. And in the face of this multifaceted paradox, it becomes the teacher's and parents' job to disentangle the competing forces, to address risk through effective instructional and intervention strategies, and to enhance resiliency by building on the child's strengths. But one of the greatest challenges teachers and parents face today is the increasing number of children who do not respond to traditional instruction and classroom management techniques. Chief among the children who present such a challenge are those who were prenatally exposed to alcohol and illicit drugs. To complicate matters, many if not most of these children suffered significant emotional and social trauma early in their lives. In the past twenty years, we have learned increasingly about these children and the lives of chaos and daily change many of them face. The difficulty has been translating this growing body of knowledge into practical information teachers can use in the classroom and parents can use at home.

But there is good news. We now have research-based information that can guide schools and families in their efforts to address the needs of children affected by prenatal substance exposure and early trauma by developing appropriate interventions for behavioral and learning

problems. This book incorporates the latest research-based information into a guide designed for teachers, parents, physicians, psychologists — for anyone who works with children. We recognize that in many (if not most) cases, you will not even know a specific child was exposed to alcohol or drugs before birth or endured significant trauma early in life. But the strategies we propose are appropriate for any child whose behavioral difficulties do not respond to standard interventions.

Our Approach

We know you are busy, so we have bridged the gap between research and practice with descriptive information, case strategies, and practical examples to get you started right away, applying this material in the classroom or at home. In developing this book, we have assumed that

- whether you are a teacher in a classroom or a parent at home struggling with homework, you often are "on your own" and do not have ready access to help from psychologists or other specialists when behavioral problems arise;
- interventions in a classroom or at home must be practical and easily used with a high degree of success; and
- parents and teachers wish to use interventions that reflect a "best practices" approach, i.e., strategies that have been proved in research to be effective for behavioral problems.

In this sense, there are three basic themes throughout this book:

1. Be proactive rather than reactive

In a proactive approach, planning and organization form the basis of the educational experience that aims to help children perform. In a reactive approach, a problem occurs and an action is taken without carefully planning an effective method to address the problem. We are not saying situations do not arise that require immediate attention. However, long-term behavioral change is best accomplished through a proactive approach.

We will take a developmental approach in describing the impact of prenatal exposure or postnatal trauma on the long-term outcome of the child, starting in the newborn period and following the child through adolescence.

2. *Take a problem-solving approach*

In this book, we will take you through a problem-solving approach for finding solutions for children's behavioral problems, starting with approaches for the general classroom or home environment and moving to individual, child-specific behavioral management strategies when necessary. As you become familiar with this approach, we believe you will better be able to describe the problems you see in specific terms and arrive at a practical, effective, and time efficient solution, applying the interventions in a confident and logical manner.

3. *Emphasize internal management over external control*

In all the chapters, we emphasize that your goal should not be to control behavior by suppressing or eliminating it. Rather, it should be to teach children how to gain internal structuring and self-regulation capabilities; this is especially important for children affected by prenatal exposure to alcohol and drugs. With appropriate interventions, children will learn better how to manage themselves and take responsibility for their behavior. By emphasizing management, we propose that you teach children behavior management skills just as you would teach subject material.

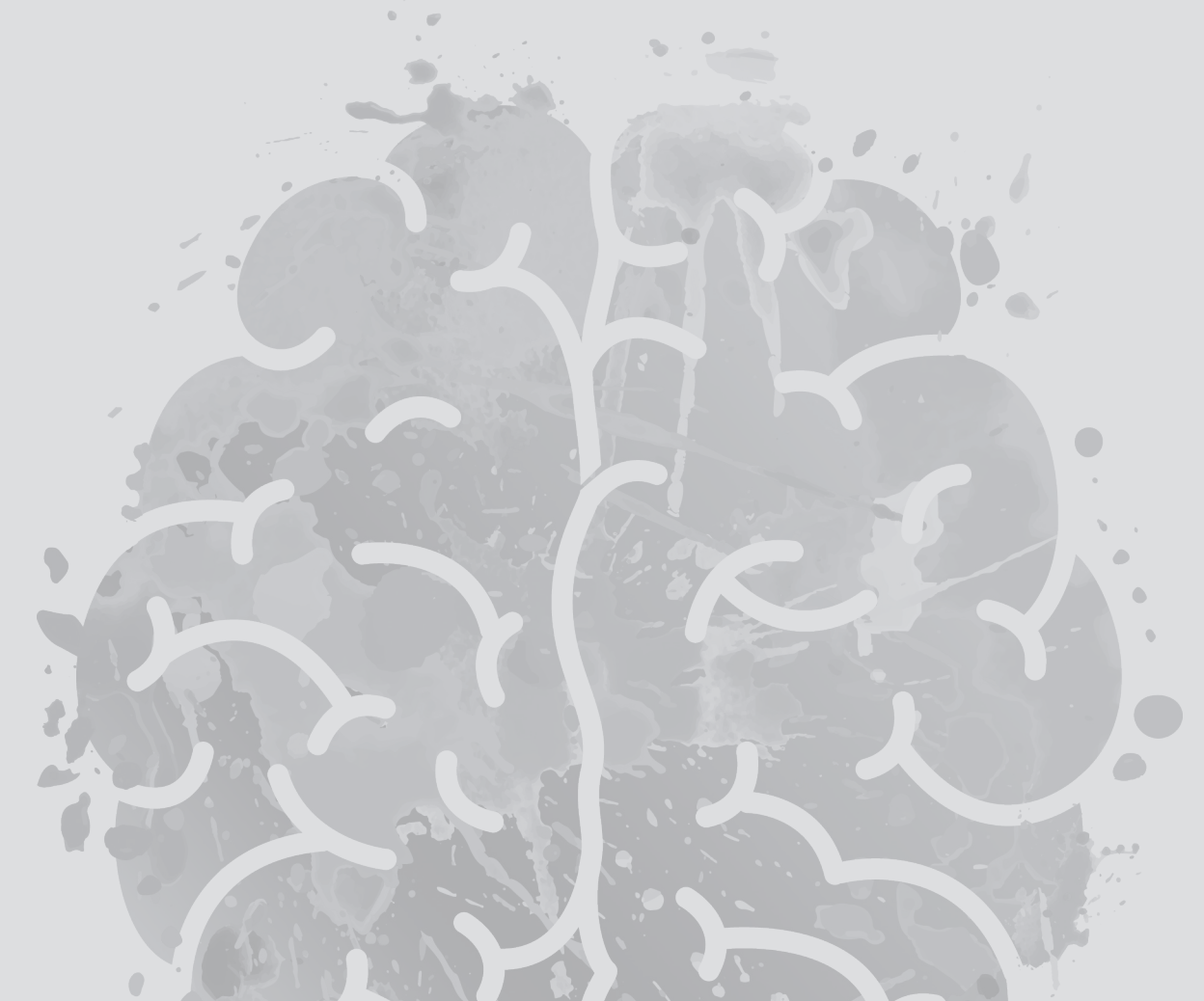
Throughout this book, we will ask you to shift your perceptions of the child affected by prenatal substance exposure or who suffered early trauma from one who is willfully disobedient to one whose central nervous system may have been affected by conditions that were beyond his or her control. We will describe patterns of behavior exhibited by many complex children in a variety of research studies, but we will caution you to remember that all children are unique and that there is a wide range of home and school factors that influence the behavior of any child.

We will take a developmental approach in describing the impact of prenatal exposure or postnatal trauma on the long-term outcome of the child, starting in the newborn period and following the child through adolescence. Also, in the context of prenatal substance exposure, although our emphasis is on alcohol, we recognize that almost all children reported to have been exposed prenatally to drugs, whether legal or illegal, also were exposed to alcohol, so that the interventions will also work with this population of children. Finally, we will use actual cases from our experience to provide an "anchor" to our learning approach.

Be aware that this book will not help you specifically identify a child affected by prenatal alcohol — or drug — exposure or early trauma; it will, however, enhance your ability to address the needs of any child demonstrating difficulties in the classroom. The book focuses on complex children with both prenatal and postnatal risk factors because so little information exists about this population of children and because there appear to be differences in the way the behavioral difficulties induced by alcohol exposure and trauma, especially, need to be addressed.

CHAPTER 1

How Does Learning Take Place?



"The only source of knowledge is experience."

ALBERT EINSTEIN

Class had already begun when Jeff stepped through the doorway for the first time. The teacher glanced up from his class roster and the two looked at each other with mutual apprehension. Averting his eyes to the floor, Jeff shifted his weight uneasily as he waited for directions. The teacher glanced at the enrollment form quickly trying to gain some insight into this new arrival. Although Jeff was seventeen years old, this was the first time that he had ever been enrolled in a comprehensive high school. That fact alone made everyone uneasy, and the common question of "Is he going to be able to handle this?" seemed to be on everyone's mind. Jeff's parents stood quietly in the doorway, their eyes fixed on their son. His father stood resolute with his hand resting on his wife's shoulder. Her hands were clasped prayerfully under her chin.

For the past eleven years, Jeff had been educated in the protected environment of a small two-building campus housing fewer than 100 special needs students. Now, Jeff was entering a sprawling campus of forty acres with hundreds of hormone-marinated teenagers flooding the narrow hallways between classes. The small campus for children with moderate to severe intellectual disabilities had been Jeff's parents' choice. Concerned for his safety and unsure whether he would be able to find his way from one classroom to another, Jeff's parents had opted for a more controlled and nurturing environment. It was a familiar setting with supportive and caring staff, and Jeff was well liked by his teachers and classmates. However, as Jeff approached graduation, his parents' concern shifted to whether Jeff was prepared to navigate the larger community. If he couldn't navigate campus hallways, how would he do on city streets? If he had difficulty finding his way from one classroom to another, how would he be able to

make it from his work to his residence? Or to the store? Or restaurants? And so, with two years left in high school, Jeff's parents had decided to make a change. It wasn't the comfortable choice, but it was the right thing to do. Shaking hands with the parents, the teacher offered reassurances that everything would be all right and then showed Jeff to his seat and introduced him to the rest of the class.

Although the other students in the classroom had special learning needs as well, it became immediately apparent that Jeff had never been exposed to the academic curriculum of a comprehensive high school. In contrast, Jeff had received instruction in daily living skills. But since his living skills instruction was provided within the small-campus classroom rather than embedded in the natural community environment, Jeff had been unable to practice the daily living competencies in an applied setting.

As the teacher worked with Jeff to determine his academic strengths and weaknesses, math emerged as a particularly mystifying concept. When given a work sheet with simple addition problems, for example, Jeff had no trouble solving the problems accurately. When Jeff saw a problem like 2 + 6 =, he quickly wrote 8 in the empty space. However, when a handful of pencil erasers was placed on his desk, Jeff was bewildered by the instruction to "Show me two." He looked blankly at the erasers for a moment before shifting his attention back to his paper. Picking up his pencil, he wrote the numeral "2" on the paper and then proudly held it up for the teacher to see. Since Jeff's previous math instruction had consisted entirely of worksheets, he was familiar with numeric symbols, but he displayed no understanding of the concept of numbers. Without a general understanding of the concept of numeracy, Jeff regarded the handful of erasers on his desk as irrelevant to the request to, "Show me two." As a result, Jeff responded to the direction by utilizing the skills that he had learned – simple addition facts by rote. Repeated over and over again, he

As the teacher worked with Jeff to determine his academic strengths and weaknesses, math emerged as a particularly mystifying concept.

had memorized every single digit addition combination involving numbers from 1 to 9. But rote learning of addition facts had left out a key concept – quantity. Jeff could read and write the numeral "2", but he had no idea what "2" meant.

From that point on, the teacher stopped using paper/pencil math problems; instead, he used concrete items that Jeff could touch and manipulate. Jeff started with counting erasers, beans, and poker chips to gain the concept of one-to-one correspondence. "Show me two" became "Show me ten." Soon, Jeff learned to group stacks of beans into sets of ten and, pointing to each stack, counted by tens to one hundred. Within two weeks, Jeff had a breakthrough. He could not only count to one hundred, but he also could demonstrate addition and subtraction problems with the beans. He divided beans into sets using muffin cups to represent place values and began to solve more advanced addition and subtraction problems utilizing the muffin cups like an abacus. Once the concept of quantity and the representation of sets were learned, Jeff transitioned to understanding the value of money by using coins and bills. And when he mastered the concept of building parts to a whole by counting coins to a dollar, the process was reversed, and he was introduced to the concept of fractions by using a tape measure and sliced fruit. By the end of the year, Jeff had progressed more than three grade levels in math.

Jeff's story illustrates that learning is not merely a matter of the memorization of facts. Although the high stakes assessment culture of public schools places an inordinate emphasis on the recall of facts as a measure of whether learning has taken place, learning cannot be defined solely by the ability to recall information. Numerous studies show that the brain has the capacity to learn independent of the ability to recall any information at all. For example, amnesiac patients can learn

Declarative learning: information that can be stated verbally

even though they are unable to recall either previous experience or information. This finding led to the discovery that there are two separate and uncorrelated learning circuits in the brain. One learning circuit is responsible for declarative learning and the other is responsible for procedural learning. Declarative learning involves information that can be stated verbally. It is explicit learning in that it involves information that can be represented in conscious thought. As a result, new information can be analyzed, grouped into concepts, and combined with other pieces of information to create new knowledge. When we think about the information that is taught in schools, we are generally referring to declarative learning.

In contrast, procedural learning involves muscle movement, balance, coordination, the position of the body in space and the motor skills related to physical activity. When you ride a bike, play a sport, or practice the piano, you are using procedural learning circuits and relying on procedural memory to perform the task well. Unlike declarative learning that can be expressed with language as conscious thought, however, procedural learning is implicit. It is very difficult, for example, to explain to someone how you ride a bicycle. You just do it. And while declarative learning and procedural learning occur through two separate neural learning circuits, the brain seamlessly integrates the knowledge from both circuits to properly formulate a response to an environmental cue. For Jeff, the use of concrete manipulatives employed procedural learning pathways to augment the declarative learning of mathematic concepts. His case illustrates that knowledge without the ability to apply it in a proper context is not useful and is why recall of facts cannot be used as the primary test of learning.

Procedural learning: muscle movement, balance, coordination, the position of the body in space, and the motor skills related to physical activity

The distinction between declarative learning and procedural learning is important because it highlights the fact that learning is broader than the

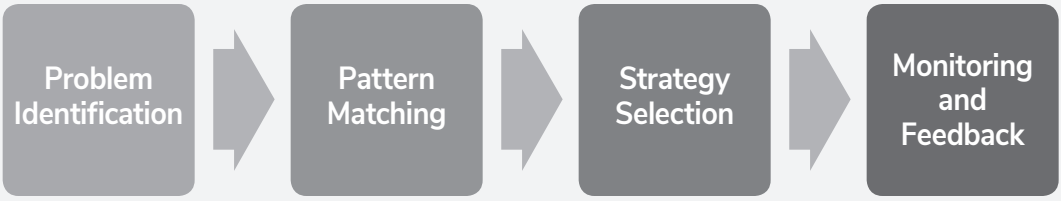
simple memorization of facts. Learning has to do with the way that the brain processes information to solve problems. It involves the manner in which we make sense of the experiences, perceptions, and interactions that we have with the world and the subsequent meaning that we make from those experiences. Understanding the learning process, then, provides insight into how the conditions of learning can be adjusted to enhance both the efficiency and the effectiveness of learning experiences for children who struggle in the classroom.

The Learning Process

The way the brain processes new information proceeds through several well-identified stages. In its basic form, these stages can be identified as

1. Problem identification,
2. Pattern matching to known strategies,
3. Strategy selection, and
4. Performance monitoring and feedback.

When a problem is brought to conscious awareness, the brain immediately searches stored memory to see if a well-defined pattern already exists to address the dilemma. If it does, then that strategy is employed first and the brain monitors the outcome to ensure that the problem is resolved. But if the problem is new, or defined patterns of response do not work, then the brain searches through a repertoire of known strategies to seek a solution. If a selected strategy is subsequently unsuccessful in solving the problem, then yet another strategy is selected,



and the process is repeated. The stages in the learning process, then, are interactive and fold back upon each other through a performance-based feedback loop that continues to search for solutions until the problem is resolved. As straightforward as this progression may seem, however, each of these steps in the process is vulnerable to disruptions that can originate from both endogenous as well as exogenous sources, and if a disruption occurs at any point in the process, then learning does not take place.

To illustrate, let's reexamine the stages that Jeff encountered as he processed the new math task. When presented with the pile of erasers and given the direction to "*Show me two,*" (problem identification) Jeff's brain responded by searching for a defined strategy that would assist in solving the problem (pattern matching to known strategies). As a result, he defaulted to the only strategy that he had acquired from his previous experience by writing a "2" on his paper (strategy selection). Since that was an unsuccessful strategy (i.e. the wrong answer), Jeff's brain searched for another strategy. But with no other strategies in his knowledge bank, Jeff was bewildered, and frustration began to mount (performance monitoring and feedback). If the teacher had not been immediately available to calmly reassure Jeff and coach him through the next step, Jeff's rising anxiety about his inability to handle the problem would have triggered the release of stress hormones, and the learning experience would have been disrupted by the selection from several avoidance strategies that all serve the function of relieving the brain of the responsibility to solve the problem (disruptive influence). Because the teacher was present, however, and was able to reassure Jeff that he was in a safe and supportive environment, a state of calm was restored, and Jeff was able to learn a different strategy to address the problem (strategy selection). Through continued practice and gradual exposure to new problems that continued to build on his newly acquired problem-solving skill, Jeff was then able to extend his knowledge to problems of increasing complexity (pattern matching to known strategies). As his proficiency grew, so did his confidence and ability to work independently (performance monitoring and feedback).

Once the process is understood, the challenge becomes how to create the conditions that foster engagement in the learning process, while mitigating, to the extent possible, the disruptive factors that threaten to derail the learning experience. To answer that question, let's explore the stages in the learning process in greater detail.

Problem identification and pattern matching

For any type of learning to take place, the brain must first recognize the problem. This may seem like a glaring statement of the obvious, but the brain is constantly engaged in a filtering process that actively selects which experiences should be the subject of focused attention and which experiences should be ignored. To do this, the brain applies three basic rules. These rules are related to the following areas:

1. Known experiences. Does this new experience fit into an existing pattern or apply to anything that I have already seen before?
2. Interest. Is this new experience original or surprising?
3. Emotional significance. Is this new experience threatening or emotionally arousing?

By interpreting new experiences through these filters, the brain protects itself from being overloaded by unnecessary sensory information so that it can pay attention to those phenomena that are the most important for survival. But these filters can be unreliable and can distort our perceptions of reality when unpredictability is injected into known experiences.

Learning changes what we know as a result of our experience. It may or may not change behavior, but learning adds to the bank of knowledge that becomes the basis of what we know and how we respond to the world that we live in. Not all experience, however, results in learning. The brain is not interested, for example, in learning the routine and predictable. It is only sensitive to new information from the environment that is novel, or so surprisingly

Not all experience results in learning.

different from our expectations, that it is brought to the attention of our senses. Most of our daily interactions and routines are so unremarkable that they leave no memory trace at all. To test this hypothesis, participants in one study were asked to purchase an item in a store. Since the item was not on display, they were required to ask the "salesman" (one of the researchers) behind the counter for help. The salesman told the customer that he would need to retrieve the item from beneath the counter. For half of the sample (the no change group), the salesman ducked out of view behind the counter and then reappeared with the item. For the other half of the sample (the change group), the salesman disappeared behind the counter and exchanged places with another researcher dressed in different clothing, who then reappeared and presented the item to the subject. In a debriefing following the exercise, the participants were asked if the salesman who had retrieved the item for them was the same person that had received the request. As expected, most participants from the "no change" group reported that the person was the same. Remarkably, however, most subjects in the "change" group also reported that the same person who had received their request had also retrieved the item. Because the behavior of the salesman matched the anticipated pattern of behavior that was stored in memory, the subjects did not pay attention to the difference in physical cues.

The ability of the brain to ignore the routine experiences of our lives is a highly efficient adaptation. This cognitive bias toward evidence that confirms our existing patterns and assumptions, however, also serves to blind us from evidence that might contradict our beliefs. As a result, when our expectations about the routine and predictable nature of our world are violated, massive confusion sometimes results.

Most commuters would acknowledge that stopping in the middle of your lane on the freeway because you don't know which way to go is not only unacceptable behavior, but is tantamount to a death wish. Remarkably, however, on a heavily-traveled freeway in the pre-dawn hours of Southern California, this bizarre behavior was the default reaction of hundreds of motorists at exactly the same time. For over two years, the multi-lane thoroughfare had been characterized by a continuous state of

construction as lanes were widened and new overpasses were built to relieve a chronic bottleneck at the intersection of two busy interstates. On a daily basis, over 25,000 early morning commuters had become accustomed to construction cones, concrete barriers, and detours as they traversed this section of freeway at speeds that were unimpeded by the well-advertised construction speed limits. But on this morning, circumstances were different. Construction had been completed overnight, cones and barriers had been removed, and the new freeway interchange was opened to traffic for the first time.

For four decades, the transition between the two freeways had split predictably. The transition lanes to the intersecting southbound freeway exited to the south while the westbound lanes of the freeway continued west. To the complete shock of everyone, however, as a result of the interstate realignment, transition ramps between the two freeways had been reversed, and the once familiar exit for the southbound freeway now coursed to the west over a new overpass that then arched to the south high above the remaining lanes. Lanes that used to continue straight for motorists intending to stay on the westbound route, now exited to the south. And while new signage had been erected to reflect this change, no one seemed to have noticed. Traffic was snarled for miles as confused drivers heading west suddenly discovered their mistake and careened across multiple lanes to the south. Suddenly, the familiar routines of old commuting patterns no longer worked. Many drivers simply stopped in their lane, confused about which way to go. Others, out of deep frustration, swerved wildly as their erroneous assumptions became immediately obvious. Minor collisions occurred as hundreds of cars were caught up in the confusion. It is remarkable that no one was seriously hurt in the ensuing chaos that snarled the intersection for hours during the heavy morning commute. In the aftermath, confused state transportation officials were unable to explain why the end of construction and the removal of all barriers had resulted in such gridlock.

From a neurological perspective, however, the motorists' behavior was completely understandable. It is the way that the brain works. The brain

is a highly complex problem-solving and meaning-making organ. And although we are unaware of the flurry of neurological activity that is going on continuously, the brain is busy making hundreds of decisions within fractions of a second to ensure that our bodily systems operate efficiently, that we are protected from threats in our environment, and that we survive long enough to pass our genetic code on to the next generation. To that end, the brain is continually surveying the environment while keeping most of this information out of our conscious awareness. Imagine how disruptive it would be if every sound, touch, taste, smell or visual stimulus were in our conscious thought. We would quickly become overwhelmed. But although most of this sensory information is non-conscious, we have the capacity to activate our awareness of any sensory input at any time. For example, the feel of clothing, the pressure of the chair on your back, the weight of a ring on your finger, are all sensations that have been, up until just now at least, non-conscious. You haven't needed to think about these sensations, so your brain turned the perception of them off. Once they have been brought to conscious awareness, however, you can feel them clearly. And if you closed your eyes and focused on any one of these sensations, you would be able to fine tune your awareness to distinguish characteristics about the sensation in much greater detail. Is your weight distributed equally in the chair, or are you sitting in such a way as to put greater weight on one side of your body or the other? Is your weight shifted forward or to the back? Is the chair hard or soft? The ability of the brain to block out distractions or to shift focus to a particular feature in our environment is an important aspect of learning. So, what can we learn from snarled traffic in an early morning commute? How does our experience impact learning? And, why are some experiences remembered easily while others are not noticed at all?

Imagine how disruptive it would be if every sound, touch, taste, smell or visual stimulus were in our conscious thought.

The world that we live in is so complex that our brains simplify our environment by creating patterns that help us to predict our world. These patterns form mind maps—internal working models that organize our world into understandable sequences that make up our daily routines. The patterns enable us to make meaning of our complex surroundings. They give us predictability, and they allow us to simultaneously hold vast quantities of complex information in our minds so that we can manipulate the information to gain understanding and form new patterns to solve emerging problems. These internal working models form the basis of all learning.

But these complex patterns also can create barriers to new learning. When presented with new information that does not fit into existing knowledge, the brain questions the veracity of the information gathered through our senses and without further confirmation or supporting evidence disregards the information completely. This is what happened to the Southern California drivers. Traveling at freeway speeds, most commuters were unable to process traffic sign information that conveyed directions that were the exact opposite of past experience. Newspaper reports of the traffic chaos the following day were marked by statements of incredulity. Department of Transportation officials could not understand why commuters were so confused by the new traffic pattern, citing new signage that directed drivers to the proper transition lanes miles before the interchange. Some drivers, however, reported that they had no recollection of the signs whatsoever. Others stated that the signs had provided incorrect information or were confusing. And yet, by the following morning, normal traffic flow was restored, and thousands of commuters transitioned seamlessly over the new interchange. While new signs had failed to effect the desired change in driver behavior, the new traffic pattern was learned effectively through a singular highly stressful experience.

This mundane example of traffic congestion illustrates much of what we know about how the brain pays attention to stimuli from the environment. Drivers were presented with new information that

did not fit into existing knowledge. As a result, many were confused and frustrated to the point of paralysis while others persisted in employing old paradigms of thinking and wound up traveling in the wrong direction. But because of this singular and emotionally charged experience, commuters learned a new traffic pattern and adjusted their behavior so effectively that traffic flowed freely on the second day at speeds that were well above posted limits. It might be tempting to conclude from this example that highly stressful experiences are a valuable catalyst to learning. But although there is a neurological explanation for why motorists learned the new traffic pattern quickly, such a strategy would not be useful in the classroom. Running a classroom like a Marine Corps boot camp would be profoundly detrimental to learning.

The hippocampus, a critical area of the brain responsible for encoding experience into memory, is covered with stress hormone receptors. As a result, the experience of a stressful event as well as our emotional response to it are paired almost immediately into memory. This highly adaptive survival strategy ensures that if we manage to escape a dangerous situation once, we will not test the fates by placing ourselves into the same life-threatening position again. Aside from this specialized survival purpose, however, our brain is not designed to operate efficiently under stress. When the brain is flooded with stress hormones, the ability to concentrate, or to generalize and adapt information to new situations is seriously compromised. National surveys show that between thirteen and twenty percent of American children have been exposed to significant levels of trauma in the home. Experiences of abuse and neglect as well as experiences characteristic of household dysfunction such as separation or incarceration of a parent, parental mental illness, substance abuse, or domestic violence, produce a state of chronic stress in the child's brain that lasts a lifetime. Unable to concentrate or remember, absenteeism increases and disruptive school experiences multiply. Over time, hormones produced by toxic stress destroy the neural pathways

Stress is the primary disruptive influence on learning.

Children exposed to chronic stress in the home are,

- 17x more likely to experience academic difficulties
- 3x more likely to be expelled from school
- 13x more likely to be removed from their homes
- 12x more likely to attempt suicide

that are essential for learning and inhibit the generation of new nerve cells in the hippocampus. Given the startling consequences of stress for children, it is imperative that adults create learning environments that provide empathy, reassurance, and trust in order to infuse a sense of felt safety into the classroom. A growing body of evidence demonstrates that a supportive and caring learning environment will assist children from difficult circumstances to develop self-regulation skills so they can manage "big feelings" in order for learning to take place. Studies also show that a protective factor against disruptive school experiences and one of the strongest correlates of whether a child does well in school is whether he connects with a teacher or other adult on campus that he believes truly cares for him.

As discussed in the next chapter, stressful disruptions to the learning process can originate from within the child as well as from sources external to the child. In either case, however, the mechanism by which learning is impeded relates to the over-stimulation or the under-stimulation of key learning centers in the brain. Disruptive influences that originate from within the child include affective states such as lack of motivation or heightened states of emotional arousal. But changes in brain architecture or neurological structural changes, such as those that result from prenatal alcohol exposure or traumatic stress, may also impede learning. Under such conditions, the brain is on constant alert, resulting in the hippocampus being constantly flooded with sensory

information that demands attention to determine if a threat to survival exists. Attention problems, distractibility, and poor impulse control are the overt behavioral manifestations of the natural reaction of the body to perceived threat as the brain tries to regulate a hyper-aroused state. Similarly, disruptive influences that originate from sources external to the child can affect the learning process by placing the child in states of arousal at one extreme or the other. *Over-stimulation* occurs when the intensity of arousal is so amplified that the child is unable to sort out the salient sensory cues from those that are irrelevant to the task. In contrast, *under-stimulation* occurs when the information is presented in such a way that it does not generate a sufficient degree of arousal to stimulate the problem-solving centers of the brain. Educators, then, must be sensitive to the individual needs of the child and strike the balance between the two extreme states of arousal to meaningfully engage the child in learning regardless of the specific content that is to be taught. The "three bears" approach of striking a balance that is "just right" in terms of stimulating interest is the critical key, then, to engagement in the learning process.

Strategy selection

The learning process depends upon the ability to focus attention on selective stimuli received from the environment through our senses; to organize the new information into existing patterns or meaningful new clusters of information; and to problem solve, elaborate, generalize, and apply strategies to the new information so that it can be accessed later when needed for the purposes of action or reflection. These three stages of memory – encoding, storage, and retrieval – are facilitated by a few basic strategies that enhance the efficiency and effectiveness of knowledge acquisition.

Strategies for enhancing knowledge acquisition

- Elaborative rehearsal and organization
- Repetition
- Timing
- Review

Elaborative rehearsal and organization

Retaining information long enough for it to be useful to the process of knowledge acquisition depends upon the principles of elaboration and organization. Learning occurs best when we connect new information to existing knowledge, moving from large concepts to supporting details, and when we organize the things that we are trying to learn in such a way that we can see the relationships that they have to each other. The more elaborately the connections are constructed, the more embedded in memory the information becomes. The pattern-seeking nature of the brain constantly wants to fit new information into existing collections of knowledge. Ask any new parents, and they will open their baby book to give multiple examples of how this works.

A young mother related how her three-year-old son burst into the house excited about his new discovery in the back yard. “Mama,” the boy blurted. “There’s bugs out there!”

“Yes,” his mother said, sharing in his excitement. “Are they ‘BB’ bugs?” she asked, invoking a common name for pill bugs or roly-polies.

The young man seemed momentarily stumped by her question and furrowed his brow. Then just as quickly, his face lit up as he responded with wide-eyed enthusiasm. “Uh-huh,” he exclaimed, “and Mama bugs too!”

From a neurological perspective, this story illustrates how the brain utilizes both elaborative rehearsal as well as organization to encode new information. *Elaborative rehearsal* refers to the tendency of the brain to connect new information with existing knowledge. *Organization* refers to the ability of the brain to detect associations among sensory stimuli such as sights and sounds or concepts and feelings and store them in relationship to one another. The neural networks that are formed in this way extend into multiple cortical centers throughout the brain, tapping simultaneously, for example, into sensory, motor, emotional, and

semantic networks. The greater the number of associations and shared features among new information and existing information, the more likely it is that new information will become embedded in long-term memory and the easier it will be for that information to be retrieved when needed. The dialogue between the toddler and his mother reveals how the associative architecture of the brain works. Because the boy was unfamiliar with the term, "BB bug," his brain instantaneously sought connections with words that were already within his known lexicon and that would also fit within the syntax and context of the conversation in order to make meaning of the interaction. "BB bugs" sounded like "baby bugs" and in the context of the question that his mother asked, if there are "baby bugs," then there must be "mama bugs" too. It was the organizational function of the brain that made this connection possible.

In fact, the organization and associative structure of memory is so efficient in helping us to predict expected responses, it works without conscious application, reason or logic. And because this process is automatic, it produces, at times, inaccurate responses. For example, as you consider the color of the background to the type on this page, consider the answers given to the following questions.

Question: "What color is this paper?"

Answer: White

Question: "What do cows drink?"

Answer: "Milk"

Given the sequence of the queries, the answer to the final question is rarely recognized as anomalous. Because the brain instantly scans semantic memory for connections between "white," "cow," and "drink," "milk" is retrieved as the answer with the strongest relationship between these three terms. No sooner is the answer given, however, than people recognize their own mistake. Patterns and connections made by the brain are unconscious. But, given an instant for reflection, the logical, problem-solving prefrontal cortex will generate a more accurate and refined

response. The impulsive first response becomes the punchline. It is the characteristic source of humor due to the misdirection or contradiction between the pattern-matching brain and the rational, logical prefrontal cortex. For the little boy, his endearing reply is humorous precisely because the brain recognizes the multiple meaning of words and the connections between word pairs that sound alike. In fact, the brain is so efficient in recognizing these word connections, that it is the basis upon which pun humor is dependent. Rhyme, rhythm, song, novelty, and humor all serve as powerful encoding mechanisms because they tap into the elaboration and organization principles that serve to lock new information into long term memory. (Just think of how you learned your *ABC's*!) In order, then, to give structure to the new information that we wish to store in memory and to create as many neural connections as possible, new information should be progressively connected to existing information and those connections should be made as elaborate as possible.

Rhyme, rhythm, song, novelty, and humor all serve as powerful encoding mechanisms.

Repetition

Psychologists once believed that the primary means by which new information is encoded into memory is through repetition. The notion that information was moved from short term memory into long term memory through rehearsal strategies was a bedrock of early theories of pedagogy and can be found in most of the curricula that dominated public education until well into the later part of the twentieth century. The "Dick and Jane" reading series, for example, was widely used as a basal reader in American schools from the 1930's until the 1970's. It was built upon the assumption that a child must be exposed to a new word six times in order for the word to become a part of the child's "sight vocabulary." A page from the series read: "See Dick run. Run, Dick, run. Run, run, run."

Addition facts and multiplication tables were taught in the same way through flash cards and "times table" drills. Even misbehavior was addressed with repetitive writing assignments under the assumption that writing "I will be kind" one hundred times, for example, would result in learning a valued character trait and serve as a protective hedge against future misbehavior. Repetitive rehearsal strategies remain a primary means of retention and are widely used by students as a staple of all night cramming sessions across college campuses. However, in many cases, repetition is highly inefficient. In fact, if the commuters had been required to learn the new traffic pattern through repetition, the interchange would have remained snarled in chaos for weeks. Fortunately, the brain is versatile and utilizes multiple strategies to facilitate the encoding of information into long-term memory.

Timing

Psychologists use the term "executive function" to describe the problem-solving and information processing functions of the brain. The main purpose of the executive center of the brain is to guide planning and completion of tasks through monitoring, organizing, coordinating, and adapting knowledge and strategic resources as well as through self-regulation. These steps are intended to modify future behaviors and consequences for the individual. This is the principle distinction between learning and reacting. But to utilize these highly evolved information-processing functions, the brain needs time and depends upon a delay between the stimulus and response to allow for the expression of four uniquely human capabilities: separation of affect, prolongation, internalization of language, and reconstitution.

Separation of affect allows time to separate the initial emotional response from the causal stimulus to allow for a more rational and logical analysis. The behavioral manifestation of the delay that allows for the separation of affect is impulse control.

Prolongation relates to the holding of information in working memory to allow for further processing. Working memory is the brain's internal

sketchpad. As the brain receives new information, working memory captures the important aspects and holds it temporarily in consciousness while it searches existing knowledge for connecting patterns and related concepts. In this way, working memory can process information in greater depth and to compare with similar past events. Working memory holds multiple pieces of information in mind at the same time so that common themes can be consciously analyzed and contrasted with additional information. As a result, information is reprocessed and consolidated in order to construct new meaning for future memory storage. This process results in a reconstruction of experience that results in both object permanence as well as a sense of the past.

Internalization of language related to the event allows for both reflection as well as exploration. By attaching words to the experience, the information becomes temporal, which allows sequencing of the experience and frames the event for the purpose of hypothetical processing. This allows for the anticipation of consequences for future behaviors and increases the child's capacity to internalize rules. These rules provide a robust means by which the child can take control over her reactions to future events. The internalization of language related to the experience also provides a tool for the application of knowledge to hypothetical situations as well as the generalization of knowledge to similar experiences.

Reconstitution has to do with the analysis and subsequent reconstruction of memories into new messages. When an experience triggers a past memory, both the elements of the new experience as well as the past related memory can be broken into constituent parts, analyzed, and manipulated to explore different applications of the experience. When this new experience is then stored again in long term memory, it is different than the original memory trace. Stored in a richer and more elaborative form, the new memory is both enriched as well as more easily retrieved in the future.

Efficient learners seamlessly employ strategies such as these within the stages of the learning process. But as we have seen, these abilities depend upon complex mental processes of attention, executive function, and memory all working together. Tragically, these are the cognitive processes that are most compromised by prenatal exposure to alcohol. They also are the most sensitive to disruption from the toxic flood of stress hormones associated with abuse, neglect, and traumatic early life experiences. Inefficient learners, then, struggle with processing new information because they lack well-established learning strategies due to the chronic disruption of the stages in the learning process by impulses that are beyond their control. Unable to control the heightened state of arousal that accompanies an overreaction to environmental stimuli or the fear response that accompanies the seemingly constant flood of stress hormones, academic failure becomes predictable. Psychologists have identified that the twin states of loss of control plus a lack of predictability are at the heart of learned helplessness. Learned helplessness is the psychological state characterized by a refusal to try to problem solve because the child has come to believe that he is powerless to affect the outcome. The good news is that these disruptions oftentimes can be minimized by the way instruction is organized and presented within the classroom.

Psychologists have identified that the twin states of loss of control plus a lack of predictability are at the heart of learned helplessness.

In the following chapters, we will expand on some of the issues raised here, take a closer look at how the brain works, and discuss in greater detail the roles that prenatal substance exposure and toxic stress play in interrupting the learning process for children at risk.