Joy of Learning

Robert Sylwester, Editor

David Moursund, Editor

This book is dedicated to Robert Sylwester, who died on August 5, 2016. Bob served for many years as co-editor of the *IAE Newsletter*.

Shortly after becoming co-editor late in 2009, Bob proposed that the editors select topics that lend themselves to a sequence of newsletters. He proposed that such a sequence could then be published as an IAE book. The book you are now reading is the seventh book based on his idea. He co-edited all of these and used this vehicle to help many of the authors improve their writing skills.

A number of his colleagues have contributed short memorial statements about Bob. They are given immediately after the Table of Contents.

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In Memory of Robert Sylwester

Robert Sylwester died on August 5, 2016, at the age of 89. Bob requested that any memorial contributions people might wish to make be given in his name to Concordia University in Portland, Oregon, and/or the College of Education at the University of Oregon. Should you ever want to communicate with one or more members of his family, please send your messages to his son Lawrence, LAWSYL@HOTMAIL.COM.

Bob became co-editor of the *IAE Newsletter* beginning in December, 2009, with the newsletter's 31st issue. He suggested the idea that we develop single-topic sequences of newsletters and then publish books based on the newsletter series. Thus, we jointly edited and published six books. You are now reading the seventh and last book in that series. **Bob took the lead in collecting and editing the *IAE Newsletters* that constitute this seventh book in the *IAE Newsletter* book series. This book is dedicated to Bob**.

Obituary from *The Register-Guard* Newspaper

Robert (Bob) Sylwester, professor emeritus of Elementary Education at the University of Oregon, one-time elementary school teacher, prolific author, relentless editor, sought-after speaker, loved and respected father, grandfather, and great-grandfather, died peacefully in his sleep early Friday morning, August 5, 2007, at the age of 89.

Bob was born on January 5, 1927 in Portland, Oregon, the 8th of 10 children parented by FWJ Sylwester, the founder and first president of Concordia Lutheran College in Portland, Oregon (now Concordia University) and his wife, Arina Fiss Sylwester. Bob and his many siblings had a humble but extraordinarily happy childhood growing up in a house which was on what is now the campus of Concordia University in Northeast Portland.

One didn't know Bob without also knowing Ruth, and vice versa. They were married three days after Christmas in 1951 (taking frugal advantage of a church still decorated for the holidays) just two weeks after Ruth's 19th birthday and a week shy of his own 25th. They were married for 64 years until Ruth, challenged by years of dementia, passed away this past May with Bob dutifully sitting bedside, holding her hand, just as he had vowed 64 years earlier -- "in sickness and in health, until death do us part." Their marriage and their lives, and the lives of those who knew them, were filled with art, music, theater, books (and lots and lots of newspapers and magazines), good food and good (Oregon) wine, humor, and rigorous intellectual (often loud) discourse.

One thing is for certain, neither Bob nor Ruth could ever be accused of being "stuck in their ways." They rode the political and social and religious challenges of their time here on earth like a wave, ably and quickly adapting to and embracing the rapidly changing world around them. But above all else, Bob and Ruth will be remembered for their welcoming kindness, generosity, and unconditional love which, at times, considering the unpredictability of seven headstrong children, must have been difficult for anyone to manage.

Bob was a proud long-time professor at the University of Oregon after moving to Eugene from Seward, Nebraska in the summer of 1968. Quite literally Bob and Ruth were

forced into starting with a clean slate when, soon after their arrival in Eugene, a devastating warehouse storage fire destroyed nearly all the family's belongings, including photos, Ruth's wedding dress, and many farmhouse antiques collected by Ruth during their nine years living in rural Nebraska. One could make the case, at least this once, that this was the Lord working in mysterious ways, as life in Eugene, 1968, was certainly different from life in rural Nebraska, and a clean slate was exactly what was needed for them and their young impressionable family. To their respective ends, and despite the challenges of age and their declining health, Bob and Ruth were blessed to be able to continue to live in the large family home they had built 48 years ago.

During and after his long decades of teaching at the UO, Bob traveled the world as a celebrated and sought-after speaker, and authored 20 books and countless articles, many of which were in his adopted field of neurology and brain development and the associated applications to primary and secondary education. Bob and Ruth parlayed his academic celebrity by filling their home with beautiful art and collectibles that Ruth gathered on their many trips abroad. The grand dining room table that sits 14 was the center of their home, and was the scene of many spirited family discussions, game nights, and memorable family meals that turned into late-night talks. To the end, Bob was an enthusiastic and engaged Oregon Ducks fan who felt compelled by Duck duty to pen a weekly email detailing and celebrating their ups and downs (lately, mostly ups) to his family and fellow Duck fans. Even for those who are no longer the Duck fans we were growing up, this coming football season (at least), in memory of Bob, we are all Duck fans. So, Go Ducks!

Bob and Ruth were very fortunate to be survived by all seven of their children and their spouses – Mike (Zofija), Steve (Koe), Tim (Norma), Tricia (Michael), Larry (Chau), Peter (Robin), and Andy (Mary) – as well as 20 grandchildren and step-grandchildren, and one toddler great-grandchild. They also leave behind dozens and dozens of extended family (including his lone surviving sibling, Alfred), and hundreds of colleagues and former students of Bob's and dear friends across the world whose hearts were unforgettably touched by Bob and Ruth somewhere, at some time, along their wondrous journey together. We are all blessed to have known them, and in their memory we will strive to embody the qualities and principles by which they lived their lives -- acceptance, respect, kindness, love, charity, and generosity.

Bob and Ruth

A Final Message from Robert Sylwester

Shortly after Bob's death, his son Lawrence Sylwester sent an email message to Bob's extensive email list:

> Bob Sylwester passed away this morning, August 5, at 2:04 am. He had requested I send out the following email to his family, friends, and colleagues after he had gone. We were all blessed to have known both Robert and Ruth, and their legacy lives on in all of us.
>
> Lawrence Sylwester

* * * * * * * * * * * * * * * * * ** * * * * *

Dear Family, Colleagues, and Friends:

When you get this, I will have died of grief and a recurrence of cancer.

Many thanks to all of you who recently wrote such heartwarming messages.

I had wanted to respond individually, but alas, I couldn't. I trust that this general response will suffice. I was able to live a personally and professionally satisfying and productive life, and for that I'm incredibly grateful.

It's so nice that many of you were able to participate in that journey somewhere along the line. Your friendship added immeasurably to it.

Should you ever want to communicate with one or more in our family, please send your messages to: Lawrence Sylwester LAWSYL@HOTMAIL.COM. He will pass on such messages to all or the appropriate others in the family.

Thanks to all of you.

Goodbye.

Bob

Remembrance from Marcus Conyers

In a communication with Bob last year, I reminded him that it was the 20th anniversary of his groundbreaking book, *A Celebration of Neurons* with ASCD, which was launched about the time I first met him. At the time, I was desperately struggling to find practical applications of cognitive neuroscience from books such as Francis Crick's *Astonishing Hypothesis.* Not easy! Bob's brilliant translational work was transformational for me. Last year, Donna and I dedicated our new book with ASCD to Bob, thereby completing a circle of gratitude. Over the last two decades, one of my professional life's treats has been to work with him on a project in Florida, to catch up with him in person at conferences, and in the last couple of years through our ongoing correspondence to get feedback on various writing projects. His enthusiasm about recent breakthroughs in cognitive neuroscience has always been infectious, and his generosity of spirit through to his very last days has been inspiring. All of us who have known him have been blessed. He and his beloved Ruthie truly lived their lives to the fullest. One more vital lesson modeled by Bob!

Marcus Conyers

Center for Innovative Education and Prevention

Remembrance from Barbara Given

Bob was a wonderful man as all who knew him are well aware. I do so appreciate the opportunity to know and work with him on various projects. He was always willing to share his expertise to guide me in my thinking.

Thank you so much for the invitation to continue with the newsletter in some capacity; however, the cafe my son and I were creating is now finished and I'm working in it more than full time as we get it started in his absence. As you may recall, he passed away Easter morning 2015 of cancer and I decided to devote my time to bringing our joint project to fruition. Today we end our first full month of being open and it has been a fantastic learning experience so far.

Consequently, I will not be available to work on the newsletter, but I will continue sending good wishes for its continued success. Congratulations to you and Bob for carrying on this important contribution to education.

Barbara Given

Special Education Teacher Preparation

Remembrance from Ray Hull

1967: A year of juxtaposition for Bob and me. Bob is in Seward, Nebraska, preparing to accept a faculty position, science education/curriculum, in the College of Education, University of Oregon, not to commence until Fall, 1968. The current UO science educator unexpectedly resigns (Fall,1967) and two graduate students, Terry Thomas and myself, are engaged to cover the science education portion of the assignment until Bob arrives. Hence the beginning of a career long association with Bob, first as a mentor, teacher, and

colleague, and eventually as a very good friend. I'm not sure Bob ever did teach the elementary science education course. He was much more interested in classroom environment, initially the external environment but eventually, and in much greater depth, the interface between the external and internal environments of learners, often thought of as the ecology of the classroom. His pacesetting efforts in reinterpreting new knowledge in fields of neurobiology and cognitive science in terms of teacher behavior, curriculum, and classroom environment became the focus of a very successful and productive career. Bob was an excellent teacher, an active and sought after advisor, and a prolific writer. His many students and his many friends will certainly remember him as a talented and committed educator, and, by the way, as a very good person.

Ray Hull

Professor Emeritus

University of Oregon

Remembrance from Mary K. Morrison

I am so grateful to Bob for all he contributed to the world and to me personally. He was such an amazing mentor and friend and I am so grateful to him for how he impacted my life. His encouragement was the inspiration for my first book, *Using Humor to Maximize Learning.* Several times he indicated that he liked the fact that I was exploring the world of humor including the research. Of course he had an amazing sense of humor. I frequently let him know that I mentioned his work in my workshops. He was just such an amazing mentor and his contributions to education are immeasurable.

Mary K. Morrison

Speaker, Educator, Author

Remembrance from David Moursund

Bob Sylwester was one of my best friends. His death has left a large hole in my life. I deeply miss him!

Bob had a very long and highly successful professional career as a teacher, writer, and speaker. I thoroughly enjoyed his stories about his initial years of teaching in a one-room school, and his successful endeavors to become an income-producing professional writer and speaker.

Bob Sylwester and I began to work together in the mid 1980s. He taught me about brain science and I taught him about computers. Bob became co-editor of the *IAE Newsletter* beginning in December, 2009, with the 31st issue. He suggested the idea that we develop single-topic sequences of newsletters and then publish books based on the newsletter series. Thus, we jointly edited and published six books. You are now reading the seventh and last book in that series.

Bob and I were both long-time members of a small group of retired University of Oregon College of Education faculty members who had lunch together on Tuesdays. For a

number of years, Bob and I spent a half-hour or more after lunch discussing the *IAE Newsletter*, our personal lives, and our insights into what was going on in the world. In addition, we spent a great deal of time communicating by email as we jointly edited the incoming flow of *IAE Newsletter* submissions. We also edited each other's writings, and had fun arguing about the correctness and importance of our own individual points of view.

Bob really enjoyed helping novice authors learn to write better, and especially to write for the IAE audience. He also had fun working to improve my writing. For example, he even used the diagramming of sentences to show me I should not start a sentence with "There" or "Here." Since I had learned essentially all of my grade school learning about diagramming sentences, it was an uphill struggle for both of us.

In the last couple of years of his life, Bob often shared quite personal stories with me—especially stories about his family. I found these to be both delightful and educational. Bob really liked to tell stories!

You are now reading the seventh book that Bob and I produced together. Bob took considerable pleasure in the volunteer work he did for IAE. Indeed, several times he told me that IAE helped to fill the hole in his life when he could no longer readily travel to meetings to present talks and workshops. This book is dedicated to Bob. **The world has lost a great person!**

David Moursund

Emeritus Professor

University of Oregon

Remembrance from Dan Raguse

A Teacher's Teacher

Ask people to recall a person who impacted their life, and there's a good chance they will name a teacher. It's not hard to understand why. Great teachers care about the lives of their students, they inspire, encourage, and give more than they take.

If you asked me who was influential in my life, I would tell you Dr. Robert Sylwester. He was a professor, a writer, a speaker, a mentor. And at his core, he was a teacher. Bob passed away about six months short of living 90 years. He left behind a legacy many aspire to achieve. He was well known for his books on cognitive science and for his ability to capture an audience with insights and facts about learning and the human brain.

I could sit and listen to Bob all day long. Because of him, I became a better teacher. I learned that learning was more than memorizing and following procedures. I learned that teaching was more than telling. I learned that our greatest gift is our ability to grow our brains, to think more deeply, ask more questions, explore more ideas, make more attempts, and celebrate more "aha!" moments.

I will miss Bob's frequent newsletters, his humor and stories, his love for the Oregon Ducks, and his passion for learning. But because of who he was and what he did, he will continue to live on through me and countless others.

Daniel Raguse
Executive Director
The Math Learning Center

Front Matter

Acknowledgements

Thanks to the authors who contributed so generously of their works.

Thanks to readers who provided written and oral feedback.

Thanks to Ann Lathrop for her editing assistance.

Thanks to Ken Loge for his technical and publishing support.

Information Age Education (IAE)

Information Age Education (IAE) is a non-profit company in the state of Oregon that was established in 2007 by David Moursund. Its goal is to help improve worldwide informal and formal education at all levels.

David Moursund has provided the funding for IAE since its beginning. His volunteer time plus the help of a number of other volunteers have created a large collection of free materials designed specifically for preservice and inservice teachers, parents, and others interested in improving education.

Advancement of Globally Appropriate Technology and Education (AGATE)

David Moursund had his 80th birthday on November 3, 2016. During the previous two years he worked on developing a successor plan (what happens to IAE after Dave dies) to ensure the continued availability of the IAE materials and the continued addition of new materials.

This has led to the creation of a 501(C)(3) non-profit corporation named AGATE (Advancement of Globally Appropriate Technology and Education). David Moursund is the Chief Executive Officer, Russell Moursund is the President, and Sonia Moursund is the Treasurer. IAE is now part of AGATE. AGATE was established both to help secure IAE's long-term future and to further other technology-related aspects of helping to improve the quality of life throughout the world.

Many other non-profit and for-profit organizations have the same goals. The Wikipedia Corporation provides an excellent example. Our world has been changed by the major progress that Information and Communication Technology (ICT) has made over the past few decades. And, the best is yet to come. Through the work of AGATE and others, the goal is to make appropriate information available in a timely fashion to those who can use it to improve the quality of their lives.

Through contributions from David Moursund and a number of other people, an Endowment Fund is being created. Contributions to help pay for AGATE’s continuing expenses and to build the Endowment Fund can be sent to:

AGATE
% Sonia Moursund
2375 Carriage Avenue
Richland, Washington 99352
USA

If you want to discuss contributions and other ways in which you and/or your organization can help to further the work of AGATE, please contact:

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Editors (Bob and Dave)

Robert Sylwester, Editor and Author

Robert Sylwester was an Emeritus Professor of Education at the University of Oregon, and co-editor of the *IAE Newsletter*. His most recent books are *A Child's Brain: The Need for Nurture* (Corwin Press, 2010); *The Adolescent Brain: Reaching for Autonomy* (Corwin Press, 2007); and co-authored with David Moursund: *Creating an Appropriate 21st Century Education* (IAE, 2012); *Common Core State Standards for K-12 Education in America* (IAE, 2013); *Consciousness and Morality: Recent Research Developments* (IAE, 2013); *Understanding and Mastering Complexity* (IAE, 2014); and *Education for Students' Futures* (IAE, 2015).

He wrote a monthly column for the Internet journal *Brain Connection* during its entire 2000-2009 run.

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David Moursund, Editor and Author

David Moursund is an Emeritus Professor of Education at the University of Oregon, and co-editor of the *IAE Newsletter*. His professional career includes founding the International Society for Technology in Education (ISTE) in 1979, serving as ISTE's executive officer for 19 years, and establishing ISTE's flagship publication, *Learning and Leading with Technology*. He has served on the Board of Directors on The Math Learning Center , a 501(C)(3) corporation, since it was established in 1977. He was the major professor or co-major professor for 82 doctoral students. He has presented hundreds of professional talks and workshops. He has authored or coauthored more than 60 academic books and hundreds of articles. In 2007, Moursund founded Information Age Education (IAE). In 2016, he headed the project to create Advancement of Globally Appropriate Technology and Education (AGATE). AGATE is a 501(C)(3) corporation designed to continue and expand the work of IAE.

Authors

The following is an alphabetical list of authors who wrote the *IAE Newsletters* contained in this book.

Becky Burrill is an educational therapist, movement educator, dancer, and visual artist. She received her doctorate in studies focusing on the relationships between movement, brain evolution, child development, art making, and learning. She is trained in a dance-movement therapy assessment tool—The Kestenberg Movement Profile, and in occupational therapy related systems such as Brain Gym, Rhythmic Movement Training, and Body-Mind Centering. She works in private practice as an educational therapist and movement educator with all ages. She is a certified elementary educator and is artistic director of improvisationally based dance programs in schools, K-12. She recently performed a solo dance piece—Dancing the Dunes—linking languages of nature with languages of art, exemplifying her work of linking human intelligence with primal human relationship with

Nature as instrumental in the development of language and art. Through this understanding she seeks to renew human engagement with the primary creative intelligences of movement, sound, feeling, imagination and ecological conscious and their natural, organic, empowering and integrative capacities.

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Carolyn Chapman is an international professional developer and conference keynote speaker. She was a teacher before becoming a consultant in teacher training in Georgia. Carolyn is the author of many educational publications including seven books, four CDs, and training manuals on differentiated instruction.

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Barbara K. Given initiated the Special Education Teacher Preparation Program, served as Special Education Program Coordinator, and co-directed The Adolescent and Adult Learning Research Center and Krasnow Institute for Advanced Study at George Mason University (GMU) in Fairfax, VA. She is a former Director of the Center for Honoring Individual Learning Diversity, an International Learning Styles Network Center.
Given received two prestigious research awards. In addition to publishing many articles, she is the senior co-author of *Excellence in Teaching and Learning* (Learning Forum Publications, 2015); *Teaching to the Brain's Natural Learning Systems* (ASCD, 2002); *Learning Styles: A Guide for Teachers and Parents* (Learning Forum Publications, 2000); and *Alphabet Cue Cards* (Ideal School Supply, 1972). In her retirement, Given is a GMU Associate Professor Emerita of Special Education and Faculty Affiliate at Krasnow Institute for Advanced Study.

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is *Pathways Between Eastern and Western Education* (Information Age Publications, 2009). He has retired in Surrey, British Columbia, Canada, but still enjoys teaching on call for the Richmond School District and Southridge Private School. Besides writing about educational reform, he enjoys spending time with his family, photography, playing in various bands, and travelling the world with Debbie, his wife of 43 years.

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Martha Kaufeldt is a professional development specialist, author, and a part-time teacher at a public charter school in California. Since 1984, her specialty has been interpreting and applying educational neuroscience into classroom practice. She travels internationally, conducting workshops and trainings on curriculum development, differentiated instruction, school restructuring, natural learning, and brain-friendly strategies for teachers and parents. Martha has also been a district staff development specialist and gifted education program director. She has written several books including *Begin With the Brain: Orchestrating the Learner-Centered Classroom.* 2nd ed. (Corwin, 1999); *Teachers, Change Your Bait! Brain-Compatible Differentiated Instruction* (Crown House, 2005); and *Think Big, Start Small* co-authored with Gayle Gregory (Solution Tree, 2012). Her most recent book, co-authored with Gayle Gregory, is *The Motivated Brain: Improving Student Attention, Engagement and Perseverance* (ASCD, 2015).

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Rita King is an international trainer, consultant, author, and keynote speaker. She directed the teacher-training program in the laboratory school at Middle Tennessee State University while serving as the school's principal. Rita is the co-author of six books, four CDs, and training manuals on differentiated instruction.

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Norman Metzler is Emeritus Professor of Theology at Concordia University, Portland, Oregon. He received his Master of Divinity at Concordia Seminary, St. Louis, MO, his Master of Theology at Yale University, and completed his doctorate in theology with Prof. Wolfhart Pannenberg at Ludwig-Maximilians University, Munich, Germany. He has taught for many years in theology, philosophy, and ethics, and did his doctoral thesis on the relationship of ethics and eschatology (the Christian doctrine of the last things). A practicing Lutheran Pastor, Metzler resides in Vancouver, WA, with his wife, Mary, a retired nurse. They have two grown sons.

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David Moursund is listed in the Editor and Author section given above.

Pamela Nevills is first and foremost a teacher, working with learners from preschool through postgraduate programs. Pamela's expertise as a staff developer began with a county-level position and management of a curriculum and instruction office. Subsequent activities included state-level leadership for teachers' professional development and student-to-work programs. She was a collaborator and data collection manager for a mathematics research project spanning four states. Recently Pamela supervised student teachers/interns and taught methods classes at California State Polytechnic University and the University of California, Riverside.

Dr. Nevills studies neurology, mind imaging, and research for education, organizational change, and neurology. By combining information about how the brain functions for child and adult learning, she provides innovative insights for educators and other professionals. Her present position with Brandman University expands her expertise in transformational change into many aspects of society.

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Brian Pack taught secondary school science in Wisconsin, including physics and AP Chemistry, and received the United States Presidential Scholar Teacher Award and the Siemens Advanced Placement Teacher of the Year Award. He served as head grade level advisor, and coached both football and cross country. He was a community advocate, and coached the six-time state champion Academic Decathlon team. He did numerous stints at research institutes in molecular biology and biochemistry.

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Michael Rousell is a Certified Counseling Psychologist and Associate Professor of Education at Southern Oregon University. Dr. Rousell's book, *Sudden Influence: How Spontaneous Events Shape Our Lives*, is in 1000 institutions in 60 countries. He spent 25 years studying life-changing-moments.

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Robert Sylwester is listed in the Editor and Author section given above.

Pat Wolfe is a former teacher of Kindergarten through 12th grade, county office administrator, and adjunct university professor. Over the past 25 years, as an educational consultant, she has conducted workshops, seminars and keynote addresses for thousands of administrators, teachers, boards of education and parents in schools and districts throughout the United States and in over 40 countries internationally. Her major area of expertise is the application of brain research to educational practice. She is an author of the award-winning book, *Brain Matters: Translating Research to Classroom Practice*. She is co-author with Pamela Nevills of *Building the Reading Brain.* She has appeared on numerous videotape series, satellite broadcasts, radio shows, and television programs. She presently resides in Napa, California.

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Preface

Some students find going to school to be a joyful experience—while others don't. Most fall somewhere between these extremes. They find some parts of a school day to be joyful and some not.

However, this description is a gross over-simplification.

Imagine a scale running from 1 (completely lacking in joy) to 10 (as joyful as an event or experience can be). You can personally assign meaning and examples to the points on such a scale. However, likely no two people will assign the same meaning and examples to the points on their joy scale.

Increasing Joy

A child comes home from school, and a parent asks, "How did school go today? Did you have a good time at school today?" What is the parent expecting in terms of an answer? Hmm. Perhaps the parent is thinking:

> "Well, my child, you have just had eight hours of school experience. Please give me a very short answer that summarizes the joyfulness of these eight hours. Then, I'll ask you what you learned today. I'll expect some detail in your answer, because it is important to me that you get a good education."

Some parents are very good at making such a conversation into a meaningful, experience for both child and parent. Indeed, parents play a significant role in both the joy that their children experience in school and the learning that occurs there.

Perhaps the parent is making an underlying assumption that, if the child is enjoying school, a good amount of learning is occurring. Education research supports that assumption.

The following quote is from *The Atlantic* (Engel, 1/26/2015):

> A look at what goes on in most classrooms these days makes it abundantly clear that when people think about education, they are *not* thinking about what it feels like to be a child, or what makes childhood an important and valuable stage of life in its own right.
>
> …
>
> I'm a mother of three, a teacher, and a developmental psychologist. So I've watched a lot of children—talking, playing, arguing, eating, studying, and being, well, young. Here's what I've come to understand. The thing that sets children apart from adults is not their ignorance, nor their lack of skills. It's their enormous capacity for joy. Think of a 3-year-old lost in the pleasures of finding out what he can and cannot sink in the bathtub, a 5-year-old beside herself with the thrill of puting together strings of nonsensical words with her best friends, or an 11-year-old completely immersed in a riveting comic strip. A child's ability to become deeply absorbed in something, and derive intense pleasure from that absorption, is something adults spend the rest of their lives trying to return to.

Increasing Joy in Education

This book focuses on increasing the joy that students experience while at school. Assume for a moment that you are a classroom teacher. You make a decision to increase the amount of joy each student experiences while having you as a teacher.

Will you be working alone, or will your fellow teachers also be involved? How about parents, your school administrators, the district's administrators, and the School Board? As you work to increase the joy that students experience in school, put part of your energies into getting others to do what they can do to help!

The Book Is Divided into Four Parts

Part 1: Introduction. These five chapters provide an overview of key ideas in the field of joy in education. A wide range of topics are covered, including joy in learning, joy in game playing, intrinsic motivation, and extrinsic motivation.

Part 2: Internal Elements: Underlying Neurobiology. What is going on in a brain that is experiencing joy?

Part 3: Psychologically Driven Elements. Joy in humor, gaining and using expertise, and experiencing success in learning.

Part 4: External Elements. Seven chapters covering diverse topics such as joy in teamwork, joyful conflicts, making grading more joyful, and joy in learning.

Reference

Engel, S. (1/26/2015). Joy: A subject schools lack. *The Atlantic*. Retrieved 12/14//2016 from http://www.theatlantic.com/education/archive/2015/01/joy-the-subject-schools-lack/384800/.

Part 1: Introduction and Background

The first five chapters of this book provide background information about joy (pleasure) in learning and using one's learning. An intact human brain is naturally curious and has a tremendous capability of learning and making use of what it has learned.

Such learning and use of learning has survival value. So, it is not surprising that the human brain is designed so that it gains pleasure as it learns and uses its learning. The learning and doing cause the release of certain chemicals in the brain's pleasure centers. This is an important idea that is addressed over and over again in this book.

All readers of this book have experienced pleasure in learning and using their learning. To repeat what was said above, this is a natural, ongoing process. Every learner and every teacher should understand this fundamental idea. Moreover, every person is both a lifelong learner and a lifelong teacher. The ability to learn is built into our brains, and we learn through the intake and processing of information. Whether you are awake or asleep, your brain is receiving input from internal and external sources, and processing it.

Somewhat similarly, every communication with self or with someone else provides information that is processed and contributes to learning. Even a tiny baby's cries help a caregiver learn that the baby wants "something."

Humans have had thousands of years of experience in gamification of learning (making what is to be learned into a game or "fun" situation). We have carried some to this into our formal schools. For young children, *story time* is a fun part of the school day.

Humans have long been adept at telling and listening to stories. Now, a child can learn to read, so that the child has more control over what stories are available and when they are available. However, it takes considerable time and effort to learn to read well enough so that reading can be an ongoing source of pleasure and of information useful in helping to solve problems and accomplish tasks.

Gradually, people have come to understand how a human brain learns to read, and how to design and implement good instruction and aids to learning to read. We have improved the instruction of reading through such processes. Similar statements hold for the various other subjects that are taught in schools.

Now we have electronic games, electronic sources of information, and electronic aids to teaching and learning. When appropriately designed and used, these bring pleasure to the learner and increase the speed/effectiveness of learning. We have always had games and other activities that were fun. They vary considerably in how much they contribute to learning that adults and societies consider to be important.

A science of game development has emerged—researchers and developers are now able to produce electronic games that are very intrinsically motivating and addictive. Research and development of electronic aids to learning and using the traditional school content has not been nearly as successful as the entertainment industry.

One of the ways that schools have attempted to meet this challenge is to make curriculum content, instructional processes, and assessment more *authentic.* Of course, the

meaning of what is authentic varies from student to student and from teacher to teacher. **(Remember, every person is a lifelong learner and a lifelong teacher.)** This situation has led to the following question:

> If Information and Communication Technology (ICT) can significantly help in solving a problem or accomplishing a task that is deemed important to a student and/or to a teacher, what should students be learning about use of ICT in school and outside of school?

As you read this book, think about how to improve the education of yourself and others. Consciously work to becoming a more effective livelong learner and lifelong teacher.

For some help in pondering this question, you may want to read the short, free book, *The Fourth R* (Moursund, 2016). It recommends thoroughly integrating ICT throughout the school curriculum.

Reference and Resources

Moursund, D. (December, 2016). *The Fourth R.* Eugene, OR: Information Age Education. Read the book online at https://moursundagatefoundation.org/wp-content/uploads/2022/04/Alfabetizacion-Informatica-Cultural-para-Educadores-final.pdf.

Moursund, D. (1/20/2016). *Learning problem-solving strategies through the use of games: A guide for teachers and parents.* Eugene, OR: Information Age Education.

Chapter 1

The Joy of Learning: An Introduction

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Conscious learning as we currently think of it is a conscious/rational process that begins with an unconscious arousal system called *emotion*. Emotion alerts us to potential environmental dangers and opportunities. Sufficiently aroused, emotion activates a focusing system (called attention) that informs us of the nature, location, and intensity of what caused the arousal. Attention can also lead to conscious feelings that incorporate previous experiences and help us to determine how important the challenge is and then help to direct an appropriate resolution. The lower (or subcortical) part of our brain processes unconscious emotions, and the upper brain systems (or cortex) process the conscious feelings that regulate learning. Various forms of joy emerge when these innate-to-conscious systems mesh seamlessly.

Let's use a narrative to clarify the process. You've dozed off on an afternoon and are suddenly jarred awake by a ringing. You wake up and realize it's the phone. You walk over and pick it up. Good news. It's a friend you had hoped would call. He has the information the two of you need for a collaborative project. He suggests that you drive over to his place and then the two of you can go to get what you need. You learned how to drive years ago and you remembered how to get to his house. You get in your car and drive over. Emotional arousal had led to an attentional focus, which had engaged related feelings, memories, and problem solving. A feeling of joy emerged from the appropriate resolution of the problem.

Think thus of emotion as a biological thermostat that monitors and reports variations from normality. If no innate response exists for a particular emotional challenge, the nature of the arousal will activate our attention system, which further identifies the basic dynamics of the challenge and the relevant problem-solving systems that consciously respond to the challenge. Almost everything that we currently do thus begins with unconscious emotion and with such variants as conscious feelings, temporary mood, and long-term temperament.

(The Notes section at the end of this chapter briefly describes three learning systems: genetic/innate, conscious/rational, and unconscious/implicit learning. This book covers only the conscious/rational system of learning that is most exemplified in nurturing and formal instruction.)

Our conscious brain evolved so it can recall past related experiences, analyze the current situation, and anticipate probable local and distant results. We thus function within a temporal/spatial environment—the past/present/future and the here/there.

Is it any surprise that feelings of satisfaction and joy emerge when we (either alone or with help) can merge a potential problem into the sort of a satisfactory conclusion that we

can also use later in related settings? Joy, in its various forms that emerge from learning, thus enhances life.

Many young people lack the current maturation that such emerging capabilities require. Parents and teachers are examples of adults who nurture and instruct. Adult culture can also make complex demands that are beyond the capabilities of many. Various forms of leaders and pundits assist, sometimes helpfully and sometimes not so helpfully.

The various forms of dementia signal the loss of such rational capabilities. Caregivers must then provide guidance and assistance.

The Joy of Learning

Children are born with the unconscious emotion/attention elements, so we don't have to teach these elements. However, we adults have to help children learn how to appropriately channel emotion/attention into the affective or feeling elements that lead to the satisfactory problem solving and decision-making behaviors that must be learned. This book will thus focus on learning and the joy that can come from learning. It will consider the following:

- What values (educational benefits) emerge when we help students increase their level of joy/satisfaction in learning?
- How can informal and formal educational activities help students to increase their level of joy in learning?
- As a parent or teacher, what can I learn from this series of newsletters that will be valuable to me personally, and to my interactions with children and/or students?

To do this, the book will follow this sequence of major ideas and issues:

- An explanation of learning, and discussions of such basic issues as intrinsic/extrinsic motivation and play/games in joyful learning.
- Explanations of the central neurological systems that are involved in joyful learning.
- Discussions of such psychological issues as the role of humor, testing, and awards; and the roles that such phenomena as religious belief have in increasing/decreasing the joy of learning.
- Extensive discussions of instructional systems that will enhance learning and increase/decrease the joy of learning.

Notes

Learning occurs through three learning systems:

Genetic (or innate) learning. Most animals survive by innately responding to challenges. In earlier eras (and with most animals today) those that could effectively respond to challenges survived, could reproduce, and thus pass on their genes. Over genetic time, we could thus say that the successful animal species genetically learned how to respond effectively to given challenges.

Conscious (or rational) learning. The expansion of our brain's cortex opened up a new form of learning that functions within a generation through memory formation and recall, problem solving, and decision making. It also involves older to younger transmission.

Unconscious (or implicit) learning. We master many forms of complex information in an incidental manner, without conscious awareness of what has been learned. The kinds of self-exploration that occur through play and games are good examples.

Chapter 2

Joy in Learning and Playing Games

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"All the world's a stage,
And all the men and women merely players;
They have their exits and their entrances,
And one man in his time plays many parts…"
(William Shakespeare, *As You Like It*)

All the world's a game,
And all the men and women merely players:
They have their exits and their entrances;
And each person in their time plays many games.
(David Moursund, adapted from Shakespeare)

Imagine that you are a parent with a grade school child. You have a very strange dream. In this dream you hear your child saying:

> "Can I go play now? I want to go do my homework, practice on the guitar, and read the book I just checked out from the school library."

In this dream you hear yourself replying in a stern voice:

> "No, you may not go play right now. You haven't finished responding to all of your Facebook messages, and you didn't post a selfie yesterday or today. Also, you need to post at least six more Tweets and Instagrams today—remember our rule about a daily dozen! And you need to spend at least 15 minutes more on Minecraft. You are falling behind what the teacher and I are expecting of you." (Moursund, 2014a).

Did you wince or get a chuckle out of that dream scenario? It presents a reversal of what we usually call schooling and recreational activities. I like to think about whether our current schooling system might be improved by a partial reversal.

People play games because they get pleasure and happiness out of doing so. This pleasure and happiness serves as intrinsic motivation, and it leads to wanting to continue playing. Game research and development teams know a lot about developing games with the characteristics that tap into intrinsic motivation.

Significant progress is being made in developing games that are educationally sound and can make important contributions to the education of children and adults of all ages. This chapter provides a brief introduction to the use of intrinsically motivating games in education.

Some Background Information

Through informal or formal study and practice, a person can become more skilled at playing a particular game. Moreover, there may be considerable transfer of learning from one game to another of a somewhat similar type. With appropriate instruction considerable transfer of learning may occur to non-gaming topics such as learning to learn, metacognition, problem solving, planning ahead, anticipating the consequences of actions you are thinking about taking, and other topics in the school curriculum.

Our world's entertainment industry is spending large sums on research and development to produce and distribute games that are increasingly "gripping"—might we even say, "addictive"? Electronic games are now a routine part of the lives of a significant portion of the population of the world. In the U.S, and many other countries, computerized games consume a significant amount of their players' time. Many students experience a time-competition among school and homework, computer games, computerized social networking, other use of waking hours, and sleep time. Over the course of a year, many students now spend as many or more hours playing computer games and participating in computer-based social networking and other "fun" telecommunication activities as they spend in school and doing homework.

Our educational system is well aware of this competition for students' time and attention. One proposed solution is to develop educational computer games and social networking activities that are gripping and pleasurable, but are suitable to be used as a routine component of schooling. Considerable research and development efforts are being made in this endeavor, and certainly with some successes.

What Is a Game?

The literature about games tends to agree that a game has:

1. one or more goals;
2. rules;
3. a feedback system useful in measuring and improving one's level of performance;
4. voluntary participation.

We all talk about "playing a game", and we may have trouble distinguishing between just plain "playing" and "playing a game". For very young children, play is spontaneous and not done in a rules-based environment. Young children develop their personal patterns of play. One might think of such personal patterns being types of game playing in which they invent their own rules and goals (Sylwester, November, 2015).

Here is a somewhat facetious but often-quoted statement about game playing:

> Playing a game is the voluntary attempt to overcome unnecessary obstacles. (Bernard Suits; Canadian philosopher; 1925-2007.)

If you are not a golfer, you might agree that this statement describes golf. However, it misses the point of the social interactions and exercise experienced by a group of friends playing golf together.

A key aspect of games is that players are intrinsically motivated to learn and play the game. They play voluntarily and they gain pleasure in doing so. Compare this with the way that many students experience the "ordinary" school curriculum.

Broadening the Definition of Games

As I think about the definition of *game* given above, it seems clear to me that social networking (Facebook, Instagram, Snapchat, Google+, Reddit, Tumblr, Twitter, etc.) texting, instant messaging, and other versions of computer-based communication are often used as a game-like type of recreation.

Of course, it takes some stretching of the traditional definition of a game to make them fit. For example, different "players" tend to make their own goals and rules. However, with this broadened definition we can understand why traditional schooling and homework are having so much trouble competing with student engagement in games.

Next, what about computer-assisted instruction? Two relatively obvious potential values of well-designed computer-assisted instruction are:

1. Computer simulations can create learning environments that are quite game-like in nature, but that are specifically designed for teaching and learning. Consider driver education, pilot training, astronaut training, and many other computer simulations that are sufficiently good to now be routinely used for educational purposes.
2. In many situations, the computer-as-tool is also a computer tutor that teaches one to use the tool. This is a steadily increasing aspect of computerized tools (Moursund, September, 2014).

Finally, consider the roles of computers in computer graphics, animation, filmmaking, and 3-D printing. Such use of computer technology empowers students by integrating learning and doing in a game-like activity that students find intrinsically motivating. We especially see this in graphics-oriented programming languages (Intersimon, 11/23/2009). Children learning and using a programming language such as MIT's Squeak become immersed in a programming environment that facilitates their joyfully learning to create products (programs) that they feel proud of and enjoy sharing with others. Often students use these learner-oriented programming languages to develop games and animated stories.

My point is that there is no fine dividing line between what constitutes intrinsically motivating and fun games designed strictly for entertainment and joy, and those that have considerable educational value. I include both in my definition of *game*.

In brief summary, games help to create environments in which the participants are empowered and voluntarily participate in activities that develop their mental, physical, and (often) social skills.

Some Goals for Educational Uses of Games

Here is a short list of possible goals for making educational uses of games in a classroom setting (Moursund, 1/20/2016).

1. To help students learn more about themselves in areas such as:
    a. Learning to learn and understanding how concentrated, reflective effort over time leads to an increasing level of expertise.

   b. Learning about one's cooperative versus independent versus competitive inclinations both in learning and in demonstrating or using one's learning.
   c. Learning about oneself as a giver of feedback to others and as a receiver of feedback from others. This includes learning to complete and to make use of both self-assessment and peer assessment.

2. To help students better understand problem-solving strategies and to increase their repertoire of and use of problem-solving strategies. This includes:
   a. Learning about low-road (essentially, rote memory) and high-road transfer of learning, especially as they apply to problem solving. Low-road transfer of learning tends to be based on rote memory applied to routinely occurring and nearly identical problem situations such as tying one's shoes. High road transfer involves: cognitive understanding; purposeful and conscious analysis; mindfulness; and application of strategies that cut across disciplines (Moursund, 2014b).
   b. Learning how to recognize/identify a problem-solving strategy and explore its possible use across many different problem domains.
   c. Learning how to do high-road transfer of learning of problem-solving strategies that cut across many domains.
   d. Increasing fluency in making effective use of one's repertoire of domain-independent problem-solving strategies.
3. To help students learn some games and increase their understanding of historical and current roles of games and game playing in our society. This includes:
   a. Learning games as an aid to social interaction in small and large groups.
   b. Learning games as part of the culture and history of a family or community.
   c. Learning games as environments that facilitate communication, collaboration, and peer instruction.
   d. Learning games as an aid to understanding one's personal competitive, collaborative, and non-competitive natures.
   e. Learning how to help other people learn a new game. (Think of the idea that every student plays both learning and teaching roles in life.)

Final Remarks

Computer technology is now a routine and pervasive aspect of our lives. For some reason, our educational system is having trouble accepting this situation and fully accommodating it in terms of curriculum content, teaching processes, and assessment. The very word *game* brings condemnation from many who think that use of games degrades education.

In this chapter I have used a definition of game that is far broader than is conventionally used. You may not believe that "All the world's a stage" or that "All the world's a game." However, I am sure you realize that computers, including computer games, have greatly

changed our world and have become routine parts of the lives of a great many students of all ages.

Researchers in the theory and development of intrinsically motivating games have provided our educational system both with a great challenge and with great opportunities. I believe that our educational system can become considerably more successful if all of us work together to identify and address needed changes being brought on by computer technology and computer games.

References and Resources

Intersimon, D. (11/23/2009). Scratch, Squeak, Alice, and Go—programming for kids, adults, and everyone else. Retrieved 12/17/2015 from http://www.computerworld.com/article/2468227/internet/scratch--squeak--alice-and-go---programming-for-kids--adults-and-everyone-else.html.

McGonigal, J. (February, 2010). Gaming can make a better world. (Video. 20:03.) *TED Talks.* Retrieved 12/15/2015 from https://www.ted.com/talks/jane_mcgonigal_gaming_can_make_a_better_world?language=en.

Moursund, D. (1/20/2016). *Learning problem-solving strategies through the use of games: A guide for teachers and parents.* Eugene, OR: Information Age Education.

Moursund, D. (2015). Goals of education in the United States. *IAE-pedia*.

Moursund, D. (2014a). Can I go play now? *IAE Blog.*

Moursund, D. (2014b). Transfer of learning. *IAE-pedia.*

Moursund, D. (September, 2014). The teaching machine is both tool and teacher. *IAE Newsletter*.

Moursund, D., & Albrecht, R. (2011). *Using math games and word problems to increase math maturity.* Eugene, OR: Information Age Education.

Sylwester, R. (November, 2015). Non-kin collaborations and complex projectiles. *IAE Newsletter.* Retrieved 12/17/2015 from http://i-a-e.org/newsletters/IAE-Newsletter-2015-173.html.

Chapter 3

Intrinsic and Extrinsic Motivation

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> "Curiosity killed the cat, but satisfaction brought it back."
> Variation of a proverb, "Curiosity killed the cat".

> "We discovered that education is not something which the teacher does, but that it is a natural process which develops spontaneously in the human being. It is not acquired by listening to words, but in virtue of experiences in which the child acts on his environment. The teacher's task is not to talk, but to prepare and arrange a series of motives for cultural activity in a special environment made for the child." (Maria Montessori; Italian physician, educator, philosopher, humanitarian, and devout Catholic; 1870-1952.)

A human infant has innate (built in) survival mechanisms. Driven by its survival instincts and curiosity, a human infant makes use of its external and internal senses, its cognitive capabilities, and its physical abilities to survive and to learn. These survival instincts and curiosity are a type of intrinsic motivation.

Human babies have a long childhood in which they need to be cared for and nurtured in order to survive and to grow toward a functional and productive adulthood. Caregivers provide feedback, rewards, and punishments to help guild a child's learning. I like to think of the environment provided by child caregivers as a type of extrinsic motivation. That is, humans create this external environment and strongly encourage children to adapt to it. Good parenting provides an appropriate balance between a child's intrinsic and extrinsic motivation.

As a child matures, its learning continues to be driven by a combination of innate drives and the extrinsic motivation of its environment. Gradually, however, the child begins to have an increasing control over some aspects of its environment. It develops a cognitive ability to consciously decide what to explore and to understand what it explores. It develops the physical abilities needed do the exploration. The child's motivational drives expand from their innate beginnings to include conscious and physical intrinsic motivations.

Thus, we all grow up in a world that includes intrinsic and extrinsic motivation. Both home and school environments provide excellent examples of instances when a child's intrinsic motivation can conflict with external motivation drives/forces. In brief summary, "joy" in these situations occurs when the intrinsic and extrinsic motivation are aligned.

Three Key Research-based Ideas

Richard Ryan and Edward Deci's article, Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions, provides an excellent introduction to motivation (Ryan & Deci, 2000). Here are three key ideas quoted from this research paper:

1. When we talk about motivation in schools, we are generally talking about whether students are motivated to learn. Researchers measure "motivation to learn" by the degree to which students are committed to thinking through problems and working through challenges to master a concept or gain a new skill. **This goes beyond student enjoyment of an activity, as students must persist through obstacles.**
2. We experience intrinsic motivation when we find ourselves seeking answers to a question that intrigues us or pushing ourselves to work hard to master a skill. Extrinsic motivation is when we work for an external reward or to avoid an external punishment provided by someone else.
3. [If] our goal is to build life-long, independent learners, it is important to be aware of the dangers of extrinsic rewards and punishments, and to use them sparingly and carefully as a means to build intrinsic motivation in only those individual students who may need it. Indeed, instilling intrinsic motivation is a longer process that may use some external rewards but really focuses on self-improvement and helps students to shift from doing something for a reward or for a teacher or parent to doing something for themselves. [Bold added for emphasis.]

The bold section in #1 above is often stated as, "No pain, no gain." A high level of knowledge and skill can be gained in an area, but this typically requires considerable extended effort.

Intrinsic Motivation and the Joy of Flow

For me, shutting out the outside world and being deeply involved in a game, problem-solving task, or reading a good book provide examples of what Mihaly Csikszentmihalyi calls *flow.* Quoting from the Wikipedia (n.d.):

> In his seminal work, *Flow: The Psychology of Optimal Experience,* Csíkszentmihályi outlines his theory that people are happiest when they are in a state of flow— a state of concentration or complete absorption with the activity at hand and the situation. It is a state in which people are so involved in an activity that nothing else seems to matter. … **The flow state is an optimal state of intrinsic motivation, where the person is fully immersed in what he is doing. This is a feeling everyone has at times, characterized by a feeling of great absorption, engagement, fulfillment, and skill**—and during which temporal concerns (time, food, ego-self, etc.) are typically ignored.
>
> …
>
> One state that Csikszentmihalyi researched was that of the autotelic personality. The autotelic personality is one **in which a person performs**

> **acts because they are intrinsically rewarding, rather than to achieve external goals**. [Bold added for emphasis.]

I see no inherent reason why all students should not experience flow in a variety of learning activities that contribute to their getting a good education.

Improving Education

Many of us are intrinsically and extrinsically motivated to improve our educational systems. We consider the characteristics and overall quality of our current informal and formal educational systems, ways to make them better, and how to achieve the goal of making them better.

My experience is that people tend to pose overly simplistic "solutions" and then argue that these solutions should be widely implemented. I am reminded of the quote:

> "There is always an easy solution to every human problem—neat, plausible, and wrong." (Henry Louis "H.L." Mencken; American journalist, essayist, editor; 1880-1956.)

Here is my modification of Mencken's statement:

> "Every human problem has an easy solution—neat, plausible, and wrong—and/or likely impossible to implement." (David Moursund.)

Our educational system is huge and tends to be quite resistant to change. Moreover, we experience conflicts within our own minds and with other people on such basic issues as what constitutes a better educational system and how to get from our present situation to a desired (presumably, "improved") goal.

This *Joy of Learning* book is exploring an educational change that is applicable to our entire educational system, as well as to the education of each individual student. The proposal is simple enough: **Design education so that it brings increased joy to learners and at the same time produces better overall learning results.**

The underlying assumption is that with more joy in education, students will be more intrinsically motivated and this will lead to their obtaining a better education. Chapter 2 explores some possible roles of games in education. Considerable research supports the use of games as a means of bringing a type of joy or pleasure, and that many people are intrinsically motivated by the games they play. Moreover, considerable research exists on how to increase the intrinsic motivation of games.

I recently encountered the term *gamification* in a book I was reading. I had not seen this word before, so I was interested in finding out how widely it is used. My Google search of the term *gamification of education* produced nearly 3 million results. Proponents of this approach to improving education might be well served by reading my modification of the quote from Mencken given above. I strongly believe that appropriate use of games and the research on intrinsic and extrinsic motivation of games can be a useful aid to improving our educational systems. However, this alone will not begin to give us the educational system our children need and deserve for their futures in our complex and rapidly changing world.

Final Remarks

What we can do to help improve education is to provide students with interesting, meaningful, and enjoyable introductions to a very wide variety of topics and discipline areas in which it is possible to gain considerable knowledge, skills, and satisfaction. When a student shows some signs of developing intrinsic motivation in one of these areas, we can both foster the growth of this intrinsic motivation and use the situation as a vehicle to help the student learn to learn, to become a more independent self-sufficient learner, and to gain confidence in his or her abilities to learn.

References

Ryan, M.R., & Deci, E.L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*. Retrieved 12/14/2015 from http://www.sciencedirect.com/science/article/pii/S0361476X99910202/pdf?md5=b9e2589a068cf7f9529c1bff165ddd55&pid=1-s2.0-S0361476X99910202-main.pdf.

Smith. J.M. (9/3/2013). Homeschooling continues to grow! U.S. Department of Education. Retrieved 1/9/2016 from https://www.hslda.org/docs/news/2013/201309030.asp.

Wikipedia (n.d.). Mihaly Csikszentmihalyi. Retrieved 12/29 2016 from https://en.wikipedia.org/wiki/Mihaly_Csikszentmihalyi. Also see his 19 minute *TED Talk*, Flow, the secret to happiness, available at https://www.ted.com/talks/mihaly_csikszentmihalyi_on_flow.

Chapter 4

The Problem with Defining Learning

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Educators and Authors

> "All the world is my school and all humanity is my teacher." (George Whitman; American-born owner of Shakespeare & Company, a fabled English-language bookstore on the Left Bank in Paris; 1913-2011.)

The place to begin school learning is with an understanding of everyday learning from life. Most people, when talking about schooling and education, use the word "learn" happily and freely as though its meaning were obviously generic. Indeed, the meanings of "learn" and "learning" seem to be so obvious that they are used more than 100 times in *No Child Left Behind*, but they're never defined.

Many attempts have been made over the years to explore the many meanings of "learn" and "learning." One example goes at least as far back as the 1956 framing of *Bloom's Taxonomy* (Bloom, 1984) and its reworking (Anderson & Krathwohl, 2001). Other examples include the *SOLO Taxonomy* of Biggs & Collis (1982), *Webb's Depth of Knowledge Guide* (2009), and a variety of attempts to map these objectives onto differing ways to use technology (e.g., Carrington, 2013). Excellent treatises on how to teach more effectively also use the nature of learning as a starting point. (e.g., Jones, 2013; Reigeluth, 2012).

Most of these attempts to unpack the meaning of learning are framed with education and schooling in mind. Let's adopt a different tack. Imagine that we are exploring the way that the words "learn" and "learning" are used in the course of everyday life. Without seeking to be complete, nor completely accurate, these twelve (of many more) common usages define what it means to learn:

1. We might have to learn a phone number or the way to barbeque chicken. Here "learn" means *memorize and acquire information*;
2. We might have to learn why the weed killer that is great for killing the clover that covers our beautiful lawns could also harm the environment. Here "learn" means *grasp core concepts*;
3. We might have to learn why social and economic systems can be influenced but not controlled because they are self-organizing systems that emerge as the cumulative result of the beliefs of all the individual members. Here "learn" means *develop a deep theoretical understanding*;
4. We might have to learn how to design and market a website and, perhaps, know a lot about Web design and do it really well. Here "learn" means *acquire a skill or skill set* and *become expert*;

5. We might have to learn how to read the situation and react appropriately when we unexpectedly meet new people at a friend's apartment. Here "learn" means *developing new situation lenses*. Sometimes this is revealed as *having a feel for things*;
6. We might have to learn the reasons why both men and women often select the wrong sort of partners or procrastinate. Here "learn" means *become aware of*;
7. We might have to learn how to avoid impulse buying, delay gratification, and plan for the longer term. Here "learn" means *develop some self-mastery*;
8. We mighty have to learn how to work and connect better with others. Here "learn" means *develop more social intelligence*;
9. We might have to learn how to adjust to new cultures or situations or technologies. Here "learn" means *become more adaptive*;
10. We might have to learn how to design a yacht in radically different ways in order to win a yacht race such as the 2013 America's Cup, where the hulls of the competing catamarans were literally above water much of the time. Here "learn" means *be creative and generative*;
11. We might have to learn how to function more effectively as citizens who need to work together to survive and thrive in a very complex world. Here "learn" means *grow up and become more mature*;
12. We might have to learn a more general way of seeing and being ourselves in the world. Here "learn" means *develop mental models and worlds of personal meaning*.

And so on.

One word, many meanings. And all of us use some or all of those different meanings at different times in our everyday lives. Yet most of those core meanings are left at the door when discussions about schooling, education, and test scores take center stage.

Left at the door? Everyone does it. Parents talking about school and what their children are *learning*; reporters writing reams of stuff about every facet of education and the impact on *learning*; educators at every level, from teachers to administrators, who want to improve *learning*; bloggers flooding cyberspace with opinions about schooling, education and *learning*; policy makers intent on raising standards by having students *learn* more and *learn* better; politicians who make "better education" and "closing the achievement gap of *learners*" front and center of their campaigns; and (this is perhaps the most breathtaking), vast numbers of research scientists and academics who research and study and report about *learning* without bothering to precisely define it.

A Generic Definition of "Learning"

Rather than leave the word "learning" undefined, let's look for an umbrella process of which all of these elements are a part. We believe that the place to begin is with the dance of *perception* and *action*. Every human being (and every living organism to some extent) must be able to "read" its environment – the essence of perception – and be able to act appropriately in and on it – action (Caine & Caine, 2011). These are not two separate and distinct processes. Rather each is a part of, and interacts with, the other. Even basic sense perception, at the level of responding to a bright light, calls for parts of the body to be positioned and move appropriately. These two processes are central to all experience.

"Learning" means making sense of experience and developing capacities to act in and on the world (Caine & Caine, 2011).

It can be seen that all the different learning outcomes spelled out above are embraced by this definition. That challenge is to develop sufficiently sophisticated approaches to teaching and schooling to blend and incorporate them all naturally. The approach that best does this is what we call the *Guided Experience Approach.* It is unpacked in depth in the third edition of our book, *The Twelve Brain/Mind Learning Principles in Action* (Caine, et. al., 2015).

References

Anderson, L., & Krathwohl, D.A. (2001). *Taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives.* New York: Longman.

Biggs, J., & Collis, K. (1982). *Evaluating the quality of learning: The SOLO taxonomy.* New York: Academic.

Bloom, B., ed. (1984). *Taxonomy of educational objectives, Book 1: Cognitive domain.* 2nd ed. New York: Addison Wesley.

Caine, R.N., Caine, G., McClintic, C.L., & Klimek, K. (2015). *The twelve brain/mind learning principles in action: Teach for the development of higher-order thinking and executive function.* 3rd ed. Newbury Park, CA: Corwin.

Caine, R.N., & Caine, G. (2011). *Natural learning for a connected world: Education, technology and the human brain.* New York: Teachers College.

Carrington, A. (2013). *The pedagogy wheel. In support of excellence.* Retrieved 10/2/2015 from http://www.unity.net.au/allansportfolio/edublog/?p=324.

Jones, T.B., ed. (2013). *Education for the human brain: A road map to natural learning in schools.* Lanham, MD: Rowman & Littlefield.

Reigeluth, C. (2012). *Instructional theory and technology for the new paradigm of education.* RED, Revista de Educación a Distancia. Retrieved 12/22/2016 from en http://www.um.es/ead/red/32. Retrieved 112/22/2016 from http://www.um.es/ead/red/32/reigeluth.pdf.

Webb's depth of knowledge guide: Career and technical education definitions (2009). Wisconsin Center of Educational Research. Retrieved 11/2/2015 from http://www.lmu.edu/Assets/Centers+$!2b+Institutes/Center+for+Teaching+Excellence/Webb$!27s+Depth+of+Knowledge .

Chapter 5

A Sometimes Joyful Wandering Mind

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We tend to think that we're consciously engaged during most of the time that we're awake, but the reality is that we're consciously engaged during only about half of it. Further, goal directed activity encompasses only about 1/3 of the typical 24-hour cycle. The renowned psychologist Michael Corballis (2015) suggests that much of the rest of our time is spent in an idling process called mind wandering. He discusses the phenomenon in an intriguing book, *Mind Wandering: What the Brain Does When You're Not Looking*.

The basic point of a wandering mind is this: Our brain simultaneously processes a variety of concerns. A satisfying response for some problems occurs almost immediately. Some responses require us to delay and incorporate additional elements. Some problems have no immediate solution and require ongoing searches.

The following situation often occurs when I'm writing during an evening. I'll come to a point at which I can't think of the appropriate term or phrase that I need to continue. Checking Google doesn't help. Finally, I decide to forget about it and go to bed. I lie down, and a few minutes later, the elusive phrase pops up in my mind. I get up and jot it down because if I don't, I'll have forgotten it in the morning. What occurred?

My evening writing had been only one of a variety of body systems and cognitive issues that my brain had been processing. My sensory and motor systems basically shut down when I lay down to sleep, but some currently important cognitive problems continued to occupy my mind as long as I was still awake. Since more of my relaxed brain was now available to search for the elusive phrase, it quickly emerged since it was obviously a phrase that I had previously used. You've undoubtedly had similar experiences so you understand the mental joy that such solutions bring.

A student uninterested in a class session can similarly wander mentally into a different set of experiences. Some such wanderings can be quite pleasurable, others seek solutions to difficult problems. This daytime wandering mind process is commonly called day dreaming.

Daytime Mind Wandering

Mind wandering can assume various forms. Some formats, such as novels, poems, songs, films, and political promises are fictional. Others, such as inattentive accidents, often begin with mind wandering. A fictional work can begin with mind wondering, but the author's actual development of it requires a focused mind, one that will catch and then eliminate the kinds of omissions that can occur with pure mind wandering. Fictional works are about an intriguing *pretend* story, but they have to match (or at least approximate) the realities of real life. Fictional development thus shifts back and forth between mental wandering and focused thought. This back and forth shift is pretty much what we do during

much of our waking time. Corballis suggests that it creates an even split between focused and wandering thought.

Mind wandering occurs within what's called the default-mode network, which is composed of various brain regions that aren't involved in regulating sensory/motor functions. Think of the diffuse activity in a small town. People are carrying out their normal tasks when a noisy event occurs. Those who can temporarily leave their tasks do so to see what occurred. The rest of the community continues on with what they were doing, but the overall activity is now briefly centralized around the noisy event, and it's reduced elsewhere. People gradually wander back to what they were previously doing (perhaps telling others about the event) and things go back to normal. The default-mode network can thus be easily and temporarily distracted, an advantage for an alert brain that needs to process many challenges. The comedian Steven Wright put it, "I was trying to daydream, but my mind kept wandering off."

Nighttime Mind Wandering

Conscious activity periodically leaves us, and especially for an extended period at night. A night's sleep is commonly divided into 1.5 hours of REM sleep (rapid eye movement, or dreaming sleep) and the rest in non-REM sleep (NREM). NREM sleep is thought to consolidate learned material and memories. Think of periodically taking one's car in to get its parts and systems serviced.

REM sleep occurs about every 90 minutes, and it also activates the default-mode network. The length of dreaming increases as the night increases, and also as we get older. Narratives enter into dreams at about seven years of age. Dreams are much less about consolidating and contemplating than is NREM sleep. In most people, dreams become explorations of mostly visual phenomena. Yearnings and fears can dominate. The prefrontal cortex is fortuitously deactivated during dreaming to keep us from acting out our dreams, many of which are positive and upbeat. Ted Geisel, the author of the Dr. Seuss books, suggested that, "You know that you're in love when you can't fall asleep because reality is finally better than your dreams."

External Mind Wandering

We've evolved to periodically escape the complexities that dominate the here and now. Mind wandering is the internal version, and the varieties of play comprise the external. Play is the opportunity that we and others have to observe our mind wandering. Play is antic in that others may find our behavior strange, but it's something that we find enjoyable from childhood on. Play can involve childhood explorations of what to do with legs/body/arms, or adults paying a lot of money to watch a ballet company explore the greater complexities of legs/bodies/arms. We call football sequences *plays* but they're actually well-rehearsed sequences designed by coaches who don't *do the plays*. Well, maybe they did play when they imagined what might occur if this player did this and that player did that.

Whatever. Mind wandering isn't a waste of time. We have occasions when we need to attend carefully to a task, but we've also evolved to day-dream and night-dream and to mentally wander off briefly during a lot of occasions in between. It's irrelevant whether mind wandering results in creative developments that will change society or only provides a

bit of imaginative enjoyment or concern. It's evolved to be an integral part of who we are. That's enough.

Reference

Corballis, M. (2015) *Mind wandering: What the brain does when you're not looking.* Chicago: University of Chicago.

Part 2: Internal Elements: Underlying Neurobiology

Research in cognitive neuroscience has helped us to develop an understanding of what is going on inside a brain that is experiencing pleasure. The three chapters of Part 2 explain the molecular and systems organizations that our brain uses to enhance our body/brain's survival. The chapters provide useful insights along with underlying theory about how to make learning more joyful.

Quoting from the beginning of chapter 6:

> "Education is discovering the brain and that's about the best news there could be… Anyone who does not have a thorough, holistic grasp of the brain's architecture, purposes, and main ways of operating is as far behind the times as an automobile designer without a full understanding of engines." (Leslie Hart. *Human Brain, Human Learning*.)

Quoting from chapter 7:

> Scientists formerly believed that the release of the neurotransmitter dopamine caused us to feel pleasure when we achieved a goal or finished a task. The "dopaminergic pathway," part of the medial forebrain bundle, was previously referred to as the brain's "reward system." The latest research by Panksepp, Kent Berridge, and other affective neuroscientists shows that the release of dopamine actually causes us to experience anticipation, excitement, desire, arousal, and the need to pursue and search. Dopamine increases our general level of arousal, inquisitiveness and goal-directed behavior. The release of dopamine makes us become excited when we believe we are about to get what we desire. This is generally a good feeling of enthusiasm. Panksepp also notes that the system seeks, and is attracted to, novelty, the anticipation of having fun, playing, and winning (achieving success). This SEEKING System is believed to generate and sustain curiosity and motivation.

Quoting from chapter 8:

> The vagus nerve is the longest cranial nerve in the human body. It begins in the brain stem, and its connections with all body organs helps to regulate them. In his educationally significant article, Polyvagal Theory, Stephen Porges (April, 2009) suggests that in mammalian species, the vagus nerve evolved through three distinct stages that support essential behaviors, including those that enhance the levels of satisfaction and joy we feel in learning.

Chapter 6

The Biology of the Joy of Learning

Pat Wolfe
Consultant: The Educational Applications of Brain Research

> "Education is discovering the brain and that's about the best news there could be… Anyone who does not have a thorough, holistic grasp of the brain's architecture, purposes, and main ways of operating is as far behind the times as an automobile designer without a full understanding of engines." (Leslie Hart. *Human Brain, Human Learning*.)

Although our brain is capable of many amazing things, its main purpose is to enhance our survival by rewarding us for doing those things that help to keep our species alive. Understanding how a brain and its reward system functions is thus critical to understanding human learning and behavior.

The Reward System

Sensory input begins a neuronal process that can eventually lead to such behaviors as playing a musical instrument, kicking a soccer ball, solving a difficult problem, or creating stories and artistic expression. Electrical and chemical signals allow such brain cells to continually and rapidly communicate. Simply put, stimulated individual neuronal cells that reach an appropriate response threshold send electrical signals down extended branches (axons). These axons branch at their terminals and release messenger chemicals (neurotransmitters) that then can activate the receiving neuron at a tiny gap called a synapse.

One neuron can communicate with thousands of other neurons. This interconnection results in the formation of large neuronal networks that can store and transmit information.

To learn something results in the development of memory networks that store and use the information. The mechanism for this storage and retrieval is an active but still poorly understood research topic.

The continued ease of the retrieval of resulting memorized information depends on the frequency of a network's use. Some learned behaviors are more likely to be repeated than others. For example, the basic moves in a repeatedly played computer game or in riding a bicycle can become automatic, although they were initially mastered consciously. The neural connections for these automatic behaviors are strong (and are often called "hardwired"). Conversely, the connections for a foreign language learned in high school but seldom used later in life may weaken over time. Our interest in the mastery and the amount of the network's use plays a major role in whether or not a memory network will continue strong.

The Natural Molecular System

Satisfaction and joy also have a molecular basis within our brain's approximately 50 neurotransmitters. Several of these neurotransmitters provide a natural system that creates and strengthens memory connections. The natural molecular systems use such neurotransmitters as glutamate, GABA, acetylcholine, dopamine, histamine, norepinephrine, epinephrine, and serotonin. This chapter will focus specifically on dopamine.

The “pleasure center” or “reward pathway" are the terms commonly used to identify innate brain systems that strongly influence learning and behavior (Kringelbach, 2009). The systems exist in the Ventral Tegmental Area (VTA) and the Nucleus Accumbens (NA) that are located deep within both brain hemispheres. The VTA and NA were both formerly thought to mainly play the central role in reward, pleasure, and addiction, but they may also play a related positive anticipatory role in problem solving. That relationship will be explained in the next chapter of this book.

The VTA and NA release a natural (or innate) neurotransmitter called dopamine when we engage in a behavior that increases our search for and consequent chance of survival. Dopamine causes us to feel good and so it makes it likely that we'll repeat the current successful behaviors. Recreationally used drugs such as cocaine and heroin also cause (or, in some sense, trick) the reward pathway to release dopamine and so often result in addiction.

In order to survive, the members of a species must carry out such vital functions as eating and reproducing. Pleasant social interactions also appear to be vital as we have a better chance of survival within a group than in living alone (Sylwester, November, 2015). All these actions result in an increase in the pleasurable sensation created by the release of dopamine and so they increase the chances that they will be repeated. We are thus literally rewarded for carrying out these vital life functions.

The Joy of Learning

So what do the functions of the reward pathway and its release of dopamine have to do with the joy of learning? Our brain's frontal lobes have an abundance of dopamine receptors. These lobes control much of our cognitive functioning, and especially problem solving. It should thus not be a surprise that dopamine is released when students are successful when learning and in their consequent ability to solve problems. Further, students are motivated to continue the behaviors that the good feelings caused. Motivation, learning, and problem solving are survival issues. Throughout evolution, the brains of humans and other animals that were successful in learning and problem solving had an increased chance of survival.

This dopamine release can be easily observed when children take their first steps and a big smile lights up their faces. Teachers are familiar with the same facial expression when a student says, “I figured it out!” or when the puzzle of reading begins to be solved. How happy teachers and parents are when children become excited by learning. I recall my own dopamine release when my ten-year-old grandson informed me he was tired of the rides at the fair and wanted to know if we could go to the library. As parents and educators, that joy of learning is also our challenge and our ultimate goal.

Many of the chapters later in this book provide examples of activities and programs that activate the feelings of satisfaction and joy that learning enhances.

References and Resources

Hart, L. (1983). *Human brain, human learning.* New York: Longman.

Kringelbach, M. (2009). *The pleasure center: Trust your animal instincts.* Oxford University.

Sylwester, R. (November, 2015). Non-kin collaborations and complex projectiles. *IAE Newsletter.*

Wolfe, P. (2010). *Brain matters: Translating research into classroom practice.* 2nd ed. Alexander, VA: Association for Supervision and Curriculum Development.

Wolfe, P., & Nevills, P. (2009). *Building the reading brain, PreK-3*. Thousand Oaks, CA: Corwin.

Chapter 7

Increase Student Learning by Activating the Brain's SEEKING System

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How can teachers leverage students' intrinsic motivation to maximize engagement and learning? The emerging field of affective neuroscience suggests that intrinsically motivated behaviors are actually exploratory behaviors. The brain has a natural "SEEKING System," described by neuroscientist Jaak Panksepp as a primary emotional processing system that energizes our behaviors and attitudes (Panksepp & Biven, 2012). The SEEKING System prompts us to eagerly anticipate, and ultimately to find the things we need for basic survival, such as food, a mate/companion, and shelter. It is the instinctual drive that all mammals need in order to survive and thrive. It generates the enthusiasm that underlies all positive motivation and keeps us intensely interested in exploring our world. The SEEKING System plays a key role in learning and making connections as it helps create anticipatory eagerness – including a thirst for knowledge. In our recently published book, *The Motivated Brain: Improving Student Attention, Engagement and Perseverance,* Gayle Gregory and I provided suggestions for teachers on how they might harness the power of their students' intrinsic motivation to make learning fun, engaging, and meaningful (Gregory & Kaufeldt, 2015).

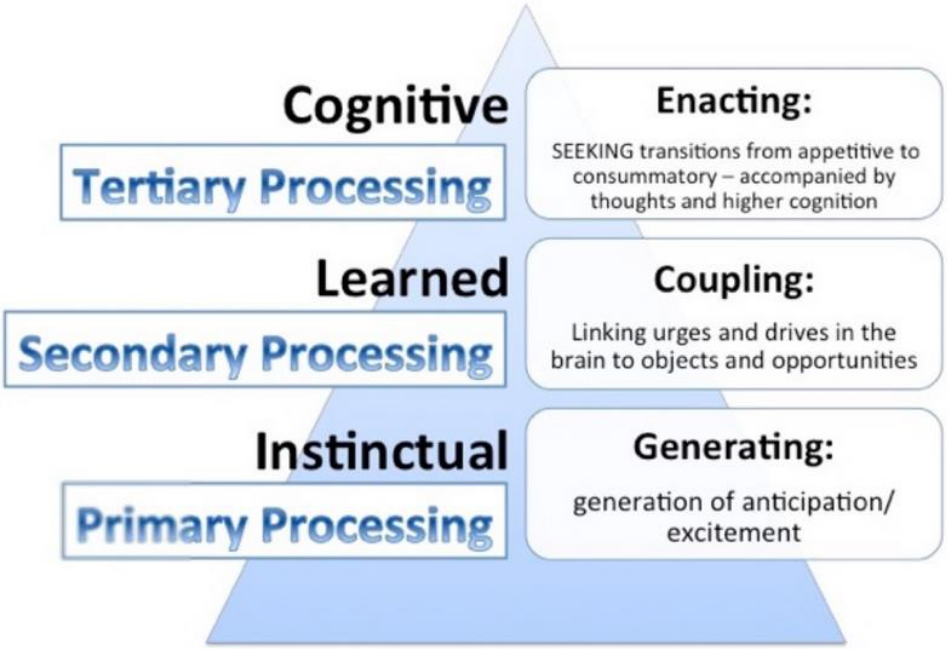
Scientists formerly believed that the release of the neurotransmitter dopamine caused us to feel pleasure when we achieved a goal or finished a task. The "dopaminergic pathway," part of the medial forebrain bundle, was previously referred to as the brain's "reward system." The latest research by Panksepp, Kent Berridge, and other affective neuroscientists shows that the release of dopamine actually causes us to experience anticipation, excitement, desire, arousal, and the need to pursue and search. Dopamine increases our general level of arousal, inquisitiveness and goal-directed behavior. The release of dopamine makes us become excited when we believe we are about to get what we desire. This is generally a good feeling of enthusiasm. Panksepp also notes that the system seeks, and is attracted to, novelty, the anticipation of having fun, playing, and winning (achieving success). This SEEKING System is believed to generate and sustain curiosity and motivation.

Once we have "found" something needed, useful, or interesting, we become satisfied and temporarily stop further seeking. The latest research shows that it is the opioid system and the release of endorphins and endo-cannabinoids (separate from dopamine) that makes us experience pleasure and feel "rewarded." According to Pecina and Berridge (2013) the dopamine system is the "wanting" and the opioid system is the "liking." The wanting system gets us into action and the liking system makes us feel satisfied and to temporarily stop seeking. Recent research shows that the dopamine system is stronger than the opioid

system. We seek more than we are actually satisfied. The journey may in fact be more enjoyable and satisfying than reaching the destination.

The SEEKING System and Its Three Distinct Processing Levels

The SEEKING System has three distinct processing levels (Wright & Panksepp, 2012). Understanding how each one works may be of great help to classroom teachers who want to motivate students and promote engagement. The most basic is called the Primary Processing System. This instinctual system coordinates all incoming sensory information and generates an urge to see which such resources are available. When interactions with objects begin and discoveries are made, the Secondary Processing System launches and learning begins. The Tertiary Processing System is the most advanced level of thinking and learning. It is at this level that we SEEK knowledge and answers to higher-level complex questions. Each of these levels is an integral part of the learning process.



Primary Processing (First Level)

The very basic emotions emerging from deep within the brain that are instinctual, ancestral "memories" are what all mammals need in order to survive and are the essence of the Primary Processing System. Enthusiasm and anticipation are generated as we explore the environment for possible resources and anything that might bring pleasure. These urges (also referred to as anoetic consciousness) motivate us to seek out, find, and acquire all of the resources we may need to survive – without any prior learning. It is the inner drive that keeps us enthusiastically investigating our environment. We are particularly attracted to anything novel or threatening in the environment. Beyond meeting our basic needs and

without any expectation of rewards, we vigorously explore everything and everyone around us in order to make sense of our environment.

How might educators use the Primary Processing Level of the SEEKING System to promote motivation that results in student engagement? The answers are not new to us: Orchestrating an enriched learning environment that encourages exploration, movement, and investigations. Opportunities for unstructured discovery play are imperative at the younger grades and may also be key factors to engage older students. Students need time to explore materials, realia, artifacts, and real problems, as well as opportunities to make choices. This exploration time can be enhanced when students get to collaborate and share ideas. Educators must be vigilant about keeping up with novel experiences. "When a stimulus ceases to be novel (when the animal becomes accustomed to it) the SEEKING system no longer responds" (Panksepp & Biven, 2012).

Secondary Processing (Second Level)

The foraging and exploration generated by the SEEKING System at the Primary Processing Level ultimately produces interactions with the environment. Our brains begin to make new dendritic connections when we experience an "AHA!" moment as resources are found and we are rewarded with nourishment, pleasure, play, social interactions, and new knowledge. The brain begins to learn that certain conditions and cues may be worth investigating because it remembers the results from past interactions. This appetitive motivation and goal-oriented behavior occurs when the brain couples new experiences to memory schemas and seeks to recreate the reward or experience. Now the generalized SEEKING System begins to anticipate possible rewards and resources and becomes consummatory. Noetic consciousness is when we begin to develop an understanding about our world. When an experience gets intense enough or proves to be of value, we can describe and reflect on it. This "recognized awareness" is the beginning of the learning process.

If educators apply this understanding to the design of learning environments, it is possible that students may experience greater anticipation and motivation by making connections to prior learning. Encourage the Secondary Processing Level of the SEEKING System to engage by discussing new learning experiences, making a connection to prior learning, discovering relevance to students' daily lives, and creating sustained anticipation and interest.

- Make a connection to what students already know and have an interest in.
- Offer opportunities to socialize and connect with others.
- Provide a "call to action" to help others or the planet (to CARE).

Brains are growing and making connections as we are adapting to the environment, maximizing resources, understanding patterns, and developing memories. Making sure that students see connections to prior learning will spark the SEEKING System to attend and engage. Using metaphors and analogies helps students to compare elements of the new experience to aspects that are like previous concepts they have already learned. Additionally, curriculum content must be relevant, meaningful, and seem important to the

learner. The brain may interpret topics as worthless of pursuing if they appear meaningless, irrelevant, and not connected to students' everyday lives.

Tertiary Processing (Third Level)

The SEEKING System's Primary Processing Level urges are instinctual, unconditioned, and survival-based. The Secondary Processing Level makes connections and true learning begins to take place. In humans, the development of the cerebral cortex allows us to think and make connections at much higher levels. This Tertiary Processing Level is our ability to begin to think beyond the present, imagine, create, synthesize and make cognitively sophisticated plans. This level of SEEKING grows with maturity (Wright & Panksepp, 2012). Executive functions in the neocortex include: making plans, problem-solving, complex thinking, organizing, keeping track of time, strategizing, and combining knowledge and ideas into new possibilities. At the Tertiary Processing Level, brains SEEK answers to big questions, imagine possibilities, and analyze our understanding through meta-cognitive strategies.

How might educators orchestrate classrooms and instruction to promote creative thinking, problem-solving, meta-cognition, and other 21st century skills? Part of the SEEKING System involves the internal thought processes and strategic planning one does as we seek. Thought requires understanding concepts and articulate language. As the human brain seeks, it is constantly comparing incoming data to what is known; always sizing up the situation. When presented with new experiences, students who can swiftly generate strong and useful analogies will be able to make more immediate connections (Sylwester, September, 2013). Helping students "to think like scientists" helps them to learn how to generate hypotheses, gather data, and refine their process. Working on real problems and projects allows students to make predictions, experiment, and seek out solutions. Teach meta-cognitive strategies to encourage self-reflection, analysis, and goal-setting.

Student Motivation & Engagement = Activate the SEEKING System

The essence of natural learning is what biologists call the "perception/action cycle." All organisms have to do two basic things in order to survive: gather information about their environment and themselves (perception), and based on this information, they have to manipulate their environment and themselves, in a way that is advantageous to them (action) (Fuster, 2003). Using metaphors and analogies helps students to compare elements of the new experience to aspects that are like previous concepts they have already learned. In addition to prompting us to enthusiastically search for resources to meet our basic physical and emotional needs, the SEEKING-EXPECTANCY system also allows (urges) us to develop strategic thinking and higher mental processes as we create hypotheses, make predictions, and fine-tune our expectations.

When the SEEKING System is engaged we feel good while we are doing tasks – not just upon their completion. The SEEKING System provides us with continued enthusiasm, interest, and motivation while we are in the midst of processing incoming information that is important for us. Sharing this with our students is imperative. Instead of the focus of a school task being on the completion or the grade, teachers must continue to point out the joyful feelings that come when we are working toward the goal. SEEKING answers, investigating, and researching are all natural instinctual processes in our brains. Providing opportunities to do REAL things, with REAL stuff, in REAL-WORLD situations will

captivate the SEEKING System and will, in turn, stimulate motivation and ultimately student engagement.

"I agree that this system, so important for generating feelings of 'enthusiasm' as opposed to rewarding 'pleasure' needs to be on the radar of educators. If this system can be captivated by teachers, they have done half their job." (Jaak Panksepp, personal communication, March 22, 2014.)

References and Resources

Fuster, J. (2003). *Cortex and mind: Unifying cognition*. New York: Oxford University.

Grandin, T., & Johnson, C. (2009). *Animals make us human*. New York: Houghton-Mifflin Harcourt.

Gregory, G., & Kaufeldt, M. (2015). T*he motivated brain: Improving student attention, engagement and perseverance*. Alexander, VA: Association for Supervision and Curriculum Development.

Gregory, G., & Kaufeldt, M. (2012). *Think BIG, start small: How to differentiate instruction in a brain-friendly classroom*. Bloomington, IN: Solution Tree.

Hallowell, E.M. (2011). SHINE: *Using brain science to get the best from your people*. Boston: Harvard Business Review.

Hattie, J., & Yates, G. (2014). *Visible learning and the science of how we learn*. New York: Routledge Academic.

Panksepp, J., & Biven, L. (2012). *The archaeology of mind: Neuroevolutionary origins of human emotions.* New York: W.W. Norton.

Pecina, S., & Berridge, K. (2013). Dopamine or opioid stimulation of nucleus accumbens similarly amplify cue-triggered "wanting" for reward. *European Journal of Neuroscience.*

Pritchard, R., & Ashwood, E. (2008). *Managing motivation: A manager's guide to diagnosing and improving motivation.* New York: Routledge Academic.

Sylwester, R. (September, 2013). Understanding and mastering complexity: The central roles of the varieties of analogy. *IAE Newsletter.*

Wright, J.S., & Panksepp, J. (2012). An evolutionary framework to understand foraging, wanting and desire: The neuropsychology of the SEEKING System. *Bulletin of the International Neuropsychoanalysis Society.*

Chapter 8

Polyvagal Theory Helps to Explain the Joy in Learning

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The vagus nerve is the longest cranial nerve in the human body. It begins in the brain stem, and its connections with all body organs helps to regulate them. In his educationally significant article, Polyvagal Theory, Stephen Porges (April, 2009) suggests that in mammalian species, the vagus nerve evolved through three distinct stages that support essential behaviors, including those that enhance the levels of satisfaction and joy we feel in learning.

Stage One (Immobilization as Defense)

The most ancient branch of the vagus nerve produces a reaction that conserves metabolic resources by slowing heart rate and lowering blood pressure, often to the point of unconsciousness. Extreme fear immobilizes animals so they can avoid being seen and thus harmed. A mouse will slow its physiological functioning when caught in the jaws of a cat that simply holds it without biting down. The frightened mouse appears dead and may even die if left in that immobile state. If released, the mouse will remain motionless until its internal organs once again function normally, at which point the mouse will rapidly scurry away.

Fear may similarly cause humans to faint, or the mind to go numb and separate emotion and attention from the experience that produces amnesia of parts of the event (Scaer, 2001). When we're cornered or held down by a larger person (such as when beaten or raped), this immobilization mode tends to block some of the event's anguish and pain. Traumatic events such as fighting in a war may have a similar impact. When soldiers see their friends blown up, the freeze reaction unconsciously sets in and the viewer becomes immobilized and often psychologically dissociated. Guilt at not rushing to their friends' defense often plagues survivors even though they had no conscious control over their reactions. Survivors of fearful situations generally need help to understand and overcome the residue of immobilization reactions.

Stage Two (Mobilization as Defense)

Unconscious environmental stimulation can instantly trigger an automatic self-preservation fight or flight response. It's a kill or be killed, a flee or be eaten or beaten response. Awareness may shortly set in and we may wonder why we're running or fighting so ferociously. LeDoux (1996) describes how flight automatically occurs when a rattlesnake is about to strike—we run away before we consciously know what's happening.

Porges explains that a high level of sensitivity results as our nervous system continually processes and evaluates the risk of incoming challenges. This process does not require

conscious awareness and may detect danger before we are consciously aware of the nature of the challenge (Porges, May, 2004).

In school, mild forms of stage two behaviors occur when students “fight” with back talk or oppositional behavior in an environment they consider unsafe. They may avoid others with whom they feel emotionally or socially uncomfortable.

Stage Three (Social Engagement)

In mammals, a unique branch of the vagus nerve evolved to link the heart's neural regulation to the regulation of facial and head muscles. In order for mammals to manage this functional shift, the Polyvagal Theory emphasizes that sensory information from both the environment and our visceral organs travels from our body to our brain, affecting how we respond to the environment.

In contrast to the unmyelinated axon extensions of Stages 1 and 2 that travel from the body to the brain, Stage 3 information also travels from our body to our brain through myelinated (insulated) axons of the vagus nerve. Via cognition, positive or negative self talk, and interactions with others, this system influences our nervous system and produces feelings of either safety or risk. The Poyvagal Theory suggests that positive reciprocal human interactions regulate one another's physiological states and help us to feel safe, maintain our health, and survive by facilitating the regulation of our physiology.

The uniquely mammalian stage three vagus nerve can help us to heal. Consciously engaging neural pathways from the human brain to the body can effectively dampen the visceral reactions of fight or flight. Self-talk can calm our mind so it can assess a situation to determine if danger exists. Learning in an emotionally and socially safe school setting can thus calm our nervous system with components in the body and brain that relax and make social engagement possible.

The Polyvagal Theory emphasizes a hierarchical relation among the three evolutionary stages. The newer circuits of Stage 3 (social engagement) inhibit the older Stage 2 (mobilization) and Stage 1 (immobilization) defensive behaviors. What's interesting and educationally relevant is that Stage 2 defensive mobilization strategies may actually keep us from reflexively using Stage 1 immobilization as a defense as it behaviorally shuts down, dissociates, and possibly causes fainting.

This new way of thinking is perhaps Porges's most exciting insight. Even though self-talk has been valued for many years (Luria, 1961), understanding why self-talk works is a cognitive breakthrough: (1) the mammalian strand of the vagus nerve and its branches are uniquely myelinated; and (2) the Stage 3 mammalian strands link to the muscles of the face and head as well as to internal organs, so we have come to understand that smiles suggest happiness, and that voice rhythm, intonation, volume, etc., reflect types o f emotional communication and contingent social behavior (Porges, April, 2009).

However, if mind and body fail to recognize the environment as safe, the systems will remain in Stage 2 flight-fight readiness. Social engagement will continue to be guarded, oppositional behaviors or withdrawal will be present, and the formation of relationships will only be superficial if they are formed at all (Porges, May, 2004; April, 2009).

Porges (in Eichhorn, 2012) states that unless we can turn off our evolutionarily programmed defense systems, we give up positive access to such social engagement components as benevolence, care, compassion, and shared experiences. This happens because we are stuck in a survival mode, mobilized for defensive states that result in "biological rudeness." The whole aspect of what is gained by being interactive with another person has disappeared. Even in the absence of danger, fear, or trauma, it is extremely difficult to shut off the residue from immobilization trauma or the mobilization of fight/flight behaviors that influence our mind and body, such as seen in post-traumatic stress disorder (PTSD) of victimized adults and children.

From his study of HIV patients and autistic children, Porges (2011) found that caregivers often feel unloved, angered, and insulted because the patient fails to respond with appropriate facial expressions and vocal intonation.

This insight may transfer to relationships between students and teachers, especially when students look away rather than make eye contact or otherwise let teachers know they are engaged. Teachers may try to motivate such students without realizing that they may be suffering from freeze/fight/flight residue that forces them to keep up their guard. Teachers may not like such students, may become angry or aggressive, and may even ridicule and blame them for not caring about learning. Teachers may feel guilty and frustrated without realizing that neither the students' behaviors nor theirs were willful, but rather were attempts by our nervous system to protect the student from further harm, and the teacher from feeling rejection and disappointment.

When our Stage 2 mobilized and Stage 1 immobilized vagus circuits are inhibited by our Stage 3 social engagement system, Stage 3 social communication and the joy that can come from it can be expressed efficiently. Positive teacher/student interactions are thus critical to student learning and teacher successes. Learning becomes a joyful experience.

References and Resources

Eichhorn, N. (2012). Safety: The preamble for social engagement. An interview with Stephen W. Porges. *Somatic Psychotherapy Today*. Retrieved 5/20/2013 from http://www.usabp.org/.

LeDoux, J. (1996). *Emotional brain: The mysterious underpinnings of emotional life.* New York: Simon and Schuster.

Luria, A.R. (1961). *The role of speech in the regulation of normal and abnormal behavior.* Oxford, New York: Pergamon.

Porges, S.W. (2011). 'Somatic perspectives' series: Interview with Serge Prengel. USABP and EABP. Retrieved 5/19/2013 from http://www.somaticperspectives.com/.

Porges, S.W. (April, 2009). The Polyvagal Theory: New insights into adaptive reactions of the autonomic nervous system. *Cleveland Clinic Journal of Medicine*.

Porges, S.W. (May, 2004). Neuroception: A subconscious system for detecting threats and safety. *Zero to Three*. Retrieved 5/14/2013 from http://www.zerotothree.org/.

Porges, S.W. (n.d.). Stephen Porges. Retrieved 5/19/2013 from http://en.wikipedia.org/wiki/Stephen_Porges.

Scaer, R.C. (2001). *The body bears the burden: Trauma, dissociation, and disease*. New York: Haworth Medical.

Part 3: Psychologically Driven Elements

The four chapters in Part 3 explain some psychological aspects of brain functioning. The chapters provide useful initial insight into how to make learning more joyful.

For example, think about humor. What makes you laugh? You don't laugh when you tickle yourself, but you do when something "tickles your fancy". When you hear others experiencing the joy of laughter, you are apt to feel some of the joy and may also laugh.

Humans are social animals. They get enjoyment through participating in group activities. Such group activities often include learning together, playing together, and just plain socializing.

Consider the following quote:

> "In short, learning is the process by which novices become experts." (John T. Bruer; American psychologist and cognitive neuroscientist; from *Schools for Thought: A Science of Learning in the Classroom*, MIT Press, 1993.)

Think about some of your areas of expertise. Likely you find pleasure in having and using the expertise. Learning that leads to usable expertise that one can actually make use of tends to bring joy to the learner. Schools can help students to develop this psychological aspect of gaining and using expertise—and it is applicable to every subject they study in school.

Part 3 also contains a chapter about religion. Children gain their early religious education and values from parents, siblings, and other caregivers. This education may continue through education in church services and/or in schools. For a great many people, religion helps to meet a deep psychological need.

Chapter 9

Humor Adds Neurological, Cognitive, and Physiological Sustenance to Learning

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The comedian W.C. Fields once said that, "I believe in clubs for kids, but only when kindness fails." If you smiled or laughed at that comment, it probably also enhanced the mood of others who observed your reaction. Research on what are called **mirror neurons** demonstratively shows the contagious effects triggered by expressions of humor.

Mirror Neurons

The neuroscientist Marco Iacoboni discovered that we and some primates have mirror neurons in our premotor cortex and inferior parietal cortex that activate both when we perform certain actions and when we observe someone else performing them (Iacoboni, 2009). Neuroscientist Michael Gazzaniga observed that, "Not only do we unconsciously copy the mannerisms of others, but we like and have smoother interactions with them when they copy our mannerisms. Reflexively, a connection is formed, and we tend to 'like' people who are similar to us" (Gazzaniga, 2011). Humor increases the essential educational elements of rapport, enhanced trust, and collaboration within a classroom. This is especially applicable if students work in groups. Beginning your class with humor and sprinkling humor throughout the day thus creates a trusting collegial atmosphere.

The Use of Classroom Humor

Humor is holistic. Appropriately used, it can serve as a tremendous teaching tool (Trout, 2013). Its purposeful cultivation can nourish both effective teaching and learning (Morrison, 2012). Think of it as a skill that can be practiced and enhanced. Ziv (1988) discovered that when teachers were trained to use humor in their classroom—even as few as three times per lesson—learning increased by almost 15 percent, and continued throughout the entire semester.

My door opens, students arrive, and they prepare for class. They look up at the screen to see a one-minute humorous video segment, a recent cartoon, or a quote like the one that started this article. They laugh. Even the act of dimming the lights for the daily humor-starter typically prompts a smile. Now they are ready to learn. Research shows how the feel-good neurotransmitters dopamine, endorphins, and serotonin are all released when their smiles flash across their faces (Lane, et al., 2000).

Dopamine, the neurotransmitter most closely linked with humor, is often considered the brain's reward chemical. That's why it is linked to motivated learning and attention. The serotonin release brought on by their smiles lifts their moods (Karren, et al., 2010). Smiles also release neuropeptides that work toward fighting off stress. This not only relaxes their bodies, but it can lower their heart rate and blood pressure (Seaward, 2013). Humor is an

educational elixir we can all include in our classrooms. The most effective teachers already do so.

I do most of my work in groups, but even lecture-based teachers can improve retention and learning with humor. More than 500 students at San Diego State were enrolled in what they thought was a normal introductory psychology course on Freudian personality theory, but different students attended different kinds of lectures (Kaplan and Pascoe, 1977). One lecture incorporated humor relating to the course content. A second lecture incorporated humor that wasn't related to the material but still kept students entertained. And a third lecture used no humor at all, only a serious treatment of the subject material. When the researchers tested students' retention six weeks after the lectures, they found that those who attended the two sets of lectures that used humor related to course content scored significantly higher than the other students.

Humor doesn't just improve learning and engagement, it may even make us smarter. Consider the results of the following research on humor and problem solving (Isen, et al., 1987). One hundred and sixteen students at the University of Maryland were divided into four groups and then told to complete a problem-solving task. Prior to the task, each group received a different intervention. The first group watched a compilation of funny bloopers. The second group watched a five-minute documentary on Nazi concentration camps. The third group watched a math film. The fourth group had a choice of relaxing, snacking, or light exercise.

Each of the above manipulations was intended to affect mood but only one was meant to elicit laughter. The following task, called the Drucker candle insight task, followed the intervention. Each subject received a box of tacks, a candle, and a book of matches. They were then asked to attach the candle to the wall so that it burns without dropping wax on the floor. (Pause here if you want to suggest a correct response.)

The solution: Attach the empty box to the wall using one of the tacks and then use wax or another tack to secure the candle atop the box. What makes this task challenging for many people is functional fixedness—the inability to view the box as serving any purpose other than holding the tacks. The candle doesn't have to be directly attached to the wall. And boxes can do more than just hold small objects.

Only 32 of the 116 subjects suggested a correct solution. The only one of the four groups with a success rate better than 30% was the group who had been shown the funny bloopers; this group had a 58% success rate.

Humor quickly gets to the essence of understanding and diffusing complex issues (Sylwester, 2013). It engages parts of the brain needed for critical thinking. Test your insight with this short activity. Decipher what word goes together with this three-word group: Cottage, Swiss, Cake. In the remote semantic association test you get 15 seconds to figure out that "Cheese" is the answer. The test gets progressively more difficult. Time yourself to see if you can do the following grouping in 15 seconds: Tooth, Potato, Heart. If you answered correctly, you are uncommon, as less than one in five gives a correct response (I'll provide the correct answer below). Subjects at Northwestern University who were in a good mood at the time solved more of a set of similar problems successfully, and they also engaged a specific part of the brain called the anterior cingulated (Karuna, et al., 2008).

A positive mood improves focus by helping the anterior cingulate hold back unwanted responses such as "ache" with tooth, "eye" with potato, and "attack" with heart. You arrive at the correct answer "sweet" sooner when you're in a good mood (sweet tooth, sweet potato, and sweetheart). Watson, Matthews, and Allman (2007) suggest that both the dopamine centers and the anterior cingulate are active in humor. The funnier the jokes, the more engaged the anterior cingulate.

Insight isn't the only complex cognitive skill that benefits from humor. One study showed that reading funny jokes also improves student scores on creativity tests, reflecting increased mental fluency, flexibility, and originality (Ziv, 1976). Finish your class with a laugh or smile. The peak-end rule suggests that we tend to judge our experiences by how we felt during the peaks and ends. Teachers who finish their lessons with a cartoon, joke, or funny clip prepare students for emotional engagement in the next class. Our minds need emotional engagement just like they need exercise. Without that engagement, we become passive to our environment. **Learning is a game, so let's play.**

References

Gazzaniga, M. (2011). *Who's in charge: Free will and the science of the brain.* New York: Harper Collins.

Iacoboni, M. (2009). *Mirroring people: The science of empathy and how we connect with others.* New York: Picador.

Isen, A., Daubman, K., & Nowicki, G. (1987). Positive affect facilitates problem solving. *Journal of Personality and Social Psychology,* 52:6, p. 1122-1131.

Kaplan, R., & Pascoe, G. (1977). Humorous lectures and humorous examples: Some effects upon comprehension and retention. *Journal of Educational Psychology,* 69:1, p. 61-65.

Karren, K., Smith, L., Gordon, K., & Frandsen, K. (2010). *Mind/body health: The effect of attitudes, emotions and relationships.* New York: Benjamin Cummings.

Karuna, S., Kounios, J., Parrish, T., & Jung-Beeman, M. (2008). A brain mechanism for facilitation of insight by positive affect. *Journal of Cognitive Neuroscience,* 21:3, p. 415-432.

Lane, R., Nadel, A., & Kaszniak, A., eds. (2000). *Neural correlates of conscious emotional experience.* In *Cognitive neuroscience of emotion.* New York: Oxford.

Morrison, M. (2012). Creating an appropriate 21st century education: The top 10 reasons why humor is fundamental to education. *IAE Newsletter.*

Seaward, B. (2013). *Managing stress: strategies for health and well being.* 8th ed. Burlington, MA: Jones and Bartlett Learning.

Sylwester, R. (2013). Understanding and mastering complexity: The role of caricature. *IAE Newsletter.*

Trout, S. (2013). Understanding and mastering complexity: The complexity of humor. *IAE Newsletter.*

Watson, K., Matthews, B., & Allman, J. (2007). Brain activation during sight gags and language-dependent humor. *Cerebral Cortex,* 17, p. 314-324.

Ziv, A. (1988). Teaching and learning with humor: Experiment and replication. *Journal of Experimental Education,* 57:1, p. 5-15.

Ziv, A. (1976). Facilitating effects of humor on creativity. *Journal of Educational Psychology,* 68:3, p. 318-322.

Chapter 10

Group Productivity Enhances Joyful Learning

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A Modest Beginning

Those Monday after school faculty meetings were a real drag, and so you can imagine how we felt when our principal announced, "Kathy from our middle school is going to discuss the merits of cooperative learning" at 5 pm. Notwithstanding, she was enthusiastic and eloquent as she expounded on the benefits and some of the strategic elements during her fifteen-minute presentation.

My walks down the hallway in the following months revealed clusters of students working cooperatively on assignments in a few classrooms. I decided to try this approach to teaching and learning, and so had my chemistry students put their desks together to complete fifteen-minute tasks from time to time. They worked in an industrious manner, perhaps finding the group work to be novel. I wasn't sure about cognitive gains but saw it as a nice change of pace from my being the center of attention the entire period.

As with many educational innovations, the number of teachers using cooperative learning in our school diminished. Over time, however, I began to see value in it. I routinely made use of cooperative short worksheet assignments after a presentation. As a chemistry teacher, collaboration was normal because students were paired in the laboratory and thus were accustomed to the cooperative mode about twice per week while manipulating apparatus, collecting data, as well as retrieving reagents or weighing samples.

After a student remarked sarcastically that it would be nice to do graded quizzes in a collaborative manner, I followed suit and arranged for such a process in groups of three. In time, all quizzes were done in this manner. Either distributed around the lab stations or in desk clusters around the room, students were noticeably engaged and never balked when quizzes were given. Furthermore, as you would expect, the grades were considerably higher than were grades from individual attempts.

I became particularly sensitive to the cognitive gains in this area and established a collaborative 'how to' agenda that explained the value of teamwork and how everyone benefits from the process. Only in rare instances would a student complain that classmates were not collaborating. I would typically see three-person modules with heads hunched over, in close proximity, sharing wisdom to derive answers.

I found this method very beneficial and that it could be done up to three times per week. It provided a comprehensive and considerably faster review of homework compared to doodling at the board. More importantly, cooperative quizzes amplified engagement considerably and the long-term effect manifested in a better understanding of the curriculum. Scores on unit tests and final exams increased. Further, the stronger students

received praise for their leadership and everyone derived a feeling of inclusiveness. As an educator I was particularly pleased because significant engagement occurred and with it a universal sense of ownership of my content area.

Recent Research Has Revealed Why I Had Success in this Area

Why did my students flourish in this setting? Brain scans have elucidated the profound effects of socialization on different regions, particularly memory. Here are a few recent studies.

1. Brains Synchronize

Greg Stephens and Uri Hasson, Professors of Psychology at Princeton University, used functional magnetic resonance imaging (fMRI) to scan the spatiotemporal brain of people as they *read a* story into a tape recorder. The researchers then scanned people that *listened* to the recorded story. What they found was that the listeners' brain pattern mirrored the speaker's. In some cases it coincided perfectly, as if the listener was anticipating the words. The experimenters found that those research subjects who demonstrated higher comprehension of the narrative had remarkably similar scans, or what they referred to as high neural coupling. Stephens and Hasson concluded that coupling crossed many brain areas "aligning with phonetic, phonological, lexical, syntactic, and semantic representations as well as processing social information crucial for successful communication, including, among others, the capacity to discern the beliefs, desires, and goals of others".[1]

2. Face-to-face Proximity Amplifies

A team from Beijing Normal University investigated the neural consequences of face-to-face communication by comparing brain scans with Functional Near-Infrared Spectroscopy (fNIRS). Four male–male pairs and six female–female pairs were each scanned during four task sessions sitting: (1) face-to-face with dialog, (2) face-to-face with only one speaker, (3) back-to-back with dialog, and (4) back-to-back with only one speaker. They found a significant neural synchronization increase in the left inferior frontal cortex, or language and sound processing center, only in the face-to-face dialog scenario.[2]

3. Eye Contact Sets Off Neuronal Activity

The midbrain's amygdala receives a vast array of sensory signals from the environment and makes determinations that have emotional contexts based on potential threat. By targeting 318 individual neurons in the amygdala of three Rhesus macaques, Katalin Gothard, a neurophysiologist at the University of Arizona in Tucson, noted that twelve percent selectively changed their firing rate when the subject fixated on the eyes of monkeys in movies. They contend that most amygdala neurons are category-selective in that they respond differently to monkey faces, human faces, and objects. The human context is that we process another's gaze as the first line of information by eye-sensitive amygdala neurons about external cues such as objects, events, and individuals, along with internal cues like emotions, beliefs, desires, and intentions. From the classroom perspective, students build trust and friendship with teammates with a repetition of this instructional technique.[3]

4. Rapid Communication Promotes Productivity and Camaraderie

Dr. Alex Pentland, computer science professor at the Massachusetts Institute of Technology, used a small device (about the size of a cell phone) called a sociometer,

strapped over a person's shoulder, that captured an assortment of data from infrared, sound, and movement detectors. The combination of signals from the sociometer were received by a computer and quantified to derive what Pentland calls honest social signaling. From a compilation of a group's workday data using mathematical algorithms, an assessment of the company's network intelligence was compiled. They amassed data from hundreds of participants from many venues and found that groups are at peak productivity when they:

- Accrue a large number of ideas: many short contributions rather than a few long ones;
- Their interactions include responsive comments (such as "good," "that's right," "what?" etc.) to validate or invalidate the ideas and build consensus; and
- Accumulate a diversity of ideas and reactions. [4,5]

Improving the Model

Sensing that collaborative work was having a significant effect on the achievement level of my students across the board, I built a pedagogy that apportioned time for group work. At the start of the school year I stressed the value of collaborative learning and established guidelines that emphasized camaraderie and task efficiency. Furthermore I developed a script of comments that students could use to guide their work 'statements' and asked them to develop their own script that encouraged member participation. I also monitored their progress and made recommendations. In time, the groups became autonomous and productive. Students simply liked being in the collaborative setting to complete a wide array of tasks.

Take It to Another Level

- Eventually, students worked collaboratively not just on quizzes but also on test review guides coupled with student-led chalkboard explanations.
- The most daring application was eliminating the one month teacher-led review before the Advanced Placement Exam and replacing it with an almost exclusively team collaboration using well-crafted review guides and even laboratory experiences. Scores on that national test went up across the board.
- Laboratories were done in pairs but teams could check with other classmates on data collection and interpretation. I incorporated more elaborate experiments to accommodate this full-range collaborative lab work.
- Students made group presentations to the entire class on a wide array of tasks and topics.
- In some courses, students took their final exam in a team format.
- Many students from the poorest demographic in the Milwaukee area came to my weekly after-school mentoring program, and improved their academic performance in their school through tutoring and social interactions with my students.

I saw young people who were relaxed, smiling, encouraging one another to understand the material fully, and employing a full range of prosody and gestures not observed in row settings. In general, they were completing tasks and having fun with their peers expressing ideas without fear, able to ask questions that they might not offer in the teacher directed situation. It was participation to the highest degree.

Did I Abandon Lecturing?

No. It continued to be the starting point for many lessons, but expedited within a time window that allowed students to attend to other tasks individually or in groups for the rest of the period. Anticipating a collaborative element, students were very focused during the teacher presentation to assimilate core knowledge for the subsequent tasks. Moreover, students developed a greater respect for me because they recognized that I trusted them to manage their learning and goals. Whole period lecturing was no longer a common occurrence.

The American education system is often criticized these days, and blame is distributed to many parties. In my judgment, using strict autocratic means to control behavior by maintaining equidistant rows minimizes content area mastery and favors the auditory-able students. I found that this pedagogy was labor intensive and did not take into account the full range of learning styles of my students as well as any discipline concerns brought on by monotony. Building a strong collaborative system changed all that, and bolstered the comprehension, enjoyment, and achievement levels of everyone in the class.

My colleagues were good content area facilitators but many petered out of the collaborative realm because they were accustomed to the chalk-and-talk methods experienced in their formative years. I hung on in the early going because collaborative learning seemed to be a good way to break up the tedium for both the students and myself. However, it was extended so that they could experience nearly full control of the learning atmosphere and pace of the lesson. They were rewarded with the enjoyment that goes with brain enhancement accompanied by socialization and eye contact. They liked coming to chemistry class. It was a risk worth taking and I hope my colleagues will do likewise. Research supports it.

References

1. Stephens, G.J., Silbert, L.J., & Hasson, U. (2010). Speaker-listener neural coupling underlies successful communication. *Proceedings of the National Academy of Sciences of the United States of America*. Retrieved 5/11/2016 from http://doi.org/10.1073/pnas.1008662107.
2. Jiang, J., Dai, B., Peng, D., Zhu, C., Liu, L., & Lu, C. (November, 2012). Neural synchronization during face-to-face communication. *The Journal of Neuroscience*.
3. Mosher, C., Zimmerman, P., & Gothard, K. (2014). Neurons in the monkey amygdala detect eye contact during naturalistic social interactions. *Current Biology*.
4. Pentland, A. (2008). *Honest signals: How they shape our world*. Boston: Bradford.
5. Pentland, A. (2014). *Social physics: How good ideas spread—The lessons from a new science*. USA: Penguin.

Chapter 11

Joy in the Vision: The Joyful Knowledge in Religious Learning

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This book explores various aspects of joyful or positive experiences associated with "learning." Caine and Caine (January, 2016) define "learning" as making sense of experience and developing capacities to act. Part 2 explored the bioneurological components of joy in learning or motivational and achievement aspects associated with joy in learning. The unique role of this current chapter is to survey briefly the perspectives of various religions on joy in learning, and to propose some relationships between religious dimensions of joy in learning.

The concept of "joy" or happiness is prominent in religious learning and experiential contexts. This can be thought of as a type of intrinsic motivation. The religious sense of "joy" is not just "enjoyment" of a momentary activity, but a larger sense of joy as well in persisting through obstacles on the way toward the goal. Joy in learning within the religious context is associated with "big picture" joy, a deeper and more profound joy, an overarching personal investment in and commitment to moving toward an autonomously-chosen higher goal.

Joy in Eastern Religions

A general sense of "joy"—happiness, blessedness, well-being—is associated with religious experience and learning that may be found across the religious spectrum. The character of this "joy" does take on different nuances in the various religious traditions. In the major world religions of the East, "joy" is generally associated with learning to interpret and transcend this present material world of illusion and pain. Hinduism holds that the activities of our human senses cause attachment to material things, resulting in anger, delusion, and suffering. The purpose of spiritual activity is to turn our mind inwardly from sensory objects, so that our mind/ego can be dissolved in an endless state of bliss. This state of bliss or deep spiritual joy arrived at through inward focus and insight is called "ananda" (see http://hinduwebsite.com/).

Buddhism holds that "mudita" or "empathetic joy" is that attitude of selfless rejoicing in the happiness of another. As one reflects on what has happened and the happiness resulting from it, one can apply that knowledge gained through reflection to one's own actions. This is the most difficult to practice of the four "immeasurables" or sublime attitudes in Buddhism, the practice that enables one to experience past and future in an enlightened manner that avoids suffering and encourages peace and happiness in the present. The practice of these meditative "immeasurables" likens one's mind to that of the loving gods.

The general approach of these major Eastern religions is to overcome the material world and individual attachments through enlightened thought and practice. A deep joy and sense of tranquility can be found (using Hindu imagery) in ultimately transcending individual physical being through the "atman" (individual soul or self) to become one with the "Brahman" (the all-embracing soul or self).

Joy in Western Religions

In the Western Abrahamic traditions, joy/happiness/pleasure correlate with a sense of fellowship with God and obedience to his commands.

Judaism, the earliest of the Western religious traditions, associates spiritual happiness with knowing and keeping the covenant will of God.

The Hebrew term "baruch," usually translated "blessed," has the sense in English of "happy," "joyful," "blissful," "fulfilled." Psalm 1 from the Old Testament (KJV), for example, declares: "Blessed is the man that walketh not in the counsel of the ungodly, nor standeth in way of sinners, nor sitteth in the seat of the scornful. But his delight is in the law of the Lord; and in his law doth he meditate day and night." The joyful blessedness of learning God's law and living one's life in the light of that law is the central theme of the Jewish faith.

The Western religious tradition of Islam reflects the influence of both Judaism and Christianity. It teaches that humans were created for lasting joy, happiness, and eternal bliss. Suffering is the result of a lack of conscious awareness, while unhappiness is non-alignment with the will and purpose of Allah. According to this tradition, spiritual happiness correlates with being in conscious control of one's life. As one awakens to willful submission to the will of Allah, one realizes true, deep, lasting joy and happiness.

"Joy" is also a very prominent concept in Christianity. It shares with other religious traditions the understanding of joy/happiness/fulfillment as a deeper, lasting reality, rather than just a momentary emotion. Christianity and other religions look forward to an ultimate end-time or transcendent reality of perfect, fulfilling joy, whether that be Brahman, Nirvana, Paradise, or Heaven. The unique element in Christianity is that this deeper, lasting joy or happiness is revealed by God through the teachings of Jesus, and comes to be known in his "Gospel," which is the vision of eternal life with God in his heavenly Kingdom as a pure gift of divine grace.

This teaching of Jesus is in the first instance an objective, public proclamation available to all. However, as the Spirit of God works on the heart and mind of an individual in and through this Gospel message, the learner internalizes this message and makes it his/her own. This internalization of the Christian vision is what Christianity calls "faith," where faith means trusting God for the gift and acting according to that internalized vision. The deep "joy" that one finds in learning of this vision and living by it is much more profound than a momentary "enjoyment" of a particular experience, and it persists through the vagaries and obstacles of daily life. Spiritually speaking, it is the joy of knowing an intimate connection with one's ultimate destiny.

The Relationship to Cognitive Neuroscience

In chapter 7 of this book, Martha Kaufeldt utilizes the research of Jaak Panksepp in suggesting that teachers might, "Increase student engagement by activating the brain's SEEKING System." Panksepp's work explains that the human brain has a natural "SEEKING System" which at a primary emotional processing level "prompts us to eagerly anticipate…the things we need for basic survival…" More than this, however, the SEEKING System "plays a key role in learning and making connections as it helps to create anticipatory eagerness—including a thirst for knowledge."

Dopamine was earlier thought to produce the pleasurable feelings of "reward" for achieving a goal or outcome, but this "reward" phase is now associated with opioids and the release of endorphins. Quoting Kaufeldt from chapter 7:

> According to Pecina and Berridge (2013) the dopamine system is the "wanting" and the opioid system is the "liking." The wanting system gets us into action and the liking system makes us feel satisfied and to temporarily stop seeking.

In short, anticipation of a hoped-for successful outcome is the motivator for present seeking and learning activities, and such anticipation is related in broad terms to feelings of joy, excitement, and eagerness.

The fascinating and promising connection between this recent neurological research and Christianity is that the Christian faith has long understood daily life to be motivated by a hope that envisions and anticipates a big-picture outcome, namely eternal life with God in his heavenly Kingdom. One lives life in the present hopefully, joyfully, eagerly, as one anticipates that final goal and outcome of one's faith. Jesus taught that one's top priority in life should be to "seek first the Kingdom of God and its righteousness" (KJV & NIV, Matthew 6:33). This means that one should anticipate in the present those attitudes and actions that correlate with the ultimate state of affairs in God's coming Kingdom: loving, forgiving, healing, reconciling —in short, all aspects of God's righteousness or goodness.

We may thus conclude that these recent insights into brain functioning and the SEEKING System can be seen to corroborate the religious understanding of the fundamental dynamic operating in human life and history, namely that our attitudes and actions are driven by what we envision and anticipate as a desired outcome. A deep sense of abiding joy, blessedness and fulfillment accompany one's learning about and being motivated by that desired outcome, which in the Christian faith is our ultimate goal and destiny with God in his Kingdom. Commitment to the ultimate outcome enables one to persist in living anticipatorily and eagerly in the face of obstacles experienced along life's way. Jesus proclaimed in the Sermon on the Mount: "Blessed [joyful, happy] are those who are persecuted because of righteousness, for theirs is the kingdom of heaven" (KJV & NIV, Matthew 5:10). And St. Paul writes: "I consider that the sufferings of this present time are not worth comparing with the glory [joy, blessedness, happiness] that is about to be revealed to us…" (KJV & NIV, Romans 8:18).

From the religious perspective, a profound joy, peace and sense of fulfillment comes with learning of God's ultimate purpose and destiny for our lives, which includes and transcends all the penultimate joys of learning and life. This leaves us with the following

issue: Might religious beliefs and cognitive neuroscience discoveries finally be converging to explain something as central to human life as "joy?"

References and Resources

Caine, G., & Caine, R. (January, 2016). *IAE Newsletter*. The problem with defining learning.

KJV & NIV (n.d.). *The Holy Bible*. King James Version and New International Version.

Panksepp, J., & Biven, L. (2012). *The archeology of mind: Neuroevolutionary origins of human emotions*. New York: W.W. Norton.

Pecina, S., & Berridge, K. (2013). Dopamine or opioid stimulation of nucleus accumbens similarly amplify cue-triggered "wanting" for reward. *European Journal of Neuroscience*.

Smith, H. (1991). *The world's religions*. New York: Harper & Row.

Wikipedia (n.d.). Brahmaviharas. Retrieved 6/3/2016 from https://en.wikipedia.org/wiki/Brahmavihara.

Chapter 12

Joy in Gaining and Using Expertise

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> "In short, learning is the process by which novices become experts." (John T. Bruer; American psychologist and cognitive neuroscientist; from *Schools for Thought: A Science of Learning in the Classroom*, MIT Press, 1993.)

This chapter focuses on the joy of a student or a team of students achieving and making use of expertise. Individuals experience joy from being good at something, be it making friends, telling jokes, getting good grades in school, achieving a high level in a computer game, or reading a good book. Meeting face-to-face with some friends and/or spending time texting to friends is a joyful experience for many. Members of a sports team, a musical or other performance group, or a school newspaper staff experience joy through their group participation and individual contributions.

In all of these activities, an individual can gain in expertise—become better at participating and enjoying the participation. Each person has different innate capabilities and limitations. A person's gains in expertise in an area are influenced by informal and formal education, personal drive, intrinsic motivation, extrinsic motivation, and other factors. The joy in gaining and using an increasing level of expertise in an area can be strongly intrinsically motivating.

An Expertise Scale

Understanding and gaining expertise is not just about increasing one's personal levels of joy. Our society depends on students gaining the knowledge and skill (the expertise) they will need to be productive and responsible adults. This chapter makes use of the expertise scale given in Figure 1.

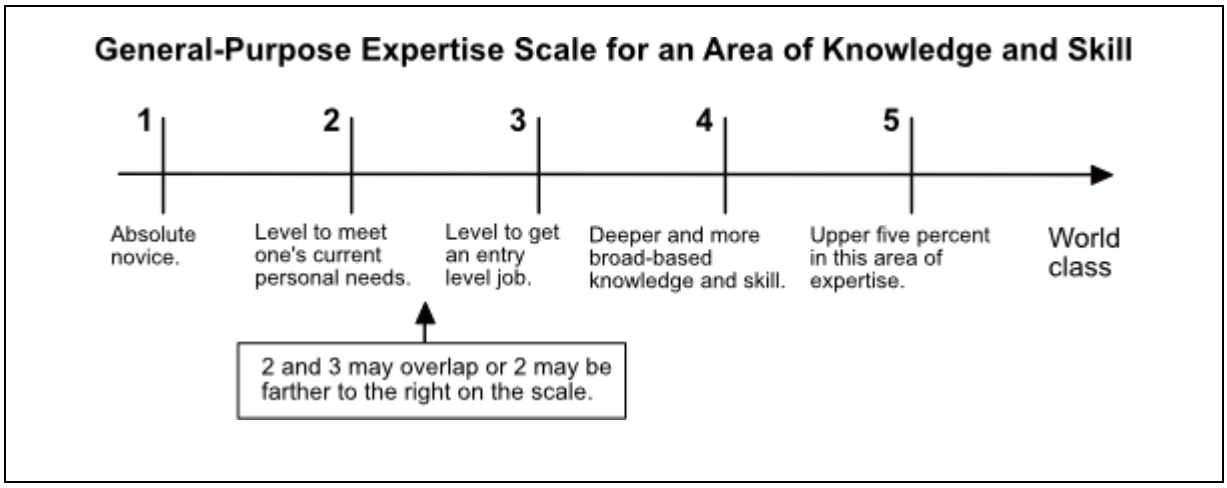

Figure 1. An expertise scale. It is not a uniform or linear scale.

This scale refers to expertise in a specific area—an *Island of Expertise*. A first grader says proudly, "I can read," and then demonstrates by reading aloud a first grade picture book. For a first grader, this is a huge achievement and certainly deserving of praise—which brings still more joy. Ability to read a first grade picture book is a small inland of expertise. One need not be "world class" in an area of expertise to experience joy in having and using personal expertise.

As children gain in physical and cognitive capabilities, they can develop more islands of expertise and deeper levels of expertise. The joy of reading certainly illustrates this point. A child can learn to read an increasing variety of material with an increasing level of understanding.

However, this situation also illustrates a challenging educational problem. Some children progress more rapidly than others, both in their general reading skills and in their level of understanding what they read. If a school's reading instruction environment is highly competitive, a child may well lose the joy of learning to read because his or her reading performance is deemed inadequate in comparison with "standards" or with the level of other students.

Cooperative and Competitive Learning Environments

Consider a learning environment scale with one end labeled *Highly Competitive* and the other end labeled *Highly Cooperative*. This scale is applicable to home, school, neighborhood, and other learning environments.

Now consider a specific student who faces substantially different learning and living environments throughout the day. Perhaps part of the child's day is spent in a highly competitive environment, part in a highly cooperative environment, and part in a relatively neutral environment. You might say, "What's the big deal? That's life."

The "big deal" is that children vary considerably in their innate abilities and in the interests they develop as they grow up. Consider math as an example. Some combination of

innate ability and the way we teach math leads to a large number of students who experience little or no joy in their math education experiences. Failure in the required math taught in our schools is often a major contributor to students dropping out of high school.

Or, consider the number of women majoring in the various STEM disciplines in higher education (Moursund, 2016b). The science areas —especially engineering—of study have long been somewhat hostile to girls and women. Quoting from Engineering Needs Still More Women (Crawford, September, 2012):

> Although the number of female engineers today has greatly improved since the early 1980s, when only 5.8% of engineers in the U.S. were women, it's still surprisingly low. Currently, only 14% of engineers are women, according to the Congressional Joint Economic Committee.
> "In the U.S., about 18 percent to 20 percent of engineering students are now women, an improvement over the abysmal numbers of 25 years ago," says Joanne McGrath Cohoon, an associate professor in the Department of Science, Technology, and Society at the University of Virginia, where 31% of undergraduate engineering students are female.

We have no evidence that this has to do with differences in innate ability between men and women. The reasons for this disparity in the number of women completing such degrees is much more subtle—in essence, a type of discrimination against women. People do not experience joy in being discriminated against.

Creating Personal Islands of Avocational and Vocational Expertise

> "Try to learn something about everything and everything about something." (Thomas H. Huxley; English writer; 1825–1895.)

The quote from Thomas Huxley is now about 150 years old. The totality of humanity's collection of knowledge and skills has grown many fold during this time, and the rate of growth has substantially increased. As a consequence, many of us suffer from information overload (Moursund, 2016a).

Schools struggle with this situation. What should be in the required curriculum, and what level of expertise should students be expected to gain in each of the required curriculum areas? How much freedom should K-12 students have in selecting areas that they will study?

Take another look at levels 2 and 3 of the Expertise Scale in Figure 1. Think about these two levels in terms of an adult working 40 hours a week on a job and having 128 hours a week for sleeping, eating, shopping, etc.,—and for avocations. Quite a few people think of their hobbies and other avocations as their "night job" that they do for joy, as contrasted with their "day job" that they do to produce an income.

Now, think about a K-12 student's informal and formal education. How much of this time should be spent in becoming "college or career ready," and how much in becoming ready for responsible adulthood that may include raising a family, pursuing multiple avocations, interacting with colleagues, travel, and many other activities that contribute to having a good quality of life?

I think quality of life is a particularly important issue. I have written several *IAE Blog* entries about this topic (Moursund, 2/12/2016; 2/5/2016; 12/24/2014). I believe this topic should be integrated into education of all students.

Our informal and formal educational systems provide students with many opportunities to develop islands of expertise that might become lifelong avocations. As an adult, think about some of the pastimes that bring you joy. Perhaps you have developed a personally satisfying level of expertise in cooking, photography, watching sporting events on TV, hiking, collecting antiques, performing with a local theater or musical group, or other activities that can bring personal joy.

Here is an observation and suggestion. Success in identifying and achieving a personally satisfying level of expertise is a marvelous accomplishment. Doing so a number of times as a youth lays a foundation for having the confidence and positive learning attitudes needed to continue to function this way throughout life. **It is clear to your author that this focus on the joy of learning to gain expertise should be a significant component of the goals of K-12 education.**

References and Resources

Crawford, M. (September, 2012). Engineering needs still more women. *American Society of Mechanical Engineers*. Retrieved 3/17/2016 from https://www.asme.org/career-education/articles/undergraduate-students/engineering-still-needs-more-women.

Moursund, D. (2016a). Information underload and overload. *IAE-pedia*.

Moursund, D. (2016b). Women and ICT. *IAE-pedia*.

Moursund, D. (2/12/2016) Improving worldwide quality of life. *IAE Blog.*

Moursund, D. (2/5/2016). Quality of life. *IAE Blog.*

Moursund, D. (12/24/2014). Quality of life: Working toward a better future. *IAE Blog.*

Moursund, D. (2013). Education for increasing expertise. *IAE-pedia.*

Moursund, D., & Sylwester, R., eds. (April, 2015). *Education for students' futures.* Eugene, OR: Information Age Education.

Part 4: External Elements

The seven chapters of Part 4 explore diverse topics such as joy in teamwork, joyful conflicts, making grading more joyful, joy in learning, and joy in the arts and crafts. Here are a few quotes from these chapters.

> "Our math education system faces an uphill battle with many students after about the seventh or eighth grade. The math being taught simply does not seem relevant [that is, does not seem authentic] to a great many students. Many begin to claim that they hate math and cannot do math. Math classes are not a joyful part of their days!" (Moursund, chapter 13)

> "Conflict is a normal part of life, learning, and school. Conflict includes disagreement, competition, and discord about something of value to each party. Negotiation is the customary method to resolve disputes. [Thus, schools provide a good environment both to study and to practice conflict resolution.] Conflict initiates a brain sequence of emotional arousal, conscious feelings, and purposeful thinking." (Gleave, chapter 14)

> "We have observed that the teachers who are the most successful in Differentiated Instruction exhibit contagious enthusiasm for their entire class. They eagerly seek to help all of their students reach their full capabilities. Their on-going assessments identify each individual student's unique needs. They understand variations in content information and present them through intriguing strategies." (King & Chapman, chapter 16)

> "Student questioning is perhaps one of the most under-utilized teaching strategies. Its use can enhance all the appropriate neural pathways and draw visions and connections that can ultimately lead to some new and original thinking. A teacher who is gifted at posing the right questions can create a whirlwind of excitement, but what does student questioning accomplish? How many opportunities do we adults give young people to inquire within *teachable moments*? Can we afford to miss these prospects?" (Nevills, chapter 17)

Chapter 13

Joy of Learning and Using Math

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> "God created the natural numbers. All the rest is the work of man." (Leopold Kronecker; German mathematician and logician; 1823-1891.)
>
> "If I have seen further it is by standing on the shoulders of giants." (Isaac Newton; English mathematician and physicist, in letter to Robert Hooke, February 5, 1675; 1642 -1727.)

Many people enjoy learning about the history of science and technology. I especially enjoy learning about the steady progress humankind has made in these disciplines.

The first quote given above emphasizes that the natural numbers 1, 2, 3, etc., are all around us—we grow up with them and they are part of our natural languages. The second quote indicates that humans have accumulated a tremendous amount of knowledge (in math, the sciences, and other areas) going back even before reading and writing were developed more than 5,000 years ago. We routinely use and build on this accumulated knowledge.

As two simple math examples, negative numbers were invented about 2,600 years ago and the number zero was invented a little more than 2,300 years ago (Rogers, February, 2011; Matson, 8/21/2009).

The point is that math is a vertically structured discipline, and each student is faced by thousands of years of progress that math researchers have contributed. We expect grade school children to learn about negative numbers and the number zero—things that the leading mathematical minds of the world did not know 2,600 years ago!

What Is Mathematics?

As noted above, math is a very large, steadily growing, and vertically structured discipline of study. Here are some of the reasons it is an important discipline of study:

1. Math includes an oral and written language that can be considered to be part of natural languages and also part of the languages of many other disciplines of study (Moursund, 2016a).
2. Knowledge of math and skill in using it empowers people in their everyday lives. Such empowerment brings pleasure and joy. Put another way, the inability to do mental math and make mental math estimations certainly takes away some of the joy in life.

3. Math can be used to help represent and solve problems in math and in a very wide range of other disciplines. For example, math is an indispensable component of all sciences.

For these and other reasons, mathematics is part of the basics of a modern education. Our schools require precollege students to study math year after year. Many academic programs at the college level require still more study of math.

Here are some statements that help to capture the breadth of the discipline of math. Many people find joy in using math in one or more of the areas listed below:

- Math is an art form. Mathematicians talk about the beauty of certain math results and proofs.
- Math provides a way to study and create patterns, and many people find such patterns have beauty or other special meanings.
- Math is an important component of the study of music and musical instruments.
- Math includes the study of logic and the analysis of logic-based arguments.
- Math provides a basis for understanding the probability and statistics that are a routine part of our lives.
- Math provides an environment in which a student can have the joy of discovery and can struggle with cognitively challenging problems.
- Math aids in the creation of and use of measurement systems. Quoting Lord Kelvin, "If you can not measure it, you can not improve it."
- Math is an essential component of computer modeling and simulation approaches to problem solving.
- Math is important in computer animation, such as in videos and video games.

I suspect that even people who profess “I hate Math” make use of math from time to time in a manner that brings them a level of satisfaction and a certain type of joy.

Some of the glory and mystery of math is presented in the NOVA video, *The Great Math Mystery* (NOVA, 4/15/2015).

Teaching and Learning Mathematics

1. What math should all students be required to study?
2. How should we assess the math learning of students, and what standards should we set?
3. What aids to teaching, learning, and doing (using) math should we make available to teachers and students? Remember, adults use such tools if they find them useful and know how to use them.
4. How can we make math education more intrinsically motivating and fun for students?

These questions are intertwined, but the next four subsections provide my thoughts on them as separate questions.

Math Requirements

At the current time, the "average" adult in the U.S. performs at about the eighth grade level in math, and does poorly relative to adults in other countries (Anderson 3/15/2016; Kornell, 11/27/2012). About 90 percent of U.S. adults have completed high school or a GED (U.S. Census, n.d.). This type of data suggests that the results of three or more years of required math coursework beyond the eighth grade may be cementing earlier math knowledge and skills, but may have little long-term effect in moving average students above that level.

Here is a different way to think about this situation. For an average person, routine life in the U.S. does not require the use of math beyond the eighth grade level. Those people having a need for a greater level of math knowledge in their vocation, avocations, and everyday life learn, use, and retain the math that they find useful.

Our math education system faces an uphill battle with many students after about the seventh or eighth grade. The math being taught simply does not seem relevant to a great many students. Many begin to claim that they hate math and cannot do math. Math classes are not a joyful part of their days!

As noted earlier, math is a useful tool in the various subject mater areas students study in precollege education and, in many of their subsequent areas of study) The relatively poor preparation of many students often leads course instructors in on-math courses to downplay the use of math. This deprives students practice in using math that would add to long term retention.

Math Assessment

To a large extent, the content of precollege math focuses on learning to solve the types of math problems for which a student's answer is either right or wrong. Tests are designed to determine whether students can produce a right answer under the constraints of the testing situation.

However, math is far more than producing right answers in paper-and-pencil or computer-administered test situations. Math, itself, is an authentic component of our everyday lives. Most math assessment is not authentic relative to the lives of the students being assessed (Concordia Online Education, 1/9/2013).

This topic reminds me of when I spent quite a bit of time observing teachers who were teaching elementary school math. Once I singled out a couple of third graders and asked them what time it was. They looked at the clock on the wall and told me the correct time. I then inquired about how long it would be until school ended for the day. They were not able to answer that question. They could read a clock, but they lacked an understanding of time needed to answer my question. They are missing out on some of the joy of being able to tell time and use this knowledge to plan for the future.

So it is with much of student understanding of math. By rote memory, most students reach a level whereby they can pass the tests. But, they do not reach a level at which they can understand the math in a manner that allows them to apply it to novel and challenging

situations. They do not readily meet the *transfer of learning* challenge—moving their knowledge of math from the classroom to outside the classroom.

Some students experience joy in scoring well on math tests. However, we know that math learned through rote memory, or that passing math tests by being "taught to the test" produces little long-term retention. I believe this test-passing joy is superficial relative to the joy of understanding what one has learned and using it when the need arises in one's everyday life.

Aids to Learning and Doing (Using) Mathematics

Beginning with the invention of the counting board and then the abacus about 2,500 years ago, humans have found it helpful to have mechanical aids to calculation (The Abacus, n.d.). This use began at a time when very few people received formal schooling, so merchants and others needed aids to do arithmetic. The abacus is still in use in some parts of the world, and bead frames are commonly used in elementary school math instruction.

A wide range of by-hand and computerized math manipulatives are now commonly used in elementary school (Moursund, 2016b). Skilled teachers can add considerable joy for their math students—as well as improved learning—through the use of such manipulatives.

Let me share another story with you. More than 30 years ago, I was teaching a computers and math course. Essentially all of the students in the course were high school math teachers. A few hours before one of the class meetings I received a copy of *Wolfram Mathematica* for my Apple computer (Wolfram, n.d.). This is software designed to solve math problems. I installed the software, found my old freshman calculus book, and took my computer and book to class. I then "amazed" the students (and myself) by keyboarding in problems from the calculus book and having the *Mathematica* program solve them. It even did well in the "starred" (extra difficult) problems at the end of the chapter.

In essence, for many years computer users have had free access to such computer software that can solve all of the types of computational problems that students are taught in precollege math and up through the first two years of typical college math courses. What this means is that, if we wanted to, we could transform our precollege math education system so that it placed a great deal more emphasis on the non-calculation aspects of math—such as understanding and using math to represent and solve problems that one encounters in everyday life, at work, and at play.

This does not mean that learning and understanding math does not require considerable rote learning and practice. A person who is unable to mentally, rapidly, and accurately do simple addition, subtract, multiplication, and division is significantly handicapped in our world. Also, the language of mathematics has a large vocabulary and special notation. One must know quite a bit of the vocabulary of math to be able to communicate using the language of math.

We now have computer systems with sufficient intelligence to individualize and speed up this type of rote learning instruction to the needs of each student. We have substantial research evidence on the value of this type of instructional use of computers.

We also have a growing collection of carefully crafted educational games that are designed to be both fun and educationally sound (Moursund, 1/20/2016).

Making Math Education More Intrinsically Interesting

It is my contention that students find math education more joyful when they gain knowledge and skills that empower them to solve problems and accomplish tasks that are meaningful to their everyday lives both in and outside of school. In school, this means that the math they are learning or have learned should routinely be used and found useful in the other disciplines they are studying. Outside of school, this means that students should find that the math knowledge and skills they are gaining are useful aids to improving their quality of life (Moursund, 2/15/2016).

As noted earlier in this chapter, there can be much more to math education than just "covering" the required textbook or syllabus. The "I hate math" and "I can't do math" outcomes that occur for many students are certainly undesirable. It is my impression that this type of situation occurs much less frequently in other required parts of the school curriculum. That is certainly suggestive that we can do better. My 4/25/2016 Google search of the expression *"I hate math" syndrome* produced over 45,000 hits. Many contain suggestions for improving this situation.

A Book on Math Tutoring

My friend and colleague Bob Albrecht and I have written *Becoming a Better Math Tutor* (Moursund & Albrecht, 11/27/2011). The focus of the book is on engaging students in ways that they find to be fun. This free book contains numerous examples and success stories.

References and Resources

Anderson, J. (3/15/2016). Americans are spectacularly bad at answering even the most basic math questions. *Quartz*. Retrieved 5/22/2016 from http://qz.com/638845/americans-are-spectacularly-bad-at-answering-even-the-most-basic-math-questions/.

Concordia Online Education (1/9/2013). *Authentic assessment methods for mathematics*. Retrieved 4/25/2016 from http://education.cu-portland.edu/blog/reference-material/authentic-assessment-methods-for-mathematics/.

Kornell, N. (11/27/2012). US math achievement: How bad is it? *Psychology Today*. Retrieved 5/22/2016 from https://www.psychologytoday.com/blog/everybody-is-stupid-except-you/201211/us-math-achievement-how-bad-is-it.

Matson, J. (8/21/2009). The origin of zero. *Scientific American*. Retrieved 5/1/2016 from http://www.scientificamerican.com/article/history-of-zero/.

Moursund, D. (1/20/2016). *Learning problem-solving strategies through the use of games: A guide for teachers and parents*. Eugene, OR: Information Age Education.

Moursund, D. (2/15/2016). Improving worldwide quality of life. *IAE Blog*.

Moursund, D. (2016a). Communicating in the language of mathematics. *IAE-pedia*.

Moursund, D. (2016b). Math methods for preservice elementary teachers. *IAE-pedia*.

Moursund, D., & Albrecht, R. (11/27/2010). *Becoming a better math tutor*. Eugene, OR: Information Age Education.

NOVA (4/15/2015). *The great math mystery*. (Video, 53:10.) Retrieved 4/25/2016 from http://www.pbs.org/video/2365464997/.

Rogers, L. (February, 2011). The history of negative numbers. *NRICH*. Retrieved 5/1/2016 from https://nrich.maths.org/5961.

The Abacus (n.d.). *Brief history*. Retrieved 4/25/2016 from http://www.ee.ryerson.ca/~elf/abacus/history.html.

U.S. Census (n.d.). *Educational attainment in the United States: 2015*. Retrieved 4/24/2016 from https://www.census.gov/hhes/socdemo/education/.

Wolfram (n.d.). *Wolfram Mathematica*. Retrieved 4/25/2016 from https://www.wolfram.com/mathematica/. A somewhat limited but very good version of this software is available for free online use at https://www.wolframalpha.com/.

Chapter 14

Joyful Conflict in Schools

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Conflict is a normal part of life, learning, and school. Conflict includes disagreement, competition, and discord about something of value to each party. Negotiation is the customary method to resolve disputes. Conflict initiates a brain sequence of emotional arousal, conscious feelings, and purposeful thinking. Unfortunately, joyful feelings and empathic thinking are unusual in conflict negotiations. Ancient fight, flight, or freeze responses typically follow feelings of fear, anxiety, or anger. Fear prompts escape, anxiety encourages avoidance, and anger goads confrontation. Empathy and happiness are commonly associated with creative and considerate conflict resolution. Simultaneously emphasizing feelings and goals leads to joyful achievement. Positive or negative approaches to conflict in school can either nurture or poison the school culture.

When I was beginning to teach, I was inspired by a school opening address. The superintendent recognized happiness as crucial to education. He proclaimed joy as the way we were to teach. This became a cultural ideal I emphasized throughout my thirty-year career as a high school science teacher and superintendent of schools.

School culture may be defined as “the way we do things around here.” Culture embraces feelings as well as patterns of thinking and behaving. Culture is created and reinforced through social interaction. Open expression of feelings, valued learning styles, and socially accepted conduct are continually observed and become codified. Instruction and practice in these codes of conduct are internalized by everyone. This cultural process seems consistent with the formation and reinforcement of neural networks.

Patterns of emotional arousal, conscious feelings, and collaborative thinking can also become the taken for granted way to resolve conflicts in school. Instruction, modeling, and guided practice can nurture ways of handling school conflict that simultaneously solve disagreement and leave participants feeling joyful. The following positive conflict solving approaches are intended to be used in concert.

In chapter 8 of this book, Barbara Given describes Polyvagal Theory, an adaptation of the common freeze/fight/flight response to stressful situations. Polyvagal Theory focuses on socially stressful situations, and seeks to heal them.

The Basics of a Strategy that Seeks to Heal

- Insist on positive assumptions about the other person's intentions, verbal, and nonverbal communications. This often means consciously overcoming negative feelings and thoughts. Premeditated smiles and friendliness will be contagious.

- Recognize and respect the other person's feelings, beliefs, experiences, and culture. A relationship based on trust and respect will be built up over time.
- Pursue dialogue to discover shared interests, rather than self-interests. Brainstorm propositions that attain shared interests. Attempts to win initial positions or advance self-interests generate negative feelings that lock people firmly into their position.
- Be rigorous in ensuring that each person's goals are achieved fairly. Apply fair decision criteria such as school goals, research findings, and conflict precedents. Both parties will support solutions that are fair and achieve goals.
- Openly disclose what will happen for each person if the conflict is not resolved. Each person needs to adjust negotiating flexibility in light of relative gains and losses from a stalemate.

Case Study Examples of Healing

The following case studies are based on my experience as a teacher, staff developer, and school superintendent. They illustrate positive and negative approaches to conflict. The first case study examines a contract dispute between a school division and a teacher association. The second conflict involved myself and a student who had been defeated by grade nine science. The third conflict was between two grade twelve physics students.

1. School Division and Teacher Association

A school division and teacher association were in protracted contract negotiation. Teachers wanted to increase preparation time for elementary teachers. The school division was opposed because it would require a property tax increase for additional teachers.

Teachers were insistent about the need to level preparation time for elementary and secondary teachers. The school division wouldn't budge either. Each side was frustrated and annoyed with the other party's intransigence.

The teacher association announced that teachers would begin a series of rotating strikes. Service would be withdrawn in one or two schools each day until contract demands were achieved. This would be a relatively inexpensive strike for teachers. The uncertainty of which school would be closed would be difficult for the school division to manage. Furthermore, uncertainty would be problematic and exasperating for parents. Parents would pressure their elected representatives to end the strike.

The school division announced that it would lock teachers out of all schools following the first rotational strike. The teacher association was unable to provide sufficient strike pay for all teachers so the rotating strikes were postponed. Negotiations were locked in a mutually untenable and unwinnable situation. A previously positive relationship was being poisoned by mistrust and anger.

Fortunately, a division administrator who had received training in shared interests negotiating convinced both sides to attempt this approach. It worked! A consultant in shared interests negotiating assisted the sides to a mutually satisfactory agreement. Trust and positive relations were mended as this approach was entrenched.

2. A Grade Nine Student

I met Helen when she was assigned to my grade nine science class. Helen was repeating grade nine science for a second time. Helen expressed exasperation with and antipathy toward basic math and science. Helen had previously acted out when she was frustrated with class projects. She seldom worked in class, skipped regularly, and eventually dropped grade nine science. She was defeated and it was now my challenge to help Helen meet the requirements of grade nine science.

I asked Helen to meet with me following our first science class. I smiled and told her I was happy that she was now in my science class so I could help her pass the course. I asked her how she liked to learn in school. She told me that she liked the language arts and social studies. She liked doing research in the school library and writing reports on her research. I asked her if she would like to do science research in the school library and write reports for me to review. She agreed and we jointly selected a significant number of science reports based on her interests and the science curriculum. Due dates were agreed for each report. She agreed that she would not leave the library during science period.

I occasionally went to the library to check on her progress and to assist her with research. We met after school to review and evaluate each of her science reports. Helen completed all curricular requirements for grade nine science. Helen exhibited trust and respect for me throughout her high school career. This is one of my enduring memories of teaching.

3. Two Students

Dave and Barry sat together in my grade twelve physics class. They were friends and excellent students. One morning as the class was about to begin they abruptly stood up, yelled at one another, and began a vigorous fist fight. I immediately separated them and asked them to stay after class for follow up.

After class I informed them that the school rule was that they would be suspended or expelled for fighting at school. I told them that I was willing to deal with the fight as a classroom conflict if they were willing to negotiate a solution to their dispute. Each of them quickly agreed. They were willing to shake hands, apologize, and commit to their friendship.

I told them to forget what they were each trying to achieve by fighting and instead talk about their shared goals for a negotiated solution. After a time, they agreed that they each wanted a mutual friend to clarify the kind of relationship she wanted with each friend. The solution was individual dates with the girl where they would ask her to clarify the relationship she would value with each young man. This clarified a desirable and workable relationship among the three friends. Barry and Dave restored their friendship and each earned a high mark in grade twelve physics.

These three cases illustrate pain from negative conflict and happiness from positive conflict resolution. Teaching a simultaneous emphasis on feelings and goals in conflict resolution will also create a school culture where positive feelings and goal attainment are supported. Joyful conflict can become the norm for students and teachers.

References and Resources

Berger, P.L., & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge.* Garden City, NY: Doubleday.

Brooks, A. (2015). Emotion and the art of negotiation: how to use your feelings to your advantage. *Harvard Business Review.*

Fisher, R., & Ury, W. (1983). *Getting to yes: Negotiating agreement without giving in*. New York: Penguin.

Given, B. (March, 2016). Polyvagal Theory helps to explain the joy in learning.

Chapter 15

A High School Music Teacher Unravels an Assessment Conundrum

John P. W. Hudson
Retired Music Teacher

A recent *IAE Newsletter* article described how the Olympics solve an evaluation problem that educators also confront: how to fairly combine *objective* and *subjective* assessments, when the two seem incompatible (Sylwester, October, 2014). I experienced confusion at trying to combine subjective and objective assessments during my very first semester as a teacher. I had no idea what the underlying issues, causes, and conflicts were. I just felt an uneasy sensation when trying to combine them. I pieced together my solution over many years, and only in retirement have I gained clarity about what I did.

The Olympics use *objective* (quantitative, measurable, or countable) assessment processes for competitive distance or speed events such as running, swimming, jumping, throwing, and basketball. In objectively assessed races for example, the athletes' objective is to run from the moment the starter's gun goes off and get to the finish line in the shortest time. Because running times can be measured with precision calibrated to thousandths of a second, the validity of Olympic objective measurements is considered a gold standard.

The Olympics use *subjective* assessment processes for an expressive (qualitative, not precisely measurable) performance, such as in gymnastics, figure skating, and diving. A team of competent, credible judges makes this subjective judgment using a ten-point scale. The athletes' goal is to increase their subjective score by doing all of the required movements with style and grace. Events such as diving include both required and diver-selected dives. A diver can obtain a higher score by selecting an especially difficult dive and doing it very well. Similarly, a figure skater can gain points by doing a quadruple Lutz rather than a triple Lutz.

The requirement that a judge produce a numerical score allows the scores of the various judges to be compared and an average computed. This quantification of a subjective performance is a difficult challenge to judges but is essential in scoring such Olympic events.

The veracity of subjective scores is completely dependent upon the judges' credibility and the validity of the judges' evaluative criteria (Moursund & Sylwester, 10/9/2015). However, the subjective assessments of the judges can be, and have been, swayed by bias and nefarious influences. This problem is partially addressed by having a large number of judges and throwing out the highest and lowest scores that a performer receives.

Teachers Assessing Students

I was a band teacher. I assessed both objective and subjective aspects of the performance and the learning of each of my individual students. Certainly all teachers in the fine and

performing arts face this dual assessment challenge. Most, if not all other teachers also face this challenge. This is obvious in courses that require writing and/or oral presentations. And how about the challenge of assessing a student's progress in learning to read—*with understanding*—across the curriculum?

In my subjective judgments of individual students, I am the only judge. I need to accomplish fair, reliable, valid scoring of each student, so that the students are all treated in an equitable manner.

My fledgling teaching assignment was to direct elementary and secondary school bands and, of course, to assign a letter grade to each student. I could objectively measure correct notes played, but the expressive aspects of playing required my subjective judgment. My challenge was to combine objective and subjective assessments into a single letter grade, when objective and subjective evaluations are fundamentally incompatible. Objective assessments are anchored to countable or measurable acts, but subjective assessments have no such tether, and are vulnerable to interpretation, the antithesis of objective reporting.

After years of grappling with the thorns of this opaque dilemma, I attempted to skirt the oil and water conundrum altogether by making all of my assessments objective. I taught and tested musical theory, counted correct notes, and presumed that a high correlation would exist with expressive performance.

This assumption was definitely wrong. The year in which I emphasized only objective measures, my students scored very high on their music exams, but the band ranked poorly in festival competition. The students and I were despondent. I had traded expressive rehearsal for test rehearsal, and irrespective of their high letter grades, the results were counter to our real goals: excellent musicianship, stellar performances, and fulfilled, joyful learners.

I then considered the idea of using only subjective assessments, but I had no concrete foundation for validity. I realized this would not be appropriate for the wide range of students in my band classes.

Powerful Lessons

When I had naïvely used only objective assessment, I inadvertently learned that whatever is being assessed tends to become the curriculum. Having witnessed this tendency of assessment to drive curriculum, I decided to lever that effect to my advantage.

Music festivals use criterion-referenced assessment terraced into three levels—bronze, silver, and gold—hierarchically organized as descriptive statements within rubrics. Tuning, balance, blend, and many other expressive elements are combined with objective assessments as in the Olympics, but correct notes, correct rhythms, and other countables were *described* rather than *counted*. To describe countables was to put objectively derived evidence of learning on the same footing as evidence of subjective expression.

Instead of numbers as a bridge between subjective and objective assessments, rich descriptions of authentic evidence can be used. *Epiphany* is a word that evokes moments of heavenly streaming light, and despite searching desperately for a less clichéd simile. I can't find a better way to describe how I felt at that pivotal moment of understanding.

On the day our band performed poorly at festival, I put a copy of the evaluative criteria away for study over the summer. I decided the students should read it too, so I presented it to them in September. I let the festival assessment criteria become the performance curriculum, which had the advantage of being clearly described by the most successful band directors over many years. The effect was immediate. With clear objectives, the students and I had a clear ladder to climb; our daily learning deepened, and performance swelled with newfound understanding. Describing countables had erased the need to use numbers to score subjective performances. Students could see their path to success clearly. Our performances that year earned satisfaction from students, parents, myself, and staff.

Applying letter grades was a simple matter of equating gold with 'A', silver with 'B', and bronze with 'C', 'C' plus, or 'C' minus. Authentic expression was finally on an equal footing with objective assessments. Problem solved. Almost.

Wilkerson's Warning

Letter grades are still necessary for reporting. Although they were fairly derived in my case, I witnessed over my career the damaging effects of translating authentic evidence into scores, which hides important evidence from reporting by using proxies (scores and letter grades). For example, students' identity can be so completely subsumed into academic performance that anything less than an 'A' is too often seen as a failure. Scores being corruptible and vulnerable to negative influences only magnified the tragedy of the fallen, broken body of a senior high school student I saw, only moments after her decision to end her life. Her shame of low marks, insufficient to enter university, had overwhelmed her. (It is for her that I dedicated my studies to finding a solution.)

Isabel Wilkerson said, in her book *The Warmth of Other Suns*: "Submerging an individual into abstractions is bad science... [and leads to] ...dehumanization" (Wilkerson, 2010). After years of suffering the angst of judging others whose musicianship sometimes approached my own, I came to understand how it is that scores aren't real evidence, but rather, are just a proxy: a way to translate the descriptive language of subjective expression into the hard-wired language of the objective. Scores had become trite, demoralizing, unsettlingly impersonal, and I was glad to be rid of them; but still, to use letter grades to describe expression similarly devolves performances into the mere abstractions, and the tragic consequences Isobel Wilkerson warns us about.

I now believe that Wilkerson's warning can be heeded by making descriptions the common measure for combining objective and subjective evidence of learning, rather than scores. I believe all demonstrations of learning are performances, whether they be spelling, math questions, historical dates, or dance moves, and all can be anecdotally described. All performances are empirical evidence of learning, so they should be reported in real terms. Even tests and examinations can be described in terms of what students can do with their knowledge. Naming accomplishments is as easy as counting scores, and is much more powerful and meaningful for reporting and growth than is the use of letter grades.

That said, our society has letter grades deeply embedded in how schools should report student performance. We know them, and we accept them as currency between teacher, student, and parent. Students accept them as imperfect representations of their efforts, and it gives them a common language to compare themselves with others as well as their own

progress. However, I believe this social ranking effect of letter grades is not healthy. It can be ammunition for bullying by peers or parents, and as the suicide I witnessed is testament, dehumanizing. I believe students should compare themselves to a standard, not to each other.

Hope exists. British Columbia, Canada, no longer uses letter grades in primary grades. Descriptive evidence is presented instead, with a guide for comparative purposes (does not yet meet expectations, meets expectations, fully meets expectations, exceeds expectations). It is my hope that letter grades will eventually be replaced by descriptive reports at every level.

Every year, I understood more deeply the power of assessment. When used as a tool, it is a potent motivator and provides clear direction for curricular design. More important, by valuing uncountable or expressive elements, a very wide door opens to a humane education: one in which empathy, teamwork, imagination, creativity, energy, and passion have equal weight with knowledge.

I loved designing my lessons with a passion for student growth in mind, which to me is a much larger lesson than the knowledge or skills to be learned. Most of all, I had used assessment as a powerful ally to honour the young lives in my care with the dignity, power, and control they deserve. The school's job, after all, is to be everything it can be in service of the learners, their families, their community, and the world.

References and Resources

Moursund, D., & Sylwester, R., eds. (10/9/2015). V*alidity and credibility of information*. Eugene, OR: Information Age Education.

Music festival adjudication rubric examples:
http/::uhsaa.org:music:Forms:201112:Large_Choir.pdf.
http://uhsaa.org/music/Forms/2011-12/Large_Choir.pdf.
http://www.uiltexas.org/files/music/band-concert-rubric.pdf.
http://acappellaeducators.com/wp-content/uploads/2014/08/JudgingRubricDescriptions-Final.pdf.

Sylwester, R. (October, 2014). Credibility and validity of information. Part 1: Introduction. IAE Newsletter.

Wilkerson, I. (2010). *The warmth of other suns*. New York: Knopf Doubleday.

Chapter 16

Assessment for Differentiated Instruction

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K-12 Differentiated Instruction (DI) can be a joyful way to teach students because it is tuned to the ways in which each individual student functions best. Quoting from the Wikipedia:

> Differentiated instruction and assessment (also known as differentiated learning or, in education, simply, differentiation) is a framework or philosophy for effective teaching that involves providing different students with different avenues to learning (often in the same classroom) in terms of: acquiring content; processing, constructing, or making sense of ideas; and developing teaching materials and assessment measures so that all students within a classroom can learn effectively, regardless of differences in ability.

DI probably functions better in single-class elementary classrooms than in multi-class secondary settings, but imaginative teachers across the K-12 spectrum can effectively use elements of it.

In chapter 15 of this book, John Hudson discusses the complexity of evaluating instruction focused basically on objective (such as math) and subjective (such as the arts) elements of instruction.

This current chapter focuses on adapting to the capabilities of individual students when considering teaching and assessing such issues as cognitive capability and personal/family/ethnic backgrounds.

DI's Instructional Base

We have observed that the teachers who are the most successful in DI exhibit contagious enthusiasm for their entire class. They eagerly seek to help all of their students reach their full capabilities. Their on-going assessments identify each individual student's unique needs. They understand variations in content information and present them through intriguing strategies.

These teachers thus determine a student’s knowledge and willingness to go beyond, and use it to guide instructional strategies. This pattern suggests an eventual development of a repertoire of appropriate instructional strategies that can work effectively with individual students working in various settings. DI teachers think in terms of the **TAPS** acronym to assist in this: **T** working in a **total group**, **A** working **alone**, **P** working with a **partner**, **S** working within a **small group**. Our work throughout life involves competence at each of these four levels. DI teachers thus carefully observe students as they engage in doing assignments. They intervene, as needed, with a review, clarification, or analysis of the task.

The student then returns to the group, works independently, or is assigned to a more appropriate group.

Planning for individuals, partners, and small groups who finish assignments at different times can become a challenge. Tomlinson and Imbeau (2010) refer to varied task completion periods as "ragged time." Thus, it is necessary to design meaningful follow-up tasks related to the lesson for students who complete their work early. These include station work, journal writing, choice boards, and academic contracts. These anchor activities keep everyone engaged and provide a productive environment for classmates who need more time. Before a work period begins, students thus know what to do when their task is finished. They understand available options, guidelines, and how to access materials, so they do not interrupt the work session.

In his book, *How the Brain Learns,* David Sousa (2011) emphasizes that the brain attends to novelty or anything new or different in the environment. Steve Barkley (2013) suggests "Wowing" students and adding pizzazz to activities. Interspersing unique, unexpected experiences in lessons entices students to enhance their memory.

Preliminary DI Assessments

Although the concept of learning styles is now somewhat questionable (Bruff, 1/28/2011), teachers can learn much of student variance from continuing casual conversations, observations, surveys, and journal entries. Teachers can identify student in/out of classroom behaviors that affect learning, those that help them to stay aware of a student's evolving changes in their continually changing life.

Assessing During and After Learning

Various informal assessment tools identify personality traits and work preferences (such as working alone, in pairs, within groups). Teachers share results with each person who assists a student. For example, if a student seems to learn best through one or another sensory modality, focus on that as much as possible.

On-going assessment is vital for planning. Use an informal assessments approach that reveals needed useful information. Analyze the results to monitor the student's placement in productive, comfortable learning situations (working alone, in pairs, in groups, etc.).

Administer needed pre-assessments to gather data related to the student's background knowledge and level of readiness for the identified skill or standard. Do this a few days before the scheduled lesson. This provides ample time to analyze the data and plan appropriate activities, select activities, and gather materials.

Assessment during learning occurs through observations, class discussions and questions, and tests. Intervene when needs are evident. Review, reteach, or modify if the assignment is too difficult. If an assignment is too easy, expand or extend it in a manner that helps to increase the depth of a student's understanding.

Assessment after learning provides data that is analyzed for mastery of the standard or skill. Use the results to guide upcoming instruction.

According to Farrell, Marsh, and Bertrand (November, 2015), some practitioners and policymakers believe students who engage with assessment data "exert extra effort" and

"gain a better understanding of their strengths, their weaknesses, and how to improve." The following analogy emphasizes to students the value of self-assessment for staying on track to improvement: *Racecar drivers constantly monitor their vehicles and pull into the pit to make adjustments.*

A student's brain functions best in the student's psychologically-safe environment, and testing should provide this environment. Remove or replace elements that create anxiety and generate negative feelings. Encourage students to think of testing as an opportunity to show what they know now, so that you can help them to move forward. Consider this aphorism when preparing assessments: **Accentuate the positive! Eliminate the negative!**

Planning Adjustable Assessments

Assessing K-12 competence related to a skill or standard usually reveals a classroom range from low to high. Low-level competence needs additional instructional help. Middle-level competence can generally function with the new information or tasks. High-level competence can function with tasks that create a broader understanding of the initial tasks. Do your best to tune assessments to these group ranges before moving towards assessments tuned to individual students.

It's obviously easier for an elementary teacher with a single class of about 25 to do this than for a secondary teacher with several classes of 25 across the school day. Still, with the concept of DI central in their brain, imaginative secondary teachers will begin to implement its elements.

For example, students working with challenging personalized tasks often wonder why they have to work with difficult problems while others have easy problems. Good point. A teacher might use an electronic game as a learning example that requires mastery at one level before the player can move on to the next level.

Summary

All assessments are opportunities for learners to showcase their knowledge and improve while developing positive attitudes toward testing. On-going assessment results guide selection of differentiated instructional strategies. It is important to plan tasks for each student's knowledge base and comfort level.

The joy of learning is reflected in the students' words, actions, and body language when they are engaged in tasks on their success levels. Observable reactions include jumping with excitement, smiling, sparkling eyes, and eagerness to begin. When instruction is personalized these responses are more prevalent. The associated feelings prepare students emotionally for lifelong learning.

References

Barkley, S. (2013). *Wow! Adding pizzazz to teaching and learning*. 3rd ed. Allentown, PA: Performance Learning Systems.

Bruff, D. (1/28/2011). Learning styles: Fact and fiction—A conference report. Retrieved 7/7/2016 from https://cft.vanderbilt.edu/2011/01/learning-styles-fact-and-fiction-a-conference-report/.

Farrell, C., Marsh, J., & Bertrand, M. (November, 2015). Doing data right: Are we motivating students with data? *Educational Leadership.* Retrieved 7/7/2016 from

http://www.ascd.org/publications/educational-leadership/nov15/vol73/num03/Are-We-Motivating-Students-with-Data%C2%A2.aspx.

Gregory, G., & Chapman, C. (2012). *Differentiated instructional strategies: One size doesn't fit all.* 3rd ed. Thousand Oaks, CA: Corwin.

Sousa, D. (2011). *How the brain learns.* 4th ed. Thousand Oaks, CA: Corwin.

Tomlinson, C., & Imbeau, M. (2010). *Leading and managing a differentiated classroom*. Alexander, VA: Association for Supervision and Curriculum Development.

Books Related to Assessment and Differentiation by Carolyn Chapman and Rita King

Chapman, C., & King, R. (2012). *Differentiated assessment strategies: One tool doesn't fit all*. 2nd ed. Thousand Oaks, CA: Corwin.

Chapman, C., & King, R. (2008). *Differentiated instructional management*. Thousand Oaks, CA: Corwin.

Chapman, C., & King, R. (2009) *Differentiated instructional strategies for writing in the content areas*. 2nd ed. Thousand Oaks, CA: Corwin.

Chapman, C., & King, R. (2009). *Differentiated instructional strategies for reading in the content areas*. 2nd ed. Thousand Oaks, CA: Corwin.

Chapman, C., & King, R. (2012). *Planning and organizing standards-based differentiated instruction*. 2nd ed. Thousand Oaks, CA: Corwin.

Chapman, C., & King, R. (2009). *Test success in the brain compatible classroom*. 2nd ed. Thousand Oaks, CA: Corwin.

Chapter 17

The Role of Student Questioning in Joyful Learning

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Teachable Moments Anytime

Student questioning is perhaps one of the most under-utilized teaching strategies. Its use can enhance all the appropriate neural pathways and draw visions and connections that can ultimately lead to some new and original thinking. A teacher who is gifted at posing the right questions can create a whirlwind of excitement, but what does student questioning accomplish? How many opportunities do we adults give young people to inquire within "teachable moments"? Can we afford to miss these prospects?

Here is a personal example of a teachable moment. I was recently reading the story of *A Baby Sister for Frances* by Russell Hoban to Abby, my five-year-old granddaughter. We observed that Frances is a girl, but an animal girl. "What kind of animal?" Abby asked. I responded, "She is a raccoon." Abbey asked, "What is a raccoon?" I responded as best as I could. I added that her grandpa once had a raccoon for a pet but that it did not turn out well. Raccoons have sharp claws and they scratch. Abby pressed on. "What do they really look like?" I was momentarily at a loss, thinking of encyclopedias that might have a picture.

"Ask your cell phone," Abby said. So I Googled the word *raccoon* and found pictures and information, but that was not enough. "I want to see a video." My phone had access to YouTube. Needless to say we had a delightful time learning about raccoons, seeing them in action, and hearing accounts of other people who had worked with raccoons as a pet. Abby's questioning determined the search for information. I can only imagine the conversation around the dinner table at my granddaughter's home that night.

> **Editor's note:** Were you a little surprised that a five-year-old child knows that her grandmother could use the Web to find needed information? See David Moursund's free book, *The Fourth R* (Moursund, December, 2016). This short book proposes that our schools would be significantly improved by thoroughly integrating a **4th R** of **R**easoning (computational thinking; use of Information and Communication Technology) throughout the curriculum at all grade levels.

Catching a teachable moment took an even more significant turn on another day. I was playing some music from a compact disc in the car. Abby and I usually try to identify the instruments that we hear, and this time the sound was unusual. Abby asked, "What makes that sound? It is a bagpipe?" We stopped and accessed a YouTube video that featured a Scottish man in a full kilt uniform playing a bagpipe song with no accompaniment. After that I was often asked when driving, "To play the CD with the bagpipe music." Abby's two-year-old sister was also struck by these strange sounds and melody. I again had to produce the video on my phone.

It seems that after that, every time I came to their home, my younger grandchild wanted to go into my car to hear the bagpipe music. This story took an interesting twist, because their mother was drawn into the joy of the girls' learning. She bought an entire disc of bagpipe music and encouraged the girls to dance with the music. The ultimate experience for these children is that their mom read of a bagpipe festival in a nearby city, and took them to enjoy it. And all because we responded to their questions.

I am not certain how important it is for these young learners to be familiar with raccoons and bagpipe music. But, the experiences left them with some impressionable realizations. They were listened to. What was interesting to the children became a focus for the adult. They had conversations about their curiosity. Useful information is now available through hand-held devices that they need to master. They were challenged to fit this new information into previously developed or newly formed neural pathways in various parts of their brains.

Why Outside the Classroom?

School is our society's most significant learning place. But, the average classroom includes one adult with up to 30 (sometimes fewer, but nowadays, oftentimes more) students. Much of the school curriculum is required core content. Tests are used to measure the basic, foundational, and expected general knowledge students are gaining.

School should also be the place where students are encouraged to be curious, to question, and to resolve problems. As students gain in cognitive maturity, school should thus help students to develop their critical thinking skills. In summary, during the most important hours of the day and for most of the calendar year, students should be enrolled in classes to attain what society dictates that they learn. This creates a situation in which the teachers tend to ask the questions and the students answer, rather than the other way around. Teachers are often pressured to cover the prescribed materials and to make certain that students test well. The excitement of learning is overshadowed by the dictates of societal expectations.

Where is the joy of learning in this scenario? Gifted teachers are able to sustain a "joy of learning" environment for most, if not all, of their students. Their requirements for learning are encased into stimulating joyful practices. Good teachers consciously plan engaging activities, but they must also pursue skill development through repetitive practice. Each of the thirty or more students needs unique experiences to stimulate their individual brain.

A unique part of very child’s education can be what they do with an adult individually or in very small groups outside the school walls. Parents, grandparents, and other adults must also notice that when a child wonders about a raccoon or bagpipe music, they are unlikely to have their curiosity satisfied in school. Such inquisitiveness offers stimulating experiences that, when satisfied, can bring joy to learning.

What Is Needed?

Here is my advice to teachers, parents, and others who have the opportunity to follow it:

1. **Realize that you do not have to have all the answers.** I appreciate this condition only too often with my eighteen-year-old grandson, who possesses an exceptional storehouse of knowledge that he has learned through extensive Internet activity. I

often have no understanding of his explanations. I start by establishing an initial base so I am able to understand the subject. Then I become the student as he explains the issue. We switch roles, because he has the knowledge and I need to be a good questioner and summarizer. He has an opportunity to deepen his knowledge base and communication skills as he searches for and uses information in his brain or on his phone or computer.

2. **Practice the art of asking questions.** Develop questions that have many right answers. Become a good listener. Realize that answers can lead to another question. Perhaps respond with what the answer meant to you, to ascertain that you heard correctly.
3. **Pay attention to what students are saying to discover what interests them.** We often lose opportunities because we are also actively caring for their physical needs of safety, eating, or cleanliness. We thus ignore the opportunity to nourish the curiously developing brains of students as well.
4. **Be aware of opportunities.** Events, museums, points of interest exist within the community and also on your cell phone. Think about the extension of learning opportunities through the arts and project development.
5. **Know when to stop.** If you are pushing too hard to learn more about the topic a student introduced and note that interest has waned, let it drop. A student was supposed to choose one book to read for 20 minutes for a sustained reading activity. After 10 minutes he went to the teacher and asked for another book. "This book is telling me more about penguins than I care to know," he pleaded.

The Human Brain Is Wired to Learn

To conclude, let us take a basic look at what actually is happening when a young person or child experiences the "joy of learning." Realize that we have an insatiable, living, changing brain designed to determine who we are and how we respond to the world around us. The innermost parts of the brain contain structures that are more primitive than the outer parts. Buried deep within our brain is a structure called the *thalamus.* It is connected to all other areas of the brain as a type of switchboard. It receives information from the senses of hearing, seeing, smelling, tasting, and touching. It sends information back to the areas of the brain that are adept at interpreting the sensory signals. Furthermore, the thalamus is located near the *amygdala*, which is our emotional center. Chemicals are released when exciting sensory stimuli are received and interpreted. The chemical interactions create feelings of joy, excitement, and accomplishment. These explainable and highly desirable times of joy for children and learners of all ages happen as adults grasp the occasion to satisfy a young person's constant need to learn.

References and Resources

Moursund, D. (December, 2016). *The Fourth R.* Eugene, OR: Information Age Education. Read the book online at https://moursundagatefoundation.org/2018/07/the-fourth-r-second-edition/.

core way. Thousand Oaks, CA: Corwin Press.

Nevills, P. (2011). *Build the brain for reading, grades 4-12*. Thousand Oaks, CA: Corwin Press.

Chapter 18

Joy and Satisfaction in Natural Learning: Creative Improvisational Explorations

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I find that the joy and satisfaction in learning is in its creative, improvisational aspect. This kind of learning is explorative. It is instinctual and natural. Its essence is play. It is amplified in open-ended art making. This chapter describes an arts-based after-school program in which creative exploration and improvisation are central. The chapter also discusses ideas that support the value and importance of creative improvisational learning.

It is highly recommended that readers pause here to see an accompanying video, Wood and Arts Project, available at https://vimeo.com/144686169. This 29-minute video tells the story of a community-based project that began with a national park historical landscape restoration in the surround where I grew up. This entailed a large area of trees being cut down. I have a personal relationship with the trees and landscape of this place and was deeply disturbed by the tree cut, so I investigated.

I learned from the park personnel that the intent of the restoration was chiefly ecological—to reestablish disappearing grasslands in a concern for certain wildlife species. The park personnel learned that I wanted to honor the trees and landscape of my native place. I submitted a proposal for an arts project concerning the cut trees. It was accepted.

The intent of the project, through art, was to express empathetic human relationship with Nature. I—a dancer and teacher—teamed up with a local after-school program, ten interested middle school students, and a wood historian and artist. The park gave us cut wood for the students to sculpt. The finished sculptures where installed in the wilds of the restoration site for one year. The video documents this process from my beginning investigations with the park, through the exploration, learning, and sculpting processes of the students, to finished and installed sculptures.

As part of the sculpting process of honoring the trees and landscape, the students and I visited the restoration site to move—to "dance place" (1). We were looking for Nature's communications to us through various non-verbal gestures of sound, textures, shapes, color… whatever we sensed around us. We responded to Nature's gestures through movement improvisation, which gave us an embodied experience of value and meaning—an empathic process. We translated this gestural conversation into ideas for sculpting.

Back in the classroom, Dick, our wood artist, introduced sculpting tools and the use of them to the students. The students began the difficult task of using adult tools with minimal technical instruction to sculpt their own vision of what would emerge from their block of wood. These were a dedicated and inspired group of young people. As Dick says, "These

kids took something and made something really good out of it, without being told what to do or how to do it. We showed [them] how to use tools but I didn't really tell them how to carve: work with the grain of the wood, work with what you have in there, but what you see in that block of wood is your idea."

There was a continued energy and openness on the part of the students to explore something new. Debby, art teacher and director of the Art Spark after school program, comments, "I was impressed with [the students'] willingness to just start with a project. That it wasn't like—what are we doing? What's it going to look like? And you know, what's it going to look like didn't exist. I think the middle-school-age student is open to ambiguity, open to an experience and not having an end result in their brain." Find this and much more in the video mentioned above, Wood and Arts Project, available at https://vimeo.com/144686169.

I deeply value this project, which could not have happened without the community of people who appreciated my meaning and intent, and collaborated. My educational philosophy is strengthened by the creative improvisational quality, the place-based and project-based learning, and the community context of this project. This philosophy recognizes instinctual and natural learning processes as primary in human meaning and value making. I propose this to be so, not only in general way, but also from an evolutionary and, most importantly, a developmental way. And, through my research and life experience, I believe that in school learning the arts are a best way to allow students an explorative, open-ended way of making meaning of their own learning. I find joy and satisfaction in this process as a teacher and as a learner.

One of the people whose work I draw on to support my position is Paleolithic scholar and artist, R. Dale Guthrie. He writes that first human art-making was improvisational, "… a kind of play that was specifically targeted and specifically dedicated to exploring and sharing new perceptions… Paleolithic art is that first clear spoor of advancing creativity in the human line" (2).

Guthrie also observes that the creative imagination and ingenuity that is characteristic of the first human art-making "forcefully point to an upbringing that encouraged creativity" (3). This kind of development and learning was deeply contextual, embodied in a community of biological, social, cultural, and spiritual interweavings. It is what we would call place-based and project-based education.

This kind of development and learning was also deeply embodied in a relationship with Nature as intrinsically meaningful. As David Orr, environmentalist and educator writes, "We have good reason to believe that human intelligence evolved in direct contact with animals, landscapes, wetlands, deserts, forests, night skies, seas, and rivers" (4). That maturity and full potential of human intelligence is dependent upon rich life experiences with an expansive and healthy natural world.

When the students and I "dance place" we amplify this relationship through art making. Our moving, sensing bodies are communicators. And this nonverbal capacity evolved in relationship with the natural world (5). Its source is pre-human and underlies 90% of human face-to-face verbal communication. It relies deeply on contextual interweavings of cues. It is a creative, improvisational exploration. Our moving, sensing bodies are the basis for

communication, relationship, and learning. Instinctual and natural learning processes begin with the body as primary in human meaning and value making.

The value of instinctual and natural learning has been downplayed in conventional public school education. Iain McGilchrist writes that in Western culture we have made decontextualized, theoretical learning more important than contextual, embodied learning (6). He explores this through an understanding of the brain's cerebral hemispheres—left and right—each with a particular disposition or stance toward engaging with life.

McGilchrist recognizes the recent novelty vs. familiar theory on the organization of brain hemispheric specialization promoted by Elkhonon Goldberg (7). In Goldberg's view, the right hemisphere processes novel information and the left hemisphere processes familiar information. McGilchrist takes this beyond information processing and looks at the two hemispheres as differing dispositions in relationship with the world. The right engages with immediately lived experience, which always entails an improvisational quality. Its knowings are implicit—hard to pin down. An example of this is the non-verbal communication between infant and mother, which is a choreography of moving, sounding, gestural expressions.

The left translates lived experience into decontextualized bits of information and stores them in codes, symbols, and categories that represent lived experience—makes it familiar, that is, no surprises. An example of this is verbal language that is fixed in its meaning and given explicit definition, such as a list of words in a dictionary. Compare this with the implicit and improvisational meanings of mother-infant communication. Both dispositions, when working together, complement and enhance one another, but it is the right that gives the lived, interrelated context for value and meaning making.

As McGilchrist poignantly demonstrates, Western culture mistakenly identifies the left hemispheric stance to be of dominant importance, while marginalizing and devaluing the right hemispheric life view. This plays out in all aspects of our culture, not the least being education. Joy and satisfaction of learning as a creative, improvisational exploration recognizes the primacy of the right hemispheric disposition when it comes to deep human needs and the learning process (8).

The recognition of the right hemisphere life view to be of primary importance in learning and development comes up in different ways in education. There is a long tradition in progressive education of that recognition. For example, the work of Alfie Kohn (9) spells out progressive principles to include hands-on learning, multiage classrooms, mentor-apprenticeship relationships, and the desire to nourish curiosity, creativity, questioning, and compassion. These describe a learning environment that makes primary natural relationships in contextual, embodied, learning processes.

Kohn explains that there are decades of solid research data that support the effectiveness of the values and practices of progressive education. Such evidence of effectiveness includes long-term retention of what is being taught, the capacity to understand ideas and apply them to new kinds of problems, and a desire to continue learning—all aspects of creative, improvisational learning. He contrasts this with the lack of data supporting the effectiveness of traditional schooling such as standardized testing, homework, conventional discipline (based on rewards or consequences), competition, and others (10).

Kohn also points out that progressive teachers have to be "comfortable with uncertainty, not only to abandon a predictable march toward the 'right answer' but to let students play an active role in the quest for meaning" (11). This implies that teachers must also enjoy learning as a creative, improvisational exploration of the unfamiliar in the teaching process.

Another example of how the right brain disposition plays out in educational practice is Visual Thinking Strategies (VTS) (12). VTS is a creative meaning-making and problem-solving approach that draws on visual viewing of fine art to engage students in patterns of thought that turn out to underlie, are the foundation for, academic critical thinking. Phillip Yenawine stumbled upon this approach as education director for a major art museum, and later found the approach to have insightful benefits in school teaching and learning. Yenawine explains that this approach allows for the "permission to wonder" (13)—that is, the permission to engage in open-ended thought exploration, neither inhibited nor limited by parameters of specifically right or wrong answers.

As classroom teachers experimented with VTS, they were consistently surprised at the peaked interest, enthusiasm, and level playing field that the approach inspired in their students. This led to the application of the approach to other academic subjects, such as social studies, math, and even standardized test preparation. Yenawine points out that success in applying VTS across the curriculum requires that students must have learned the process first through viewing art.

From my perspective, VTS is an approach that stumbled upon the primacy of right hemisphere life view in learning processes. It is an example of what I name in my work—Arts with Literacy Integration™. Yenawine observes that learners need to "reconnect with how they learned as uninhibited children, something that schooling may in fact diminish" (14). Uninhibited learning is an intrinsically creative, improvisational exploration, which is amplified in the artistic process.

We can better facilitate the joy and satisfaction of learning through creative, improvisational exploration and the permission to wonder, since wonder really is the appropriate way to encounter the world. Art-making is the amplification of that encounter. It organizes and illuminates. It informs and teaches us to recognize and appreciate something of that great undeniable mystery within and without.

Notes and References

1. To "dance place" is to interrelate with the natural place where you are through dance and reciprocal gesture.
2. Guthrie, R.D. (2005). *The Nature of Paleolithic Art.* Chicago: University of Chicago, 392, 399.
3. Ibid, 425.
4. Orr, D. (2002). *The Nature of Design: Ecology, Culture, and Human Intelligence.* New York: Oxford, 299.
5. Burrill, R.R. (January, 2016). Dancing our Kinship with Animate Earth. *Minding Nature.* Retrieved 9/3/2016 from http://www.humansandnature.org/dancing-our-kinship-with-animate-earth.
6. McGilchrist, I. (2009). *The Master and His Emissary: The Divided Brain and the Making of the Western World.* London: Yale University.

7. Goldberg, E. (2005). *The Wisdom Paradox.* New York: Gotham.
8. Burrill, R.R. (October, 2010). The Primacy of Movement in Art-Making. *Teaching Artist Journal.* Abstract available at http://eric.ed.gov/?id=EJ901442.
9. Kohn, A. (2011). *Feel-Bad Education: And Other Contrarian Essays on Children and Schooling*. Boston: Beacon.
10. Ibid, 26.
11. Ibid, 28.
12. Yenawine, P. (2013). *Visual Thinking Strategies: Using Art to Deepen Learning Across School Disciplines.* Cambridge, MA: Harvard Education.
13. Ibid, 13.
14. Ibid, 13.

Chapter 19

Out with the Old and In with the New

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> "What the best and wisest parent wants for his own child, that we must want for all of the children of the community." (John Dewey; American philosopher, psychologist, and educational reformer; 1859-1952.)
>
> "Do not fear going forward slowly; fear only to stand still." (Chinese proverb.)
>
> "The longest journey begins with the first step." (Chinese proverb.)

You have heard the expression, "Out with the old—In with the new." In K-12 education, the old has served us well, but many new ideas are available. As we work to improve our educational system, we must make judicious decisions about what to keep and what to replace.

This chapter explores some aspects of our current K-12 schools that can be changed or replaced in a manner that will being more joy to students and improve their education. Keep in mind, however, that it is not so easy to simultaneously do the following:

1. Make good decisions on what to remove, and what to add or significantly change.
2. Actually be successful in implementing these decisions.
3. Create a more joyful, intrinsically motivating learning environment for students and working environment for staff.

The **new** may be based on progress in technology. See, for example, David Moursund's book, The Fourth r. (Moursund, 2016). It strongly recommends integrating use of computer technology throughout the everyday curriculum at all grade levels. Certainly the progress in Information and Communication Technology (ICT) has been accompanied with a very large number of proposals on how to make effective use of ICT to improve education. Or, the **new** may be based on educational research. We certainly know a great deal more about cognitive neuroscience (brain science), social and economic inequalities, and medicine than we did 20 years ago. Other sources of **new** lie in progress in genetic engineering, issues of sustainability of the various life forms on earth, achieving global cooperation in dealing with global warming, and so on.

ICT provides interesting and challenging examples. Let's use a Smartphone for an example. Worldwide production of Smartphones is now at a rate of over a billion a year. In the "developed" nations, they are ubiquitous. For the most part, children and adults manage

to learn to use them without the benefit of formal schooling. Frequently, children who are self taught or who learn from other children develop a range of Smartphone knowledge and skills exceeding that of many adults. Indeed, they may well help their parents to learn to make more effective use of Smartphones.

You know that Smartphones are hugely popular and widely used. I believe it is safe to say that a high percentage of students who have Smartphones find them to be intrinsically motivating. Here is a fundamental three-part Smartphone question:

1. What problems and tasks can a Smartphone-equipped person effectively deal with better than can a person who does not have such an aid?
2. How important are these problems and tasks to the person and to the education of the person?
3. How are our schools making use of what students + Smartphones can learn to do together?

In these questions, the term Tablet Computer can be substituted for or added to Smartphone. Educators need to better understand how much *transfer of learning* occurs from an informal educational environment to the formal schooling environment. How might schools better help students to understand such transfer of learning and to take advantage of it in school and in their lives outside of school?

These are not simple questions and they do not have simple answers. However, the capabilities and "smartness" of Smartphones and Tablet Computers are steadily increasing, so the challenge to our current educational system is growing. We recognize the joy and other benefits that Information and Communication Technology bring to the lives of many students, but we see many school districts strongly resisting the routine, everyday use of ICT in school.

Some Examples from Will Richardson's Article

Will Richardson has recently written a provocative article, Nine Elephants in the (Class) Room that Should "Unsettle" Us (Richardson, 4/13/2016). To a large extent, each of the nine elephants that Richardson addresses is an example of the heritage of our current educational system, and they tend to decrease joy in education. This section briefly discusses three of his ideas.

Students Forget Much of What They "Learn" in School

All adults know this. They need only think back to what they "learned" in various courses and grade levels, and how much they still remember. I was shocked many years ago when my older daughter took a freshman calculus course and would come to me for help from time to time. I—with my doctorate in math—had trouble with some of the details of the material that I had not used for many years.

As Richardson notes:

> **That's primarily because the curriculum and classroom work they experience has little or no relevance to students' real lives.** … Yet we continue to focus our efforts primarily on content knowledge, as is evidenced by the focus of our assessments. If we would acknowledge that true learning

> is unforgettable, made of the things that we want to learn more about, we'd radically shift our focus in the classroom. [Bold added for emphasis.]

The point is that, as students progress through school, more and more of their time is spent on content that is not immediately useful to them. The statement "use it or lose it" certainly applies to school content. We need to reconsider both the content and possible interactions among the various content areas so that more content is "used" by students when and after it is covered in the curriculum.

For example, math and science are part of essentially every discipline of study. We teach them as isolated subjects and we do poorly in integrating student math and science knowledge and skills into the rest of the curriculum. I believe that some of the fun of math and science is lost in this approach to education.

Our Schools Are Not Set Up to Produce Deep, Long-lasting Learning

Quoting again from Richardson:

> When we look at the things that each of us has learned most deeply in our lives, the same certain conditions almost always apply: Among other things, we had an interest and a passion for the topic, we had a real, authentic purpose in learning it, we had agency and choice, deciding what, when, where, and with whom we learned it, and we had fun learning it even if some of it was "hard fun."

The "hard fun" reference is to an article by Seymour Papert, a pioneer in use of computers in school (Papert, n.d.). Papert was a wizard at using the Logo programming language to create joyful learning experiences in schools, especially at the elementary school level. Learning can be (and often is) hard work. But intrinsic motivation and success in using one's new knowledge and skills can often help to turn this hard work into hard fun.

Note that Richardson is focusing on what might be called "pure" academic content. He does not discuss the many aspects of schooling that prepare students for their current and future lives. For example, in school students make friends, and they learn to work together with fellow students. They learn about cooperation, sharing, helping others to learn, and learning from each other. These are all continuing and very important aspects of bringing students together for long periods of informal and formal interaction.

Parts of Our Curriculum Are Archaic

Richardson says this more poetically as follows:

> The way we talk about "The Curriculum" you would think that it was something delivered on a gold platter from on high. In reality, it was pretty much written by 10 middle-aged white guys (and their primarily white, middle-aged friends) in 1894 called "The Committee of Ten." They were from some of the most prestigious schools and universities at the time, and they fashioned the structure of much of what we still teach in schools today [CSMC, 2004].

It is easy to be critical of the work of "The Committee of Ten" done more than 120 years ago. This work definitely advanced secondary school education in the U.S. However, it also solidified some ideas that have resisted change.

Ten-person subcommittees worked in each of ten different discipline areas. In math, for example, the Committee's five reports were:

- General statement of conclusions.
- Special report on the teaching of arithmetic.
- Special report on the teaching of concrete geometry.
- Special report on the teaching of algebra.
- Special report on the teaching of formal geometry.

Over the years, educators have made changes to this set of recommendations, but they continue to weigh heavily on the math curriculum.

Currently, the typical grades 8-12 schooling provides students with the opportunity to take two years of algebra, a year of geometry, a year of pre-calculus (calculus prep) topics, and calculus. (Increasingly, the first year of algebra is offered in the eighth grade.) The math recommendations have been moved downward a year and new content has been added. However this "college track" math curriculum is not meeting the needs of a great many college-bound students. Evidence of this is provided by the fact that the majority of students who graduate from high school and begin college are forced to take remedial math courses based on their math placement test scores.

In addition, at the current time the "average" adult in the U.S. performs at about the eighth grade level in math. This is despite the fact that 90 percent of U.S. adults have completed high school or a GED (U.S. Census, n.d.).

In a completely different academic area, we definitely have made progress in modernizing the curriculum. In languages, Greek and Latin used to be required for admission to many colleges, and so were emphasized at the precollege level. That is no longer the case.

Other Examples

Substantial research tells us that the sleep patterns of teenagers are different from those of younger and older people. Many adolescents suffer from sleep deprivation (National Sleep Foundation, n.d.). Quoting from this site:

> Teens are among those least likely to get enough sleep; while they need on average 9 1/4 hours of sleep per night for optimal performance, health and brain development, teens average fewer than 7 hours per school night by the end of high school, and most report feeling tired during the day. The roots of the problem include poor teen sleep habits that do not allow for enough hours of quality sleep; hectic schedules with afterschool activities and jobs, homework hours and family obligations; and **a clash between societal demands, such as early school start times, and biological changes that put most teens on a later sleep-wake clock.** As a result, when it is time to wake up for school, the adolescent's body says it is still the middle of the night, and he or she has had too little sleep to feel rested and alert. [Bold added for emphasis.]

Here is another example. Have you thought about why most school "years" are only nine months in length? It is certainly **not** because students' brains need a yearly three-month rest. We developed the nine months school year when farmers needed their children's help in the fields during the summer. That time is long past.

For a fourth example, consider the teaching of non-English languages in U.S. schools. The research strongly supports starting at as young an age as possible—for example, kindergarten, pre-kindergarten, or still earlier. While we have some language emersion schools that follow this idea, most of our non-English language instruction begins when students are much older—and when their brains have substantially reduced language-learning capabilities. Quoting from Jeanette Vos's article, Can Preschool Children Be Taught a Second Language? (Vos, n.d.):

> For years it has been thought that teaching a foreign language to preschool-age children would be futile. However, recent studies indicate that the best time for a child to learn another language is in the first three to four years of life.
>
> …
>
> "During this period and especially the first three years of life, the foundations for thinking, language, vision, attitudes, aptitudes, and other characteristics are laid down," says Ronald Kotulak, author of Inside the Brain.
>
> Consequently, it would be a waste not to use a child's natural ability to learn during his or her most vital years, when learning a second language is as easy as learning the first.

Many bilingual and trilingual people experience joy in their language communication skills and knowledge of a second and/or third culture. Interestingly, research indicates that there are cognitive advantages of this linguistic achievement (Chan, 6/14/2014).

Final Remarks

I don't know about you, but when I start on a car trip I tell my Smartphone my starting point and destination. As I drive, my Smartphone tells me where to turn, how far I still have to go, and how long this is apt to take. The capabilities of today's cars continue to improve, and eventually most people will be riding in self-driving cars. These aids to driving are only one of the many ways that ICT is changing our daily lives.

When I have a question that other people are apt to have studied and answered, I communicate with my Smartphone or computer and am quite likely to be provided with a useful answer. Think of this as my computer working with me to solve problems and accomplish tasks better than either of us can do alone.

It is vitally important that a modern education prepares students to solve problems and accomplish tasks using both their own physical and cognitive capabilities, and the physical and cognitive capabilities of machines. Yet, in many schools we are doing a very poor job of preparing students to make effective use of the rapidly growing cognitive capabilities of computers.

It also is important that we pay attention to the joy that so many of our students find in exploring the capabilities of their computer, Smartphone, and other electronic tools. Wouldn't it be grand to bring much of this joy into our classrooms?

What You Can Do

Our formal K-12 educational system is very resistant to change. You may enjoy reading two short, delightful parables about educational change available in an article by Ann Lathrop (6/24/2015).

Every teacher and every parent has the potential to bring considerable change and modernization into content, teaching processes, and assessment. Think about this as you interact with K-12 students. Even small changes can make a large difference in the life of an individual student. You don't have to make a huge production of "Out with the old—in with the new." Just bite off a small change that you can accomplish. **Try it—see if you like it.**

References and Resources

Chan, A. (6/14/2014). Seven reasons why it's good to speak another language. *Huffpost Healthy Living.* Retrieved 5/21/2016 from http://www.huffingtonpost.com/2014/06/14/bilingual-brain-benefits_n_5453033.html.

CSMC (2004). *The Committee of Ten.* Center for the Study of Mathematics Curriculum. Retrieved 5/21/2016 from http://www.mathcurriculumcenter.org/PDFS/CCM/summaries/comm_of_10_summary.pdf.

Lathrop, A. (6/24/2015). Note to a friend with children. *IAE Blog.* Retrieved 7/15/2016 from http://i-a-e.org/iae-blog/entry/note-to-a-friend-with-children.html.

Moursund, D. (2016). Improving the world: What you can do. *IAE-pedia.*

Moursund, D. (December, 2016). *The Fourth R.* Eugene, OR: Information Age Education. Read the book online at https://moursundagatefoundation.org/2018/07/the-fourth-r-second-edition/.

Moursund, D. (5/12/2016). Building a personal library for children. *IAE Blog.*

Moursund, D. (1/23/2016). Learning problem-solving strategies by using games: A guide for educators and parents. *IAE Blog.*

Moursund, D. (2015). *Brain science for educators and parents*. Eugene, OR: Information Age Education.

Moursund, D. (2/25/2015). The coming technological singularity. *IAE Blog.*

National Sleep Foundation (n.d.). *Backgrounder: Later school start times.* Retrieved 5/21/2016 from https://sleepfoundation.org/sleep-news/backgrounder-later-school-start-times.

Papert, S. (n.d.). Works by Seymour Papert, Ph.D. Retrieved 5/21/2016 from http://www.papert.org/works.html. Provides a list of about 100 articles written by Papert, including links to many of them. The article Hard Fun is available at http://www.papert.org/articles/HardFun.html.

Richardson, W. (4/13/2016). Nine elephants in the (class) room that should "unsettle" us. *The Huffington Post.* Retrieved 5/202016 from http://www.huffingtonpost.com/will-richardson/9-elephants-in-the-classr_b_9649394.html.

U.S. Census (n.d.). Educational attainment in the United States: 2015. Retrieved 5/21/2016 from https://www.census.gov/hhes/socdemo/education/.

Vos, J. (n.d.). Can preschool children be taught a second language? *Earlychildhood News*. Retrieved 5/21/2016 from http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleID=60.