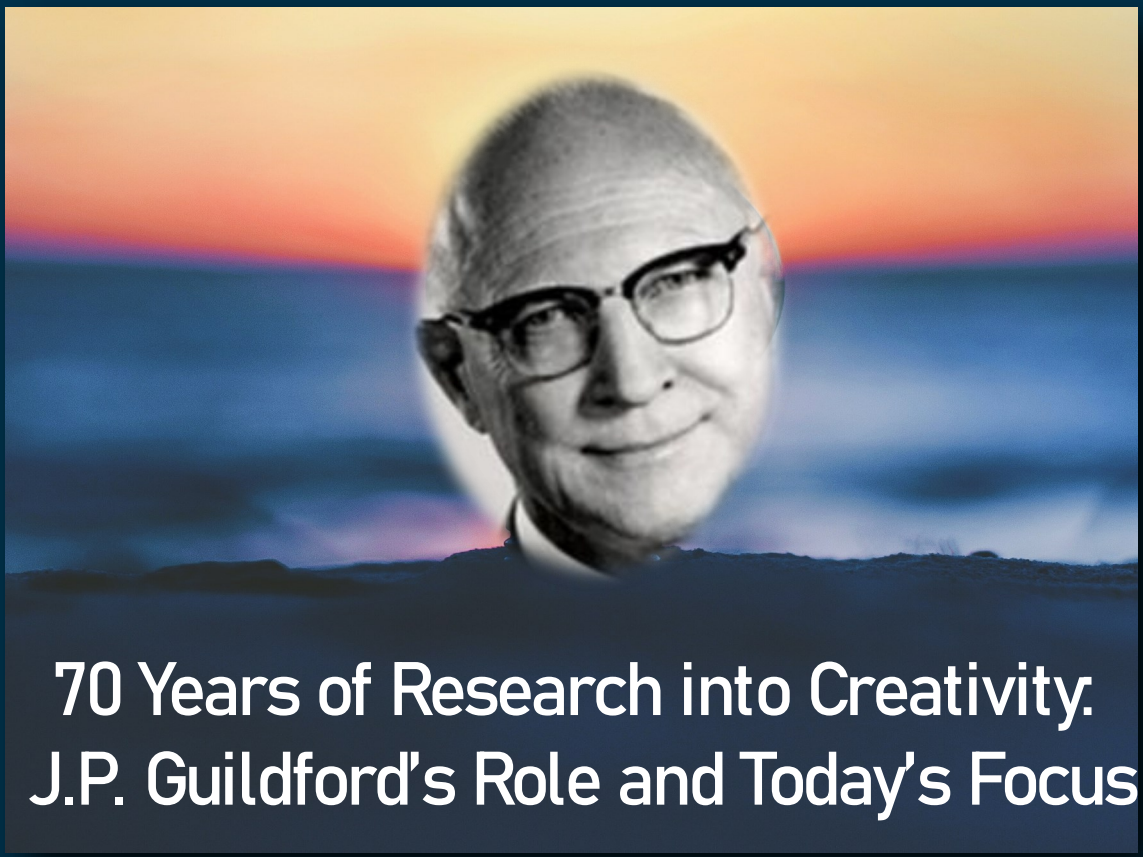

70 Years of Research into Creativity: J.P. Guildford's Role and Today's Focus

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Editor
Fredricka K. Reisman, PhD

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70 Years of Research into Creativity: JP Guildford's Role and Today's Focus

KIE Conference Publications

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Debbi Ponella holds a master's degree in Creativity & Innovation from Drexel University and a degree in cello performance from The Hartt School, University of Hartford. Her principal mentors in the study of Creativity have been Fredericka Reisman, Rick Kantor, and Larry Keiser at Drexel. Her primary cello teachers were David Finckel (Emerson String Quartet) and Fritz Magg (Berkshire String Quartet) at Hartt, and Zvi Maschkovski (Daniel String Quartet) in Rotterdam, The Netherlands. Though the winner of multiple concerto competitions, her preference has always been chamber music and collaborating with others. Debbi has founded and expanded programs providing opportunities for personal and collaborative creative development that have benefited her local communities and beyond, including Kids Compose, Stages Bloomington, and children's programing for the Bloomington Early Music Festival (BLEMF). Through her graduate work, continuing research, and teaching, Debbi has been able to incorporate all of her life

experiences into her creativity studies, being awarded the Fredricka K. Reisman Award for Outstanding Graduate Work in Creativity, presenting in various venues on music and creativity, and as she further explores her passion for creativity in all forms and fashions, focusing on the creative process.

Dorothy A. Sisk

Dorothy A. Sisk, PhD, is a professor at Lamar University in Beaumont, Texas, and she teaches the graduate courses in gifted education in the Teacher Education Department. She is an international consultant focusing on gifted education, leadership and creativity development, and former Director of the U. S. Office of Gifted and Talented in Washington D.C. Dr. Sisk was a co-founder and first President of the American Creativity Association, and a co-founder and President of the World Council for Gifted and Talented Children, serving as their executive administrator, and editor of *Gifted Internationa*l (1980-1990). She is author and co-author of 14 books and numerous chapters and articles, and serves on a number of national and international journals as a reviewer or editor.

Fredricka K. Reisman

Fredricka K. Reisman, PhD, is founder of Drexel's School of Education and is Emerita Professor in the School of Education. Additionally, Dr. Reisman served as Assistant Provost for Assessment and Evaluation, Interim Associate Dean for Research of the Goodwin College, and currently is Director of the Drexel/Torrance Center for Creativity and Innovation. Dr. Reisman received her Ph.D. in Mathematics Education from Syracuse University. Prior to coming to Philadelphia, Dr. Reisman served as Professor and Chair of the Division of Elementary Education at the University of Georgia and as an elementary, middle school, high school mathematics teacher in New York State, and mathematics education instructor at Syracuse University. Dr. Reisman has an impressive record of external funding from the National Science Foundation (NSF), the US Department of Education, the PA Department of Education, and foundation support such as the Wallace Funds and the Anna E. Casey Foundation, to assist pre-and in-service teachers in developing their mathematics and technology skills both in regular and charter public schools including national projects. In 1984, Dr. Reisman headed the Drexel project management team for the Computer Applications in Teaching Program which was the first major effort to integrate computing into instruction in the Philadelphia high schools.

She recently completed her fifth year as ACA President (James Kaufman was installed ACA president in November 2017). She has worked with a team of instructional designers and software developers at Drexel to create simulations for pre and in service, teachers addressing school-age violence and classroom management. Dr. Reisman was a virtual keynote speaker at the KIE conference held in Riga, Latvia in July 22-15, 2014 (see http://www.kiecon.org/page3.html). She also presented virtually at KIE conferences in London, Istanbul, and Berlin. The recent KIE conference was at Drexel in Philadelphia with participants from the UK, Finland, and several US locations. Dr. Reisman received the 2017 National Association for Gifted Children E. Paul Torrance Award with the following statement:

Fredricka Reisman's championing of creativity—as author, educator, test developer, and advocate—is consistent with Dr. Torrance's spirit and wisdom. She has been the long-time president of the American Creativity Association. She is an active scholar who has written numerous books and articles about STEM, learning, and creativity. She has successfully obtained funding in excess of $13M over the last 15 years towards improving mathematics and science creativity in K-12 schools. Keeping up with the times, Dr. Reisman recently developed the mobile app the Reisman Diagnostic Creativity Assessment. She worked extensively with Dr. Torrance at Georgia and continues to build off of his legacy. At Drexel, she founded the Drexel/ Torrance Center for Creativity and Innovation, the first Center outside of the University that had Dr. Torrance's personal permission to open.

Gavin Suss

Gavin Suss, PhD, is Dean of the School of Design and Innovation at the College of Management in Israel and lectures on creative thinking and innovation worldwide. Dr Suss served as the Academic Director at the prestigious Design, Art and Engineering School – Shenkar and was CEO of the High Committee for Public Colleges in Israel. Recently he published his second book *It's All About Creativity*." He has a PhD in education and management from Tel Aviv University and graduated from Harvard Business School's Executive Managers Program.

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Hansika Kapoor, PhD, is Research Author at the Department of Psychology, Monk Prayogshala, Mumbai, India. Having completed her Master's degree in Clinical Psychology, she is currently pursuing her PhD from IIT, Bombay, India in the area of creativity. Specifically, her thesis explores the measurement, facets, and process components of negative creativity through behavioural and electrophysiological methods. She is a practising psychologist and a passionate researcher, striving to improve the academic environment in India. Her research interests lie in cognitive science and social psychology.

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Heidi A. Rochlin, EdD, is an administrator in the K-12 public school system in Royersford, Pennsylvania. In her current role as the curriculum supervisor for math, science, and music for the Spring-Ford Area School District, Dr. Rochlin engages with teachers in professional learning and provides professional development for teachers and administrators across Pennsylvania. Dr. Rochlin has presented at the College Preparatory Mathematics (CPM) Annual Conference, with an emphasis on creatively engaging teachers in new initiatives in mathematics instruction. Dr. Rochlin has been in public education for 20 years, as a high school mathematics teacher, K-12 music teacher, and central office administrator. She resides in Berks County, PA with her husband and five wonderful children.

Kyung-Hee Kim

Kyung-Hee Kim (Kay Kim), PhD, is professor of educational psychology at College of William & Mary School of Education, Virginia, USA**.** Kay is an inventor, with two bio-medical technology US patents, and best-selling author, including *The Creativity Challenge* (USA, 2016), *Education for the Future* (Korea, 2019) and *Let Them Play Outside the Box* (Korea, 2019). She believes everyone can become an innovator using creative thinking skills. Her humble origin on a farm in Korea proves it. Her life's work promotes creative thinking skills of mastery, imagination, and critical thinking as antidotes to creativity-killing social conformity and test-centric rigidity. She began that work studying under the father of creativity, E. Paul Torrance. Kay won the Berlyne Award (2009) from the American Psychological Association, and the Hollingworth Award (2008), the Early Scholar Award (2011), and the Torrance Award (2018) from the National Association for Gifted Children, becoming one of the foremost experts on creativity assessment and innovation. Her *Creativity Quotient* assessment uses her eye-tracking patent. Media and government leaders frequently seek her expertise through interviews and speaking engagements. It is her passion to promote entrepreneurship through the creative thinking methodologies of her life's work.

Lori Severino

Lori Severino, EdD, is an Assistant Professor in the School of Education at Drexel University. Prior to her work at Drexel University, she taught in public education in special education for 26 years. During her tenure in the public school system, she taught students with reading disabilities, specifically dyslexia. Dr. Severino is a certified Wilson Language Trainer and was instrumental in bringing Wilson Level 1 certification to Drexel's Master of Special Education program and the Reading Specialist certification. Currently, she is working with faculty from the school of education and biomedical engineering to create a reading comprehension app for adolescents that uses fNIR technology to ensure the questions to the reading passages are text-based, an important factor with the new common core standards. Dr. Severino offers professional development training for teachers on topics such as reading and writing instruction for struggling students, differentiated instruction, and working with students with emotional behavior disorders. She was an invited speaker on differentiated instruction in the content areas at the Pennsylvania Branch of the International Dyslexia Association. She spoke on the same topic at the International Division of Council for Exceptional Children in Braga, Portugal. Dr. Severino has presented at numerous conferences both nationally and internationally.

Michael Brown

Michael Brown is the Programme Leader for the BA (Hons) Music degree programme within the School of Arts, at the University of Derby in the UK. He holds diplomas in Art and Music, a BSc (Hons) degree in Software Engineering, Mathematics and Music, and a Master 's degree in Contemporary Composition, which combine to serve his interest in computer creativity. He is a researcher within the school with over twenty-five years of teaching

experience; an active artist, composer and musician. His principal research interest is in the area of creativity; he has collaboratively investigated relevant theories and developed applicable strategies, in relation to the Arts and particularly Music, for implementation professionally and educationally. He has over the past few years explored a variety of related strands of investigation and has disseminated his findings on multi-modal creativity in Europe and the USA where he is an active member of the American Creativity Association. Ostensibly his core objective is to assemble a body of work that constitute a *toolkit* of applicable creative approaches that serve to offer insight into the creative process and potentially help to cultivate environmental conditions within which creative ideas may be more forthcoming.

Renaldo A. Scott

Renaldo A. Scott, EdD, is an adjunct lecturer at the University of Pennsylvania, USA. Renaldo holds a Doctor of Education degree with distinction from Drexel University's School of Education. He also earned a Master of Arts from NYU in TESOL and holds two certifications from Cambridge University to teach English language. For 14 years, he has been teaching English in various capacities, one of which has been as an adjunct lecturer of 7 years at the University of Pennsylvania where his responsibilities spanned instruction of Wharton and Penn dental students. His passion for teaching is what prompted his research into creative ways to teach complex English grammar via heuristic models. On the global front, Dr. Scott has deep overseas experience, including in China as a Distinguished Visiting Professor at Beijing Jiao Tong University and in Korea as an education entrepreneur. Lastly, Dr. Scott's multilingual ability enables him to approach pedagogy from a deeper perspective that can be of help to his students.

Ron Corso

Ron Corso is Program Director for Foundation Studies in Design and Creative Thinking Methods at the University of South Australia. He has had an involvement in Design Education for over thirty years having initially trained as an Industrial Designer then moving into teaching, administration and consulting roles across sectors from elementary, open education schools to higher and further education. He has conducted research into the teaching of creativity, convened conferences as well as publishing and presenting widely at conferences, seminars and colloquiums promoting and advocating the value of creativity in the curriculum. He has been the recipient of national (Australia) OLT grant to develop creativity teaching tools and other university grants, teaching and learning, research citations and awards in recognition of his work in the field of creativity practice and education. Current work is focused on developing a vision for a University of Innovation and Enterprise at the University of South Australia where he is playing a leading role in establishing the frameworks and strategies for building a creative dimension across all sectors and disciplines of the institution.

Ronald A. Beghetto

Ronald Beghetto, PhD, is an internationally recognised expert on creative thought and action in educational settings. He is the Pinnacle West Presidential Chair and Professor for the Mary Lou Fulton Teachers College at Arizona State University. Ron is the Editor for the *Journal of Creative Behavior*, Book Series Editor for *Creative Theory and Action in Education*, a Creativity Advisor for the *LEGO foundation*, and *Fellow of the American Psychological Association* and the *Society for the Psychology of Aesthetics, Creativity and the Arts*. He has published 10 books and over 100 articles and book chapters on the topic of creativity in educational settings. Prior to joining the faculty at ASU, Ron served as Professor and Director of Innovation House and the University of Connecticut. He is the 2018 recipient of the Rudolf Arnheim Award for Outstanding Achievement in the Psychology of Aesthetics, Creativity and the Arts and 2008 recipient of Daniel E. Berlyne Award from Div. 10 of the American Psychological Association. Ron has received recognition and numerous awards for excellence in teaching, including the University of Oregon 's highest teaching award for early career faculty (2006 Ersted Crystal Apple Award), the 2015 ALD Faculty of the Year Award at the University of Connecticut, and the Provost's Recognition for Excellence in Teaching (University of Connecticut). Previously, he was a Professor of Educational Psychology, Director of UCONN's Innovation House, and Graduate Program Coordinator for the Cognition, Instruction, Learning, & Technology Program in the Neag School of Education at the University of Connecticut.

Stuart Gluth

Stuart Gluth is currently a practice-based PhD candidate investigating the relationship between engagement and the abstract visual material generated using a single simple material, paper, until recently Lecturer in Graphic Design at Charles Darwin University, previously Teaching Fellow at the University of Southampton campus at the Dalian Polytechnic University in China, and prior to that Studio Head of Graphic Design at the University of South Australia. He continues as a practising designer, Illustrator, and paper designer and artist, typographer and typographic researcher, researcher into creativity and he conducts workshops in creative idea generation across disciplines. Stuart has acted as a consultant internationally in integrating creativity across disciplines, and taught in China, Singapore and Korea. He has conducted design workshops in remote Aboriginal communities, to inspire learning at a variety of levels and in diverse cultural backgrounds and devise alternative pathways into higher education and professional practice, including strategies for the integration of theory and practice in design education.

PREFACE

70 YEARS ON: REMEMBERING JP GUILFORD'S PRESIDENTIAL ADRESS ON CREATIVITY

> Why does a human being look up to the night sky and wonder what makes the stars bright and the earth spin? What causes someone to watch another at work, then go off and build a tool to make the task easier? What moves someone else to gather together pigments and sit outside at dusk to capture images of the fading light? Where do ideas come from? The thing that separates us from other creatures on earth is our ability to invent... We are the only creatures who seem capable of spontaneous invention, of making something from nothing, of thinking something up and making it so. It's our glory as a species; it may, as well, lead to our destruction. Such is the power of creativity.
>
> — Chris Petty (2001, p. 1)

He was a little five-year-old boy when the American Psychological Association was launched in July 1892. His primary community, Division 10, was one of the first APA charter divisions established in 1945. His presidential address, five years later, was 58th. He was ebullient; he was unassuming; he was Joy Paul Guildford.

It is 70 years since JP Guildford's Presidential Address to the APA where he charged psychologists and others in the related fields to shine their touch lights on creativity (Guilford, 1950).

Guilford was known for his work on human intelligence most notably *Structure of Intellect theory* (see, for example, Guildford, 1956, 1959, 1967, 1972), but his address at the American Psychological Association in September 1950 – coincide with 'other factors', according to Plucker (2001) – was pivotal. His talk arguably set ablaze contemporary interests in research into creativity and related fields.

70 years since Guilford's address, thirty-three years after his death, and after voluminous research, giants and trailblazers in the field – researchers, educators and practitioners – do not 'share' a language for creativity (see Welsh, 1973; Ford and Harris, 1992; Parkhurst, 1999; Joubert, 2001). Some experts in the field have conceptualised creativity as a product, some as a process, some as personality, some as environment, some as combinations of those, and some as technology including (more recently) big data science.

But researchers and educators need not 'share' a language for creativity. The fact of the matter is that creativity is never a single variable but, as Reisman (2013, 2014) posited, a complex phenomenon, multifaceted and multidimensional process that may not be easily straitjacketed into a single definition or an application.

It has been argued that it was the lack of a 'shared' language for creativity and its *evergreen* nature, as Sternberg (2006) pointed out, that endured the subject to the hearts and minds of so many people across the world. Such is the evergreen nature of creativity, and 'such is the power of creativity', as Chris Petty succinctly posited in the earlier quote.

Much has been written about the work of Dr Guilford and I have no doubt that much will continue to be written about this great man. This volume is dedicated to him—JP, as his close associates and friends fondly called him. It is an additional contribution to the work and legacy of Dr Guilford.

All that is left for me here is to thank everyone who has contributed to this volume—from the editor, Dr Fredricka Reisman, for her sterling work to Dr Ronald Beghetto and Dr Kyung Hee Kim for their wrap up. Thank you all.

James Ogunleye, PhD, FRSA
Chairman, KIE Conference
Convenor, E. Paul Torrance International Roundtable on Creative Thinking
Convenor, Reisman Diagnostic Creativity Assessment Special Interest Group

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CHAPTER ONE

INTRODUCTION

FREDRICKA K. REISMAN

This chapter provides an overview of the 2020 KIE conference book chapters, wrap up chapters by Ronald Beghetto and Kyung Hee Kim, and a personal view of the Two USA Challenges in 2020 and Beyond: Racism and the Coronavirus through an Amoeba and Paramecium Dialogue.

Severino presents a comprehensive picture of integrating creativity as assessed by the RDCA to dyslexia, dysgraphia and dyscalculia. Her chapter relates to her RDCA SIG keynote presentation.

Wilson and Brown point out that creativity remains far too often an auxiliary pedagogy to disciplinary content. They focus specifically on music as a disciplinary vehicle to celebrate Guilford's contribution to creativity. The authors explore the golden age of creativity and provide suggestions for

Corso and Gluth from the University of South Australia point out that promoting recognition and fostering creativity in education remains a challenge for educators at all levels and they elucidate causes for this dilemma. Based upon Guilford's work, the authors describe significant impact and major structural and curriculum change at the University of South Australia through their approach. Their chapter has implications for higher ed in particular.

Renaldo Scott uses Guilford's 1950 APA address as a heuristic for his creation of *Please ASK* that represents a groundbreaking aid to English as a Second/Foreign Language (ESL/EFL).

Gavin Suss argues that schools at all levels are outmoded in regard to their current structure and pedagogical objectives. He describes the innovative school, what its structure will be, what it will teach, and how its students can be evaluated. Suss emphasizes the need for creative and innovative educational design.

The chapter by Kapoor, Tagat and Prayogshala applies big data analytics to creativity science in a manner particularly appealing to techies and comprehensible to others.

The paper by David Sledge explores how heuristics, like PACH (Playing Architectural Creativity Heuristics), can close scholarship gaps between architecture students' creative self-efficacy, assessments and evaluations, and design projects.

Dorothy Sisk shares her professional pathway as she describes in the most personal terms her mentoring by Joy Paul Guilford and other creativity giants.

The Ponella chapter analyzes fundamental issues that influence inclusion or omission of music composition in the classroom, as well as strate-

gies for incorporation through innovative methods utilizing resources existing in individuals, families, schools, and communities. Research results are presented that support the author's argument for providing classroom instruction to students and training for educators for developing individual and collaborative creativity.

Ronald Beghetto and Kyung Hee Kim wrap up the chapters with their overview.

Personal Observation

Following is a personal observation by the 2020 KIE Conference Book Editor that chronicles the 2020 state of the United States of America.

> Amoeba and Paramecium Dialogue Regarding Two USA Challenges in 2020 and Beyond:
>
> Racism and the Coronavirus
>
> Hello Paramecium says Amoeba. How did we get into this mess? Our pond used to reflect the sun and birds nesting in the Tupelo trees. Paramecium replies and children of all skin colors, sizes and hair styles playing tag along our banks. Now our pond reflects people in masks going to and fro as they nod to one another and send a hello with a hand wave.
>
> But wait, Amoeba – I see a black man on the ground and a police officer with his knee upon the man's neck—appears to be choking him. Oh dear. My goodness. What can we do to help? I'm calling all my Amoebas and you call all your Paramecium family and friends and together we will swarm the cop until **he** can't breathe and let go of the black man. Then let's call upon our Coronavirus cousins to mend their ways and join the fight against this injustice called racism.
>
> Coronavirus cousins were already on the way to help as they permeated society worldwide and could immediately see where humans were acting inhumanely. Humans were trying desperately to overcome Coronavirus cousins' effects that is causing hundreds of thousands of deaths and even greater numbers of illnesses. Scientists around the globe are working feverishly to create a vaccine that would curtail Coronavirus cousins' effects. But who is working feverishly to conquer racism?

Fredricka K. Reisman, Editor
Philadelphia, PA. USA

CHAPTER TWO

USING CREATIVITY TO ENHANCE INSTRUCTION FOR STUDENTS WITH DYSLEXIA, DYSGRAPHIA AND DYSCALCULIA

LORI SEVERINO

Abstract

Creativity is an important skill that can and should be developed throughout K-12 schools. For students with dyslexia, dysgraphia, and/or dyscalculia, incorporating creative strengths while learning difficult skills can encourage grit and perseverance. Teachers are encouraged to use the RDCA to determine their own creative strengths and to foster creativity in their classrooms. A theoretical model to support creativity in teaching to mastery for students with specific learning disabilities is discussed. Example activities that include identifying and using students' creative strengths while teaching in the student's area of need are shared.

Introduction

Creativity is a 21st Century Skill. Soft skills like critical thinking, problem solving, communication, collaboration, creativity and innovation are necessary for developing accomplished citizens for our future workforce (Chu, Reynolds, Tavares, Notari, & Lee 2017). Creativity can be developed. While some K-12 schools address creativity intentionally, such as Montesorri, most schools do not.

In 2018-19, Gallup conducted a national study to explore creativity and the extent it is fostered in learning. The study looked at the value of creativity in learning according to teachers, parents and students. The definition of creativity used in this study was "the ability to imagine new ways of solving problems, approaching challenges, making connections or creating products" (Gallop, 2019). Five key findings were identified:

1. Creativity in learning produces positive critical outcomes for students, which are further enhanced when teachers leverage the full potential of technology.
2. Teachers and parents agree that creativity in learning inspires better outcomes than traditional learning methods.
3. A majority of parents and teachers do not see the value in standardized testing as a measure of student learning.

4. Students in most classrooms today spend little time on activities that foster creativity.
5. A supportive and collaborative culture, training, and autonomy to try new things are key factors that help teachers bring more creativity to learning. (Gallup, 2019)

It is concerning that creativity in learning produces positive outcomes for students; however, students spend very little time during the school day on creative activities. For students with learning disabilities (dyslexia, dysgraphia and/or dyscalculia) the opportunity to spend time fostering their creativity may be even more essential.

Definitions of Dyslexia, Dysgraphia, Dyscalculia

Dyslexia. The term dyslexia comes from the Greek roots *dys* meaning difficult and *lexia* meaning reading. Dyslexia is a brain-based disability that affects the ability to read even though the person has average or above average intelligence (NIH, 2014). It is a pattern of "learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities." (American Psychiatric Association, p.67) While the term dyslexia is used for these types of difficulties, the DSM-5 uses Specific Learning Disorders as the category that includes dyslexia.

> The International Dyslexia Association defines dyslexia as:
> A specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (IDA, 2002).

It is important to recognize that the difficulty with reading is unexpected in relation to other cognitive abilities. It is a brain-based disorder and requires direct, explicit instruction in the rules of the English language.

Dysgraphia. Dysgraphia is a specific learning disability with a difficulty in sub word letter formation when a developmental motor condition can be ruled out (Berninger, et al, 2016). "At its broadest definition, dysgraphia can manifest as difficulty writing at any level, including letter illegibility, slow rate of writing, difficulty spelling, and problems of syntax and composition" (Chung & Patel, 2015). Dysgraphia, a writing disability, has been considered the forgotten Specific Learning Disability (Katusic, Colligan, Weaver, & Barbaresi, 2009). These students have difficulty forming legible letters automatically. The amount of effort used to form the letters drains the working memory and limits the ability to get thoughts on paper (or device). Dysgraphia may or may not be comorbid with dyslexia. Comorbidity is when the student has more than one area of learning disability. For some with dys-

graphia, it is only an impairment of forming the letter and retrieving the word to write it, for others it is the struggle to spell and use appropriate grammar and syntax. It is estimated that 10%-30% of school-aged children have difficulty with written expression (Chung & Patel, 2015). Depending on the definition used, between 30-47% of students with dysgraphia also have dyslexia (Chung & Patel, 2015).

Dyscalculia. Dyscalculia is a learning disability that makes it hard to make sense of numbers and mathematics in general. The prevalence of dyscalculia is between 3% and 6 % of the population (Kaufmann & von Aster, 2012; Shalev & von Aster, 2008) Students with dyscalculia lack an intuitive grasp of numbers and find it difficult to learn number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without grasping the underlying meaning (Reisman & Severino, in press). This will lead to further problems in higher level mathematics. Dyscalculia involves impaired number sense and concepts like cardinality and ordinality, and lack of organizing thoughts when engaging with numbers. It involves an inability to compare and estimate quantities on a number line, how to work with numbers in computation—adding, subtracting, multiplying or dividing, how to employ numbers when counting, measuring, estimating, and solving word problems. A student may also have very limited retrieval of calculation skills (Kucian & von Aster, 2015).

Creativity in students with Learning Disabilities

Dyslexia is often linked with being more creative. Many famous entrepreneurs are dyslexic (Richard Branson, Charles Schwab, Jamie Oliver). The thought is that people with dyslexia think outside the box and are problem solvers, which sounds like creative characteristics. A study comparing entrepreneurs to corporate managers in the U.S. found 35% of the entrepreneurs had dyslexic tendencies while less than 1% of corporate managers identified as having dyslexia (Logan, 2009). The skillset of people with dyslexia may be well suited to the characteristics needed to be an entrepreneur.

When it comes to school-age children, many teachers believe their students with dyslexia are very creative, and there is some research to support this. Shondrick, Serafica, Clark & Miller (1992) found a positive correlation between creativity and interpersonal problem solving in boys with learning disabilities. For students with developmental dyslexia (DD), LaFrance (1997) found a higher propensity for the intuition aspects of creative thinking in the DD students versus two other groups: gifted students and gifted students with DD. Everatt, Steffert & Smythe (1999) found higher levels of creativity on figural tests in children with DD. Finally, Cancer, Mazoli & Antonietti (2016) identified areas in which students with DD scored significantly higher than the control group on three mental operations related to creativity: "widening" (divergent thinking); "connecting" (synthesizing ideas and coming up with novel solutions); and "reorganizing" (taking on different perspectives and gaining new points of view).

While there have been a few studies between students with dyslexia and non-dyslexic peers, there do not appear to be studies connecting creativity to students with dysgraphia or dyscalculia. Teachers have shared anecdotal

data describing students (with dysgraphia) orally telling a story that includes rich details and advanced vocabulary, but those details and vocabulary vanish when the student is asked to put those details in writing. Sometimes handwriting issues or the writing process require a high cognitive load and the student struggles to get their thoughts on paper. These are some challenges for students with dyslexia that may hinder the creative process. Awareness of what is needed to increase creativity and what tendencies might thwart the creative process may prove useful for the classroom teacher (Reisman & Severino, in press). Teachers who provide a non-threatening, non-judgmental classroom environment, can open the door to allow every child to find reading, writing and math fun and enjoyable experiences. A primary ingredient here is to focus on a child's strengths and offer generous praise for effort.

RDCA

The Reisman Diagnostic Creativity Aassessment (RDCA) ranks an individual's self-perception on 11 major creativity factors that have emerged from the creativity research:

- Fluency
- Flexibility
- Elaboration
- Originality
- Resistance to premature closure
- Tolerance of ambiguity
- Convergent thinking
- Divergent thinking
- Risk taking
- Intrinsic motivation
- Extrinsic motivation

The RDCA is a 40-item Likert-type self-report that can be completed in 10-15 minutes. Four of the RDCA factors are similar to those tapped by the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1966), i.e., originality, fluency, flexibility and elaboration, that in turn are built on J.P. Guilford's (1950) work. The RDCA provides an instant overall creativity score, as well as scores to identify specific creativity factors in which the participant may already be strong, factors they may be developing, and factors that might need developing. It is diagnostic in that it allows the participant to see areas of strength and areas they may wish to develop. It can be taken at different times and used to see if any factors improved through creative exercises. This is when teachers can play a vital role in the process.

Using RDCA with K-12 Students

Teachers can use the RDCA in a variety of ways. The first recommendation is for the teacher to take the RDCA and identify their own areas of creative strength. Being aware of one's creative strengths can influence how a class is

taught or what type of assignment/assessment to use to determine mastery of the content. Students will have different areas of creative strengths. Providing choice in demonstrating mastery may engage the students and produce better outcomes. By looking at results of students RDCA, teachers could find that some students need extrinsic motivation to complete work; others may thrive on their own intrinsic motivation. This is not to say that a teacher needs to focus on using these creative strengths exclusively, but rather understand the factors that would help a student persevere through challenging tasks. For instance, a student with dyslexia is learning and practicing decoding and encoding (an area of difficulty); the teacher had the class take the RDCA and knows that the student scored high on intrinsic motivation and low on extrinsic motivation. The student is going to be driven internally and will work through difficult concepts if they know they will be successful in the end. It would be important to share with this student that if they learn and practice these skills they will succeed in the end. Explain to this student the brain starts to make connections with practice. A teacher can help the student set goals and develop a plan to achieve those goals. In contrast, a different student with a decoding issue scored high on extrinsic motivation. As a teacher, my approach might change. I would teach the same skills as for the other student, but I might have an external reward system set up. If the student practices reading and spelling a certain number of words, they receive a predetermined amount of points. They collect points for a reward- something they choose as important to them.

Some students have excellent verbal skills, some excel in writing, and others in drawing and creating. In addition, when a teacher is aware of a student's creative strengths, learning and activities can incorporate the opportunity for students to showcase those strengths. It also allows for an excellent opportunity to help students persevere through tasks that prove difficult for them. The Torrance Incubation Model provides a model for teachers to incorporate in learning.

Torrance Incubation Model (1979)

The Torrance Incubation Model (TIM) for Teaching and Learning includes three stages to introduce creativity into lessons:

Stage 1: Heighten awareness
Stage 2: Deepen expectations
Stage 3: Extend the learning

In stage 1, the teacher introduces the learning in a way that gets students excited about the topic. It could involve one or more of the following: create a desire to know, heighten anticipation and expectation, get attention, arouse curiosity, tickle the imagination, or give purpose and imagination. In stage 2, teachers expect the students to dig deeper and synthesize the information they are learning. This stage lends itself to the third and final stage when students apply what they learned to the real world. This is a great time to offer students that chance to solve real world problems. One never knows what can happen when students are given the chance to think outside the box.

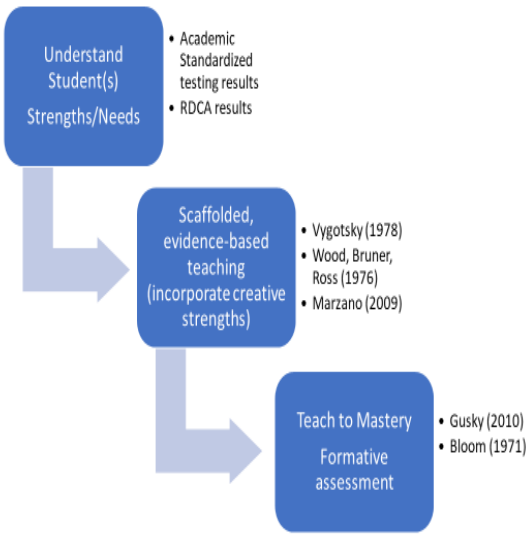
Consider Cynthia Sin Nga Lam who, at age 17, created H2PrO which harnesses light to speed up chemical reactions in order to sterilize water.

A Model for Including Creativity in Teaching to Mastery

There are many demands on teachers' time and learning one more strategy to include in lesson planning is not necessarily a high priority. One of the most important aspects of teaching is to know the students you have in front of you at any given time. Students with learning disabilities are in every classroom. In 2018-19, 7.1 million students (ages 3-21) received special education services in the U.S. of which 33% of those were diagnosed with a Specific Learning Disability (NCES, 2020).

It is important to have a deep knowledge of the students, the disability, and the intervention needed for a student to achieve mastery of the content. Figure 1 shows a model for the process that includes creativity in teaching to mastery.

Figure 1
Creativity in Teaching to Mastery



(Severino, 2020)

One of the most common misconceptions about dyslexia is that it is mostly reversing letters or mixing up the letters (e.g., b and d). Dyslexia is much more than that. The same is true for dyscalculia, it is more than mixing up number order. These disabilities are neurobiological. They originate from

unique cognitive and brain impairments. Once teachers understand the types of issues their students have, they also want to understand student strengths. Students diagnosed with learning disabilities in the U.S. have an Individualized Education Plan (IEP). The IEP will have present levels of assessment. Teachers should be trained to understand the results of the standardized assessments. Looking at the standard scores and percentile ranks will provide important information on academic strengths and weaknesses of the student.

However, the scores on the standardized assessments only paint one side of the picture for the student with a learning disability. That same student may be an excellent musician, or an artist, or an inventor. These positive aspects can be overlooked if we only see the disability. The RDCA is a free tool that teachers can use to further understand their students. It is a diagnostic tool that can help students with learning disabilities focus on their potential.

Once teachers have a deeper understanding of their students, it is time to teach using evidence-based practices. In areas of need (reading, writing, mathematics) interventions are often necessary. Students with dyslexia, dysgraphia, and/or dyscalculia should not be expected to be taught a concept and understand it on the first few attempts. Scaffolding "is the process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (Wood, Brunner, Ross, 1976). This is when teachers can use the creative strengths of the students to support grit and perseverance in difficult tasks. Vygotsky (1935, 1978) proposed that cognitive development occurs during the social interactions leading to this interactive learning process within a "zone of proximal development". According to Vygotsky, the zone of proximal development is the distance between a student's current performance and potential performance through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978). He believed that children are influenced by the environment. This time of learning will be instrumental in how students view not only their ability to learn, but how they will view learning the specific content area in the future. Students that are provided the appropriate instructional intervention in a way that supports cognitive development as well as their emotional development may provide the best results.

Providing evidence-based interventions are not the end of learning. Being certain that a student learned the content to mastery is essential. Far too often, students are moved to the next skill or area of content without the teacher knowing whether a student achieved mastery of that concept. There are skills that need a high level of mastery before proceeding to the next step, particularly in reading and math. If a student cannot map 100% of letters to the most common sound, how will they be able to read words?

Bloom (1971) suggested that given the appropriate time and learning conditions with immediate corrective feedback, most students could reach a high level of achievement. He explained that providing instruction and administering a formative assessment to identify what skills were mastered and which still needed remediation were part of *mastery learning*. Progress monitoring is an important element in mastery learning (Guskey, 2010). Formative assessment is used on a regular basis to determine whether students are mastering the intended learning objectives. Progress monitoring is also a required component of IEPs. In this process (Figure 1), the cycle begins again to address the areas that were not mastered in the first go around.

Mastery learning is not new in teaching; what is new is trying to help teachers incorporate activities that would also bring in components of students' creative strengths to assist students in pursuing mastery of the concepts and skills that prove difficult for them. It requires the teacher to know what those creative strengths are and a desire to be creative themselves in developing lessons.

Activities for Students with Dyslexia

A student with dyslexia might score high in *originality, flexibility, elaboration* and *convergent thinking* on the RDCA. These factors point to someone that might come up with many unique ways to solve a problem. For this student, who struggles with reading the words on the page, a teacher might provide a text that would engage this student's interest and acknowledge their creative strengths in a way that would level the playing field when doing group work with peers.

In group work, the student with dyslexia might work with a peer without dyslexia. The students must work together to read the text to a certain point and then provide multiple scenarios for an ending. Here, the student with dyslexia can positively contribute to the conversation and be willing to work through the heavy cognitive load of reading.

Reader's theater is also another activity that allows students with creative strengths in risk taking and originality to work on their ability to read with appropriate expression, rate, and prosody (the patterns of stress and intonation in a language). Students with dyslexia may have difficulty with smooth, fluent reading. Reader's theater offers the opportunity to practice the same story and working with others to create the scene of the book. This is a perfect activity for those who like to perform and need reading practice.

Activities for Students with Dysgraphia

A student with dysgraphia might score high both in divergent and convergent thinking and fluency on the RDCA. This student can come up with many ideas for the use of something and be able to narrow the choices down to the best solutions. A teacher can capitalize on these strengths in a writing assignment, which for the student with dysgraphia may cause strife. The teacher might offer the class an object, such as a thimble, and ask students to come up with as many uses for this thimble as possible (a strength for this student). The class could then discuss all the options and groups of three students could narrow the selections down to the best uses for the thimble and an explanation of each. Students with higher scores in convergent thinking could be thought leaders in each group. Students would then be asked to individually write a paragraph on their best choice and why it would be the best choice. The teacher might offer assistive technology or a graphic organizer to help the student with dysgraphia.

Assistive technology is designed to help students who have learning disabilities. Whether students have physical impairments, dyslexia or cognitive problems, assistive technology can help them to function within the

classroom. These tools include any type of equipment or device that helps students to compensate for their learning disabilities. While they are unable to eliminate learning problems entirely, they can help students to capitalize on their strengths and minimize their weaknesses. Among the most innovative technologies available today, the following five are the most popular: "Electronic Worksheets" that help students to line up words, equations and numbers on their assignments**; "**Phonetic Spelling Software" designed to automatically convert the student's typing into the word that they intended to write**; "**Talking Calculators" facilitate reading numbers and performing calculations**; "**Variable Speed Recorders" make lectures more accessible**;** and **"**Videotaped Social Skills" can exemplify normal social interactions (see Assistive%20 Technology%20in%20 the%20Classroom%20–%20Masters% 20i). Graphic organizers are visual and graphic displays that organize ideas and demonstrate relationships between different information and concepts. They are designed to improve learning outcomes for students, review information, and are especially helpful for students who struggle with arranging information (see https://www.verywellfamily.com/examples-of-graphic-organizers-2162277). While the writing may be difficult for the student with dysgraphia, the prior experience in using their creative strengths in the group setting may encourage them to persevere.

Activities for Students with Dyscalculia

A student with dyscalculia might score high in *convergent thinking* and *extrinsic* motivation on the RDCA. This student struggles with sequencing. The teacher understands that convergent thinking means that the child can narrow choices down to a correct response. The teacher also understands that the student will likely respond to some form of reward. The teacher can begin with two objects and ask the student to determine which object is bigger. These objects can be in the form of a treat (M & M and a cookie). The student puts the smaller object first followed by the larger object. The teacher adds one object (treat) at a time and asks the student to arrange the objects by order of size. Once the student arranges the objects correctly, they can eat the objects as a reward.

Conclusion

It is important to note that while creative factors may be present for a student in an area of interest, teachers also want to recognize that these factors may not be present in areas in which the student struggles. Baer (2016) contends that creativity factors are domain specific. When students are frustrated while trying to learn a skill that is difficult for them, the brain begins to shut down and new learning is difficult. This is a critical time for both teacher and student. The teacher can be a guide to help the student work through the frustration. Teachers that understand the tipping point of their students can provide support prior to the intense frustration. Teachers that really get to know their students and sense when the tension (learning is very difficult) is too high, skillfully provide scaffolded support to help prepare the student to cope with

the tension. Teachers can then use the creative strengths of their students to support the scaffolding.

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CHAPTER THREE

CONSIDERING THE GOLDEN AGE OF CREATIVITY (*OR A BRIEF MUSICAL INTERLUDE IN THE MIDST OF A CRISIS)

CHRIS WILSON & MICHAEL BROWN

Abstract

It is 70 years since JP Guilford triggered a proliferation and diversification of research in creativity and related fields. The intervening period coinciding with a parallel boom in the filing of patents, the popular culture explosion, space age, sequencing of the human genome and extraordinary advances in medical science, the digital communications and computing revolution, the emergence of AI and profound achievements in all areas of scientific endeavour, his legacy is undoubtedly one of germinal impact and notable prescience of vision. Nevertheless, despite paroxysms of introspection, massification and decades of systematic reform, creativity still remains a novelty in the everyday discourse of educational disciplines in overall terms and considered as something of a predominantly aspirational novelty for the majority of teachers and learners at all levels of education and entirely invisible for a significant number. Creativity remains far too often adjunct to discipline and subject to systematic inhibition. Focusing specifically on music as a disciplinary centre, this chapter seeks to celebrate Guilford's extraordinary contribution whilst exploring the notion of the golden age of creativity and what we need to do to ensure this age lies ahead and not in the past.

Foreword

The use of 'crisis' in the title is not designed to be provocative, at least with respect to the most current associations at the time of writing. Nevertheless, this chapter was primarily conceived and developed in an environment that we will probably never see again and through circumstances that have inevitably coloured the writing process and style. We have elected to embrace this and to be deliberate in our approach, both in acknowledging this here and in our overall approach to the chapter. The continually unfolding impact of the Covid-19 pandemic, an event so profound that it is likely to impact humanity in ways as sociologically marking as the KT boundary is geologically, has nevertheless not been hurriedly or retrospectively woven into this analysis as a theme. This is not because this does not have a significant bearing on the underlying focus of the chapter, or even necessarily because of insufficient

time to support relevant editorial revisions. The reality is, as authors, we are experiencing this in real-time and still just responding to events. We need to take our time to reflect and, most importantly, continue as we must to focus first on our most immediate priorities. Nevertheless, as academics we do see scholarship and intellectual enquiry as amongst these priorities and have consequently committed at least to completing this work as well as possible under the circumstances, albeit with a conspicuous absence of that most current and significant 'C' word amidst a thematic focus on others including 'creativity' and 'crisis'. We will instead confine our focus on the Covid-19 pandemic in this text to this short foreword and a closing postscript and confine discussion at this point simply to extending our best wishes to you the reader and the wider KIE creativity research community.

Introduction

The 70 years since JP Guilford's effective call to arms have seen considerable changes in our understanding of creativity and profound changes in the landscape in which this creativity operates. Prescient, certainly germinal, Guilford's work is quite simply foundational to a subsequently exponential growth in creativity research (Gabora, 2013) corresponding with a parallel boom in scientific research more generally (Jinha, 2010) and perhaps the most remarkable period of progress in all human history. From dramatic reductions in global child mortality rates, declining from 19% in 1950 to below 4% by 2017 (Rosser et al, 2020a), quadrupling of life expectancy in many parts of the world (Rosser et al, 2020b), increases in human mobility (Barbosa et al, 2018), and, alongside an increasingly concerted actions related to a standard declaration of human rights (OHCHR, 2018) despite a century of the most bloody human conflict, a measurable decline in human violence overall (Pinker, 2011). Even human intelligence is notionally following an upward trajectory, rising an average of 20 points through the same period (Wonguppara et al, 2015), alongside increases in educational participation and attainment. With less than 50% of the world population holding basic education in 1950, this has risen to over 80% by 2015 (Rose & Ortiz-Ospina, 2020). We have lept from tentative suborbital flight to meaningful exploration of the farthest reaches of the universe, seen a revolution in information technology and communication, and a flourishing of creativity in the arts in terms of participation, productivity and with respect to the cross-fertilisation of practice and ideas. The pace by which new information is being generated is accelerating exponentially and by many measures, we have become, and continue to be, more creative than ever.

> *"Between the birth of the world and 2003, there were five exabytes of information created. We [now] create five exabytes every two days. See why it's so painful to operate in information markets?"*
> — Eric Schmidt, CEO Google.

However, the question of measuring and determining human progress is at best contestable (Stiglitz, 2009; Anand et al, 2011), and by many indicators human progress is subject to greater uncertainty. The most recent 'How's Life? 2020' report (OECD, 2020), for example, an attempt to work

towards a more holistic approach to measuring human progress beyond GDP involving 37 OECD countries and 4 partner countries, does highlight a 2.8% overall increase in life satisfaction, but also increasing obesity, a decline in public trust of key institutions, persistent inequalities in other areas of education and employment, and perhaps most starkly, that 1 in 8 people experience more negative than positive feelings on a typical day with 7% reporting very low levels of overall life satisfaction. Mental health and wellbeing developing as a crisis globally (Kelland, 2020) in parallel with increasingly toxic levels of political discourse in many countries, there are at best troubling emerging trends if not active reasons to reconsider conceptions of human progress more fundamentally. Indeed, with increasing threat to biodiversity and food security, political polarisation and a rise of extremism, the Doomsday Clock, a measure of the risk of global annihilation maintained by the Bulletin of Atomic Scientists, was adjusted forward to 100 seconds to midnight in 2020 (Mecklin, 2020). As close to the threshold as the clock has been during its now 75 year history, the twin existential issues of nuclear war and the rapidly encroaching threat of climate change; "the greatest failure of the imagination in the history of the world" (Hoskins, 2018), are now both actively compounded by the 'threat multiplier' of information warfare and cyber-security. The apparent gradual erosion of our ability as a species to mitigate against our own self destruction at least challenges straightforward assumptions of an unambiguously upward trajectory in human progress, however strangely, if not entirely paradoxically, we seem to be becoming more content the closer to midnight we get. And, with a somewhat dark irony, recognising that the most significant threats stem directly from the cumulation of centuries of creativity and scientific endeavour.

> "The most fortunate of us all in our journey through life frequently meet with calamities and misfortunes which greatly afflict us. To fortify our minds against the attacks of these calamities and misfortunes should be one of the principal studies and endeavors of our lives."
>
> — Thomas Jefferson

Considering the preservation of our species alone, creativity in terms of human imagination, ingenuity and inventiveness has never been more urgently required. Yet despite there never having been more research and researchers, or as many university courses, programs and students in the field, progress in developing creativity through education has, by many measures, stalled, or even regressed over recent decades. Described starkly in terms of a 'creativity crisis' (Kim, 2011), the uncomfortable paradox for creativity research in terms of education in particular is that despite more concerted effort, and most certainly greater need, this does not appear to correlate with success or perhaps even more worryingly, that active efforts to develop creativity may even be proving counterproductive. Whilst recognising that creativity can be taught, 'non creative behaviour' can also be learned (Land and Jarman, 1993) and by some measures seems to be being learned more effectively:

> "We are becoming less verbally or emotionally expressive or sensitive and less empathetic, less responsive in a kinesthetic and audito-

> ry way, less humorous, less imaginative, less able to visualize ideas, less able to see things from different angles, less unconventional, less able to connect seemingly irrelevant things together, less able to synthesize information, and less able to fantasize or be future-oriented."
>
> — Kim (2012)

As well as difficult questions regarding the capacity for and capability of educational systems to develop creativity effectively, or at least questions as to the extent to which creativity research can exert a positive influence in educational systems design, fundamental challenges also remain in creativity research itself. Described by Glăveanu (2014) as itself a field in crisis due to methodological issues, disagreement in terms of definitions and assessment, unchallenged underpinning assumptions and a tendency towards grand theorising, John Baer's response to Glăveanu's critique (2014) further highlights the challenge of the growing awareness of the non-transferability, or domain specificity, of creativity, and of creativity being more synonymous with expertise than intelligence. Identifying in particular the disconnection between the 'experiential and ontological richness of creativity as a phenomenon' (Glăveanu in Baer, 2014) and many domain general approaches that continue to perpetuate in creativity research, Baer argues for greater fragmentation in creativity research and for a recognition that creativity in different domains may not only have differences, but may simply 'have nothing to do' with creativity in other areas; creativity with music may be as different to creativity in the biological sciences as athleticism is to poetry. Whilst creativity may have been prized for many decades, it turns out it may never have been properly understood (Bronson and Merryman, 2010).

The prism of failure and 'crisis' is perhaps an unusual one to apply in the context of a celebration of Guilford's legacy. Nevertheless, Guilford's motivation and rationale were extremely clear, undeniably laudable, and arguably more relevant today than at the time of conception. We owe not only a debt of gratitude, but also a responsibility to pause and reflect on the future of 'our' field of work. Guilford would be mortified to consider that 70 years of concerted research effort had produced anything other than unambiguously positive benefits for society, and whilst to be critical of research for generating more questions than answers is perhaps to demonstrate misunderstanding of the fundamental basis of science itself, we do at least need to sense check the impact of creativity research, particularly in terms of the educational conceptions of, and approaches to, the development of creativity itself. If the standardised measures associated with most projections of a creativity crisis in education, an apparent challenge for decades in the educational literature (Yamamoto, 1975), are indicative of a real issue, we are failing in our educational systems risking the very future of humanity. If they're not, we're measuring the wrong things in the wrong way and exerting an ineffective influence on educational practice to the detriment of humanity for other reasons.

This chapter addresses a series of perhaps uncomfortable questions for creativity research, pausing along the way to describe a story of creativity in music. Reflecting the unfortunate potential to have inaugurated a golden age of research in creativity that has at least failed to have had a measurably

positive impact in curbing humanity's unfortunate tendency towards self-destruction, or in informing positive developments in educational practices and outcomes, it almost feels as though the once vibrant, fascinated optimism of creativity as a defined area of scientific concern may be fizzling out through fragmentation and despite an increasing pace of discovery, producing greater uncertainty and an inexorable breakdown in the cohesion of foundational theories and models. It feels as though creativity may be dissolving back into the shadows of mystery and mystique. It is not only that studying creativity in a given domain may not generate insights capable of application, or indeed at all relevant to other domains, it is the realisation that there may, therefore, be no overarching framework that connects these notionally equivalent activities beyond simple coincidence of human ability, interests, opportunity and attention. Considering the most consistent determination of creativity as the combination of novelty and utility, this may simply reflect the means by which we identify creativity and label experiences of novelty but tell us nothing more. Might it actually be that whilst one can research creativity in different domain contexts, one cannot study creativity in general terms at all? If we are becoming less creative, is it really tenable that the industrialised products of our ingenuity have had no part to play in this decline? Is a surge in the discourse of creativity and publication in related fields of research in parallel with a notional decline in creative ability merely an unfortunate coincidence? Is it really just an interesting anomaly that the United States, a country that had dominated the Global Creative-Class Index for so long (Florida, 2004), in line with the highest numbers of creative researchers and organisations, now languishes outside even the top 10? Might our creativity and our research be eating itself?

Of course, depending on your choice of metrics, data or method of analysis, we may either be approaching a point of peak human flourishing or be on the precipice of disaster, and educating well to tackle future challenges or failing entirely. Nevertheless, whilst the available evidence, however paradoxical, broadly indicates at least generally favourable trends in the developing patterns of human experience, either the metrics of negative progress at best off-set positive indicators or constitute outliers to a primary direction of travel, or at worst, provide pause to consider more carefully what we mean by progress itself. Perhaps most evident with respect to the liberating and controlling dynamics of modern communications technology, some of what sets us free may also be walling us in, aspects underpinning increased quality of life now may be risking the future for others, and if we are being more creative, it seems this may be being focused in areas that are proving systematically counterproductive. What if the golden age of creativity was in the past? What if we have built the platforms for such an age in a way that elevates the worst of that which we are capable beyond that which is sustainable? What if we are already the other side of the creativity curve as a species just as AI emerges to pick up the mantle?

A Transformation of creative understanding: the circular educational journey back to the uncertainty of discipline. There remains active interest in creativity in education and the experience of the authors is that research in the subject is highly engaging and thought provoking, and that workshops for

students or staff on almost any aspect of creativity are generally well received and invariably a pleasure to deliver. It is a fascinating topic after all, at any point able to connect directly to amongst the most exciting of illustrative examples or involve engaging and playful exercises to stimulate conversation and the sharing of insights and ideas. It is never difficult to put together a colourful presentation or workshop on the subject or conjure the fizz of wonder and possibility from groups of almost any disciplinary area or profession. After all, all professions have their creativity stories. Nevertheless, reflecting on over a decade of supporting and delivering such activities, and of approaching a quarter of century teaching students to be creative, whilst it is always affirming as educators to receive positive feedback and confirmation of leaving learners or participants with 'much to think about', given the concerns identified by Glăveanu, Kim and others outlined previously, there is the uncomfortable question of whether these may constitute more entertaining distraction than meaningful educational and developmental experience. After all, at least from the perspective of student experience in higher education, there is more evidence to indicate that core disciplinary learning activities can tend towards simply being perceived as 'hard work'. Never quite able to resist the temptation to highlight the extraordinary and the captivating--why would you focus on the mundane or routine when considering creativity?--it is uncomfortable to reflect on the at best fuzzy evidence that these activities have had any meaningful lasting impact on the creativity of our students or participants. We know that our graduates and graduates of higher education in general adapt and create wonderfully through their careers. Whatever the contention regarding the impact of university study more generally, graduates ultimately earn more and live longer. Nevertheless, how this success relates to their creativity, much less how our efforts and that of the wider creativity research community influences this, is much less certain.

Creativity has been at the heart of humanity's search to understand some of the most fundamental aspects of human experience, and the acts and artefacts of creativity, our reference point for mapping key points in human history and progress. Nevertheless, our understanding of creativity has changed enormously in recent decades and been transformed since Guilford's identification of neglect in this field (Simonton, 2001). From once mystical conceptions of the divine (Pope, 2005), a focus on hereditary genius (Galton, 1869), psychoanalysis and the drive of 'unsatisfied wishes' (Freud), humanistic theory (Maslow, 1943), consideration of psychoticism (Eysenck, 1983), addiction (Lapp at al, 1994) and mental illness, and social systems models (Csikszentmihalyi, 1990), there has been a gradual shift away from Guilford's focus on creativity as a component of a general aspect of intellect towards domain specific understanding (Kaufman et al, 2009). On the one hand open to more accurate prediction in terms of testing for general aptitudes and abilities, creativity is recognised as ultimately more a matter of expertise and a consequence of repeated engagement with defined areas of activity and of consequently active neglect of others. From Guilford's early focus on cognition and the measurable mental abilities of individuals, creativity is now understood to be at least as dependent on wider factors including personality and context opening the potential for seemingly endless variation and granu-

larity. Depending on your frame of reference and perspective, our understanding of creativity has never been more nuanced and refined, or more dynamic, fragmented and uncertain. Whilst every insight and answer developed through the research may have led to the emergence of considerably more questions, the centrality of disciplinary context at least provides for some sense of certainty.

Nevertheless, whilst it may be uncomfortable to consider quite how distant creativity in one context and activity may be from that in another, it does at least make sense to consider transferability of creative abilities to be more likely the more closely related the context and activity. But whilst there is considerable evidence of a desire for 'more creative graduates', this tends towards conceptions of generalised problem solving or adaptability rather than towards defined disciplinary application. Indeed, whilst we would never seek to push back on any arguments presented for the value of the arts in education, or indeed of this at least being where the topic is actively visible and considered, the implication that this is almost exclusively 'where creativity is' in education (Fearon, 2015; Sheppard, 2016), is both tired and potentially part of the wider problems outlined previously. It is as if people do not realise just how much discipline and effort, or indeed how little creativity, there actually is in the arts.

For any regulated education system, even a focus on defined disciplinary qualifications and awards can leave wide scope for uncertainty. For example, all undergraduate programmes in UK higher education are subject to required regulatory alignment with the UK Quality Code and related 'Subject Benchmark Statements' (QAA, 2018) defining quite specific expectations both in terms of curriculum content and educational outcomes. Whilst only a narrow range of subjects contain explicit focus on creativity, all maintain quite a broad spread of expected competences and capabilities including many areas common to almost all subjects, notably in terms of different aspects of knowledge, intellectual skills and communication. No graduate of any undergraduate discipline in the UK at least is able to specialise beyond a certain extent until the very highest levels of university study and consistency of outcomes and standards remain paramount, precluding many opportunities for variation and individual distinction. If creativity is domain specific, no undergraduate degree occupies exclusively one focused domain of practice or study and courses have tended to drift towards the more generalised over many years as graduate employment became both more significant as a measure of university value driving towards generalisation. There is consequently no such thing as a 'standard music graduate' for example. Any two graduates of university music courses from different institutions can share very little in the way of overlapping creative abilities, interest, or indeed even knowledge, intellectual or specific communication skills. Diversity being demonstrably good things for society and certainly for creativity, that is arguably positive, but it does at least raise the question about how then do we support the development of creative musicians as educators if that can mean almost anything at all?

Creative Delineation and compartmentalisation: A musical education case study

One student speaking to another:

> *"I attended the twelve-week Bartók appreciation class upon your recommendation, as I was completely unfamiliar with his work; it was unfortunately a waste of time and money; I learned nothing. Each week the tutor would arrive, put on a recording and then leave the room without saying a word. When the music was finished he would return and show me out; and what is more, the last piece he played in the final week, wasn't even by Bartók!"*
>
> — adapted from Swanwick (1999)

Leaving to one side the uncomfortable challenge of modern university music courses in terms of their tendency to prescribe extension of musicianship into realms of scholarship and academia, the core of musical creativity remains clearly defined and widely understood. Musicianship is primarily making and performing and much of what is learned about music is ultimately not explicitly taught but developed through experience. Traditional education carefully deconstructs music into elements, which are studied and reformed conforming to modelled and observable, scaffolded patterns of behaviour, techniques and conventions. The creative act itself is almost never explicitly addressed and most often remains invisible and private. Reflecting or attempting to analyse a musical education to try to understand something more about musicianship is rather like dismantling a timepiece to understand the component relationships, then reassembling in the hope of learning something about the nature of time. The composition or creation of music is always a holistic process that is informed by the knowledge of elemental relationships giving rise to the realisation of expectations, discovery, and invariably resulting in a different destination.

Attempting to teach creativity, particularly where success is to be judged at least in part on the basis of transferability from expressive and creative disciplinary activity into other fields of practice, has been a concern for both authors for a number of years and an evident stumbling block in the wider research. Creativity as a discipline certainly can of course be studied. The dominant processes of creative individuals have been deconstructed many times (Barron et al., 1997), codified into common models (Boden, 2003), and we can indeed formulate prescriptions of profitable behaviours that if followed at least have the potential to make original thought more likely than not (Young, 2012). But how applicable this knowledge is in tactical terms, much less how transferable from experience and application in one domain to application in another, is much less clear. Even less certain is the extent to which understanding the nature of the creative process facilitates the composition of original music itself. After all, almost no world-renowned composer, song writer or producer has ever studied the subject explicitly.

What is music? An acceptable definition that may suffice for now, is that music is simply sound organised with respect to time. *Sound* because composers, certainly in the more modern sense, have sometimes been concerned with the collection, manipulation and arrangement of musical and non

-musical sounds; sounds not derived from musical instruments in a traditional sense. *Organised* because the definition assumes that an intelligence is involved, in making decisions as to the placements of sounds with respect to each other; this does not exclude the potential role artificially intelligent or natural biological systems might play. *Time* because music is naturally a temporal art form, although for composers *time*, as in the measuring out of time with regular patterns, beats and rhythms, is an aspect that may on occasion be something that composers are nevertheless also not concerned with organising at all as suspension of the perception of time may be a compositional objective. The definition is also deficient in a number of very significant ways which will prove to be important here; it does not sufficiently incorporate aspects of aesthetic value or the potential for commerciality. The definition also perhaps does exclude, possibly unfairly so, certain forms of *sonic art* or other sound producing systems dependent upon aleatoric behaviours, but for now it will allow the argument to progress.

How is music taught? Traditionally it begins with instrumental tuition, through the study of conventional techniques and the learning of staged performance pieces of increasing technical difficulty over a number of years. Early musicianship is almost invariably based on modelling and reproduction. This is normally achieved in conjunction with associating the sounds made with abstract graphical symbolism i.e. reading musical notation. The musical signs give instruction as to how to interpret the work and reconstitute it as a sonic experience, in more or less precise ways; there is scope ordinarily for a degree of interpretative licence, concerning how loud or how quick the performance should progress, within acceptable constraints. The understanding of how music *normally* functions, progresses very often implicitly through this process, developing regular listening habits, formally and casually constructed, and through the study of music theory, which consists of the study of normal patterns behaviours of archetypal composers from common practice periods of history (a dominant bias upon Western music from the 17th century onwards); music theory is as such, the codifying of *stylistic* characteristics into behavioural *rules*.

How is composition taught? It is traditionally taught through the application of the rules in largely re-creative activities, in which progressive choices are allowed within the constraints of methodologically defined *tonal* systems. Students produce pastiche stylistically modelled on the behaviour of key composers; they learn what is normal, acceptable and coherent within significant periods through the deconstructed study of harmony (Piston and DeVoto, 1994), counterpoint (Piston and Carmosino, 1968), orchestration (Piston, 1980) and form (Stein, 1979). In traditional harmony for example, students are introduced to a hierarchy of normal relationships that help to establish tonal dominance and consequently formal extension. For example, the primary *normal* harmonic connections to establish the tonality of C major would follow the *normal* scheme, see figure 1, adapted from Piston et al. (1994).

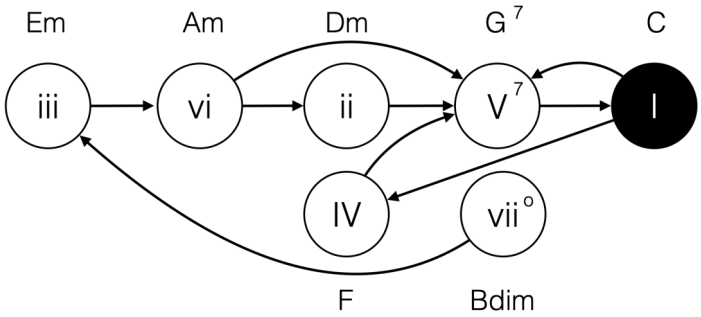

Figure 1: The primary *normal tonal* relationships

The music would begin on chord I (C) and would progress favouring the arrows until it terminated again with chord I (C), establishing C major as the dominant tonality. There are clearly other harmonic connections that can be made within this tonal structure and these are not at all outlawed but simply identified as *less common*, see figure 2. Students would systematically learn progressively complex *rules* of typical connectivity through re-creative exercises.

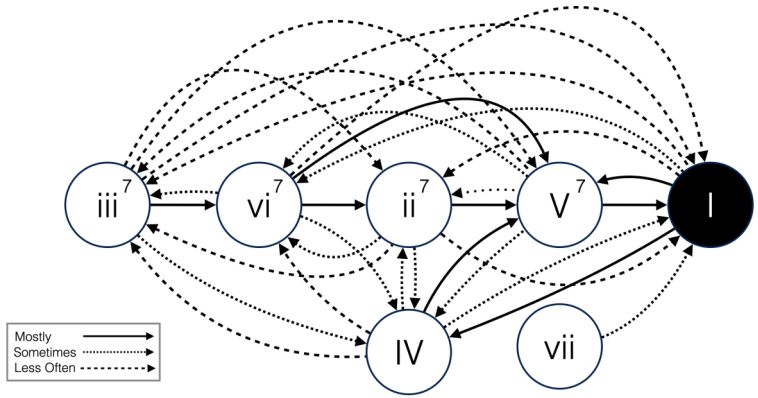

Figure 2: The extended *normal* tonal relationships

Develop this structure into a region of *extended tonality,* where additional chords are interchanged, borrowed and substituted from other tonal regions and introduce the notion of *modulation* to completely shift tonal centres, essentially moving from one collection of notes with inherent hierarchies to another, to provide extension structurally and the academic study of the *normal* becomes complex and rather unwieldy, projecting into a number of years of study; and this for only one dimension of music! Of course, composition in a modern sense can evolve from other structural schemas and can even involve the manipulation of sound, transcending such relationships, involving

synthesised or collected field recordings in music concrete and electro-acoustic forms, and even involve interactive or aleatoric elements, but if communicable coherence remains the primary objective of composition then new behavioural norms are necessarily formulated (Landy, 2007). It must be understood here that all musical theory is established fundamentally from the observation of behavioural practice and to some extent characteristics drawn out of acoustic properties. Application, following the rules, or *guidelines* will result in consistent and coherent stylistic imitation. Is this creative? Perhaps, if the rules can be adhered to within a system that has sufficient scope for interpretative variability to qualify as constrained *novelty*. If the *usual* is understood, then by exclusion so is the *unusual*. Rules may be broken, more novel connections made, harmonies adapted and even invented to introduce idiosyncratic behaviours, toying with listener expectations and potentially progress music theory in a new *normal*. Music evolves! As Frank Zappa expressed (Zappa and Occhiogrosso, 1999) *"without deviation (from the norm), 'progress' is not possible...in order for one to deviate successfully, one has to have at least a passing acquaintance with whatever norm one expects to deviate from."* What is the mechanism of deviation and how might it be recognised once achieved? Deviate not far enough and disinterest or possibly plagiarism may result; deviate too far and coherence is engendered. Prospective composers listen to, study the work of other composers to establish formal structural priori, conform to established (sometimes over generations) patterns of expected behaviours through imitation, then intentionally contrive or accidentally subvert the product with subtle novelties. A lucky few may also study under an established composer that may guide and encourage idiosyncratic behaviours or are animated by insightful texts (WIlkins, 2013) but at what cost? Might individualisms sometimes be at the sake of coherence, potentially pushing beyond the boundaries of our original definition? Should the training of students of popular music be any different? The fundamental musical concerns are actually not that far removed from the traditional; texts such as that produced by Pedler (2003) demonstrate that even the *Beatles,* as indeed many modern commercial artists, are very compliant, albeit quite often unwittingly, in terms of applying the tonal relationships as outlined above. Perhaps less significant in the training of popular musicians are the detailed formal mechanisms of modulation and orchestration; but basic training in counterpoint and voice leading would perhaps not be wasted, along with a study of modes and improvisation. The difference is often the increasingly informal musical background with which the student of popular music enters HE and because the significant influences from the world of popular music equally have little formal training, the question perhaps should be asked concerning the value of education at all in this context. Putting this aside, the mechanisms of music, popular or otherwise, can be understood but what can be said of aesthetics and creative method?

What then is creativity with respect to music? Composition, creativity in music, is here conceived as the choices one makes within a sufficiently defined constrained system which involves such organisational structures as discussed above, physical limitations of instruments, limitations of performers and potentially limitations of technology. The idea of *choice* therein lies

the concept of *freedom of expression and individuality;* the constraints ensure that the work has an audience. The system is important because it involves a transaction between composer and audience with inherent temporal and textural expectations. It involves the making of novel selections or arrangements, *intuitive* or otherwise construed, from constrained sets of musical or sonic elements, in the *hope* of discovering a unique but coherent and *attractive* individual expression; assuming coherence remains an objective and the composer wishes to earn a living by producing functional work.

Creativity as a discipline related to music is often never academically addressed. The students that compose well, are those that invariably already can; possessed with the prerequisite level of intuition, imagination and more importantly the motivation to do so in the first place. A reduction of the process to a series of dispassionate or even semi-autonomous choices, however well informed, generally does not sit well with these students, who depend predominantly upon intuition and aesthetic sensibilities to holistically steer their creative endeavours. The dominant formally composed structure within the author's experience is that of a song. On a number of levels, songs may be reasonably assumed to fit predetermined stylistic templates since every song, after all, is more like every other song than it is like any other musical structure. As with genus classifications, all songs share more or less similar features modelled upon typical expectations, which we can regard as *style* and as with *birds-of-a-feather,* the differences however slight may form significant divisors and consequently the basis of subcultural possession. Musical products produced by the students do tend to be conceived largely as a combination of related elements in dialogue, informed by listening habits and experience than by probabilistic deduction, even if the destination could be on some levels determined, the journey involving perceived freedom, playfulness and discovery is, it seems, much more important. Students are generally reluctant to actively learn normal patterns of behaviour preferring to follow intuitions, even if these largely conform to predictive observations; some fear perhaps that the intuitive mechanism might be derailed. Freedom in the creative act is a necessary belief but very often only a persistent illusion since when given, students invariably choose to recreate past successes normalising their own experiences rather explore novel forms; despite this, products cited as being of *inspired* origins are generally exceptionally conformist. Computing technology has become increasingly at the heart of popular creative endeavour, students are becoming comfortable in accommodating predetermined recordings or loops, the new *norms*, to underpin their creations and AI collaborators are more easily accepted as creative allies (Liu, S.,2019), even if there is some reluctance to surrender the act completely.

Implications and creative considerations

How do we evaluate or measure musical creativity? How useful is objective criteria and are we as academics actually concerned with the levels of creativity and/or originality? Is there any virtue in attempting to measure the distance each student has travelled from their respective norms or evaluate the commerciality of the work through committee or other validation method?

However conceived, how do we even know when we have created something new that will be sufficiently interesting to others? This question is less often addressed (Mahil, 2019); who are the 'gatekeepers' for creative validation; locally this is through student communities and the assessment process, but there is the perennial fear of copyright infringement; unintentional plagiarism remains an issue when the objective is to offer the stylistically familiar. Without statistical tools, which are not inconceivable, it is difficult to determine the level of originality in assessment although technology here may also provide some solace (Riehl, 2020). It can also be difficult to recognise the worth of a new idea especially if you have no personal aesthetic frame of reference. Engaging self-critical facilities too soon in the creative process can potentially avert original ideas; as Leonard Cohen said: "The cutting of the gem has to be finished before you can see whether it shines." (Zollo, p.337). Fear of failure also inhibits risk taking. Students chase grades with known/familiar or perceived 'safe' solutions; they become unwitting saboteurs of their quest for individuality and educational systems are complicit in encouraging this behaviour. It may not be that students are becoming less creative, but it certainly true that we have systems that make aiming for that a more dangerous approach to study.

Is there any point trying to teach creativity?

The authors of this chapter have been actively raising awareness of the creative process over a number of years in music composition classes, introducing key concepts and mechanisms and in some cases creating models to facilitate creative progression. The development of an applicable *Creative Toolkit* was a prime objective that could be consulted, particularly when inspiration was not forthcoming, especially if there is perceived virtue in exploring realms unfamiliar. Where is the divergent thinking? Are composers of music even creative thinkers at all? The attempt to tease students out of their comfort zones, away from their particular *normal* however often results in pale exercises that fall short of *real* music exhibiting little understanding of context; the *unfamiliar* is not always a desirable or comfortable destination, particularly for students of popular music. One profitable starting point to cultivate developments within more local stylistic domains is the active identification of personal norms from which a departure from personal constraints might be sought. The documentation of collective creative approaches can be very insightful; the identification of common pathways in the form of models of creativity, drawn out of observed patterns of behaviour, see figure 3, and the active pursuit of connections, world interactions above and beyond the purely musical.

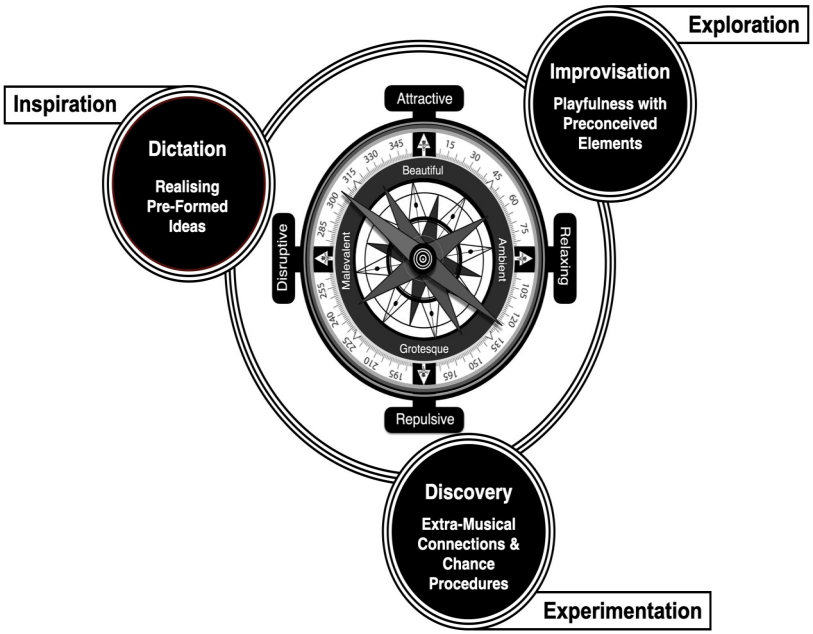

Figure 3: A Creativity Model

Are we doing it wrong? And above all else, we are assessing it wrong? Encouraging conformity and fueling the fear of failure through qualitative evaluation methods. How might we improve the situation? Include compulsory elements that are not qualitatively assessed? There is a reluctance to systematically learn the respective norms from which reflective deviations can be accomplished but the dilemma is that freedom when liberally offered is invariably never exercised! Students respond with distinctive well-worn patterns of re-creative predictable behaviours; they remain in their respective intuitive cages. Perhaps a more top down driven process is the answer? Release creatives academically from commercial constraints? The constraints are perhaps too rigidly confined by the cages of commerciality which are often at the heart of our budding composers' motivations. Can creativity be taught? Of course, it can, but perhaps it is just too difficult because ultimately involves quite fundamental behavioural changes. Sacrifice and dedication are required to make changes to long established habits, it is perhaps not unlike trying to change your diet or establish a new fitness regime.

Summary and conclusions: What Creativity Crisis?

It would be conventional at this point to simply revisit the questions outlined in the introduction and to summarise some of the key points of discussion. But whilst admittedly not usual for scholarship in the field, particularly in terms of introducing new information in a conclusions section, there is of

course a deliberate twist in this narrative and a level to which the underlying premise of this chapter is purposefully obtuse and provocative. Aggregation of all the optimism and negativism, both in terms of the clumsy metrics associated with determining human progress, and in terms of the integrity of creativity research, clearly indicates at least potential for an actual net neutral position. If the standard measures of creativity associated with determination of a crisis in education are equally associated with a crisis in methodological terms, is there not a chance the pessimism may be at least partly misplaced? Might these crises simply cancel each other out? Indeed, more than perhaps just challenging assumptions of a creativity crisis or the severity thereof, there may be positive grounds to refute this entirely. Highlighting the individualised focus on standard measures of creative ability for example, Michael Shrage (2010) even goes as far as suggesting this is a fundamental flaw, completely overlooking "the most powerful interpersonal dynamic now shaping contemporary corporate innovation" in terms of collaboration, and argues instead that there is ultimately "no shortage of creativity and ingenuity" at all.

Whilst there are many that will always lean towards pessimism and focus concerns on the normalising impact of education, it is perhaps important that there is always a critical lens applied to all forms of educational practice both to guard against complacency and to maintain the drive towards better educational practice. Equally, given the marketisation of higher education in particular, and the politicisation of educational systems in terms of regulation and accountability, it is important to acknowledge that the value of educational approaches and outcomes will perhaps always be contestable. Aligned with such a dynamic pace of transformation and change in terms of the context in which the outcomes of educational processes are tested and applied, contestability meets ambiguity and uncertainty.

So, can we teach creativity? Perhaps as educationalists we are looking in the wrong places, in the wrong way, or simply expecting too much? The seeds we sow may not germinate within a single academic semester or indeed within years of graduation. There is a potential chasm, particularly in music, between esoteric knowledge that is often hard won and the childlike playful risk-taking attitudes that we often associate with creative behaviours when both are of course needed. Perhaps it is easier to teach the *rules* to the risk-takers or perhaps we overestimate the valuer of analytical insights. This is absolutely a polarised view from the perspective of HE academics teaching students of popular music, but the intentions are no less sincere.

Whilst it may be that the 'golden era' for creativity research may now be in the past, to perceive regret in this interpretation may be to misunderstand the human tendency towards nostalgia. Depending on the generational perspective brought to bear, whilst the current era represents the broadly cumulative point in human history of most sophisticated understanding and capability, it would be no surprise if considerable numbers pointed towards previous decades as an equally if not more golden era for our exploration of space, of artistic expression, of literature or popular culture. We are creatures of our time and emotional in our interpretation. In terms of when most exciting, novel and synergistically connected with wider matters of social interest and change, there may never be a period such as the first few decades follow-

ing Guilford's address. Nevertheless, of course the golden era for any field of research is always the present, and in the case of creativity, not despite fragmentation of understanding, but because of it. Yes, our inability to manage our base instincts may amplify the negative alongside our more positive tendencies, abilities and actions, but maybe, just maybe, that tension between conformity and 'doing the wrong thing' is fundamentally what creativity means.

Postscript

The final editorial work on this chapter has been completed during a difficult time for both authors as we are sure it has been the experience for others contributing to this book. Whilst leaving the Covid-19 pandemic to one side in this analysis, it has of course been at the forefront of our minds throughout. It is interesting to reflect on the impact of extraordinary circumstances on the approach to and experience of scholarship and writing recognising that it is, of course, not the first time that such activities have been undertaken during pandemic circumstances. Many were quick during the early stages of lockdown to point out the parallels with the bubonic plague of over 350 years ago and Newton's discovery of gravity whilst 'working from home'. The bar was raised high from the outset but whilst not every aspect of lockdown has been erosive of the intellectual capacity and space to work in ways with which we both find familiar and comfortable, the practical reality has been far from the isolated opportunity for introspection and serendipity experienced by Newton. Beyond an initial period of calm and adjustment following the closure of university campuses for both students and staff, technology suddenly escalated and intensified interaction and engagement to an almost unimaginable degree. Most academics and researchers have had little opportunity to feel isolated, never mind the opportunity to revel in a sudden release of capacity and space. Related to some of the critical questions outlined in the introduction to this chapter, there is a serious question as to whether we would know what gravity was today had Zoom existed during Newton's time.

Nevertheless, the wider response of the academic community during the crisis has been extraordinary and deserves some acknowledgement here, recognising the wide range of analysis that will undoubtedly follow in the coming weeks and months. Beyond strenuous steps to maintain support for students, social and charitable activities, the immediate release and even manufacture of medical equipment and resources--as well as the rolling up of sleeves and return to practice of clinical practitioners--universities have demonstrated significant agility and commitment to everything universities should be committed to supporting. Research ideas resonant with wider considerations of sustainability and creativity have emerged perhaps most quickly (Brem & Punte-Diaz, 2020), and professionals numbered in their hundreds of thousands replaced their normal patterns of work for laptops propped up on washing boards and mobile phones on kitchen tables and just got on with it. Whilst knowledge and learning are perhaps amongst the most fungible of all tradable and deliverable products and materials, the adjustments to educational practice and student support moved rapidly in universities and as evidence indicates so far, remarkably well under the circumstances. Leaving aside here

the massive wall of financial challenge that will inevitably trouble higher education for years to come, the safety and security of students and staff are consistent first priorities across the whole sector. At least from the experience of the authors, whilst we have not found working circumstances more straightforward or less time consuming, we have found the challenge affirming and worthwhile.

From the perspective of the underlying themes and provocations in this chapter, Covid-19 presents both questions and opportunities for the creativity research community and for higher education more generally. If there are any domain general features of creativity, we hope we have been working to develop these with our colleagues and for our students. But we have to admit, the extent to which we are both able to compose music idiomatically and with stylistic creativity has at best only translated and been transferable in extremely loose terms.

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CHAPTER FOUR

CHALLENGES TO BUILDING ADVOCACY AND CHANGE IN THE INTRODUCTION OF A CREATIVE DIMENSION IN AN INSTITUTION OF HIGHER EDUCATION

RON CORSO & STUART GLUTH

Abstract

Promoting recognition and fostering creativity in education remains a challenge for educators at all levels. Why creativity is not more widely accepted and advocated as an essential approach in our lives broadly is due to a number of factors. It's messy, unpredictable, and directly opposed to the conformity, predictability, rightness, unambiguity, standardization, risk aversion and obedience historically dominating education, business, government institutions, and society more generally, based on an aversion towards the different, unquantifiable and/or unknown. In response, in exploring the same principles that Guildford expressed in 1950, the authors have developed an ongoing approach to creativity in education establishing and practicing a strategy, by taking the expected creative problem-solving approach in design education, and expanding this approach across disciplines where it is clearly important but hasn't been adopted. This has led to a significant impact and major structural and curriculum change at the University of South Australia through its Enterprise 25 initiative. Critical analysis of this work has given rise to and sets out to address the real question; 'why haven't these approaches been more widely and readily accepted, and, more importantly, adopted, where their advantages would be obvious?', echoing Guildford's initial observations about the lack of recognition of the importance of creativity

Introduction

Expectations of a creative dimension in education which might have been expected after Guildford's paper and which our own work might have engendered, but which have not been met.

The Authors together have been advocating and conducting workshops to introduce a creative dimension into a diverse range of specializations in higher education, and some other levels of education including primary, preschool education, teachers' professional development and the university Senior Management Group to the extent that we have been awarded a national Office of Learning and Teaching grant as well as a Citation for Outstanding

Contribution to Student Learning. What changes has this brought about? Not a lot!

Most of our access to programs has been through individual educators who have acknowledged the importance of this 'creative dimension' to their programs and the importance of our approach in embedding this in the specialist knowledge of their specialization (rather than the supplementary general 'one size fits all' programs often espoused) and there has been some sort of wishy washy acknowledgement by administrations of its importance, but nothing much has changed. Albert Einstein thought that his schooling was like the army with soldiers marching in perfect step, with the school deciding what to teach and made sure that every student was taught the same thing in the same way, and it didn't really matter whether students enjoyed what they were learning or understood what they were taught! (Sullivan, 2003) More than a century later, Ken Robinson, (1998) documents the same approach of the regimentation that reminded Einstein of the army, designed to meet the uniformity needed by the empire but still extant in the late twentieth century in a supposed democracy advocating social equality. So, the authors have struggled on against the slings and arrows of outrageous university administrations, education departments, political interference, cost cutting, standardisation, obsession with qualification rather than understanding, etc.

Perhaps this begins with inappropriate emphasis on (English language) literacy and numeracy, and the denigration of visual and other arts and design. We do not say that universities need to compromise their standards, but they do need to rethink the ways in which these standards are achieved, and undo some of the pointless and prohibitive protocols, language and etiquette which have in the past been used to maintain academia access uniquely for the privileged. Many of these qualities may not advantage knowledge and learning themselves, and in many cases become constructs and orthodoxies which inhibit them and are seemingly perceived in that way by many enterprising, imaginative or divergent thinkers (Giroux, 2017).

Even the newer universities in our country which have been cobbled together from previous institutions, including colleges of advanced education (CEAs), polytechnics and institutes of technology, some of significant standing, by a centre left government trying to widen access to university education. Some of these newer universities still retain vocational education (VET) or technical and further education (TAFE) programs, which have distinctly different and much less unfriendly, intimidatory, judgemental and sanctimonious approaches and protocols, entry requirements and codes of teaching and assessment which may serve as a less intimidating model for a different possibility in higher education courses. However, many of them strive, unsuccessfully, to establish that they are equally worthy of the designation in the eyes of their predecessors earlier established institutions, which in turn have strived in the past to imitate the medieval ideals of European and North American models, alas.

Creativity is itself a difficult subject for universities to deal with, despite the acknowledgement of its importance in the information age by Guildford and many others both before and after him. Part of this problem is the one of perceive orthodoxies about creativity. As discussed above, univer-

sities seem particularly vulnerable to such orthodoxies, both current (perhaps populist or politically driven for the sake of short-term advantage) and historic (for the reasons mentioned above) (Sawyer, 2006). This is nothing new, beginning perhaps with inventions trying to understand natural phenomena which became religious dogma, such as Plato's insistence on divine principles rather than observable, measurable but 'corrupt and degraded' reality of our bodies and 'the heavens', to Saint Augustine's condemnation of the sin of curiosity which dominated thinking for centuries during the middle ages, continuing through renaissances looking back to the classics, where Galileo had to suffer the 'stuffed shirts of the peripatetic school who still considered Aristotle and Ptolemy as absolute authority (Koestler, 1959, p329) and enlightenments all with their own unquestionable flawed orthodoxies. For instance, 'some of the greatest discoveries consist mainly in the clearing away of psychological road-blocks which obstruct the approach to reality, which is why, post factum, they appear so obvious' (Koestler, 1959, p305). There is no reason to think that it is any different today, in the third decade of the twenty first century, there are still orthodoxies about the nature of creativity seventy years after Guildford's landmark paper; being the inborn unteachable quality of the elite, individual genius, specialised, and concerned only with the arts and design disciplines as opposed to the plain evidence that Erica McWilliam's (2007) so called 'new' creativity, which is in fact as old as humanity, but perhaps newly rediscovered, is community based, collaborative, cross disciplinary, characteristic of everyone (if repressed) and teachable (or re-teachable). But, unlike orthodox 'science', which is held to be rigorous and replicable, (but with its own orthodoxies, for example Barry Marshal's twenty year grant refusal to investigate a bacterial cause of stomach ulcer, which we held to be caused by stress) creativity can be seen to be a 'science of possibilities' (Dilnot, 1998) and therefore may be perceived as difficult to judge, grade, standardize, teach with objectivity, or explain or justify to the Pythagorean uninitiated (AKA Galileo's 'ignorant superstitious masses' (Koestler, ibid., p xvi)

Further, there is still an attitude in creative people themselves that 'my' creativity belongs to me, and any outside impositions, such as history or theory (knowledge) placed on 'me' would stifle 'my' creativity. Our own experience has shown that the opposite is true! That the introduction of a structure based on the integration of 'theory' and practice improved their apparent confidence and creative idea generation markedly; confidence clearly must be regarded as a principal underpinning for a creative attitude, as they head off into the unknown, confident that their approach and process would see them succeed.

It is hoped that the strategies we have developed and instituted set out in the following, illustrating embedding a creative dimension in the students' specialist knowledge may be useful in overcoming some of this reluctance in many students to undertake a more creative approach to the possibilities of the content of their university education. Indeed, in fact by changing the educational institutions' approach to its teaching and learning may encourage many students to undertake a university education who might have been previously dismayed by its possibilities or daunted by it.

Advocacy for Creativity as an Approach in Education Beyond the Arts and Design

Early research since Guildford's address had been influenced by his hypothesis on the characteristic that creative individuals possess, namely divergent thinking and specifically skills in fluent, flexible, original and elaborative thinking, and it is these characteristics and the value of these characteristics in human behavior that are at the core of the argument for the promotion of creative thinking practice, Guilford (1950 pp. 62,66). His work has had considerable impact on the study and specifically the measure of creativity (Torrence, 1974) where Guildford's dimensions and terminology have been used to confirm the value and benefits of creative thinking abilities to creative output. However, it can be seen that there is still that emphasis on the 'creative individual' that we would hold to be misleading, and that may lead many people to mistakenly believe that they're not individually or collectively creative, and that there's nothing they can do about it, personally or educationally.

Advocacy for creativity in the past 70 years has appeared in many forms and has been justified as a genuine field of study for the perceived benefits it brings to industry, business and commerce, education and the wellbeing of humans in general. As a result of this expanded interest in creativity, the 'promotion' of creativity and innovation is becoming evident in arts policy such as 'Creative America' USA, (1997), Creative Nation (1994), 'Clever Country', Australian Labor party campaign slogan for the 1990 Australian election, National Innovation Agenda' Australia and Creative New Zealand (2014/15). There appears to be so much interest in it that creativity seems to have become seen as some sort of panacea, or maybe just another buzz word; part of the jargon for progress and reform. It has traditionally been associated only with the arts, but is now perceived as being relevant to in other domains in business, industry, commerce, management theory and practice, education and psychology, triggering interest and becoming manifest in government innovation and creative industries policies and the wellbeing of individuals more broadly (Madden, 2001) In reference to the last of these, the authors argue that 'creativity is an important, even the most distinctive, characteristic of human wellbeing' (Gluth and Corso, 2017; Madden 2004).

According to Murfee (1992), creativity advocacy is bias towards 'instrumentalism' (which we could well interpret as platonical social constructs, perhaps related to some of the previously attributed characteristics of creativity; individuality, innateness, specialization, genius, etc., in opposition to being based on scientific realism and our new understandings determined from the psychology and even the neurology of creativity (Alexiiou, Zamenopoulos, and Johnson, 2009; Mogi and Tamori, 1997)). Therefore, it has been focused mainly on economic benefits where creative endeavor has led to inventiveness. Certainly, in industry, business and commerce across the globe are advocating the importance of entrepreneurship and creativity programs within business schools to prepare graduates to build and grow organizations within the context of an increasingly complex, challenging turbulent and ever -changing external environment that demands more than analytic abilities (Bennis and O'Toole, 2005). Current university students will face scenarios

that will not always be suited for the rational-analytic framework they have been taught in many programs, and there is feeling that current programs and in particular business education does little to develop empathy or sensitivity to the experiences of others (Glen, Suciu and Baughn, 2014).

Increasingly students must be capable of solving problems in disruptive conditions, with no adequate data and with unpredictable outcomes often defined as wicked problems (Buchanan, 2010; Rittel and Webber, 1973; Jackson, 2008). The need to deal with this has led to a creative approach in the form of so called 'design thinking' being included in the university curriculum at both undergraduate and graduate program levels to build an extra dimension to the current analytical approach (Glen et al., 2014).

Students and graduates will need to move from approaches appropriate to an information age to those that will allow them to achieve in a conceptual age (Pink, 2005) in which workers with conceptual abilities will be valued as creative human capital. Dilnot (1998) sees this way of thinking as the science of possibilities or speculative thinking, through learning collaborative real life skills, in scenarios that provide an understanding of users, in addition to deductive and inductive skills, (Dunne and Martin, 2006)

These and other citations indicate that creativity is now an acknowledged capacity recognized as a valuable component of social and economic enterprise, not as a garnish to the productivity roast, but as a fundamental approach to an increasingly complex, challenge-ridden and rapidly changing economic and social order (McWilliam, 2007), and where according to (Csikszentmihalyi,1996) creativity is no longer seen as a luxury but a necessity – for all individuals and enterprises.

Advocacy has come to be an important part of being an art and design educator, and in particular creativity and entrepreneurship addressing educational, cultural, social, and environmental problems. The National Art Education Association (2009 and 2018), Bobick and De Cindio (2012), and Saunders (1979), among many others, have influenced decisions in art and design education that have had a broad, and often lasting, impact, in addition to the teaching in art and design. This advocacy of a broader application of this approach to creativity is demonstrative of another important way in which educators help shape human potential and improve public life. Having and building a case for art and design education based on the attributes of creativity has strengthened the importance of the role that arts education in schools can play in students' lives beyond the mere production of artifacts. This has helped to remove the stigma of arts practice and its education being perceived as 'soft options' and less important as knowledge and fields of study for human pursuit. The creativity debate has forced teachers to present their discipline beyond the 'talent' activity it is often perceived and to consider the broader benefits a creativity experience can provide (Bobick and Dicindio, 2012; Beckman & Barry, 2007).

Advocacy for creativity in the university curricula

Recognition of the importance of creativity by governments of various countries has led to initiatives promoting educational policies to foster student's

creative abilities, particularly in higher education. In countries including China, Korea and Japan, and in America and Europe, it has become a political priority (Strom & Strom, 2002). The Creativity in Higher Education Project initiated by the European University Association (2007) analyzed conditions which both promoted *and* hindered creativity within universities, in response to the recognition of the important role that creativity will need to play in preparing graduates to enter work in an increasingly uncertain, complex and changing future. Therefore, universities are seen as needing to reframe strategies, methods and ways of working through curricula and instruction that address the development of student's creative abilities.

Emerging Re-definitions of Creativity Since Guildford's address

How definitions have emerged as a result of the interest Guildford created in advocating for increased attention to creativity.

The interest in creativity generated by Guildford's address began an inevitable debate in trying to define just exactly what creativity is and along with its advocacy there has been much presented but rarely leading to clarity and consensus. Numerous studies and research have led to quite an extensive number of theories on its definition and nature.

For example, perspectives on creativity cover a divergent variety of viewpoints, ranging across psychological, neurological, cognitive, intellectual, social, economic to spiritual (Mumford, Hunter and Bell-Avers, 2008) and across a variety of disciplines such as Design, Art, Music, Dance and Performance, Business, Commerce, Marketing, Hospitality, Psychology and Neurology, etc. (Wilson 2015).

The notion of novelty and newness coupled with value and usefulness have come to provide a level of justification and legitimacy to creativity expressed in the growth of Innovation terminology as the catalyst that will provide the added dimension to a range of disciplines including education in transitioning to the twenty-first century with all its grand challenges and scale of disruptions. Both terms are seen as interdependent of each other and promoting creativity by emphasizing one without the other is seen as only an approximation of creativity (Cropley and Cropley 2010).

Creativity is also linked to cultural and historical conditions and the outcome or production from a creative act must be seen in a social context (Plunker, Beghatto and Dow, 2004). As such social negotiations and culturally shared understandings have a big bearing on who is creative and when and how it occurs (Feldman, Csikszentmihalyi and Gardener, 1994). Collaborative and interactive human experiences in social, material and institutional relations is another way of looking at creative practice that enhances creative performance (Glaveanu, 2014).

There has traditionally been a fascination with individual creativity and the novel products of this so-called talent activity. However, even given our new understandings of creativity as communal, collaborative, cross disciplinary, teachable and learnable or re-learnable, and a possibility characteristic of all of us, the term is still perceived as complex, which of course it is, and as such creating difficulties in its definition. (McWilliam, (ibid)

In an educational context McWilliam (ibid) argues that the term creativity is paradoxical. Universities are embracing creativity in their curriculum and graduate attributes through a commitment to learning outcomes featuring creativity. However, she argues that creativity continues to suffer in that it is too nebulous and not taken seriously defying definition and certainly lacking any systematic application in learning and teaching. However, the widely held notion, that creativity is only relevant to a small percentage of graduates as future professional workers is mistaken, according to McWilliam (ibid) and is being challenged, for instance, through the University of South Australia's so-called Enterprise 25 initiative involving restructuring around a creative dimension embedded universally across all specialisations.

De-mystifying creativity has led to understandings that see it as a way of thinking associated with imagination, ingenuity, insight, inspiration, intuition in conceptualizing responses to a variety of challenges and tasks as a *process* that can be nurtured, as opposed to individual 'inborn' creativity, the domain of a talented few (Runco, Pritzker. 2020), The argument for its recognition as an intelligence goes back to Thomas Hobbs (1588-1679) who linked it to creativity. Guildford (1956), Torrance (1962) and Gardener (1993) also have linked creativity to intelligence. Einstein (2006) memorably regarded creativity as more important than knowledge,

Conceptualizing creativity around behaviour not as a personality trait or a general ability resulting from personal characteristics, cognitive abilities, motivation, social and environmental factors has been advocated by some theorists, (Amabile, 1988 and 1996). Amabile (1996) further elaborated on a model of personal creativity involving domain relevance, expertise, thinking creatively and the will to engage in a domain relevant context.

The *novelty* of the outcome, often associated with creative production is seen by Bowden (1994) as fundamental in defining creativity, linking it as a psychological trait. But therein lies one of the principle misunderstandings of the nature of creativity, that it is the *outcome* which can be *judged* to be creative, whereas the authors hold that it the process that is creative, arriving at innovative, novel or unexpectedly useful solutions or outcomes, and arguing that it is not possible to *judge* the 'unexpectedness' or measure the degree of 'novelty' of a solution or outcome (*our italics*).

Koestler's wonderfully insightful statement that 'great discoveries of science often consist . . . in the uncovering of a truth buried under the rubble of traditional prejudice, in getting out of the *culs-de-sac* (his italics) into which *formal* reasoning (our italics) divorced from reality leads; in liberating the mind trapped between the iron teeth of dogma' (1959, p189) might apply just as much towards 'our' view of creativity, and what we can do about it. He further asserts that we all have the capacity to be creative, but that it's been suppressed by the routine behaviour and automatic thinking processes that dominate our culture [and particularly our education systems]. He echoes Guildford in declaring that Psychology has done little to examine and explain the creative *'process'*, the rapid leap of inspiration and insight when the mind can come up with surprising perceptions when rational thought is suspended. He defines the creative act as taking two self-consistent but habitually incompatible frames of reference and combining and reshuffling them into new and

novel outcomes, a form of metaphorical thinking through associations joining often unrelated information (Koestler, 1964). From this comes the understanding that the creative process involves combinatorial Einstein, (1954) or combinational (Bowden1994) processes of connecting or combining seemingly unrelated situations into new models or configurations, a process whereby cross-disciplinary information and knowledge is combined and recombined into something new by the capacity to select, re-shuffle, combine, or synthesise already existing facts, ideas, images and skills in original ways. (Koestler, ibid)

A further important perspective has been added through Csikszentmihalyi's (1996) insistence on the community, not the individual, challenging conceptions of creativity that are limited to the specialist individual inborn genius and stresses the importance of concentrating creativity research on collaborative behaviour.

According to Erica McWilliam (ibid) and David Perkins (1981), the creative process encourages more elaborative thought processes like metaphorical and analogous thinking, the ability to work across disciplines, challenging of conventions in the exploration of alternatives, fluency of thought and a tolerance for ambiguity; creative dispositions which can and should be both learnt and taught.

However, problem solving has been discovered to have separate neurological pathways, processes and brain sites than 'normal' problem solving by itself (Alexiiou, Zamenopoulos, and Johnson, ibid; Mogi and Tamori, ibid).

Rhodes (1961), trying to overcome the vagueness of such definitions of creativity came up with a 4 P's model to clarify its meaning make clearer what is understood and defined by it:

person, sensitivity to problems, exhibits mental flexibility, thinks divergently in redefining existing objects and concepts into new models and configurations,

process, in assuming creativity can be taught the creative thinking process has 4 stages: preparation, incubation, illumination, and verification,

press, the surrounding environment impacts in a unique way in how people behave in perceiving their world and forming ideas,

product, is what is created when an idea becomes embodied in tangible form,

in which these four states do not exist in isolation and upon examination from the moment of inspiration, it might be possible to trace the thoughts and events leading to the idea in a way that the four stages are overlapped and intertwined with each other.

Terms such as Divergent, Convergent and lateral thinking have been articulated as a means of highlighting the distinction and value of creative thinking as an adjunct to traditional thought processes and the role of education in fostering or hindering these (DeBono, 1990), (Robinson, 2006).

Torrence (1970) also explains creativity as a process of becoming sensitive to problem deficiencies, highlighting perception and the ability to identify opportunities, searching for solutions through prototyping and communi-

cating the outcomes. This definition factors in 'process' (as in The Design Process) as we know it today.

Confidence plays an important part in understanding creativity and being creative, ideality in students the development of a strong intrinsic motivation towards the challenge or task, wherein curiosity and a questioning attitude generate interest and insights into the nature of the problem, and provocative questioning of the status quo leading to the challenging of assumptions about specific problems or issues (Amabile (ibid). This can be enhanced through analogous and metaphorical thinking as well as the introduction of random associations where the forced association or comparison between subjects creates new insights and ideas.

Much of this study on defining creativity is leading to moves to unhook creativity from 'artiness', individual genius and idiosyncrasy, and to render it economically valuable, collaborative, team- based, evident and learnable, make it difficult for those who teach in higher education to step around creativity's challenge to traditional learning and teaching practice, We need now to focus processes and practices within daily economic and social life. The complexity of creativity has become less mystical and can be engaged with purposefully (McWilliam and Dawson (2008).

The importance of creativity is that it articulates the imaginative disposition that all humans possess where we are constantly changing and modifying our immediate surroundings and activities, creating original and novel outcomes in work and leisure (Csikszentmihalyi, ibid), a process that according to (Kozbelt, Beghetto and Runco, 2010) is more subjective, personal, internal and emotional, yet this can provide the groundwork for education to stimulate and foster creativity in all individuals. (Chemi and Zhou, 2016). Education in the formal years has to concern itself with the everyday creativity of people as well as specialized talent in the domain. The social and cultural context of creativity, relying on collaborative ways of working and emphasis on the process of creativity and ways of thinking needs to translate into University education where policies and curriculum change align to building a *creative dimension* for all students, through practice, research and industry real world applications. (Craft, Hall and Costello, 2014)

Creativity and Innovation

In the definition debate resulting from Guildford's address, about what is meant by creativity, inevitably innovation comes into the definition and how we need to distinguish between creativity and innovation. The terms are often confused as one and the same, but it has come to be generally accepted that the ideas from creative though are implemented through innovative practice. Hence the well accepted general definition of creativity as a process of generating new and novel ideas that have value (Sternberg & Lubart, 1999; Amabile, ibid; Mumford, 2003).

As the debate on creativity definitions has evolved, meanings concerned with only the production of novel, unique new, unusual personal ideas have come to be seen as outdated and inappropriate leading to the definition expanding to include aspects of appropriateness and increased value. (Runco

and Charles, 1993).Thus in any effective advocacy for creativity there is consensus that it requires both a novelty and useful value and that novel ideas that have no value or use are not seen as creative and vice versa (Beghetto, 2005) This needs to be challenged, particularly in light of the authors conviction that it is a valuable contribution to all human beings' personal wellbeing. We could also refer to Rick Poyner's (2004) complaint that its implied emphasis on commercial values ignores the cultural value of creative practice.

Problem solving has also emerged as a term associated with creativity but without the addendum of originality and appropriateness there is the danger that any problem-solving incorporating skills in solving known problems with known answers in knowledge acquisition and retention models of learning is increasingly defined as creativity. Alexiiou, Zamenopoulos and Johnson (ibid) and Mogi and Tamori (ibid) have in fact established from neurological studies the creative idea generation uses different pathways and processes from 'normal' problem solving.

Modern society is increasingly disrupted, necessitating new skills and approaches towards solving problems, definitions of creativity have begun to also incorporate *futures thinking* and the ability not so much to predict the future but to certainly expect the unexpected with the confidence to deal with that uncertainty and insecurity (Costello, 2000).

Definitions of creativity now need to challenge individuals' and organizations' conformity in their patterns of behavior and their tendency to be risk averse, by embracing error and mistakes, often seen as failure to be avoided, now need to be seen as a necessary part of ways of working. (Ball, 2003).

Revitalizing the imaginative capacity in all human beings is another dimension of understanding creativity leading to the advocacy of building this capacity into formal education equally with literacy and numeracy (de Bono, 2010).

Csikszentmihalyi's (1999) focus on the importance of learning environments will need to impact on universities which could be seen as ideal learning environments for creativity with the potential to move introducing a person, product and place, socio-cultural phenomenon related perspective where shared values are negotiated within a given domain.

Amongst this myriad of responses to defining creativity enhanced by Guildford's address associated research questions are still debated as to who is creative; what represents the creative personality? What are the benefits of creativity; can it be implemented on a personal and organizational level; can it be enhanced and taught; and what social, cultural and organizational culture is needed to implement it? Some of these questions appear to the authors as increasingly irrelevant in light of growing understanding that creativity is collaborative, community based, capable of us all and cross-disciplinary.

In an attempt to synthesise all this understandable diversity in trying to define a complex human characteristic of which little is known of the neurological, psychological, sensory or even cultural processes concerning it's 'mechanics' (for lack of a better term), the authors argue that creativity has come to be identified as the capacity to make a perception shift (c.f. Kuhn's

Paradigm shift (1962)) in a combinatorial process where information from disparate fields is synthesised into new and novel combinations (Gluth and Corso, ibid). These shifts in thinking challenging the limitations of creativity as limited to individualistic psychological traits make it difficult for those who teach in higher education to avoid creativity's challenge to learning and teaching within traditional practice. They illustrate the need instead need to focus on thinking, process and practice that is less identifiable, observable, analysable, and replicable, whereupon it can be easily engaged with intentionally as the outcome of precise pedagogical work (Kuhn,1963).

So, it becomes apparent that creativity needs to be at the cornerstone of all areas of university education, not at the margins of those specialisations where it has traditionally been expected, but as an essential part embedded in *all* disciplines and ways of learning. Are higher education institutions up to it? The authors' experiences in trying to model processes to extend these concepts into even areas where a creative approach can at least be seen as useful, if not essential, incline us to believe that this will be a substantial challenge.

The impact of creativity impact in higher education

Creativity in higher education has traditionally having been the domain of the arts and design, and this has been the case for University of South Australia. At the time of Guilford's presidential address these creative disciplines operated in isolation from mainstream higher education practice (Fryer, 1996). It has taken those seventy years for the barriers to be crossed and recognition given for both the value of creativity across all domains and how the creative thinking processes and core principles of the 'creative' programs can become a valuable and integral part in many other disciplines. In the past our institution has revealed a bias toward teaching *about* creative practice rather teaching by practicing creativity. For this to change by putting into practice its so called 'Enterprise 25 Strategic Action Plan', it will require abandoning many aspects of traditional prescribed academic models of knowledge-based teaching, and instead necessarily entail stimulating and influencing individuals creative thinking and behavior. This will require teachers expanding their teaching approaches creatively through their practice

Our research and information available indicate that in a traditional academic model what was lacking was teaching practice towards being creative, individually and collaboratively in teams. It revealed that an average of a mere ten percent of students considered themselves to be creative. The need for motivation required to promote student's intrinsic creativity has often been downplayed, discouraging the necessary processes to promote and implement more creative approaches (Jackson 2006). Students have been described as recipients and audiences rather than agents and actors (Yamamoto 1975), conventional assessment having undermined any expectation of creativity.

Many examples we collaborated in attempting to include a creative thinking methodology in programs which have patronized this conventional assessment to the expense of creative practice and outcomes by students. Assessment requirements based on literature reviews of creativity, profiling cre-

atives and entrepreneurs and case studies of creativity practice completely ignored the challenge to 'be creative, which students indicated was the reason they took the course in many cases! Lecturers justified not 'presenting a challenge to be creative' by saying they didn't want it to be too hard which might result in negative student satisfaction feedback. So, in a classic irony the lecturers played 'safe' in not delving into potentially unchartered waters in terms of student outcomes and opted for the traditional knowledge acquisition academic model of delivery. Obviously then advocacy for creativity has only gone so far and is still very deficient in practice that models the changed behavior that creates innovation and creativity. What is lacking is *innovative pedagogy* (Reisman, 2016) where there is an integration of new knowledge simultaneously with its application rather than the presentation of new knowledge that somehow will be applied in the future; a process where the teacher traditionally a transmitter of information acts as a facilitator of student learning, the catalyst in the problem-solving process.

By contrast we saw and promoted a creativity experience in higher education associated with fostering student empowerment and a student-centered approach. A process where creativity can be achieved and applied with confidence by starting with small steps, across disciplines, at an everyday level and *not* expecting high level sophisticated original ground-breaking ideas which might be expected from experts in the field and which might be intimidating for lecturers and students new to the process. (Papaleontiou-Louca, Varnava-Marouchou, Mihai and Konis, 2014*).*

The entrepreneurial university

Advocating for the formation of an entrepreneurial university has come about in response to a number of social, political, economic, and technological influences summarised by Paul Bolton, CEO of the UK's National Council for Graduate Entrepreneurship (NCGE, 2005), that knowledge was once historically the domain of universities, but that this is no longer the case. We are seeing the many ways that information can be both distributed and accessed through advances in communication technology. Universities are facing greater private sector competition and there is increasing demand that outputs relate and contribute more value to the economy and society through applications that have relevance.

Our graduate working as potential future 'creatives' less focused on routine problem-solving and more focused on forging new social relationships in their work, dealing with novel challenges and synthesising 'big picture' scenarios. They will be working at an accelerated pace to keep up with constant change at unprecedented speed in variable workplace cultures; less vertical, more flexible and more team-based', making it obvious that creativity cannot be left to languish on the margins of university learning and teaching, relegated to an isolated disciplinary corner. It has become everyone's business and must be taught as an inherent approach of everyone's specialised expertise. (McWilliam, ibid)

Policy support for creativity

Since Guildford's address creativity has gained superficial prominence in education and arguments have been put forward for it to be a priority as we move into what has become known as knowledge societies (Sawyer ibid, Craft 2005) In higher education there has been the proposition that creative capacity aids employability prospects by equipping students with the skills in innovative thinking that industry says in now requires.

The argument has been made at government level over many years, both in Australia and internationally, for the introduction of creativity across multiple sectors of society to foster innovation as the catalyst to bring ideas into being. Innovation, when implemented at an institutional level, can play a key role in implementing this transformation towards new ideas to create new value (Gibb, 2005).

Pink (2006) argues that we are moving from an 'information age' (value on knowledge workers) to a 'conceptual age' (value on conceptual workers or creative human capital). Florida (2002), describes this move from an industrial to a creative economy as a choice, not a natural progression and he also contends that creative capacities are important vocational attributes in all globally competitive enterprises, requiring skills in adaption, flexibility, combinatory processes and tolerance for ambiguity, experimentation and risk taking.

These attributes, usually only seen as selectively present in individuals but often latent in organizations, frequently appear as the most common indicators of the changing value systems following this massive change of economies. Though the over-arching agreement in the need to transform economies points to knowledge and creativity drivers as possible best practices, the terms of advancement are still contested, fragmented or their means of achievement unattended. In the case of Australia, the Australian Department of Education Science and Training, (2004) highlights a global knowledge-based economy with creative capacity as a key economic driver.

Institutions of higher education are seen to need to undergo a transformation locally and globally from traditional pillars of learning to being more entrepreneurial in their core business, (Kirby, 2006; Van Der Steers and Enders.2008). There is increasing pressure on universities to become more flexible and adaptable as organizations and in the graduate attributes they embed in their students, and a need to build deeper links with business, both to maximize innovation and promote growth, in order to ensure students are equipped to excel in the workforce. (Bok, 2003; Burns, 2014; Clark, 2004; Gibb, ibid; Hannon, 2006; Lackeus, 2015). These changes are having a disruptive effect on the perceived role of universities, from classical research institutions to entrepreneurial universities mimicking the modern workplace environment, requiring autonomy in their decision making, and in the way new research is developed, implemented and transferred in the relationships formed within their respective regions. (Devlin, 2009; Davis, 2009; Gaspar and Mabic, 2015).

An entrepreneurial model of a university and a way of working that creates entrepreneurial opportunity as recognized by higher levels of government authorities such as the USA's National Endowment for the Arts. (NEA), (1998), US National Academy of Science (2005), NACCE report UK (1999) and the National Innovation and Science Agenda, Australia, (2015).

In a twenty-first-century workplace, employers are increasingly seeking workers capable of contributing to original thought through interaction and collaboration as jobs change and diverge. As a result, the university curricula must be intentionally formed to reflect collaboration and creativity working in consort (Pink, ibid; Kok et al, 2010; Nunn, et al., 2007; Watermeyer, 2012). The University of South Australia's mission statement now reflects significant studies such as the 'Enterprise in Higher Education' UK Initiative (1988), Higher Education Funding Council for England (2011), National Council for Graduate Entrepreneurship (NCGE), (2006), Quality Assurance Agency for Higher Education (QAA, 2012), in believing this restructuring can produce more enterprising models of teaching and learning, developing knowledge that can contribute significantly to innovation in our economy and the transfer of knowledge to industry (Mueller, 2006). The University of South Australia believes it is responding to the many strategic imperatives aimed at building new economic models to meet future disruptions to past and outdated systems, reflecting current Australian government policies, the National Innovation and Science Agenda National Innovation and Science Agenda National Innovation and Science Agenda (ibid) and Creative Industries, A Strategy for 21st Century Australia, (2011)

The University of South Australia is attempting to follow suit in recognizing that derived 'silos' of expertise in its current structure needs to be deconstructed and that time for the flexibility, fluency and elaboration of thought need to be encouraged in a more cross disciplinary, inquisitive and collaborative space for future innovation. Following the release of two major forward planning reviews, 'Crossing the Horizon', a strategic action plan to the year 2018, and 'Enterprise 25, Strategic Plan 2018-2025', the University has identified that it should benchmark itself not only against the best in higher education but also against the best industries, ensuring a constant source of inspiration for innovation and new achievement. The university declares itself to be a university of Innovation and Enterprise and is advocating and defining the value in the application of creative ideas and innovations to practical solutions across all its areas of specialized education. The idea is intended to combine creativity, idea generation and development and problem solving, with expression, communication and practical action under the banner of 'enterprise'. As such educators are being challenged to build in students the capacity to co-create the curriculum and direct their own learning in ways that reflect the decision-making demands that a future workforce will impose on them. An increasingly uncertain and complex world demands creative and innovative approaches, and this needs to be reflected in the education we as a university provide.

Equally the university is being considerably challenged to create an understanding of creativity across the many disciplinary fields, Gibb (ibid) and to provide the structures and support for the model of learning needed to

develop student's creativity. Jackson (ibid) in The Higher Education Academy's Imaginative Curriculum project, argues that a university must harness student's imagination and creativity enabling them to work with, adapt to and exploit the complexity and change in which we are continually immersed. Creativity will need to become exemplified and enhanced for every student by new levels of investigation, cooperation, connection, integration, synthesis and by a problem-solving pedagogy (Hannon, 2018; Gibb, ibid; Livingston, 2010) and in process driven learning environment enabling students to self-direct and build resourcefulness in motivated, self-organized decision-making environments, in contrast to the current content laden and exclusively teacher controlled.

A number of creativity factors Guildford identified and advocated for their promotion and implementation are reflected in the European University Association (EAU) (ibid) as diversity, future orientation, originality, problem solving abilities and problem identification encouraged by speculation and risk taking. To these attributes further application is advocated through a design thinking Process (Brown, 2009) involving preparation, incubation, inspiration and illumination/verification. Torrence (ibid) added a documentation and assessment dimension to the process involving identification of Fluent, Flexible, Elaboration and Originality of ideas.

However, these approaches determined by Guildford towards instituting a creative zeitgeist is not part of the daily academic educational discourse of universities and the transformational power of creativity poses a clear challenge to organizational systems and institutional frameworks as well as approaches to learning and teaching reliant on compliance and constraint (Klieman, 2008). Drucker 1969) observed some fifty years ago that creativity in higher education was not being promoted, encouraged or rewarded in fact often discouraged Robinson, (1998).

Professor Alan Gibb in his Report for the UK's National Council of Graduate Entrepreneurship, *Towards an Entrepreneurial University* (ibid, p.3) observes that 'the culture of organizations such as universities where entrepreneurship is taught is often derived from a practice placing value and importance on information processing through strictly defined control structures and clear demarcation lines of responsibilities in a tight formal corporate structure', in dramatic contrast to the entrepreneurial mindset and empathy to promoting design thinking. (Morris and Kuratko, 2014), regard the task of bringing higher education creativity and entrepreneurship to greater prominence with a capacity to empower and transform within the institution as remaining a major hurdle. Maclaren (2012) agrees there is no shortage of rhetoric in championing creativity and innovation in higher education, but structural and management systems often run counter to the conditions under which creativity flourishes. Jackson (2014) argues that continuing with an 'audit' culture in our institutions dominated by prescriptive outcomes will continue a mismatch between the requirements of a routine practice system and innovative aspirations. Entrepreneurial and creative thinking needs to be seen as not just another series of subjects or discipline knowledge but as a practice and a way of thinking. An entrepreneurial mindset that maximizes impact by re-

sponding to problem-based innovation focusing resources across a variety of disciplines is needed (Thorpe and Goldstein, 2010).

The University of South Australia accepts that it needs to prepare students for lifelong learning as a means of dealing with frequent changes in occupational, job and contract status, changes in global mobility, cultural adaptation and working in a world of fluid organizational structures, as advocated by the European Commission (EPSA, 2016; Ghoshal and Gratton, 2002); Worell et al., 2000).

The University's aim is to focus on end-user inspired research and industry-informed teaching and learning, building a culture of innovation anchored around global and national links to academic, research and industry/ government partners, a so called 'triple helix' of university–industry–government relations, (Etzkowitz and Leydesdorff, 1999). It aims to move towards the provision of tailored education on demand, decoupled from the confines of strict disciplinary shackles, introducing an education where the assumed truths of information are constantly challenged, and is working on admission protocols, teaching and assessment towards ways that promote the creation of new knowledge from many inputs and in partnership with others beyond the discipline or subject area, generating an institution where relevance and the provision of value to wider society can be clearly demonstrated as it prepares students for the careers of modern times.

Drivers for innovation

In order to achieve this, a suit of core employee and student behavioral attributes are proposed to reshape the institute's culture and build the workforce required to develop as a genuine university of enterprise. This will necessitate understandings of new principles and how pedagogy will need to become relevant, structured and scalable to sustain innovative practice across the entire institution.

Work is currently in progress for a model on how these attributes might be expressed and promulgated. How the creative and innovative traits that will need to be developed combining ideas development and problem solving with expression, communication, and practical action can be achieved.

An increasing parallelism between universities and private companies as learning organizations, (as in the recent neologism "business intelligence"), is being recognized emphasizing the significance of educational and knowledge-based transformations involving capabilities that are to do with the problem-solving knowledge embodied in organizations

The University accepts that this embodied potential transformative power is often constrained by habit, and other social codes, defining normative practices. It is only in this way that future and increasingly complex grand challenges and the associated problems they generate can be tackled effectively by different ways of thinking and collaborating. Gardiner (2010), Jackson (2014, ibid). A university actively pursuing inter-disciplinarily approaches in establishing its relevance in an environment created by a wealth of multi-disciplinary centers and programs.

Responding to the challenge

The University acknowledges that the setting of the classroom is under pressure to transform into learning labs, design studios, and other learning environments that are process-rich rather than being overloaded with content. A shift from a teacher directed emphasis to one that facilitates collaborative models of teaching and learning encouraging self-directed, self-regulating and resourceful learners, where the academic mission moves from dissemination to the capitalization of knowledge (Etzkowitz, Webster, Gebhardt and Terra (2000). This in turn builds flexibility adaptability and self-management and an enterprising disposition as graduate attributes that can be applied in the workforce. du Gay (1996), Garrick and Usher (2000), du Gay & Pryke (2002), inventing and leading new hybrid professions, new cross-disciplinary industries, and new forms of creative economies across the range of transitioning industries (Kay et al., 2010).

The University is achieving these outcomes through a number of design-based innovation hubs. 'Match Studio' which has functioned since 2014 is an innovative model based on problem-based leaning as a means of building creative and innovative capacity into the curriculum. This experiential learning becomes embedded as a lifelong personal attribute. Through the utilization of parallel forms of design thinking staff and students from different disciplines draw upon an array of knowledge, ideas and methods converging upon real life, multi-faceted problems with outside partners and institutions in ways that provide the foundations for practice in their professional lives.

The Innovation & Collaboration Centre (ICC) is a strategic partnership between the university, the South Australian Government and DXC Technology, an independent information services company, supporting technology-based incubation and business growth. By leveraging world-class technology through DXC and the university's expertise in business growth, creative thinking, commercialisation and technology, the ICC supports the lifecycle from idea generation to growth and expansion for students, businesses and industry. The Centre provides a multidisciplinary environment where small and medium sized businesses, students and entrepreneurs can access a wide range of expertise to help them develop their products and grow their business.

The ICC also provides a unique environment that offers services and expertise in business growth (Centre for Business Growth), business management, strategy and marketing (University of South Australia School of Business) and commercialisation through the University's technology commercialisation company, delivering and supporting an enterprise-wide business development and industry engagement strategy for the University.

As well a number of interdisciplinary cross-school teaching and learning collaborative projects are being piloted to give staff and students the opportunity to work outside their fields of expertise. These teaching and Learning Initiatives aim to bring together academics from across the university's Divisions in order to build a community of practice and expertise in the pedagogies of inquiry-based learning (IBL) and Design Thinking and to undertake interdisciplinary, collaborative Teaching & Learning projects.

This follows the models of design thinking such as the d.school at Stanford University, the Design Factory at Aalto University in Finland, the Global Innovative Design Program across the Royal College of Art and the Imperial College in London, Keio University in Tokyo, and the Pratt Institute in New York, among others, where a rethinking of traditional pedagogy is developing the sets of skills related to innovation to create deeper learning and broader understandings (Avvisati et al, 2013). They see this way of working as essential in increasing the innovative capacity of a future workforce a workforce equipped to design and rethink reflexively, on their feet, *in situ.*

The University of South Australia's 'Crossing the Horizon' strategic plan (2013-18) and Enterprise 25, (2018-2025), states that: 'The University of South Australia will contribute to society, to industry and to its students as a creative enterprise. Research is to be organized around "grand challenges" spanning the university and creating cohorts of critical mass, anchored in an entrepreneurial environment, but also simultaneously directing efforts to address local and global socio-economic needs. The university is actively forming partnerships with the broader community (where these grand challenges reside) to solve problems and identify opportunities in collaborative environments where it can be demonstrated that one of the institution's key assets is its ability to harness a 'collective wisdom'. The challenge is for academics to now be seen as 'Change Agents' with the ability to break down the 'silos' in directing their research and knowledge away from exclusively their discipline to one that has a greater community connection. Building or growing a culture of creativity and innovation in the institution is seen as critical in order to stimulate and influence these possible future scenarios of academic – industry reciprocity.

To this aim University of South Australia has established research themes to address local and global socio-economic needs and include:

An age friendly world
Unlocking human potential across the community through intergenerational Approaches,
Transforming industries
Building industries and economies for the future,
Cancer prevention and management
Taking on one of the world's greatest health challenges with the aim of improving prevention, diagnosis, treatment and patient care,
Society and global transformations
Transforming societies through global citizenship,
Healthy futures
Understanding, treatment and prevention of, chronic diseases, and
Scarce resources
Developing safe and sustainable practices for managing the world's finite resources
making more with less.

Building a culture of innovation and enterprise

In building a university of Innovation and enterprise the University of South Australia is conscious that a culture needs to evolve that will create the environment for this transformation to occur. The importance of a socializing process (Martins and Terblanche, 2003) where individuals learn what behaviour is acceptable and the assumptions that are made about whether creative and innovative behaviour form part of the way the organization operates (Tesluk, 1997). It is envisaged that the process will encourage behaviour and activity leading to structures and policy practices that are determined through a set of basic values, assumptions and beliefs. These are supported through resources devoted to the development and communication of new ideas, and innovative ways to represent problems and find solutions; an environment where creativity is regarded as desirable and even normal and that innovative individuals are seen as role models, (Lock and Kikpatrick, 1995) and where the organization sees itself as an open system operating in an interactive way (Martins and Martins, 2002)

Laird McLean (2005) suggest that organizations influence individual's creativity not only through teaching but through the characteristics of the university and its culture. Universities need to operate beyond just 'factories' of knowledge but as environments cultivating social transformations and cultural creativity (Scott 2005) through personal and social aspects of human endeavor as well as vocational and academic ones (Kenny, et al., 2007).

As this culture is being developed there is recognition that there is much more to the experience of creativity in learning and teaching than simply 'being creative', but rather an emphasis on the centrality of creativity as transformation, and the importance of creativity in relation to personal and/or professional fulfillment (Kleiman, ibid). There is a belief that the essence of an innovative entrepreneurship culture resides in creating and exploiting opportunities and developing innovation through practice rather than curriculum 'add-ons'. A culture that subsequently encourages and enables its people to transfer their intellectual property outputs into practical application and encouraging entrepreneurial behaviour that pervades across and is an integral part of the institution, understood, felt and owned within the organization.

The university understands that the patterns of interaction required to foster a culture supportive of creativity and innovation are complex and can only flourish under these supportive structures, with and through innovative empowered thinkers and teams. The university is particularly sensitive in recognizing the significant change that might need to occur in any complex and established institution to build this attribute into various programs and courses. The origins of significant innovation in history often involves collaboration and complex strategy (Sawyer, ibid) encouraging participation to build knowledge at multi levels of an organization and this has become a major strategy in the Enterprise 25 (2019) initiative. Part of the challenge involves facilitating how the diversity of its people can be encouraged to work together by consolidating into precincts teaching, research and practice closely integrated and aligned to industry.

Consideration will be given to approaches that encourage within professions and disciplines ways of factoring in holistic opportunities and scenarios in the way problems are diagnosed. A confidence with the ambiguity of the end result, the need to 'not necessarily be right' at every stage of the process and to see many alternative and sometimes non-conventional experimental approaches that can lead to new possibilities. Within the overall institution it is seen as paramount that the refinement of the diverse range of specific specializations and approaches enhance and build the university's mission and philosophy. leading to new processes, new solutions in creating a University of genuine Innovation and Enterprise.

Our approach

Pedagogy—design thinking

Taking into account from all of the above, our challenge was to meet the university's mission for a innovative educational experience embracing creativity that contributes to a twenty-first century curriculum in an existential way, promoting optimism and embracing positive future scenarios, which is what we had always done in design education anyway. So, when we were initially approached to contribute a creative approach in other specializations where people recognized a need for it in their programs, but didn't know how to do it, we continued to do it there, with considerable appreciation and enthusiastic response. Even in specializations where a creative perspective would have been expected as a fundamental basis including later years in disciplines such as architecture and entrepreneurship, an overwhelming student response has been 'why haven't we had this before?' We had already realized that the curriculum we needed to develop under these circumstances, based on the way we worked with design students, needed to promote ways of working that are experiential in nature, through practice based on application to the students' own specialization, grounded in real world purposeful production, encouraging students to think creatively, ethically and to critically articulate values through research based and reflective practice (Kierl, 2009; Barlex, 2007). So, called 'design thinking' is about inspiring students to navigate a process from problem articulation through research, making, prototyping and interrogative evaluation. This model has become articulated and widely practiced in diverse disciplines to the extent that it has become the latest buzzword especially in business and organizational practices in management, politics and education. Rick Poyner (ibid) in particular though, has regretted the lack of recognition of its cultural significance to the wider community and individuals in it, because of the sole emphasis on its economic advantage.

Whilst all this attention has helped to build a case for the justification for including a design based creative approach in education, its implementation is still problematic as there is still much confusion as to what design thinking and innovation really mean (Davis, 2009), perhaps due to the simplified presentation of what designers know to be a focused and disciplined but complex approach to possibilities (Dilnot, ibid), and the merely economic focus of this for business. Our experience often supports Spendlove (2008), who argues that design thinking may not thrive in an education con-

text because it is distorted by traditional assessment expectations in staff *and* students, entrenched pedagogy and performativity as well as a failure to recognize the 'thinking' elements of 'Design Thinking' (Petrina, 2000)

We agree with Gardener (ibid) that if education is to progress from its narrow skilling discipline-based tradition and have a place for a creative dimension in the curriculum across disciplines, design-based learning will be required to facilitate self-directed and student-centered pedagogy that acknowledges the diverse nature of students and of learning styles, a design thinking approach, working with imperfect information from uncertain starting points and without absolute right or wrong answers, and that it needs to be a process that incorporates the interrogation of values and contested issues (Keirl 2004; Maisuria, 2005), and a reasoned and collaborative research based enquiry process through modelling that facilitates critical thinking in opposing conventions and proposing new ones (Spendlove, ibid).

Our Teaching Methodology

In our courses we attempted to convey a more holistic approach where a creative dimension was applied to the application of the specialized knowledge and each discipline's practice, to *normalize* a creative attitude to the students' specialization, and not to be experienced an isolated 'one-size-fits-all' curriculum of its own unrelated to the students own experience.

We established a program focused on future possibilities and needs, and critical thinking where ethics, consequence, questioning and integration are at the core of providing the skills necessary to make value judgements in all types of learning. We established grams that acknowledged that human beings are choice makers, who are able to naturally identify problems and solutions evolutionarily aided by the imaginative capacity to visualize and create change *a priori*, not just adapt to it *a posteriori*. We approached creativity as the capacity to create ideas, speculations and imagined scenarios what might be. Analysis of the present challenges we face worldwide can be identified as the direct result of poor decision-making processes in an environment that has educated us well in the technological, organizational, political processes but not the skills in effective identification and interrogation of ideas, leading to very efficiently executing poor ideas through lack of interrogation, (Sclove,1995,) We hope that our programs will inspire wise successful outcomes arising from the process of imaginative thinking and an *understanding* of the effective application of our imagination and creative thinking to bring about informed and sustainable change.

In programs we have conducted at the University of South Australia and outside business and other organizations, dealing with these shifting paradigms we distilled the learning experience down to 3 basic questions challenging them to set a personal critical framework for understanding the purpose and value of their education; Why are things the way they are? Why should they continue the way they are? How might they be different?

Stables (1997) describes this process as a capacity to find out how things work, (curiosity), interrogation and (questioning), to making things work (creative problem solving) and creating and reflecting on change scenarios. We understood that our task was to create a pedagogy contextualized

in a way that gives the experience a sound educational basis emphasizing informed questioning, critique, decision making, knowledge acquisition and creative knowledge application, designing and application not only of products, events and situations but their cultural contexts, by introducing a creative, design thinking foundation that can be instructive encouraging creativity within its operation and provide a model for implementation across disciplines.

We found expecting the application of knowledge other than in traditional ways that are seen to be 'tried and tested' is challenging, echoing de Bono (ibid) that education is based on the safe assumption that one only has to go on collecting more and more information for it to sort itself into useful ideas and that there is little understanding of the nature of creativity at any level, which can be clearly demonstrated by the lack of strategies or models for teaching creativity even though many disciplines have an expressed expectation of a creative outcome. Student feedback from our programs supports that students are aware of this and teaching staff have also agreed that this creative aspect needs to employ effective strategies be taught in a more meaningful way. We see a design based creative approach not so much as a subject but as knowledge-creating, a way of knowing enriching the specialist curriculum and necessary to its integrity, integrating and making meaning on issues and topics across disciplines.

Modelling

Our programs emulate the practices of creative workers, focusing on interactivity, relationships, novel challenges and identifying and synthesising 'big picture' scenarios rather than routine problem solving. Our structure allowed students to *unlearn* 'solutions' to higher order problems in an uncritical environment as quickly as they learn them. The re-adaptation and new combination of existing situations and things required creative skills utilised in a broader context integrated into informational and relational networks. Attributes developed include the ability to work in complex information spaces, use of analogous and metaphorical thinking, exploring alternatives, in cross disciplinary domains, and using fluent thinking allowing the formation of multifaceted solutions for a diverse range of purposes (Jeffrey and Craft, 2004).

Risk

A design approach must involve creativity, involving risk taking and demanding confidence to work with uncertainty, characteristics which are usually marginalized in an accountability focused micromanaged traditional teaching environments promoting strict productivity and performance (Liddament, 1996), employing a process where the teacher facilitates and guides the learning process so that the student achieves previously unknown or unanticipated outcomes, building knowledge and confidence in ways that are not always predetermined, in a way that the teaching itself models the attributes and approach, encouraging the students to undertake, creative, artful and flexible ways of working and thinking (Craft, 1997). This reflects a pedagogical stance that McWilliam (ibid) describes as 'meddler in the middle' taking on the role of facilitating the process, co-producing, provocation towards the

process and co-learning, as distinct from being in complete control, transmitting predetermined information in a program structured working collaboratively with cross disciplinary teamwork across, cultures, socioeconomic levels, etc., where conversation, communication, finding ways of working together, evaluating and considering how others see your work, in becoming exposed to and accommodating different points of view.

Research

The set 'knowledge' of any specialization is limited and sometimes dated. Therefore, we designed our programs to involve strategies for finding information from the vast amount available and utilizing it creatively within a social system, to contribute to making students creatively literate, emphasizing the ability to externalize skills and in so doing understand the thinking behind the thinking. We ask students to understand the importance of the being able to structure an argument and be able to elaborate on their thinking through the iterative process present when designing and making.

Thus, new understandings can be developed in this environment where students are challenged to work and extend themselves at their limits and beyond (Kimbell et al, 1996), particularly contributing to their development of ingrained motivation for engagement, through processes of generating interest, enjoyment, self-expression and setting personal challenges. (Amabile, ibid).

Our experience in design education programs had established the importance of research skills and the integration of history and theory (knowledge) with practice on student's creative achievement, overcoming some students' idea that it would impinge on their 'personal' creativity, challenging the idea that creativity was 'my' creativity, and building an understanding that creativity was a collaborative and community characteristic rather than a personal one. We required that students read widely in theory and history *relevant* to creative practice (e.g. history as case studies as opposed to the usual dates and clichés of traditional approaches) and apply open minded analytical skills to others' creative work and to record how these readings and analysis influenced their own creative decision making. The aim was to have them gain confidence beginning at an elementary level, as with fostering confidence, nurtured with exploration using simple elements, limited variables and processes and small achievements, increasing over the course of the program towards more complex and 'real life' projects as confidence in the process was established. To paraphrase Samuel Goldwyn, 'the more I knew the creativer I got'

Identifying and challenging Inhibitors

Equal emphasis was placed on the examination and identification of the things that inhibit creativity particularly the fear of making mistakes and the need to be right, and to have an expected answer that follows a predetermined process. We challenged the expectation that a process needs to lead to a solution, in a set way, by following a set routine, or that ideas only come at certain times and certain places (for instance in class or at school), or using only logical, analytical, routine or judgmental thinking. We presented strategies for

overcoming these expectations, attempting to unblock the associational, cultural, professional, emotional, social, language and other impediments to creative thinking by challenging assumptions or preconceived ideas through the proposition of 'alternative hypotheses' (Spendlove, 2017)

Self-evaluation

Allowing students the ability to reflect and validate their own work encouraging rigorous honestly and impersonal objectivity, not relying on social or personal expectations also demands that evaluation criteria be determined equally rigorously themselves, challenging the tendency to unconsciously and uncritically accept societal and cultural norms, by creating time for meaningful reflection, thinking critically about ideas and approaches to allow an interrogation of issues not usually questioned.

Fostering confidence

We set out to achieve students' confidence in these creative processes by providing positive experiences of the process and modelling effective ways of working at an introductory level, limiting variables, materials and expectations so that students can experience insightful results and develop confidence in the processes before slowly adding complexity as their capabilities and self -assurance develop. (Aud Berggraf, McCammon and O'Farrell, 2007; Lucas, 2001).

Relevance

Experience having demonstrated that treating creativity as an unrelated strand will not be successful in disciplines not previously expecting a creative intent, we realized it was critically important that students experience the relevance of creativity to their own discipline, by always applying our programs to their own specialized knowledge, while seemingly paradoxically setting it in a cross disciplinary setting to give that specialized knowledge a creative context by promoting a learning environment that attempts to be truly transdisciplinary, bridging silos that are often focused on just a single field of inquiry (acknowledging that accepting paradox is the essence of a creative approach).

Overall these strategies successfully built, developed and influenced student creativity through a supportive, intellectually invigorating environment, by attempting to provide the creativity and thinking skills to today's graduates at the level required for them to operate in their future careers (Papaleotiou et al., ibid), confirming that creativity can be learned and taught.

Conclusion

Guildford identified the shift needed for this transformation to occur in beginning a movement advocating the importance of creativity across all sectors of society but importantly in education. Knowledge and knowledge transmission are no longer the exclusive realm of universities. Therefore, there needs to be a shift in higher education from predominantly knowledge acquisition models of learning to broader experiences involving entrepreneurial thinking that

maximize career opportunities for graduates in a world where the scale of change is increasingly more complex, unpredictable and uncertain, if they are to remain regarded as valuable and worthy of moral, political and financial support by the populace

At the same time that governments, business, culture and society in general are demanding, initiating, and experiencing unprecedented change, traditional government funding for universities is diminishing when more value to the economy and society is being demanded, This is pushing universities in an entrepreneurial direction, ironically in increasingly depressed economic conditions impacted upon by globalization, international trade conflict and major disruptions such the Covid 19 crisis (Etzkowitz et al., 2000), and growing more imaginative and robust private sector competition

The University of South Australia along with many other universities, acknowledges that it needs to respond equally robustly to the reality that universities are increasingly being seen as more than just career preparers but needing to provide the experiences and skill relevant through an advocacy emphasizing creativity, innovation and collaboration precisely the values that Guildford was espousing in his presidential address. It is our intention that a version of his vision can be achieved in our university through a wider range of interdisciplinary activity and creation of degrees and centers based on future social, career and lifelong learning experiences embedded in and across faculties, owned by key staff and integrated into the curriculum. However to do this it needs more than *nominally* restructuring to overcome 'professionals with a vested interest in tradition and in the monopoly of learning' and who see 'innovation' as endangering authority (Koestler, 1959, p397), by giving the responsibility of their learning and its means, direction and motives to the learners themselves, individually and collectively, as would be required by flexible, rapidly changing demands of education.

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CHAPTER FIVE

FROM J.P. GUILDFORD'S 1950 APA ADDRESS TO PLEASE ASK: A CREATIVE CONNECTION

RENALDO A. SCOTT

Abstract

Creativity took center stage for the first time in history during J.P. Guildford's 1950 Presidential APA address, making this address a seminal work in the field of creativity. Guildford spoke on creativity in a profoundly new way that entailed a cognitive educational perspective. To delve into what creativity really meant, he performed a factor analysis study yielding results that provided several components indicative of creative abilities in people. These creativity factors and the author of this paper's research share an underlying link—Guildford's factors provide a loose framework that can provide insight into the creativity process at work in the author's heuristic formulation. This heuristic—*Please ASK*—was the crux of the author's doctoral phenomenological study and represented a groundbreaking aid to English as a Second/ Foreign Language (ESL/EFL) student comprehension of the article system before proper nouns. This paper will elucidate how *Please ASK* came into fruition by using Guildford's factors supporting creative abilities as a backdrop to the creativity process. In this way, Guildford's 1950 APA address will serve as a fitting precedent to the author's creativity-backed ESL/EFL research, lending further support to the school of thought that highlights the importance of creativity in the learning and education realm.

Introduction

The earliest recorded signs of creativity occurred over 2 million years ago in the form of stone instruments made by humans (Kaufman & Sternberg, 2010, Chapter 15). Fast forward to 1950, Guildford delivered an address at the American Psychological Association (APA) conference as president that centered around the topic of creativity. Although creativity in and of itself was not new, never has it been considered from an education-and-learning point of view. In his address, he pushed an urgency for psychologists to acknowledge the importance of creativity in education and learning. This push for creativity in the field was critical as psychologists' acknowledgement of creativity would mean a vaster acceptance of creativity, since the APA had such a profound influence on research and presentations, notably in the field of education and learning.

Summary of APA Address

Guildford's address could be viewed as creative. It was clear that he was shocked about the field of psychology's oversight of the subject of creativity. Guildford cleverly used his clear dismay at the field of psychology's reluctance in realizing the power of creativity as a legitimate subject of inquiry to deliver a speech to incite attention. The creative component was reflected in his avoidance of ad hominem rhetoric to address the audience, but instead he seized the opportunity to present his view of creativity. By creativity, Guildford meant the creative abilities in people that induced production of significant creative behavior, which he in turn linked to the presence of certain traits and creative personality (Guildford, 1950). His mention of the creativity/creative personality connection could be construed as a way to present to the field of psychology the relevance of the subject of creativity that the field could not clearly recognize before. Therefore, Guildford's address called for psychologists to self-reflect on their prior neglect of creative personality.

Guildford introduced a new way to look at creative abilities in people that he presented through exploratory research that he and his students conducted using factor analysis. The research acknowledged certain primary creative abilities in people. These creative abilities represented variables. Guildford then looked at the underlying sources of the variance among the creative abilities that could account for the exhibited correlations between variables. What resulted was nine underlying sources, or factors, that posited some explanatory reasoning behind the correlations among the creative abilities in people. The factors were sensitivity to problems; ideational fluency; flexibility of set; ideational novelty; synthesizing ability; analyzing ability; reorganizing or redefining ability; span of ideational structure; and evaluating ability (Guildford, 1950).

The aim of this chapter was to forge a creative connection between J.P. Guildford's address and the *Please ASK* (Scott, 2019) heuristic model, a model created by the author of this article. *Please ASK* (Scott, 2019) was the core of the author's dissertation concerning English as a Second/Foreign Language student views as they used the heuristic to comprehend the article system before proper nouns. In this writing, the author employed Guildford's nine factors as a backdrop to the process the author used to find a viable way to explain this difficult grammar to students of English. In other words, Guildford's nine factors positing creative abilities in people were used to provide a systematic guide as to how the author created *Please ASK* (Scott, 2019) from start to end.

Please ASK

Introduction

Dual Coding Theory (Boers, Eyckmans, & Stengers, 2007; Paivo, 1971, 1986) supported the use of figurative mnemonic aids in increasing the likelihood of the retention of material. In this way, *Please ASK* (Scott, 2019) represented a metaphoric, figurative mnemonic that increased the chances of learner retention of proper noun categories that called for the use of the null article, or the absence of the definite article *the*.

Please ASK Heuristic Mechanics

Please ASK. *Please ASK* (Scott, 2019) is a heuristic that gives English language learners better comprehension of the article system before proper noun. That is, the workings of this model give learners a look into how native speakers of English naturally choose the definite or null articles (and sometimes both articles) before proper nouns. *Please ASK* (Scott, 2019) is a mnemonic aid consisting of six categories denoting names of proper nouns before which the null article is used. Each of the six categories is named and explained below. In short, if a proper noun falls into any of the categories in the model, the null article is used. Likewise, if a proper noun does not fall into any of the prescribed categories, the definite article is used. In *Please ASK* (Scott, 2019), the first category, in which no article before proper noun is used, is denoted by the letter 'P', representing *Parks* (see Figure 4). *Parks* in this model not only represents the common idea of spaces for recreation, but also represents constructivist manifestations of parks. This heuristic argues that native English speakers do not use the definite article in front of parks; parks represent parks, stadiums, fields, squares, plazas, and malls. In other words, *Please ASK* (Scott, 2019) posits that native speakers mentally construct the meaning of parks and the other five offshoots of parks the same.

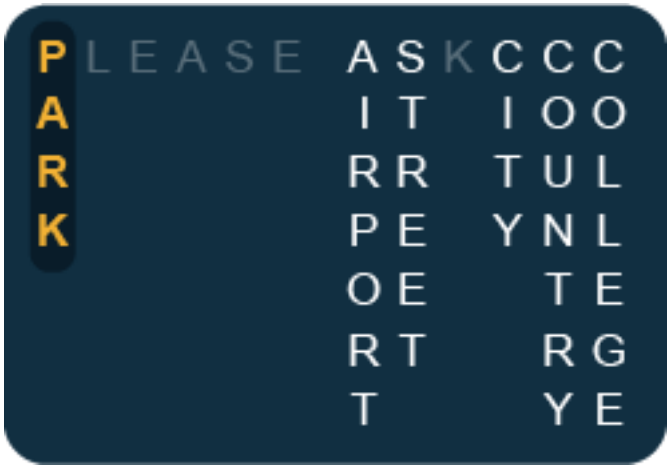

Figure 4. Please ASK 'Park' category.

The next letters—*l-e-a-s-e*—in the model do not denote categories. Rather, they are used to occupy space after the initial categorization letter 'P.' The author, for reasons expressed in the previous section, includes extra letters to formulate an English word in the model. Without the extra letters, the model would be the *PASK* model, which proves more difficult for English language learners to retain and recall when needed. Therefore, the researcher considered it best to addend these letters to form well-known words and an equally well-known sentence in English: *Please ASK* (Scott, 2019).

The second category in the model is denoted by the letter 'A,' representing *Airports* (see Figure 5). This is an example of a category in the model

that presents itself from a pure post-positivist viewpoint in that there were no further constructed meanings of this category. *Airports* means the venue that accommodates air traffic.

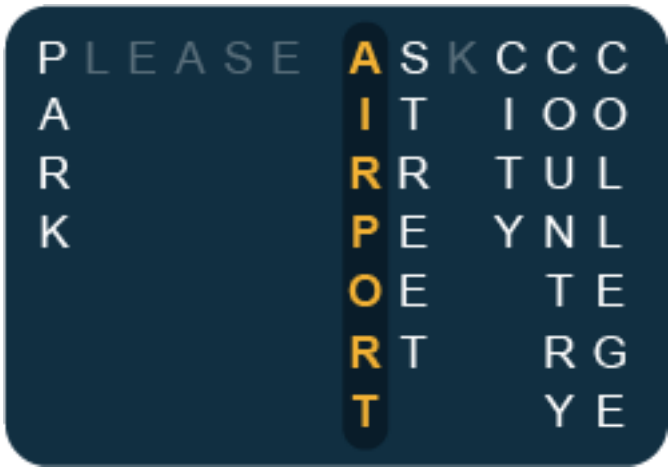

Figure 5. *Please ASK* 'Airport' category.

The third category in the model denoted by the letter 'S' represents *Streets* (see Figure 6). This category indicates the use of the null article before any proper nouns denoting streets, including streets, avenues, boulevards, roads (e.g., Old Country Rd.), and places (e.g., Nichols Pl.). Again, the researcher notes that the native English speaker post-positivist outlook into the world directly informs this category.

Figure 6. *Please ASK* 'Street' category.

The fourth category in the model denoted by the letter 'K' is transformed into a letter 'C' written three times (see Figure 7). Since the letter 'K' and the letter 'C' could be pronounced the same (the latter pronounced with 's' sound before letters *e*, *i*, and *y*), the letter 'C' written three times could creatively replace the 'K.' Therefore, the fourth category becomes three categories in the model. The letter 'C' written three times corresponds to the categories *City*, *Country*, and *College* respectively. The categories for city and country are self-explanatory. However, the final category denoting *College* has a socially constructed meaning in this heuristic. *College* connotes universities, colleges, schools (primary, secondary, trade, etc.), institutes, businesses/organizations (specifically private sector), and churches/buildings of worship.

Figure 7. Please ASK 'City,' 'Country,' 'College' categories.

Please ASK exceptions. There are exceptions to the *Please ASK* (Scott, 2019) heuristic. The first exception depicted in Table 2 concerns proper nouns in nature. Many proper nouns denoting nature employs the definite article *the* before. There exists, however, a grouping of proper noun categories of nature that calls for the use of the null article. Again, making use of a creative mindset, the researcher formulates another mnemonic to help in retaining and recalling these proper noun categories.

Table 2: *Exceptions to Please ASK, Proper Nouns in Nature*

	A tree limb falls.
L	Lakes
I	Island
M	Mountain
B	Beach
Falls	Falls

The researcher begins by constructing the following sentence: A tree limb falls. The final two words of this sentence—LIMB Falls—constitutes the proper noun categories of nature to which the null article is applied. The first letter, 'L,' stands for *Lake*. The second letter, 'I,' stands for *Island*. The third letter, 'M,' indicates *Mountain*. The fourth letter, 'B,' denotes *Beach*. The final letter 'F' represents *Falls* as written. Thus, all proper nouns denoting any of the preceding categories calls for the use of the null article before. Note that only the final category *Falls* is the only category that is pluralized since a singular form of this proper noun does not exist in the language. The preceding four categories are singular and take the null article before. Should these categories be pluralized, the definite article will be used. This does not apply to the category *Beach* as pluralization of this proper noun category is nonexistent in the English language as well.

Descriptive of. The second exception involves proper nouns that includes the preposition *of*. When dealing with proper nouns, the preposition *of* characterizes the proper noun as containing a "descriptive *of*-phrase" (Master, 1990, p. 471), meaning that the words after the preposition *of* describes the noun before the preposition *of*. For example, *the King of England* is a proper noun that contains the descriptive *of*-phrase "of England," which describes the previous noun *King*. In these cases, descriptive *of*-phrases call for the use of the definite article, as can be seen in the preceding example given.

The researcher has just completed phenomenological research involving English language student perceptions of *Please ASK* (Scott, 2019) as a successful way to understand article use before proper nouns. Prior to this heuristic, there existed no clarified way to explain this difficult grammar to students of the language. The researcher relied on creativity to ultimately flush out something that could aid students in this endeavor. A synopsis of this creative process, using the nine factors outlined in Guildford's APA address as a backdrop, follows.

Guildford's Nine Factors as a Backdrop to Please ASK Formulation

Introduction

Early on in the author's career as an English language instructor, a number of students posed an interesting question: With nouns that begin with a capital

letter, when do you use *the* or no *the*? As with any grammar question, the author embarked on finding an answer by searching relevant literature and grammar books. The results of this search were nil. That is, there existed no solidified rule that guided use of the definite or null articles (*the* or no *the* respectively). The literature advised memorization of lists of proper nouns with their respective articles before or simply guessing. At that juncture, the author realized that an answer would need to come from an alternative place. This was where the creative process to finding an explanation to the grammar commenced.

What follows is the process that the author used to find an explanation to this mental grammar— grammar that native speakers of English produce naturally but proves difficult, if not impossible, to metacognitively explain (Fromkin, Rodman, & Hyams, 2007). The author used the nine factors of creative abilities in people that Guildford presented in his 1950 APA address. Each factor represented a stage in the process. It deserves noting that the entire process was not a linear one; rather, it was an iterative process that did not follow any order whatsoever.

The Nine Factors as Stages to Please ASK Formulation

Introduction. In his 1950 APA address to the psychological field, Guildford presented nine factors that, according to his factor analysis-based exploratory creativity study, were indicative of creative abilities in people. To recap, these nine factors were as follows: sensitivity to problems; ideational fluency; flexibility of set; ideational novelty; synthesizing ability; analyzing ability; reorganizing/redefining ability; span of ideational structure; and evaluating ability. In attempts to give the reader a step-by-step process of how the *Please ASK* (Scott, 2019) heuristic came into existence, the author presented each factor with an ensuing narrative describing the creativity used to discover a useful grammar explanation to the article system before proper nouns.

Sensitivity to problems. The author's 14-year tenure in the field of English as a Second/Foreign Language served as a personal learning experience allowing the author to engage in self-analysis. From the beginning of his career in pedagogy, the author has been passionate about teaching English, and this self-realization was backed by many students who characterized the author as passionate. In retrospect, the author has espoused an approach to teaching English that moved away from the Banking Concept approach (Freire, 2018) that viewed students as reticent beings with nothing to contribute in class to an approach that saw students as intellectual beings. These intellectuals had thoughts, feelings, and difficulties with English that were important to address so as to promote student progress in the language. The author's social constructivist pedagogical approach enabled fruitful class discussions and a developed sensitivity to issues in English that impeded the progress of each student. When students asked questions, the author not only readily answered but looked to answer the questions in ways that were clear to the students.

Early in the author's teaching career, students felt comfortable asking difficult questions. One of the most challenging questions involved an

explanation to the article system before proper nouns. Looking back, the author knew that this grammar troubled students based on evidence that presented itself in essays and in speech. It became vital for the author to remain sensitive and connected to concepts in English that served as obstacles to student progress so that students could receive clarified explanations to help their English.

Ideational fluency. A substantial amount of student errors and student questioning prompted the author to find an explanation to the grammar. A perusal of grammar books, relevant websites, and refereed journals resulted in turbid explanations. Therefore, the author decided to attempt finding a solution on his own.

The author first acknowledged that native English speakers correctly used this grammar all the time without thinking. So, there had to be a way to metacognitively present this grammar to non-native speakers. In true tabula rasa form, the author began by taking a pen and a blank piece of paper, and proceeded to write down as many proper nouns with the correct articles as possible in the span of 5 to 8 minutes. The result was a sheet of paper with a plethora of some of the most common proper nouns in English with their correct articles in front. The author, at this point, looked at the proper nouns carefully to see if some pattern present itself. No simple patterns surfaced at first. However, after some time, some patterns seemed to emerge from the convolution. The author was able to detect groupings of proper nouns that used the definite article and other groupings that did not. For example, the author could clearly see five categories of proper nouns that did not use any article before—names of parks, airport names, street names, names of cities (with some exceptions), and names of countries (with some exceptions). A final category—college—materialized that was a less orderly category, meaning that the category did not only comprise colleges, but universities, schools, for-profit businesses, and places of worship. The next challenge was to clarify these patterns and determine a way to not only show the patterns to students, but to also convey the patterns in a way that students can remember them.

The next set of ideas revolved around a fitting way to present the ideas so that students could remember the patterns in route to understanding and digesting the grammar. Dual Coding Theory (Boers, Eyckmans, & Stengers, 2007; Paivo, 1971, 1986) supported the use of figurative mnemonic aids in increasing the likelihood of the retention of material. In this way, the author attempted to find a mnemonic that could represent these patterns in a compact form that could increase the likelihood of student retention and comprehension of the grammar. Several mnemonics emerged, including SKAP, APKS, KSAP, PKAS, AKPS, KASP, PSKA, PAKS, and further combinations. These mnemonics succinctly represented the categorizations of proper nouns that do not use the definite article; however, the author supposed that these mnemonics would prove hard for students to recall since on the surface they were just letter combinations. A mnemonic comprising letters that at the same time exhibited some sort of meaning would be optimal because that meaning could enable a higher possibility of recall of the mnemonic when needed. The search continued for such a mnemonic.

After sifting through further letter combinations, the author happened upon the mnemonic PASK. The letters ASK stood out because they formed an actual word. Students can connect to this since *ask* is a well-known verb to which students are exposed from basic to advanced levels of English. Then came the issue with the sole letter P. How could this letter be joined to the letters ASK to form a mnemonic device that students could connect with and remember? The letter P could stand for a word itself—*Please*. Thus, the letters PASK could be rewritten as the mnemonic *Please ASK*, a mnemonic that represented when not to use the definite article before the denoted proper noun categories.

Flexibility of set. In attempts to find a viable explanation to the grammar problem, the author had to be patient in allowing creativity to work. This exuded patience meant being flexible to permit a divergence (Brown & Katz, 2009) of possible mnemonics to take form. The author acknowledged a mindset that embraced a more pragmatic epistemological outlook instead of the more positivist outlook that has been supported in the field of English as a Second/Foreign Language for so long. In being pragmatic, the author looked to find a solution that worked to help students to understand the grammar, not a solution that was deemed "correct".

Finding an explanation to the grammar could not entail an immediate convergent (Brown & Katz, 2009) response. Rather, the author acknowledged allowing a mixture of "crazy" ideas to take form during the divergent phase. This divergent phase encompassed the author's immersion into a state of flow (Csíkszentmihályi, 2008), where the author was completely preoccupied with finding a solution, many ideas were taking shape, and the author felt a sense of happiness in helping students. The divergent phase led to the convergent phase, with the formation of *Please ASK* (Scott, 2019). This convergent phase would not have been possible had the author not maintained a flexible approach in generating sets of ideas for a mnemonic. A flexibility of set supports creativity having no boundaries.

Ideational novelty. Something deemed creative has qualities that are novel, helpful, and appropriate in some specific context (Amabile, 1996; Kaufman and Sternberg, 2010; Runco, 2004). Given this definition, the *Please ASK* (Scott, 2019) heuristic can be regarded as a creative tool, which came into fruition from a creative perspective of the English language.

Not only was the *Please ASK* (Scott, 2019) heuristic model a novel creation, but the creative process and components leading up to *Please ASK* (Scott, 2019) were also novel. The novelty quality of the creative process was just as important as the other two qualities in finding the heuristic. The author conjectured that lack of ideational novelty was one of the reasons for the absence of an explanation to the grammar in the field as a whole. The field could not see a clear explanation because the grammar issue had been approached from a non-creative standpoint, i.e., from an inappropriate, unhelpful, and non-novel point. Creativity was essential in the process that ensued to find *Please ASK* (Scott, 2019) and novelty played a major role in helping to bring something new to the field of English language.

Synthesizing ability and analyzing ability. The abilities to synthesize and analyze played key roles in the formulation of *Please ASK* (Scott,

2019). Synthesis involves the movement from the constituent parts to the whole entity, whereas analysis involves the opposite, movement from the whole entity to constituent parts (Brown & Katz, 2009, p.68). Each represents a means to comprehending on a level beyond the superficial, but from two different perspectives.

This stage was particularly critical in the creativity process involving the formulation of *Please ASK* (Scott, 2019). As mentioned previously, no grammar explanation concerning the article system before proper nouns in English existed prior to *Please ASK* (Scott, 2019). Literature only provided memorization and guessing as answers to understanding this grammar quagmire. Of interest to the author in the process was the reason why no explanation had ever existed. The reason for this rested in employing solely an analytic approach to getting an answer.

In the field of English as a Second/Foreign Language, grammar has always been taught and presented in a deductive fashion. That is, instruction and thinking has always flowed from rule to specific examples. For the most part, this is an effective approach to grammar instruction. In the case of this grammar involving articles before proper nouns, deductive reasoning leads to an impasse. The reason for this impasse is there is no concrete rule from which to flow to specific, concrete examples. So, obtaining an answer seemed frustrating, if not impossible. This is what the author experienced when attempting to obtain an explanation deductively.

The author instead jotted down a plethora of proper nouns and from this listing of proper nouns the final *Please ASK* (Scott, 2019) heuristic came into fruition. This approach involved movement from specific examples, the proper nouns, to a whole entity or rule—*Please ASK* (Scott, 2019). As such, obtaining a final answer to this grammar that previously had had no explanation involved synthesis, or inductive reasoning. Finding an answer entailed embracing creativity that encompassed going against the deductive, analytic mindset reflective of the status quo in the field of English.

To sum up, using analysis only was not enough to flush out a solution to the grammar. Rather, use of analysis and synthesis was needed to at first figure out what did not work, and then the author ultimately determined a means to finding a solution.

Reorganizing/redefining ability. The ability to reorganize/redefine manifested in two ways in the process of bringing *Please ASK* (Scott, 2019) into fruition. First, the author had to use the ability to reorganize when the brainstorming phase (or ideational fluency) resulted in an abundance of resultant mnemonic clusters that were connected to certain categories of proper nouns. Each mnemonic consisted of capital letters that stood for categories of proper nouns that did not call for the use of the definite article. The author continued to shuffle, or reorganize, the letters of the mnemonic until one was reached that presented itself as the most fitting mnemonic. By most fitting, the author intended to find a mnemonic with which all English language students, regardless of native language or culture, could connect on some level. *Please ASK* (Scott, 2019) was the epitome of such a mnemonic, since students of varying levels of fluency could understand the term *please* and the term *ask*. In the worst-case scenario, if students could not understand the two

terms, the direct translation of these two terms most likely existed in their native languages. Therefore, *Please ASK* (Scott, 2019) was the most fitting mnemonic because it presented itself as the most memorable. Second, the author had to use the ability to redefine as a way to finding a solution. Toward the beginning of the process of finding a viable explanation for students, the author questioned what the problem was. Obviously, the problem was that students could not understand this difficult mental grammar involving the article system before proper nouns. However, the English language field acknowledged an additional problem in that there was no clear way to explain this grammar, besides memorization and guessing. This view that supported no clear explanation of the grammar was the direct result of deductive reasoning. The field had difficulties in finding a grammar explanation because the field relied on reasoning that progressed from a set rule to the specific proper noun examples in reality. Since no rule existed, the ability to progress toward specific examples became downright impossible. Thus, the only answer lied in memorizing lists of proper nouns or simply guessing.

The author chose to challenge this notion of memorization/guessing being the only answer. Deductively speaking, there was no rule from which to begin. What if the process began from the specific proper noun examples and from the specific observations a rule could emerge? This question was the starting point of the entire creative process to finding a heuristic model to help students with this grammar. In essence, the author had to first recognize the problem and the attempted solutions to the problem as given by prior research and literature in the field. Then, the author realized the shortcomings of approaching this grammar problem deductively. Therefore, the author redefined the approach to coming up with an answer, an inductive approach, that resulted in the formation of *Please ASK* (Scott, 2019). Creative thinking enabled a mindset in the author that allowed for alternative ideas to flow, and a prime example of an alternative idea was the redefining of the reasoning needed to successfully find a heuristic to explain the grammar.

Span of ideational structure. This factor connected creative abilities in people to the ability to deal with complexity. When searching for an explanation to the article system before proper noun grammar, it became necessary to "…keep in mind several variables, conditions, or relationships as he [or she] thinks out a problem" (Guildford, 1950, p. 453), without becoming confused in the process.

Please ASK (Scott, 2019) was the result of a complex problem. The term complex did not only mean difficult. Complex meant that the problem contained constituent parts grouped into a system and when these parts interacted, they produced a non-linear, unpredictable system. Larsen-Freeman (2013) recognized the complexity, uncertainty, unpredictability, and nonlinearity of the English language as a whole and these descriptions applied to proper noun grammar as well.

Span of ideational structure manifested in the author's view of English language as a system comprised of systems within other systems. English is a system that comprises systems that are all complex, at times making it challenging to explain these language complexities using traditional methods. Complexity presented itself in the article system before proper nouns

that exude no apparent clear pattern.

Complexity is the foundation of systems thinking (Capra and Luisi, 2014; Senge, Smith, Kruschwitz, Laur, & Schley, 2008), which is an approach that accepts complexity in a situation as a way to ultimately see emerging patterns in order to make sense of the situation or problem. Systems thinking rejects the utility of reductionism in finding solutions, where analyzing parts of the whole is the key to comprehension. Rather, systems thinking realizes existence of many different things occurring simultaneously in a seemingly random order, thereby making attempts to analyze and predict almost nil (Doll, Fleener, Trueit, St. Julien, 2005; Senge, Smith, Kruschwitz, Laur, & Schley, 2008). In a complex system, non-linearity, change, unpredictability, and randomness are considered assets to understand the system as a whole. The constituent parts in the system interact, producing non-linear, unpredictable sub-system. By paying attention to these interactions between the parts, patterns can eventually take shape that lead to comprehension of the problem at hand. With the aforementioned heuristic, this action translated into concentrating on the interactions between the many proper nouns that were listed on the blank piece of paper. After a while, patterns materialized, and the author was then able to create several mnemonics from the patterns before settling on the finalized mnemonic—*Please ASK* (Scott, 2019).

Evaluating ability. Coming up with the creative heuristic was not the final step. The author needed to gauge whether the *Please ASK* (Scott, 2019) heuristic exhibited any success in helping students to understand the article system before proper nouns. Therefore, the author used approximately eight years from when the heuristic came into fruition as a beta test of sorts. This time period saw the introduction of *Please ASK* (Scott, 2019) to a mix of students from different countries and schools where the author instructed.

The heuristic received an overwhelmingly positive response from students, many of whom commented that the heuristic provided them an easier way to remember and understand the grammar. Still, the author did not accept the heuristic as perfect. With time, exceptions to the categories represented by *Please ASK* (Scott, 2019) became apparent, and so, the author was able to addend those exceptions to the original heuristic model to form a more wholistic heuristic. Therefore, the complete *Please ASK* (Scott, 2019) heuristic comprised *Please ASK* (Scott, 2019) the article system before proper nouns of nature (exemplified by the mnemonic *LIMB Falls*), and the article system connected to proper nouns using the descriptive *of*. The ability to evaluate was important in flushing out the shortcomings of the original model and addending new parts to the heuristic, thus resulting in a more honed heuristic for students.

Summary

In his 1950 address as president of the APA, J.P. Guildford mentioned research on creativity that used factor analysis to draw out relevant factors in the study. There were nine factors that Guildford hypothesized were representations of creative abilities and personalities in people. These nine factors were sensitivity to problems; ideational fluency; flexibility of set; ideational novelty; synthesizing ability; analyzing ability; reorganizing/redefining abil-

ity; span of ideational structure; and evaluating ability. The author of this writing used these nine factors to outline the creative iterative process whereby the *Please ASK* (Scott, 2019) heuristic was created. Each factor shed light on the intricacies involved in starting from nothing to bringing the heuristic into fruition. The crux of *Please ASK* (Scott, 2019) rested on the author's ability to use creativity to view things from an alternative perspective, thus making *Please ASK* (Scott, 2019) a creative discovery.

Summary and Conclusion

On this 70th anniversary of J.P. Guildford's presidential address to the American Psychological Association, it is most fitting to pay homage to the man and the indelible mark his speech left on the field of creativity. Guildford expressed shock at the degree to which the field failed to acknowledge creativity as a subject. What made this speech particularly important was that the APA as an entity does not only affect the field of psychology, but many other fields as well, since it serves as a gatekeeper for research structure and citations in general.

Guildford likened creativity to creative abilities in people. He elaborated on this point by including a study he conducted using factor analysis. The ensuing nine factors in the study were indicative of creative abilities in people. It so happened that these nine factors also represented stages that the author of this writing used to create a heuristic model to help English as a Second/Foreign Language student comprehension of the article system before proper nouns. It deserves mentioning that these factor stages constituted an iterative process or backdrop, whereby the author visited and revisited several phases on more than one occasion in route to finding a heuristic. The result of this factor-driven process was *Please ASK* (Scott, 2019), a heuristic that helped to clarify the difficult proper noun article system grammar.

In writing this work, the author aimed to show a link between Guildford's address and the author's creative heuristic, which was also the core of his phenomenological doctoral research. Many years have passed since this groundbreaking speech, but the speech's power still prevails. This work lends further credence to the relevance that creativity holds as a subject while at the same time solidifies Guildford's address as a true seminal work in the field of creativity.

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CHAPTER SIX

FROM BOREDOM TO CREATIVITY: A REVIEW OF WHAT SCHOOLS NEED DO NOW (BEFORE IT IS TOO LATE)

GAVIN SUSS

Abstract

I argue in this paper that schools are outmoded and have for some time been growing obsolete, even more so recently. Their current structure and pedagogical objectives do not serve the needs of industry and the world economy and do not align with the advances brought on by the technological revolution. In a rapidly changing world that can be thrown into chaos as we have been by the recent pandemic – radical changes are required to keep schools relevant to children's and adolescents' lives. This paper delineates how schools can ensure that the knowledge and content that they teach will be of practical use in a changing technological world. Creative thinking and creativity, I will argue, play a cardinal role in the solution. Notions that "creativity comes from the unconscious" and "everyone is creative" have been disproved (Sawyer, 2012); namely, schools need to take on the role of encouraging and teaching creativity. Creativity research has surged in the past 50 years, especially during the past decade (Barbot, 2019), and one of the most important areas of study is developing and fulfilling creative potential (Runco, 2016). The role of schools in the process is crucial. This paper discusses the innovative school, what its structure will be, what it will teach, and how its students can be evaluated. Like many others that have been written, it is also a wakeup call to principals, teachers, leaders in education, and politicians to recognize that if they expect schools to remain relevant and functional, change – from a traditional to an innovative framework – must happen quickly.

Introduction

Today's schools are complicated organizations that must teach, educate, and develop students for 12 long years, as well as successfully socialize them to work and life in a rapidly changing world. Schools have a very sensitive and systematic interplay between pedagogical and organizational elements (Sharan & Chin Tan, 2010), making them essential to society. But nowadays schools are boring, and for a number of reasons, are also becoming irrelevant: the type of knowledge they impart is no longer required in 2020, their teaching methods are obsolete, and the models for evaluating students that are used usually test memorization. Just as in the 20th century, schools' core curricu-

lum still consists of writing, reading, math, science, history, literature, English, and other subjects. Schools must adjust to a reality of global competition, globalization, machine learning, big data, technology, automation, and the like.

For the past 20 years, the interest in creativity and creative thinking has grown exponentially, especially in areas like education (Craft, 2005; Huang et al., 2019; Smith & Smith, 2010), for two reasons: numerous business research groups have published findings addressing its importance to achieving prosperity. For example, the Business Roundtable and the Council on Competitiveness (2005) reported that "creativity and innovation are central to economic success." One of the conclusions in the 2010 IBM Institute for Business Value study *Capitalizing on Complexity* of over 1,500 chief executive officers worldwide who were interviewed face-to-face was that "creativity is the most important leadership quality." Similarly, the recent 2018 World Economic Forum report "The Future of Jobs" offers an extraordinary view of what industry will be like in 2022: "proficiency in new technologies is only one part of the 2022 skills equation, however, as human skills such as creativity, originality and initiative, critical thinking, persuasion and negotiation will likewise retain or increase their value, as will attention to detail, resilience, flexibility and complex problem-solving." Elsewhere, the report also stresses the importance of analytical thinking and the ability to innovate. In January 2009, the European Union officially launched the European Year of Creativity and Innovation (EYCI), proclaiming that "Europe's future depends on the imagination and creativity of its people."

The second reason for increased interest in creativity according to Hernández-Torrano and Ibrayeva (2020) is the body of empirical evidence indicating the positive contribution of creativity to outputs such as scholastic performance (Fanchini, Jongbloed, & Dirani, 2019; Gajda, Karwowski, & Beghetto, 2017; Hansenne & Legrand, 2012) and the ability of organizations to create value and innovation by hiring creative employees. Creativity also plays a critical and important role in the entrepreneurial process (Ko & Butler, 2005; Suss, 2018).

Now What?

The process of training adults to increase their creativity is generally complicated. Age may be a blessing because with experience comes an ability to quickly grasp the complexity of our surroundings, an understanding of the ways that things logically connect, and people become adept at sensing and trimming nonsensical ideas. Yet, age may be a curse because age and experience can lead to the accumulation of constraints, structures, and filters that hinder creativity and innovation (Suss, 2015). Why is that the case? as people age, they tend to be mentally rigid and exhausted. When this happens, creative ideas may be rejected at an early stage because they do not strictly abide by known logical rules, so they are set aside in favor of non-creative ideas or solutions, whose main value is that they conform to the mold that needs to be rejected (Suss, 2014).

Creativity and innovation crucially contribute to economic prosperity, advancements in technology, medicine, industry and agriculture and to successful entrepreneurship and social well-being. Education can play a key role in fostering creative and innovative skills – in the sense of being able to successfully implement creative ideas (Klijn & Tomic, 2010; Suss, 2018) – among children. Given the many benefits to society and individuals, schools should indeed take on this role (Beghetto, 2005; Suss, 2018). Regrettably, this is not the case; quite the opposite, schooling and education are eroding creativity. The relevance of creativity for teaching and learning (Craft, 2005) has not evolved into a pedagogical program in most of the world's education systems, which in fact destroys students' creative potential. George Land and Beth Jarman – known for their ingeniously designed test that successfully measured the creative potential of NASA's scientists and engineers, they tested between 1968 through 1983 the creativity of 1,600 5-year-old children. The creative imagination of a staggering number of them, more than 98%, ranked in the genius level. But when Land and Jarman (1993) retested the same children at the ages of 10 and 15, the results dropped to 30% and 12% respectively. On the same test that was given to 280,000 adults age 20, only a dismal 2% showed potential. Other findings offer hope, however: creativity is not a static attribute and can increase with age (Barbot, 2019) if cultivated and strengthened (Suss, 2015, 2018; Barbot, 2019).

This paper offers both a theoretical review (Beghetto, 2005; Sawyer, 2012; Davis, Jindal-Snape, Collier, Digby, Hay, Howe, 2013 & Suss, 2015) and a practical and original approach to making changes that need to be implemented immediately in the education system. I will argue that creativity and innovation in education are not just desirable goals but are an urgent necessity. The recent coronavirus disease outbreak and its effects on markets and people have only accentuated the need for creative leaders, managers, and employees in all professions. The next decade will be even more challenging and will require that humankind deliver solutions, products, services, and technologies that are by far, more innovative and creative than today's. The places where these changes must first begin are in the schools and academia. Scholars have associated the development of creativity in educational contexts with economic and cultural prosperity (Hernández-Torrano and Ibrayeva, 2020). Creativity can be an important instrument for solving individual, organizational, and social problems and achieving sustainable development (Said-Metwaly, Kyndt & Van den Noorgate, 2017). Creative teachers are able to reinvent themselves and know how to be flexible in the way they teach and assess their students. Creative managers and employees can manage and lead teams and implement processes and strategies better by learning how to improvise, when necessary, to improve outcomes.

The four domains that schools must adapt are the physical learning environment (the classroom), teaching methods, the curriculum, and evaluation methods, and they must do so within the next five years if the education system wishes to thrive and, some scholars will even argue, remain relevant to society.

The Physical Learning Environment

Most schools remain attached to the traditional learning environment, the classroom. What is a classroom? It is where students spend most of their years in the education system and therefore the learning process and its outcomes are powerfully influenced by it. However, classroom design has not changed much in decades and has become less relevant, especially for the highly technologically savvy Generation Z. In the dynamic but physically small classroom space, groups of students from different backgrounds and cultures with various abilities and personalities are brought together.

Research shows that the learning environment is probably one of the most important factors to affect student learning and success. For example, the learning space and environment promote student creativity (Addison, Burgess, Steers, & Trowell, 2010; Bancroft, Fawcett, & Hay, 2008; Davis, Jindal -Snape, Collier, Digby, Hay, & Howe, 2013), and students learn better when they view the learning environment as relevant, positive, and supportive (Dorman, Aldridge, & Fraser, 2006). Similarly, working in an outdoor environment can foster creative development (Addison, 2010 et al., 2010; Bancroft et al., 2008). A number of recommendations follow from the studies mentioned: first, learning environments should be designed as safe open spaces that encourage autonomy, risk-taking, ideation, and teamwork. Second, teachers should be allowed the flexibility to teach where and how they choose, whether in a physical classroom or using remote-access technology, which, for example, includes screen sharing options. When physical classrooms are preferred, old-school seating arrangements with desks and chairs identical to those used 100 years ago must be replaced. The future classroom should continue to be conducive to social interactions among students and with the teacher in the newly designed environment.

To effect the necessary changes in the learning environment, the following adjustments must be introduced:

- learning in virtual spaces, as well as virtual and augmented reality applications that bring experiences to life in a way that reading a textbook cannot;
- high desks to encourage brainstorming sessions and moving about;
- open spaces to enable teamwork;
- outdoor learning on occasion;
- dynamic whiteboards to make spaces more adaptable;
- interactive projectors and additional technologies to supplement whiteboards;
- individual workstations.

A two-year study in Paris (Besancon & Lubart, 2008) comparing the effect of the learning environment on children at Montessori schools and children in traditional elementary schools showed that the Montessori children expressed greater originality in their thinking.

Teaching Methods

Teaching methods refer to the general principles, pedagogy, and management strategies used for classroom instruction. Instead of teachers delivering knowledge to their students, they will become facilitators of classroom learning and comprehension of knowledge and will assess their students' progress using formal and informal methods including project-based learning, problem -based learning, cooperative learning, portfolios, and class participation. The purpose of this paper is not to examine all the many alternative teaching methods that are being practiced, but some that have enjoyed some success are briefly described: project-based learning (PBL), interdisciplinary learning, cooperative learning, inquiry-based instruction, and visual communication. Whichever approach is preferred, the role of the teacher must be redefined to that of facilitator, expert, model, or mentor rather than the owner of knowledge.

Project-based learning (PBL)

PBL is a relatively dynamic classroom approach, in which students actively explore real-world problems and challenges and acquire a deeper knowledge. PBL enables students to develop critical judgment and thinking, equipping them with the skills needed to assess the influx of information in the era of big data; encourages awareness of diversity and uniqueness among students; and imparts socio environmental values.

Interdisciplinary learning

Interdisciplinary learning encourages, and some would say, forces teachers and students to make connections between different disciplines in the curriculum. The philosophy underlying this approach embraces using and applying all the knowledge areas included in the school's curriculum. It offers opportunities for comprehensive learning: for example, through answering questions, addressing big challenges, solving problems, or completing a final project or presentation. This style of learning compels students to view data, numbers, knowledge, ideas, pictures, and anything else they find relevant through a new set of glasses that make connections more apparent.

Cooperative learning

Sholmo Sharan's *Cooperative Learning: Theory and Research* (1990) included the latest cooperative learning models and applications, their implications, and their effects on teachers and students at both the elementary and secondary school levels. The recommendations were timely then – today their implementation is much overdue. Even though the terms of art have changed, the principles are the same: what today some call teamwork, general intelligence, or wisdom of the crowd is essentially identical to the learning style that Sharan described, in which students work in groups and research together rather than sitting and listening to the teacher. The key fundamental difference between this proven teaching style and traditional styles lies in the principle of interaction (Sharan, Shachar & Levin, 1999). Any teaching methods that enable and encourage interaction among students and with their teachers (facilitators) would be a change in the right direction.

Inquiry-based instruction (critical thinking)

This teaching method encourages teachers and students to ask provoking and challenging ("out of the box") questions that inspire students to think independently and engage in research and ideation in seeking solutions. Such critical thinking compels students to use skills and strategies that are more likely to yield an original outcome and can be learned in ways that promote knowledge transfer to novel contexts (Halpern, 1998). Halpern (2003) described critical thinking as "the use of those cognitive skills or strategies that increase the probability of a desirable outcome . . . [and] is purposeful, reasoned, and goal directed." Inquiry-based instruction is effective and those who have been taught with this approach showed greater improvement on at least one of the critical thinking assessments compared to those who did not receive inquiry-based instruction (Ku, Ho, Hau, & Lai, 2014). Inquiry-based teaching is not so much about seeking the right answer but about developing inquiring minds, and it can yield significant benefits. Inquiry-based instruction like other methods elaborated in this paper can prepare students for working in an industry that is becoming more automated and less reliant on humans. Such advanced content and knowledge can develop a new degree of cooperation between employees and technology (McKinzey Global Institute, 2017).

Visual communication

As early as 2000, *Time* magazine's cover article "The Rebirth of Design" reported on the prominent attention to design in the products of the world's best-known multinationals – Apple, Ikea, Zara, BMW, to name just a few. The rapid development of user-friendly software to create visually stimulating presentations can be used to improve any lesson and should be incorporated in teaching methods. The technology-oriented Generation Z and those that followed have an astute understanding of design, especially when used for visual communication. Data visualization is an easy application to implement and yet essential to stimulate students' creativity (Addison et al., 2010).

Creating a New Curriculum

Industry needs graduates with a new set of tools that can be effective for coping with challenges on the scale of a pandemic such as the 2020 coronavirus disease, global warming, air pollution, and the rapid growth of the world's population. A curriculum consisting of geography, history, literature, and biology are less relevant today than they were; analytical thinking, which schools have traditionally taught exclusive of any other type, should be balanced with divergent thinking, including creative thinking and design thinking. Though I do not suggest that schools and education systems do away with the humanities, I propose that they be emphasized less and that more emphasis be given to subjects that can better prepare students for industry and the types of future challenges they will have to solve. By following a curriculum that gives students some control over what they learn, we can cultivate creativity (Burgess & Addison, 2007; Wood & Ashfield, 2008).

In the future K–12 curriculum, the following subjects and skills must be included: creative thinking, problem-solving, digital skills, innovativeness, entrepreneurship, design, art, music, sports, positive psychology, and emotional intelligence. All these are of great importance and have the power to enrich humans with value in a world which is moving rapidly to atomization, robotics, artificial intelligence, and machine learning. According to the McKinzey Global Institute report from 2017, "almost every occupation has partial automation potential," and "scenarios suggest that half of today's work activities could be automated by 2055, but this could happen up to 20 years earlier or later depending on various factors, in addition to other economic conditions." The very skills that are most needed today, however, are not being taught. Though I recommend that schools continue teaching traditional subjects like history, bible, and geography, these too should be taught using creative techniques and new methods (but their scope must be reduced). Recreating the content of the curriculum will have a great impact on education and will affect the process and results dramatically.

Table 1 illustrates how a future sixth-grade curriculum incorporates the new emerging skills alongside instruction of the traditional subjects, with an emphasis on creative thinking and innovativeness.

Table 1. Proposed Curriculum for Grade 6

	Monday	Tuesday	Wednesday	Thursday	Friday
08:00 –9:30	Art/music	Creative thinking	Entrepreneurship	English	Digital skills (Computer science)
10:00 – 11:30	English	Literature	Digital skills (computer science)	Math	Creative thinking
12:00 – 13:30	Math	Art/music	Elective*	Free time for ideation/ games	Free time for ideation/games
14:00 – 15:00	Sports	History	Economics	Creative thinking	Innovativeness
15:00 – 16:00	Innovativeness	Sports	Design	Presentation skills	Elective*
16:00 – 18:00					Community volunteering

*biology, geography, science, bible, positive psychology, and emotional intelligence

My students, reacting to how emphatic I am that the content taught today in schools is obsolete, ask how I know what the future will be like and what professions will be required. I tell them that though I cannot predict how technologies such as virtual reality, artificial intelligence, and big data will change our world, I know for certain that we will need creative leaders in every sphere of human activity including but not limited to industry, the economy, politics, the military, and science.

The Proposed Curriculum incudes traditional disciplines, developing disciplines and emerging skills.

What is Creativity and Why Is It Important to Teach?

Beghetto & Plucker (2006) and Beghetto & Kaufman (2009) argue that creative and academic learning are not aligned and have been frequently regarded as separate curricular goals, and as this is the case, only a few students have had the opportunity to systematically develop their creative skills and potential in academic settings (Beghetto, 2010), this is the case in schools to. Vygotsky argued that if the primary goal of schooling is to prepare students for the future, then fostering students' creativity thinking "should be one of the main forces enlisted for the attainment of this goal" (Vygotsky, 1967, p. 88).

Creativity, manifesting in an array of skills, enables an individual to generate original ideas. Creative people are able to harness an ability to perceive the world in new ways, find hidden patterns, and create connections between seemingly unrelated phenomena and events to offer original solutions. In 1982, Heinz Pagels published *The Cosmic Code: Quantum Physics as the Language of Nature*, where he argued that quantum physics is a kind of code that interconnects everything in the universe. Interestingly, research has found similarities between how the creative mind works and certain quantum phenomena. Creativity generates a product that is both novel and appropriate

in a specific scenario (Cassani – Davis, 2018). Creativity is part of what makes us humans (Sawyer, 2012).

Creative thinking is a valuable strategy that can be applied to coping with problems to gain a different perspective of them and find unorthodox solutions. Creative thinking involves what is called lateral thinking, or the ability to perceive patterns that are not obvious. Research shows that creative thinking involves making new connections between different regions of the brain (Suss, 2018), which is accomplished by nurturing divergent thinking skills and using randomization methodologies to expose individuals to new experiences and to learning (Suss, 2018). Creative thinking is the foundation of innovation as well as entrepreneurship (Fjortoft, Gettig, & Verdone, 2018), hence its great importance. Creative thinking can facilitate deeper cross–curricular learning, improve the ability to solve problems, and achieve a more general comprehensive understanding (Starko, 2013).

The need for creativity and innovation is existential. Major global companies like Google, Procter & Gamble, Whirlpool, Apple, Facebook, General Electric, BMW, 3M, and Amazon have established innovation centers that explore new technologies, services, and products and whose employees are hired for their creativity (Suss, 2018). Most higher education institutions have also launched innovation centers to enable research, development, and industry collaborations.

Evaluation Methods

Assessment or evaluation of students' knowledge is the stage that concludes the educational process. For decades, summative evaluation was credited as the only reliable method: it emphasizes the outcome of the learning process and usually includes a memorization-based test. In the past 20 years, however, other forms of evaluation have become popular, such as formative evaluation, which enables an open and direct dialogue between students and their teachers during the learning process in the course of which teachers can correct students and help them in their learning process. Even though summative evaluation has become very popular, for the past decade schools have replaced traditional summative evaluation with other forms: for example, reflecting in groups or individually and facilitating engagement with learning (Tochel, Haig, Hesketh, Cadzow, Beggs, & Colthart, 2009). The outcomes of the numerous curriculum subjects are very different, hence the methods used to assess them cannot be identical either (Sharan, Shachar, & Levin, 1999). The evaluation process must be tailored to the subject and the learning process and its potential outcomes. Ideally outcomes should be such that can be shared with the entire class, for example – a portfolio, presentation, research, or debate – that everyone can learn from just as design students in academia present their projects to their peers and learn from one another.

Politics, interested parties, public pressure, and budgets all contribute to perpetuating and favoring traditional teaching and evaluation in schools. Decision-makers are afraid of reforming the system, which thus remains captive of old approaches. Another cause for stagnation is that academia depends on psychometric and matriculation exam scores to screen admis-

sions. Much has been written about the justified aversion on the part of faculty, students, and parents to this system, but what is of importance now is what can and should be done about it.

The traditional test (based on memorization) may remain necessary for a few subjects, but for most, teachers can use a variety of other tools to evaluate their students including interactive software such as gaming, teamwork, problem-solving challenges, and inquiry. During the recent pandemic lockdown when schools switched to online teaching, so were evaluations, a scenario that a few short months ago would have seemed unimaginable. Testing students' memorization of content has long been preferred by many involved in education, but its value is short-lasting. The harm, however, that it can cause is often devastating.

Discussion

This paper is an urgent call to all those who share my passion for educational excellence to recognize the need to change the education system. The education system must change soon, not simply for the sake of change but in order to remain relevant to society and industry. Reforms of the learning environment, teaching methods, educational curriculum, and evaluation methods are all necessary. While the launching of some promising initiatives at the local school, district, and country levels is a good start, it does not replace the holistic and comprehensive overhaul that the system must undergo. What is needed is a new strategy that promotes creative thinking, design, art, entrepreneurship, and innovativeness in the curriculum for all ages. A survey conducted in 2014 showed that teachers are rather conservative, while businesspeople generally recognize the effectiveness of creativity in their work (Palei, 2014). This needs to change. Teachers will have to play a major role in developing innovative schools. Yet at the moment, creative thinking can be more easily found outside schools (organizations and industry) than inside them. In order to help students achieve personal and professional success in the 21st century, we must equip them with creativity.

Education has always drawn interest and criticism because of its great impact on people and life. Interest in creativity over the past 20 years has risen for various reasons: The technological revolution, which is fueled by creativity; and the diversity and sizable number of researchers studying creativity from many different disciplines and perspectives (Hernández-Torrano & Ibrayeva, 2020).

Twenty-five years after writing *The Culture of the School and the Problem of Change* in 1971, Sarason reflected in an updated edition on the meaning of the word *crisis* in the context of schools. According to Sarason (1996), it is "a point in time when a dangerous situation contains conflicting forces of an intensity or seriousness that in the near term will be dramatically altered depending on which forces win out. [. . .] When I wrote the book a quarter century ago, I did not regard our schools as in crisis, . . . [but] my intuition . . . was that a crisis would come sooner or later. It has, in my opinion, come." Today, 24 years since Sarason's second book, there is no doubt that the education system is in deep crisis, increasingly irrelevant, and in need

of full-scale change. But the education system needs help changing. Several studies have shown that external partners are needed to help teachers construct a creative learning environment (Loveless, Burton, & Turvey, 2006; Mullins, 2007; Sharp et al., 2008; Wyse & Spendlove, 2007; Davis et al., 2013, Shachar, Suss & Sharan, 2010 & Suss, 2018).

Concluding remarks

The Next Big Thing for Business? Creativity, published in 2018 by The World Economic Forum stresses that "to unlock maximum performance, organizations must harness both cognitive diversity and creativity. And that means adding a new voice to the team: The Artist Innovator." Schools will have to do their part by making the necessary changes. The only questions are, how and to what extent? As for the when – the answer is now.

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CHAPTER SEVEN

EVERYTHING COUNTS: BIG DATA AND CREATIVITY SCIENCE

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Abstract

The term "data" does not appear in J. P. Guilford's (1950) APA presidential address, but in the 70 years since, data have been gathered on robust measures and correlates of creativity built upon various theories of how original thought comes to be among individuals and groups. Current trends across domains, ranging from healthcare to entertainment, look to big data to investigate both fundamental and applied research questions. This chapter proposes to examine the nature and scope of applying big data analytics to creativity science by reviewing existing data sources as well as identifying those that could contribute to building creativity datasets. Using examples such as the Global Innovation Index and the Taking Part Survey, a household survey in England collecting data on cultural engagement, we document the nature of creative units that can be studied as well as avenues where such big data can be applied. We also seek to examine creative approaches to identifying, collecting, and analyzing big data. The manner in which access to big data can enhance or constrain creativity in research is also addressed. In the age of automation, the personal and global importance of creative thinking is only increasing; this chapter highlights the gap in current creativity science, outlining the implications of big data therein.

Keywords: big data; creativity; computational social science; data analytics; predictive analysis

Everything Counts: Big Data and Creativity Science

It would be remiss to begin a chapter in a book commemorating J. P. Guilford's (1950) APA presidential address without expressing how it spearheaded the investigation of creativity as a legitimate scientific endeavor. The speech called out to psychologists to go where few have gone before--to explore and examine creativity in the contexts of measurement, theory, and associations. Nearly 70 years later, a Google Scholar search for the term creativity turns up 2,950,000 hits in less than a second. The volume of scholarship in creativity science has grown at an exponential rate and researchers have developed theories, models, definitions, and assessments, identifying correlates of this once-elusive construct. Yet, to determine what to study next in

this discipline, as researchers who study originality, we must be novel ourselves. Taking cues from current trends in computational social science, this chapter outlines how big data analytics can be applied to creativity science in two ways: (a) Examining the nature of big creative data, and (b) Assessing how one can use big data creatively. Before diving into these areas, it is necessary to know what kind of information about original behaviors we already have.

Nature of Creativity Data

Typically, academics have sought to understand original thought and behavior at the individual level, which is the most common unit of analysis. Several theoretical propositions have similarly sought to explain what makes the *Person* create, one of the four Ps (Rhodes, 1961). An example is the progressive four C model developed by Kaufman and Beghetto (2009). They appended two categories to the little-c (everyday creativity, like finding new ways to entertain yourself during quarantine) and Big-C classification (the study of creative geniuses like Picasso and Edison who achieved eminence). These were mini-c, highlighting the personal and developmental aspects of the genesis of creativity, and Pro-c, which classified individuals who were professionals in creative domains, but had not yet attained distinction. Such categorizations helped identify whether members of the general population or renowned creators were being studied; yet, the unit of analysis stayed at the individual level.

Other theories expanded the focus of the original entity to a workgroup at the organizational level. The dynamic componential theory of creativity and innovation (Amabile & Pratt, 2016) highlighted the interaction between the individual/group and the organizational levels that yielded novel output. Domain-relevant knowledge, skills related to creative pursuits, and motivation were key to fostering originality at both levels. Similarly, theories have also highlighted the influence of broader sociocultural and systemic factors, such as groups and norms, on the emergence of new ideas and behaviors (e.g., Csikszentmihalyi, 1988, 1999; Glăveanu, 2013; Hennessey & Amabile, 2010). Yet, few conceptual models, and hence, datasets derived within their assumptions, have moved beyond a micro perspective on creativity.

On the other hand, creativity can also be assessed at the country-level through the development of indices like the Global Creativity Index (GCI; Florida et al., 2015) and the Global Innovation Index (GII; Dutta et al., 2019). These metrics take into account indicators of engagement in creativity/ innovation, such as the proportion of a nation's GDP allocated to Research and Development, the number of patents filed, and the value of exports of creative goods and services. The result is a weighted index that ranks countries on the basis of their performance, enabling the comparison between nation states as a macro unit of analysis. Is this a bigger dataset? Most definitely. Is this big data? Not yet.

Big Data Applied to Creativity Science

Recall the number of hits the term creativity had on Google Scholar at the start of the chapter; it indicated the quantum of research in this discipline till date, but not much else. In contrast, when a query with the word creativity is run on Google Books' Ngram viewer (https://books.google.com/ngrams), we see a steady increase in mentions since about 1940 and then a steeper rising slope after 1950 - the year of Guildford's address (Figure 1).

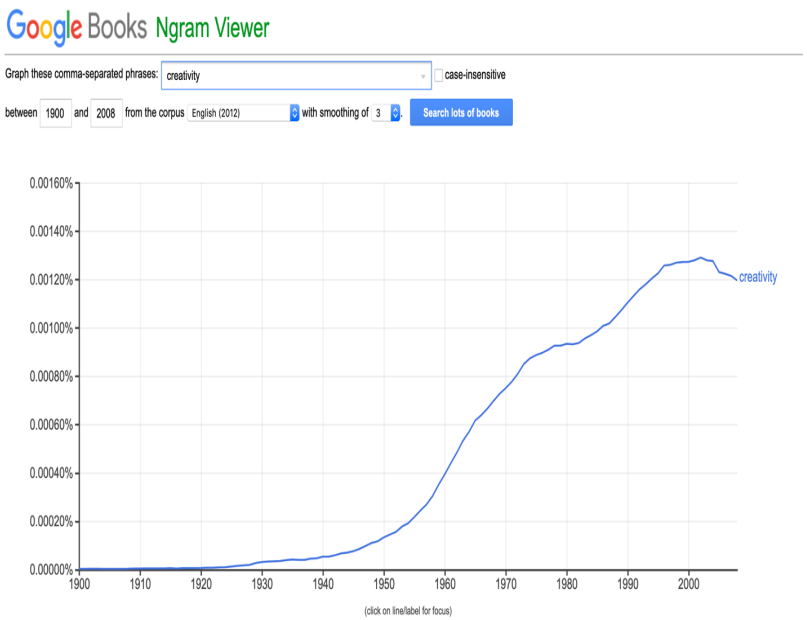

Figure 1: A graph showing the frequency of the term "creativity" appearing in datafied books from 1900 to 2008. (*Source:* Google Books' Ngram viewer)

Google's Ngram searches a corpus of digitized and datafied English texts to create a graph based on billions of data points. Big data, therefore, is not just a lot of things; it is a lot of data on a lot of things that allows one to leverage this voluminous information and draw conclusions on the basis of patterns and trends. A more formal definition describes big data as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation," (Gartner IT Glossary, n.d.). The three Vs (volume, velocity, and variety), first suggested by Laney (2001) as representing the challenges in data management, are often used to characterize big data. Volume implies that the dataset is huge, ranging in tera- to petabytes at times; velocity means that data generation and acquisition processes are rapid and sometimes occur in real-time; and variety high-

lights the different kinds of data across formats, such as text, audio, and video (Gandomi & Haider, 2015). Additional Vs of value and veracity were added subsequently, highlighting the importance of aggregating troves of seemingly low-value data to extrapolate value from the entire dataset and the inherent imprecision in some sources of data.

Big data is also considered to be a knowledge asset that necessarily requires the adoption of newer methods of analysis and computation to derive the most useful insights. In a similar vein, according to Mayer-Schönberger and Cukier (2013), big data is more, messy, and correlational. More implies that the information gathered is not a sample of all data available; it *is* all the data available at a given point in time, dubbed N = all. Big data is also messy in that the precision in recording expected from a small sample is unlikely to be met; yet, the quantum of data available minimizes the ability of a single data point to affect the overall computation. Third, big data is more useful in explaining *what* or associations between information nuggets as compared to *why* or causal effects. These features impact the nature of research questions that can be answered using big data, as well as how they are typically addressed.

A general big data analysis pipeline includes the stages of data acquisition, data cleaning, aggregation, analysis, and finally interpretation (Cui et al., 2014). The techniques to analyze big data depend on the nature of data acquired, which can be structured, semi-structured, or unstructured and in diverse formats that may need to be integrated to yield any meaningful insights. Predictive analysis is frequently used to estimate future outcomes based on past or current data, such as whether an individual would buy a particular product based on their purchase history, or how users access information on a social networking website such as Facebook. Text, audio, and video analytics are used to analyze large volumes of data serving numerous business applications, like voice-assisted technologies and surveillance systems (Gandomi & Haider, 2015). Social network analysis (SNA), such as link prediction, uses algorithms to create networks based on activity on social media, identifying clusters of similar units, such as individuals, preferences, and the like (Park et al., 2012). For instance, Bruce et al. (2017) use SNA methods to map how Arts Organizations (a collective of social, cultural, and artistic institutions in the UK) collaborate with each other and exchange knowledge among partners. Such an exercise, the authors argue, is not only important for testing the applicability of big data tools to creative activities, but also to inform future policy decisions on cultural exchange in the UK and beyond. For example, being aware of the areas that other cultural partners are working in can enable coordinated policy efforts toward collaboration in the same socio-cultural domain.

Similarly, methods in the emerging discipline of computational social science uses macro-level data on social phenomena to address novel problems. Computational social science lies at the intersection of statistical modeling, computer science, and the social sciences, relying on high degrees of interdisciplinarity to map human actions and interactions; in fact, this is suggested to be a paradigm shift in the big data era (Chang et al., 2014). Consider the amount of data traces or data exhaust (a digital footprint of sorts)

that an average individual with a smartphone leaves every day--from data on how much and how well they slept the previous night to geolocation data on their movements in the day to multitudes of data from their browsing history and social media usage. Economists, psychologists, and other social scientists (teamed with number crunchers and visualization wizards) can model, simulate, and analyze the same voluminous and detailed dataset to test different conjectures and hypotheses relevant to their respective fields.

Extending this to the domain of creativity, big data can entail capturing and datafying new and useful information, which was not previously available, to explore distinctive behaviors and phenomena that escaped researchers earlier. It is important to note that the data itself needs to abide by the definitional criteria of what is considered to be creative; it needs to be both novel and relevant to the task at hand (Plucker et al., 2004). The likelihood of a single datum being unoriginal is rather small by virtue of the size of the entire dataset, statistically speaking. However, big data at a granular level is bound to be messy and the usefulness of a single datum may be less obvious; recall that "value" is an additional big data descriptor. However, when the researcher zooms out and looks at the overall patterns presented by big data, themes and trends emerge that can be both original and push the boundaries of scientific inquiry. For example, gathering high-frequency gaming data can help understand novel gameplay tactics to examine how victory is achieved in online multiplayer games. Big data in creative domains can be collected in real-time, when information is not static and complete, but fluid and constantly emerging--a data flow and not just a data stock (Chang et al., 2014). Similarly, big data analytics can be applied to develop innovative business solutions in a world that increasingly relies on information exchange and communication (e.g., Kopanakis et al., 2016). For instance, amid the COVID-19 pandemic, geospatial tracking of diagnosed individuals could have assisted governments in contact tracing the spread of disease. At the same time, the same information could be used by online grocery stores to target specific households with offers to shop online, so that they would not have to break quarantine. Another example is in the context of collective creativity in an educational setting: where SNA was used to construct an index of participation in a collaborative exercise (Mazzoni, 2014). The study was able to quantify the frequency of interaction of collaborators and the intensity of interactions via a digital learning platform to explain its role in generating creative output. In exploring such applications, creativity researchers can begin to appreciate that today, literally everything can be data and/or datafied, with endless possibilities for identifying and solving novel problems.

Related to this is the emerging field of computational creativity that aims to use computational methods like machine learning, data mining, and artificial intelligence to generate creative output or augment human creativity (Toivonen & Gross, 2015). Most applications of computational creativity have been in domains commonly related to original productions, such as design, music, poetry, and even the culinary arts. Chef Watson, a system designed to create novel recipes and menus, was first fed scores of data points on elements like ingredients, existing recipes, dishes, and cuisines that were then deployed through a data-driven stage-based algorithm (Varshney et al.,

2019). New artifacts arising from data-intensive methods also represent scientific creativity, such as Dr. Inventor's analogical model that serves to simulate human creative reasoning (Donoghue et al., 2015) or how new, valuable, and non-obvious hypotheses can be discovered through intelligent systems evaluating their creativity (Grace & Maher, 2014). Of course, whether a machine can really be creative is a philosophical question, but creating autonomous systems that generate original and appropriate artifacts based on gigantic data from which they learn is quite revolutionary (Colton & Wiggins, 2012).

Big Creative Data

Earlier in this chapter, we stated that the information compiled by global indices like the GCI and GII does not classify as big data. It may have volume, but certainly does not have variety or velocity, being a static capture of data at a point in time. What then constitutes big *creative* data and how does one acquire it?

Consider a thought experiment. Suppose creative writing was taught at every middle school in the world (as it probably should) and we have access to millions of essays on dreams and alternate futures and talking birds. We'd need text analytic tools to read and convert each hand-written paper into digital form, language translation systems to transform everything into one common tongue to ease comprehension, and then datafy this massive corpus so that search and retrieval becomes manageable. Creativity researchers can then use a form of latent semantic analysis to compute the semantic distance between words and their combinations (sentences) to perhaps extrapolate the originality and quality of the essay (e.g., Kenett, 2019). Ethnolinguists can use the same data to answer questions about cultural variations and similarities in language use between middle-schoolers across the globe by spotting trends in word usage. Child psychologists can use the data to identify the patterns of learning disabilities associated with reading and writing across grades, arriving at estimates of the prevalence of such disorders. And on and on. Taking this a step further, consider that this dataset is continuously being updated in an automated fashion, where a teacher just has to take photos of their students' essays and upload it at one go onto a server that spits out this datafied information. And what if we could datafy however many past creative writing assignments that individuals may have saved for posterity in their attics and add these to the database with an antiquated timestamp? You get the point.

Big creative data is big data on creative products, endeavors, artifacts, outputs, outcomes, and even on creative economies and industries. It expands the potential for the mapping of new creativity data sources, from tweets to sales of art supplies. Another feature of such data is that it is associated with the actual or at least implied *production* of creative thought or actions. This means that only the *consumption* of original output (e.g., viewership ratings of a show from a streaming service) would not directly classify as big creative data. Of course, it can be argued that the production and consumption of creative ideas is circular (watching the show can prompt one to write a novel review of the same), and therefore what is and is not strictly big creative data

is still muddy. Apart from what constitutes such data, also consider the identification, collection, and analysis of big data in the creativity context. Suppose we identify tweets as innovative productions and retweets (without comment) as reproductions, we can collect big data on specific hashtags during a particular period of time for our analysis. But would all tweets meet the original + effective criteria for creativity? Probably not (unless we're tracking comedians' accounts maybe), which means that the dataset will have to be sorted and screened. Similarly, if we identify visits to museums and art galleries as representing creative engagement, would it be appropriate to infer inspiration to create as a plausible consequence from such visits? What evidence, if any, could we hope to collect of such resultant creative action? Further, what if individuals are aware of being tracked (either online or offline) when engaging in expressive or imaginative activities; would such observations inhibit or enhance their eventual output and should we do anything about this? If these arguments seem messy, it's because they are, just like big data.

To accumulate big creative data, let us begin by expanding the volume of one parameter included in the GII. The index uses the number of patent applications filed in a regional or national patent office in a particular country as one indicator of innovative knowledge output (Dutta et al., 2019). In the 2019 GII index, patent data from 2017 is used to compare the performance of different countries on this parameter, which is the fundamental goal of the global index. Based on this data, it is suggested that China ranks first in the world on this metric (i.e., patents by origin/bn PPP$ GDP). However, there are other nuances of this extremely innovative activity that can lend further insights, such as the number of patent citations, the latency between filing a patent and having it granted, and the classification of the patent. Some of this disaggregated and nearly real-time data can be procured from https://lens.org, a search engine for scholarly output and patents that provides dataviz tools as well. A preliminary look at this large dataset shows that between Jan 1, 2017 and Feb 29, 2020, the USA leads in granted patents in "education" (30,602) with China far behind (489)—a distinction that informs researchers and policymakers about patterns and areas of innovation that may differ across countries. The use of much more granular data on patents gives rise to different research questions and implications, especially if this data is used in conjunction with another big dataset, such as on trademarks. Its use, however, is limited when it forms only one of about 80 different parameters involved in computing an index.

Online creativity is another innovation output parameter in the GII and includes a metric of yearly edits on Wikipedia, by country (2017). However, "Wikipedia develops at a rate of over 1.8 edits per second" by its own admission, implying an ever-changing online encyclopedia. Accessing close-to-real-time edits on Wikipedia can present a profile of the most frequently edited pages, and also classify information on poorly or falsely cited edits. This might aid researchers who are interested in predicting vandalism on Wikipedia (intentionally editing a page to present false information). Such data might best be collected following a major event, since this is the period during which several real-time edits are likely to take place. Another area of online creativity (not included in the GII yet, but highly recommended to be)

is the generation of internet memes. These humorous images, gifs, stickers, video bursts are the modern representation of creativity; their creation and viral-like transmission is cultural currency (Willmore & Hocking, 2017) with the potential to be mapped. Datafying memes would amount to being able to measure the collective creative production and consumption of society today. The meme economy, a subreddit, is a satirical attempt to do just this, valuing memes in fictional currency and allowing traders to buy, sell, make, share, and invest in memes and meme templates. This market gives a glimpse into the valuation of original artifacts (memes) as well as their rapid decay over time, illustrating how the half-life of creativity is reducing day by day (Kapoor, 2016). Unfortunately, big data on memes is hard to come by, except tangentially via the meme economy that crowdsources judgments on the worth of a meme (which can theoretically extend to the originality of the meme as well). This would definitely be big creative data and how.

Another potential source for building big data in this context is the Taking Part Survey, a household survey in England that assesses the extent to which children and adults engage with or participate in artistic and cultural activities. The survey is continuous and has run since 2005, collecting rich data on micro-level engagements in the arts, heritage, museums and galleries, libraries, archives, and sport (Department for Digital, Culture, Media, 2019). The latest report includes participation in the arts (like singing, film or video making, among others) and digital engagements (virtually visiting a museum or gallery). Consider a few ways in which data on these behaviors can be expanded: (a) being able to access the output from participation in creative activities, which can then be rated for originality in a crowdsourced manner, (b) associating digital participation with creative production with timestamped data, and (c) tracking digital engagements in creativity, like websites that facilitate the creation of digital art. Another obvious expansion to this data would be to collect it from persons across the world and not only England, yielding global big creative data. Similarly, there are numerous websites that encourage the creation of novel tunes (https://typatone.com), artwork (https://kleki.com), or even novel Lego® models (https://www.mecabricks.com). Usage metrics (when, where, how often, how much, which platform) can help creativity researchers correlate this data with other contextual factors (the state of the economy or unemployment rates perhaps) to discern new meanings from such online behaviors. For instance, if, during the COVID-19 pandemic and quarantine, the use of creativity-spurring websites like these increased, one could analyze time series big data from these sources to draw inferences about the importance of creative expression in coping with an uncertain situation (or just to combat boredom).

Google Arts and Culture (https://artsandculture.google.com) is yet another potential data source for creative engagements. The project not only allows for virtually touring cultural institutions, but also facilitates creating, hosting, and participating in artistic and cultural experiments. Nearly all of the experiments use sophisticated computational tools and often big data to allow the general public to innovate on existing knowledge. For instance, the *Living Archive* by Wayne McGregor is a platform where one can create novel AI-assisted choreography by linking together positions from an archive of

almost half a million moments of movement. Another experiment called *Weird Cuts* helps participants make collages in AR space using photographs, encouraging and lending a scaffold to novel creative expression. Given the diversity and advancement in computational and technological creative spaces, now the acquisition of big creative data is not a question of how, but rather of how much.

Using Big Data Creatively

Certainly, all big data is not data related to creative behaviors; yet big data is perennially related to novelty in another way. Gobble (2013) suggests that innovative methods of data collection are what led to the generation of big data as we know it today. Given the unstructured nature of big data (and its associated data generating processes), it is now important for researchers to think creatively to not just generate more datasets but also inform the practice of how to manage and use them. Zhang et al. (2019) provide empirical evidence showing that an increase in the use of big data in companies demands hiring more creative individuals, thereby threatening the job security of certain employees. Evidence also suggests that firm-level innovation in product and service design is explained not just by the use of big data by companies (Niebel et al., 2019), but also their investment in information technology (IT) infrastructure and personnel that aids the use of big data. Gregg et al. (2018) find that companies who regularly mine data on consumer insights and use them in conjunction with other feedback methods (such as focus-group discussions and third-party data) are likely to achieve higher productivity and profits. Furthermore, this is usually via collaborations between the IT experts and marketing teams, resulting in data-driven creative approaches for maximizing outreach and customer experiences.

Given that big data has predominantly been used to achieve profit-oriented objectives, the only way that big data can be useful is if it is used creatively, as firms are able to derive competitive advantage from it (e.g., Acharya et al., 2018). The OECD (2013) has suggested that big data and data analytics is a source of knowledge-based capital that contributes to innovation among industries and firms. Big data offers researchers and data scientists novelty, and a data generating process that must necessarily evolve over time to suit the requirements of potential users. Thus, a likely catalyst for further use of big data for insights relies on individual ingenuity, creativity, and curiosity (Mayer-Schönberger & Cukier, 2013). It is therefore critical that big data is used creatively in order for its utility to have tangible value.

Wu et al. (2019) use data on patents from more than 2000 companies to show that capacities to analyze and use big data are complementary to innovation. It is also likely that firms with already existing big data capabilities are more likely to make breakthroughs in innovation, thus potentially creating a virtuous cycle. A similar suggestion is made by Hagen et al. (2013), who suggest that big data has been useful in a cycle of innovation best characterized as Schumpetrian 'creative destruction,' where newer methods of capturing and analyzing data are critical to a company's success. Data scientists are now able to compile information that was previously thought proprietary or

private data through a range of big data techniques. Now that researchers and data scientists have access to this data, using them efficiently and innovatively can be critical to ensuring the sustainability of such data analysis methods. Frank et al. (2019) attempt to map out the future of skilled work with the advent of artificial intelligence, and argue that limited data and analytical techniques hinder scientific understanding of this issue. Improvements in data collection related to worker skills and job postings (to name two) could potentially aid in generating a clearer understanding of the dynamics of complex labor systems, ultimately making it easier to address the issue of growth in big data analytics being complementary to overall economic growth. Below, specific examples of novel use of big data to generate insights across a variety of problems areas are discussed.

Rousseaux (2017) describes how the philosophy behind creating artistic collections has inspired the need to create a data-driven algorithm to maintain artistic archives. *ReCollection* is a tool designed to collect, maintain, and navigate digital content, typically music or video formats. The system uses algorithms to generate categories for 'similar' digital content that may be distributed elsewhere on the world wide web. Similarly, Procter et al. (2013) discuss how conventional tools of media analysis could not be applied to a large dataset of tweets provided to The Guardian news agency during the 2011 England riots. They therefore used natural language processing (NLP) tools to analyze hashtags used in tweets as well as the content itself to categorize them into media reports, pictures, rumors, and reactions to the riots. They are able to narrow down on a specific false piece of information (a rumor) to analyze how information about it was disseminated on Twitter, including the time during which the rumor dominated the underlying reality.

There are several examples of the use of big data analytics in the domain of healthcare and medicine. Mullainathan and Obermeyer (2019) focus on doctor's decisions to test for coronary episodes using a random sample of the National Medicare claims data of nearly 4.5 million doctor's visits in the United States. They use this data to check for the "predictive accuracy" of a representative doctor's advice to test a patient with potential risk of a heart attack. They combine this data with (anonymized) hospital health records to show that there is both over-testing (low-risk patients underwent testing as doctors overestimate the risk) as well as under-testing (high-risk patients were not tested) predicted by their algorithm. Thus, such a model could potentially have significant implications for public health policy, as well as illustrate a middle-ground approach of testing for health conditions when factors determining testing are unclear. Obermeyer et al. (2019) probe further to highlight how big data techniques are able to uncover systematic racial biases in decision-making related to high-risk patients in the US. Such algorithms, the authors argue, are already part of the public health apparatus, but might not be accurate in their identification of high-risk patients that need further and immediate care. The results suggest that there is a nearly 30% gap between the proportion of African-American patients that *should* be recommended treatment and those that actually are. Thus, training such an algorithm on a large dataset is able to uncover important biases in health care de-

cision-making that would in a usual scenario cause not just burdens to sick patients, but also lead to suboptimal public health policies.

Kleinberg et al. (2018) take a legal perspective on arguing for correcting discriminatory selection procedures in a range of fields, including the healthcare examples described above. Designing the algorithm therefore becomes crucial: an algorithm can be constructed and fed big data to generate specific outcomes that one might observe in the real world. For example, Kleinberg et al. (2017) tested whether a judge's decisions on releasing or jailing a defendant are reliable: they test the likelihood of crime by released defendants as well as any reductions in crime rates due to detained criminals. This is not to say that algorithms are free from bias or discrimination; rather that an algorithm designed and used on big datasets is typically only as powerful as its design. Thus, careful use of big data, keeping in mind the various biases that might result from the methodology used in generating predictions or outcomes, is critical for its efficiency and utility. Data scientists, policymakers, and researchers can come up with creative ways of using big data on criminal delinquency, healthcare decisions, and labor markets to make *predictive* policy decisions. This helps in ascertaining beforehand whether a certain policy is likely to have its intended effect.

There are several emerging applications of big data in a variety of fields beyond the realm of policy as well. For example, many researchers now use large datasets from corporations such as Uber on ridesharing and taxi rides to estimate incidence of a gender pay-gap (Cook et al., 2018), tipping behavior (Chandar et al., 2019), and congestion in urban agglomerations (Akbar et al., 2018). However, in a large fraction of such studies, researchers typically use common econometric techniques albeit on big data, underscoring the need to understand whether the same tools that can be applied to smaller datasets work predictively when N is much larger. One could think of using data from widely-used social networking platforms (such as Facebook or Twitter) or dating applications such as Tinder to take a closer look at social dynamics. Anukriti and Dasgupta (2017) suggest that there are complex cultural beliefs and social norms that may be driving the choice of partners (particularly in ethnically diverse cultures). In order to solve the potential problem of incompatible matching (which could have serious consequences for both individuals, and in some cases their families), the first step would be to collect data on participants in the marriage market. A potential source for this (in the Indian context) is from gleaning classifieds and wanted advertisements in leading dailies or from online matrimonial websites such as *Shaadi.com*. In the classifieds as well as the online profiles hosted on matrimonial websites, there is structured and unstructured data on characteristics of the individual seeking a partner, as well as characteristics sought of the partner. Such data can be scraped or collated from online sources. However, creative use of the resulting dataset is important for establishing the novelty and utility of big data. For instance, one could use a predictive algorithm to match individuals with each other, and check for predictive accuracy by analyzing data on past matches (although this data will only be available from online matrimonial websites). Given that such data is typically proprietary and well-guarded by businesses, it is likely that such a tool should be developed in

collaboration with the company rather than as an independent exercise to ensure that the algorithm takes into account any potential biases observed in matchmaking.

Finally, a discussion on generating novel ways of analyzing big data would be incomplete without understanding the ethics of data collection and ultimately the goal of any data analytic techniques applied on it. As we enter an era of greater digitization than ever before, it is important to consider whether simply signing away rights to one's data when using a particular application or software is prudent. This is often the default for most users as in practice it is often hard to gauge and foresee how corporations, businesses, and data scientists might be using this big data. Harding and Hersh (2018) point out that privacy concerns remain a major stumbling block in using big data. For example, algorithms and machine learning tools are able to triangulate and identify nearly 90% of a database of credit card holders (De Montjoye et al., 2015), leading to issues around protecting consumer identities. Similarly, when there is data collected from large-scale experiments (or A/B testing), it is often done without participants knowing that they are part of an experiment (Adjerid & Kelley, 2018). This can be addressed by creating anonymized, random records and offering them to data scientists. For example, Facebook has recently made available to social scientists a random sample of posts shared from its entire database of users to analyze trends and antecedents to specific behaviors. Thus, although individuals in such cases may never fully consent to participate in an experiment, they cannot be uniquely identified in the big data used. Similarly, Facebook's "10 Year Challenge" asked users to post their current profile picture and their picture from 10 years ago; this was met with a bit of skepticism concerning whether the social media giant was using this meme to train facial recognition algorithms (O'Neill, 2019). On the flip side, organizations like Tencent in China are using artificial intelligence to develop image-aging algorithms to predict how children who have gone missing might appear today (Burt, 2019).

Caveats and Future Directions

Big data in the domain of creativity science suggests the building of big creative datasets as well as finding new ways to use big data. A major caveat to be considered is access to such data that is, more often than not, proprietary and under lock and key. Further, because the association of big data analytics with innovative profitability is so strong, access to this data may be restricted to protect a competitive advantage. Although newer data scraping techniques have come to the fore recently, corporations are increasingly walling off access to millions of data points that could be useful to researchers and data scientists in policy or social analyses. Concerns about data privacy and ethics are also of paramount importance in the big data age. Increasingly, especially in the case of large-scale online experiments, individuals are rarely aware that their data is being tracked and collected. To the extent that such data can be used to uniquely identify data points, there continue to be privacy concerns around using big data. Finally, as studies point out, algorithms designed to predict outcomes from big data may often suffer from the same biases that

human decision-makers do. That said, acquiring or mining big data for academic purposes is not a lost cause--researchers do it all the time and this chapter argues that it would be beneficial if creativity researchers learn how to, too.

Actively seeking and identifying potential sources of big creative data would be akin to the first stage of problem-finding in the creative problem-solving process. Big data from a few of these sources may be organically available, such as memes in the meme economy or tweets. These data can be scraped and analyzed for creativity, timing, content, popularity, and other parameters that can be used in computational models. Big creative data on memes has also been used to create AI systems that in turn learn to create memes themselves (Peirson & Tolunay, 2018); creativity researchers can compare and analyze AI-generated and human-generated memes on the basis of originality and tendency to be shared, for instance. Therefore, a pertinent future direction is for creativity researchers to adopt a big data mindset that will enable expanding the nature and scope of creativity data, moving toward messier and more granular expressions of originality. Another potent avenue for big creative data is to involve creativity researchers at the time of developing new digital means of production and communication online. This would help ensure that these data recording systems are integrated with creativity science.

As illustrated earlier, expanding existing parameters used in creativity surveys and indices that enables the inclusion of finer data can further help apply big data analytics to creativity science. In a broader context, such data has been used to map the evolution and growth of creative industries in the UK, a crucial portion of their creative economy (Garcia et al., 2018). A large part of being able to collect this data comes down to how much infrastructure there exists to aid in data collection, and also being able to digitize older records on creative industries and clusters. Modelling of this nature at a global level would be able to construct a map of the world's creative economy, providing direction to investment and informed policy decisions. Similarly, integrating predictive and network analysis in estimating and understanding the impacts of creative industries on the economy would provide impetus for nurturing specific inputs. For instance, an algorithm that predicts growth in the media and entertainment industry could find that a lack of skilled / technical labor is likely to stall or hold back new projects. Stakeholders in this industry could work with the state to create training programs to bridge the gap in the skilled labor supply. Further, through network analysis one can explore how other supporting industries within the creative arts are impacted based on associations with similar strains on human resources. Such analyses can aid in understanding just how critical specific institutions or 'nodes' are in a network, and how they contribute to the sector or industry. Big data can thus help solve several tiny problems, which eventually amass to a big solution.

Creativity science, thus, is at a crossroads. One direction would be to continue collecting only individual-level data that is specific to a narrow research agenda and is inevitably static. The other would be to acknowledge the continuous proliferation of creative outputs through digital means and identi-

fy potential information sources as well as novel ways to collect and use big data. We suggest having the best of both worlds--the cleanliness and precision of small-scale studies that go on to inform the messiness and incredible scale of big data. This would certainly be novel for the discipline.

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CHAPTER EIGHT

PACH: CREATIVITY HEURISTICS FOR ARCHITECTURAL DESIGN EDUCATION

DAVID C. SLEDGE

Abstract

Heuristics in higher education can be effective tools to help college students generate creative ideas and achieve clarity in the design process of their projects. Professors need to coach students through peer-to-peer learning and self-discovery with heuristics, categorically tailored for accountability and discovery through play. Indeed, creative students now enter college with considerable experience in gaming play as learning tools, acquired since elementary school. Instructors must keep pace with the needs and skills of incoming college students, seeking to apply their creativity as future professionals in the emerging innovation economy. Therefore, professors should encourage creative self-efficacy through playing to learn-learning to play, dialogue as inquiry, collaboration, self-assessment, and a creative mindset among all students.

A pedagogical tool in development for architectural education is PACH (Playing Architectural Creativity Heuristics) to help college students improve divergent thinking skills, resist premature closure, enhance flexibility, and assess the creativity of their design projects. This paper explores how heuristics, like PACH, can close scholarship gaps between architecture students' creative self-efficacy, creativity assessments, and evaluations of their design projects. Research questions raised in this paper are: What statistically significant impacts do heuristics make in the creativity of architecture students' design projects? How do they affect creative self-efficacy? And what are the perceptions of professors and students on the effectiveness of architectural creativity assessments and heuristics?

Keywords: architecture, creativity, education, heuristics, SCAMPER, self-efficacy

Introduction to the Research

Architectural education teaches students to shape the physical environment, facilitate human life, signify placemaking through buildings, and apply their creativity in the emerging innovation economy. Yet, like most disciplines, architectural education needs to re-examine how it prepares students to suc-

cessfully work within the new global emphasis on creativity. The new innovative work environments call for a redesign of architectural education that moves from a focus on solitary projects to collaborative design dialogue and creative production. Although architectural educators strive to create ecosystems of students, professors, administrators, and parents, changes occurring across society are pressuring educators to enhance accountability, transparency, diversity, intrinsic motivation, and even make learning fun for students. Therefore, pedagogies used in architectural design studios also need to adjust to the emerging demands placed on architectural education through techniques such as, assigned videos, internet programs, social media discussions, virtual classrooms, asynchronous instruction, and play. The pedagogies needed in architectural education now should encourage experimentation, creative self-efficacy, dialogue, and collaborative play among architecture students. Indeed, *playing to learn in architecture school can foster learning to play*, flexibility, elaboration, risk taking, tolerance of ambiguity, divergent thinking, and resistance to premature closure correlated to the creativity (Tanner and Reisman, 2014) needed in the profession of architecture.

Heuristic games can serve as a playful way to learn and help students build their creative self-efficacy through self-discovery. Architecture students, professors, and guest instructors can utilize heuristics to develop creativity and the design studio into a *container for collectively shared meaning* (Bohm, 1996; Issacs, 1993) with on-going dialogue throughout an entire class. Heuristics can also be powerful tools to help architecture students learn through progressively challenging design problems while progressively enhancing their creativity. Perhaps most importantly, heuristics can help address the misunderstanding of creativity in architectural design projects, often exacerbated by cultural differences and competing vantage points. Further, there are no standard heuristics for directing architecture design projects, enhancing creativity and improving evaluations that are often unclear, inconsistent, and resulting in misunderstanding and confusion among students and professors about how creative work should be assessed (Tzonis, 2014). Thankfully, pedagogical tools such as heuristics can help close this gap in design instruction and scholarship on creativity in architectural education. Heuristic games such as PACH- specifically designed to enhance architecture students' creativity through discovery and peer-to-peer collaborative assessment play, can help students accustomed to playing learning games since elementary school, continue to learn on their own in college.

This paper explores how architectural design education can benefit from the *Heuristic Method of Teaching* (Polya,1945) by applying SCAMPER *Thinkertoys* (Eberle, 1996; Michalko, 2006) to architecture design instruction to help students learn creativity-enhancing techniques and *collective intelligence* (Bohm, 1996). By utilizing criterion-referenced assessments throughout the creative design process: diagnostic, formative, benchmark, and summative, heuristics can improve architectural design instruction in higher education. Rather than kill individual creative expression (Beghetto, 2005), heuristics and creativity assessments improve creative self-efficacy. Heuristics are needed in architectural education for transparency, consistency, equity, and directed learning among students engaging in collaborative dialogue.

Therefore, empirical data is needed to evaluate and develop heuristics with data achieved from a sample at an architecture design program in a controlled study. This paper is the first step of research on heuristics in architectural design instruction.

Need for creativity instruction in architectural education

Creativity is integral to the livelihood of architects, but it is not completely clear why architecture has been slow to embrace the research-based methodologies embraced by other disciplines linked to creativity and innovation. Architectural education also has not fully embraced scholarship on creativity, preferring instead to cling to a myth (Tzonis, 2014), "in the West, the idea of 'creators', defined as those who can 'make things out of nothing', is very old…. still felt today in many disciplines related to the production of the human-made environment including architecture and architectural education" (Tzonis, 2014). Of course, traditions are resistant to change, after all that is one of the most important attributes of a tradition, yet the global economy is rapidly changing into a design economy that will demand more, not less, accountability in creative production. Fisher (2012) ruminated on the current state and future of the emerging global economy, "…several names suggested for it- the design economy, the creator economy- but most commentators agree that the greatest value in the future will arise from innovation and creativity, the core skills of an architecture education" (p. 68).

The development and modernization of instruction in creativity still lags other important aspects such as technological integration, sustainability, community involvement, etc. Tzonis (2014) points an accusing finger at intentional mythmaking and tribalism, and Fisher suggests those who fail to keep up, will simply be left behind (Fisher, 2012). Because creativity is one centerpiece of architectural education, design instruction must enhance the synthetic, analytical, and practical intellectual skills, the risk-taking, tolerance of ambiguity, divergent thinking, flexibility, open-mindedness, experimentation, originality, intrinsic motivation, and resistance to premature closure (Sternberg, 2016) needed for innovation. Acknowledging the pressure to expand the repertoire of concerns in design studio, such as, sustainability, active-learning-classrooms, web-based-collaborative-learning, hybrid-blended-learning instructional methods, reality-based problems, and more hands-on instruction, instruction on creativity in architectural education has been left to the reflective, dialogical traditions promoted before the turn of the century (Schön, 1987). Noted architectural scholars have long agreed (Charalambous & Christou, 2016; Crysler, 1995; Danaci, 2015; Fisher, 2012, Hawlina, Gillespie & Zittoun, 2017; Hindle & Rwelamila, 1998; Tzonis, 214) that existing models used to conceive the pedagogies within design schools need to be updated to enhance creativity for diverse students. Pedagogical tools need to be updated for today's students reared in an era of gaming, yet there are few explicitly designed for creative divergent thinking in architectural design studio instruction.

Additionally, although architectural practice requires coordinated collaboration to design the complex buildings needed today, architectural

education remains slow to make the transition from past pedagogies to the type of multidisciplinary skill-development needed to collaborate and create architectural designs for the emerging design economy (Tzonis, 2014). Too often, creativity scholarship for architectural education instruction has not been fully understood or undertaken, despite pressure from the emerging "Creator economy" previously mentioned. Indeed, even a cursory review of the scholarship on creativity instruction for architectural design studio reveals gaps in the knowledgebase of students and faculty alike regarding pedagogies for creative instruction in architectural design. Therefore, the heuristic PACH (Playing with Architectural Creativity Heuristics) is offered as a beginning to help fill this gap in architectural education for pedagogies focused on enhancing creativity.

Heuristic Game Play

The pioneer in the field of heuristics was the mathematician George Polya (1945) who wrote *How to solve it,* introducing *The Heuristic Method of Teaching* in which the teacher sets the problem and asks students to discover the answer through experimentation and dialogue in an inquisitive, exploratory manner that aligns with architectural education. According to Polya's conception of heuristics, the methodology *closely aligns* with architectural design instruction on creativity utilizing an iterative process of inquiry. Thus, a brief explanation is warranted.

The Greek origin of the word Heuristic is "I find; I discover." Heuristics simplify difficult decisions and help us avoid "analysis paralysis" under conditions of uncertainty by aiding decision-making. Heuristics do contain biases but makes those biases explicit. Heuristics are not algorithms (set of mathematical rules that guarantees a correct answer), but one that gives good-enough solutions consistently. This pedagogical tool is quick, easy, fun, and helps students overcome the fear of "starting from nothing" and pressure to invent the big idea …whole cloth. Heuristics can have many uses in education as a part of the ideation, schematic design phase of design as well as evaluations taken at the end of the design process. To start a project, designers begin with questions that help clarify the problem to be solved, and heuristics can play a large role in transforming early concepts with specific feedback (Leahy, Daly, Murray, McKilligan, & Seifert, 2019). Heuristics are tools that serve a purpose, such as helping the user formulate a general strategy, or method for solving a problem (Kowaltowski, Bianchi, & de Paiva, 2010) to stimulate creativity and enable architecture students to learn something for themselves in a process of experimentation and intrinsic motivation that builds self-confidence.

Heuristics encourage the user to make quick decisions that include trial and error, rules of thumb, educated guesses, and intuitive judgment; they help simplify difficult decisions and help users strategically move towards a resolution (Passmore, 2007). Because there is no set form for a heuristic - if something helps the user solve a problem, then it has heuristic value. An architecture professor using *The Heuristic Method of Teaching,* for example, works within a pragmatic paradigm of setting the problem and asking stu-

dents to discover answers through experimentation and dialogue in an inquisitive, exploratory manner to arrive at what works. Heuristic methodology closely aligns with the inductive, intuitive nature of architectural design as inquiry, and can help architecture design students learn how to make defensible decisions.

Heuristics are not evaluation tools or rubrics or even assessment tools per se, but rather tools for further development of initial concepts created by student designers (Leahy, K., Daly, S., Murray, J., & McKilligan, S. 2019, p. 759) for decision-making in a process of problem solving. To state simply, evaluations in education measure how well a student performed on prescribed content or ability that should be known, and rubrics set the criteria for judging performance usually with a scoring scale. The scale of a rubric helps maintain consistency across evaluations. Although worthwhile methods and tools, evaluations and rubrics may not achieve the same sense of self-discovery and efficacy that heuristics foster in an ongoing design process. One such heuristic, SCAMPER (Eberle, 1996), is an integral part of this study fused with the PACH game techniques that can prompt architecture students to generate more creative architectural design ideas through divergent thinking, fluency, and elaboration.

SCAMPER

SCAMPER is a set of heuristics aimed at helping propel users forward in the design process through divergent thinking to enhance creative problem solving. The heuristic known as SCAMPER was developed by Eberle in 1996 to provide techniques and strategies to assist with idea generation and development. The word SCAMPER is a mnemonic device which stands for short phrases that can conveniently prompt numerous strategies to assist with the type of divergent thinking and resistance to premature closure needed for creative achievement (Tanner and Reisman, 2014). SCAMPER stands for, (s) substitute something, (c) combine it with something, (a) adapt something to it, (m) modify or magnify it, (p) put it to some other use, (e) eliminate something, and (r) reverse or rearrange it (Michalko, 2006, p. 74). SCAMPER is therefore a set of seven heuristics that prompt divergent and convergent thinking, idea development, creative problem solving, and brainstorming. SCAMPER may work best for idea development rather than idea generation (Eberle, 1996), but PACH addresses this gap by applying it to criteria related to architecture design. Finally, SCAMPER may benefit from an architectural professor acting as the "Idea Agent" (Michanek & Breiler, 2014) to guide the process and offer constructive prompts to move the brainstorming session along and prevent "squelching" of ideas by architecture students.

The author of *THINKERTOYS* provides useful advice for using a heuristic like PACH:

> In order to get original ideas, you need to be able to look at the same information everyone else does and organize it into a new and different pattern…. *Thinkertoys* reflect linear and intuitive thinking, both of which are necessary for optimum creativity. The basic difference between the two is that linear *Thinkertoys* structure existing infor-

> mation while the intuitive toys generate new information using insight, imagination, and intuition. (Michalko, 2006, pp. 35-39)

PACH

Playing Architectural Creativity Heuristic (PACH), is an acronym and an actual word that has many cheeky meanings, including "Multitalented, creative, esp. with leadership" (URBANDICTIONARY.COM) to represent a card game invented by the author, and playfully named perhaps tongue-in-cheek, PACH. The author envisions the cards used in numerous ways in an architecture school, from "advertising" the assessment expectations prior to the jury reviews, chronicling the design process through successive assessments, journals for communication between students and professors on design projects, rubrics, and reflections at the conclusion of projects design juries. Most important of all, heuristic tools are needed to help students build confidence in their creative abilities as they mature in their journey towards the architectural profession. The list of scholars of creativity and design advocating more targeted efforts to improve creative ability and self-efficacy is long (Danaci, 2014, Kaufman, 2019; Meinel, Wagner, Baccarrella, & Voight, 2018; Royston & Reiter-Palmon, 2017; Sternberg, 2016; Tanner and Reisman, 2014) to name a few. Clearly, there is interest in creativity research in education, and the scholarship is indeed fulsome, and yet, there is a gap in the *application* of creativity scholarship, especially in architectural design. PACH is a heuristic explicitly designed to help close this gap on creativity in architecture education.

PACH is a heuristic game played like most card games with players taking turns using cards organized in suits and scored for points based on responses to questions prompted by the cards. The heuristic works by helping students discover insights for their own design projects based upon card five suit-categories using SCAMPER techniques. Commonly defined as "Related to general strategy or methods for solving problems that enables a person to learn something for themselves. Heuristics foster trial and error, rules of thumb, educated guesses, intuitive judgment, guesstimates, and even common -sense solutions," this standard dictionary definition of heuristics is aligned with the inductive, iterative, creative process of architectural design (Eilouti, 2020). Specifically created to match the needs of architectural design education, PACH comes with two sets of 8-inch square playing cards of same size and similar design. The backs of all cards can be used for post-it-notes during brainstorming (Figures 1, 2, 3, & 4). Eight card fronts are blank for sketching, note-taking, clipart, and personal inspirations. The 72 cards each prompts a SCAMPER technique encouraging divergent and convergent thinking in five suits related to five major subjects in architectural design to enhance creativity. PACH addresses originality and effectiveness (Beghetto, 2005) with flexibility and structure (Figures 5, 6, & 7).

Scoring points in PACH

Players take turns answering each other's questions during intentionally brisk, intuitive play similar to typical card games. The range of techniques in

SCAMPER is known but players' questions are unpredictable – student decide what to ask each other using the cards as prompts (Figures 8, & 9). The purpose of PACH is to serve as a heuristic, and therefore its value is determined by how well it aids the user in self-discovery, learning, and novel problem-solving. Because students will likely want to determine the "winner" in a game, scores can be given for how well a design addresses the ten categories so scores can be tallied (Figures 10, & 11). Questions should be written on post-it-notes and affixed to the back of cards for brainstorming and aid reflection. Scoring is also possible for assessment when playing alone in "solitaire" for self-assessment. Up to five students can play per game- half of a typical design studio of ten students. PACH encourages criterion-referenced assessments throughout the creative design process: diagnostic, formative, benchmark, summative, and encourages learning through play, improvisation, peer-to-peer learning to foster fluency, flexibility, elaboration, divergent and convergent thinking skills, and tolerance of ambiguity. PACH helps architecture students understand criteria used for reviews, study major concepts, dialogue with classmates, and enhance creativity through discovery in both solitaire and self-reflection. The cards can be photographed with cellphones at the end of a game- front prompt and back post-it-notes, and then the cards are ready for reuse- photographs can be uploaded into a graphic program for presentations. Regardless of the declared winner of the game, all students win when pedagogies are targeted, tailored, timely, effective, appropriate, and learning is fun!

Discussion

Advantages of Heuristic Teaching Strategies with PACH

- Heuristics like PACH can facilitate the overall achievement of cognitive, psychomotor, and affective objectives for teaching architecture students how to discover and assess design solutions within the studio conceived as *dialogue container* (Isaacs, 1993).
- Heuristics can help students develop an attitude of strategic experimentation and improvisation. PACH utilizes randomness, collaboration, and novelty to assist creativity
- Heuristics can encourage architecture students to explore design problems by themselves, discover effective solutions to design problems, explore, and retain knowledge through divergent and convergent thinking. PACH can be played students alone or in groups.
- Heuristic teaching strategies foster self-learning, self-discovery, self-reliance, and self-efficacy. PACH provides structure to assist in the risk-taking that enhances creativity.

Disadvantages of Heuristic Teaching Strategies with PACH

- High degrees of divergent and critical thinking skills are required by the respective learners. Students who fail to quickly grasp concepts and excel from the start may find PACH too frustrating. Communication & observation by the professor is critical.
- PACH may initially be too advanced for beginning architecture design students.

- PACH will not always be practical, as some students may lack the maturity or patience to provide due diligence for this exploratory teaching method, fully work with the heuristic, collaborate and learn with classmates on design projects in architecture design studio.
- Students may be intimidated by PACH and fear approaching the professor for help. The heuristic may lose effectiveness with repetition within a course and will need to be varied to encourage intrinsic motivation and resistance to premature closure in students.
- A specific heuristic like PACH may not be transferable to all architectural instruction because it depends upon clearly stated subjects and well-defined pedagogical objectives.
- Architecture professors need to be adept as *Idea Agents* (Michanek & Breiler, 2014) in the design studio. Students need coaching with supplemental texts, videos, exercises, hints, encouragement, and strategic extrinsic motivation for discovery with PACH.

Conclusion

This paper has situated the *Heuristic Teaching Method* within the context of the type of pragmatic problem-solving techniques used in architectural design instruction and examined how time-tested heuristics such as SCAMPER, can be combined with novel architectural design pedagogies such as PACH. A brief overview of heuristics as problem-solving tools and their relevance to architectural education has been provided, along with a lineage of scholars who identified the need for more scholarship in diverse teaching methodologies for architectural education. A snapshot of the state of architectural design instruction gave context for potential benefits of adding specifically tailored heuristics to architectural education. Two heuristics were combined, SCAMPER and the author's invention PACH, to become a tool for facilitating brainstorming, improvisation, discovery, assessment, and reflection. Finally, although it is possible to use PACH as an evaluative tool, and professors should consider aligning their rubrics with the five major subjects and ten categories of PACH, the focus of this research has been on *heuristics as open-ended assessment tools* for architecture students learning design concepts.

Heuristics can help align the intangible spirit of original architectural design, with evaluations focused on the tangible aspects of appropriate buildings. Heuristic tools such as PACH can help demystify creative processes, products, and evaluations for students and professors alike. The next step in this research is to conduct a controlled study with a targeted sample to evaluate the effectiveness of PACH. Moving forward, the development of PACH as a digital game would increase its application in diverse settings and appeal to a wider range of students who could play online anywhere for distance learning. In conclusion, more heuristics created for architectural design instruction are needed; PACH may help close this gap, and research in a mixed-methods longitudinal study that includes assessment testing quantitative data & interview qualitative data could yield insight on the efficacy of PACH and help determine how other heuristics can be developed for architectural educa-

tion. Further research is warranted to help educators address the myths surrounding creativity in architectural design in education.

Figure 1. Back of PACH cards facilitate brainstorming with removable post-it-notes and teach students how to appropriately critique creative architectural designs using objective adjectives: (deficient, developing, consistent, and exemplary), for equitable consistency among students.

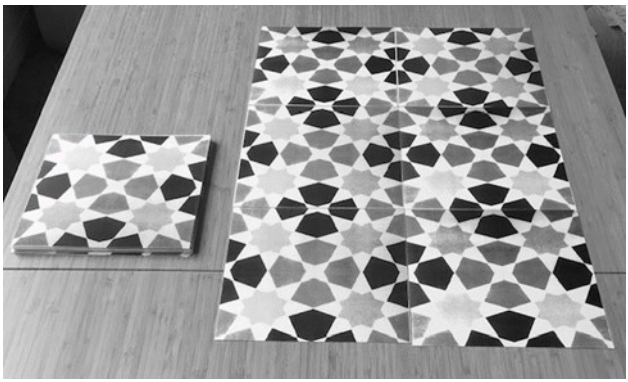

Figure 2. Back of all PACH cards illustrate geometry, proportion, ratio, rotation, symmetry, and patternmaking in seven different values. All modular cards facilitate brainstorming post-it-notes.

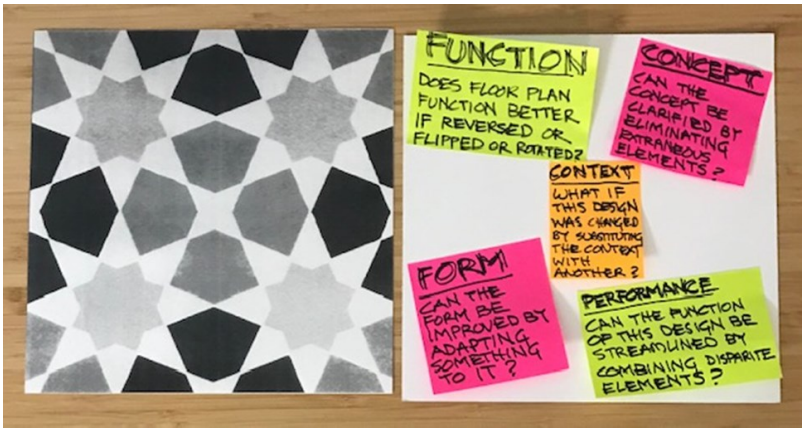

Figure 3. There are two types of modular cards in the PACH set- 72 cards for playing the game, and eight blank card fronts for notetaking and sketching. Post-it-notes can relate SCAMPER to five major subjects related to architectural design during brainstorming. The 8- inch square cards facilitate different arrangements. Students learn how to enhance creativity through divergent and convergent thinking by asking and answering questions, reflection, and assessing themselves.

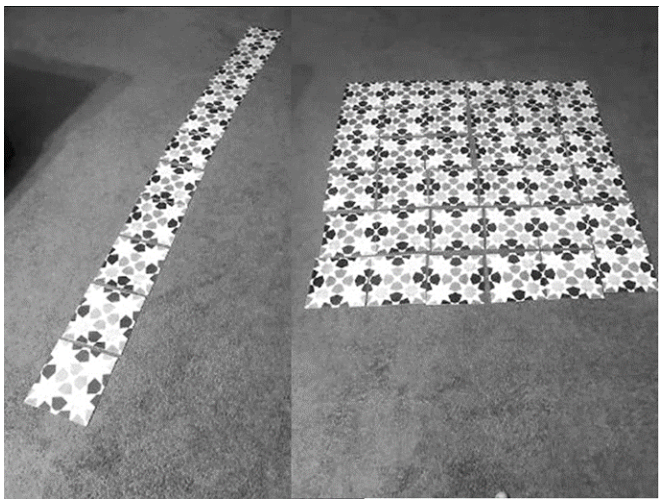

Figure 4. Cards with post-it-notes allow the class to pinup and recombine sketches and questions generated in a game into narratives/hierarchies/ adjacencies with linear and grid arrangements.

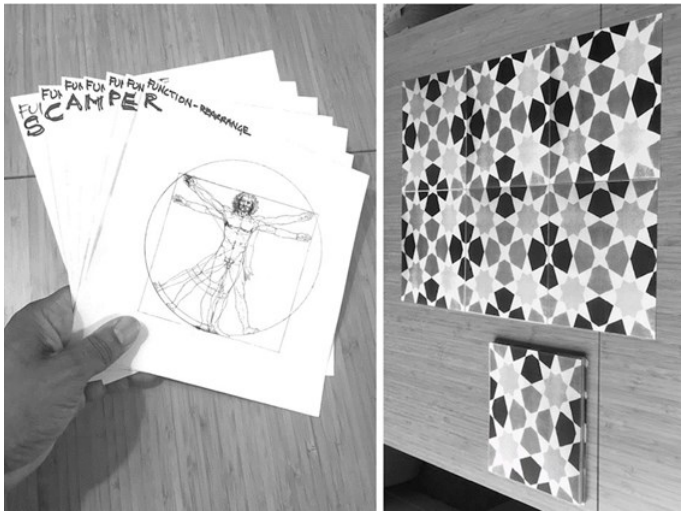

Figure 5. PACH teaches SCAMPER and golden ratio from Leonardo da Vinci's *Vitruvian Man*.

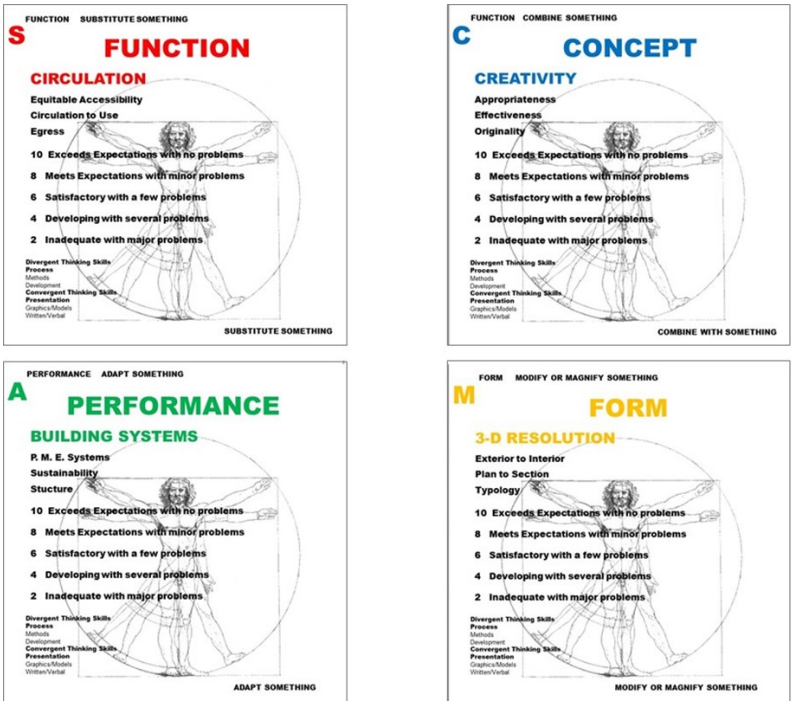

Figure 6. PACH card fronts indicate suit, subject, categories, scoring, and SCAMPER technique.

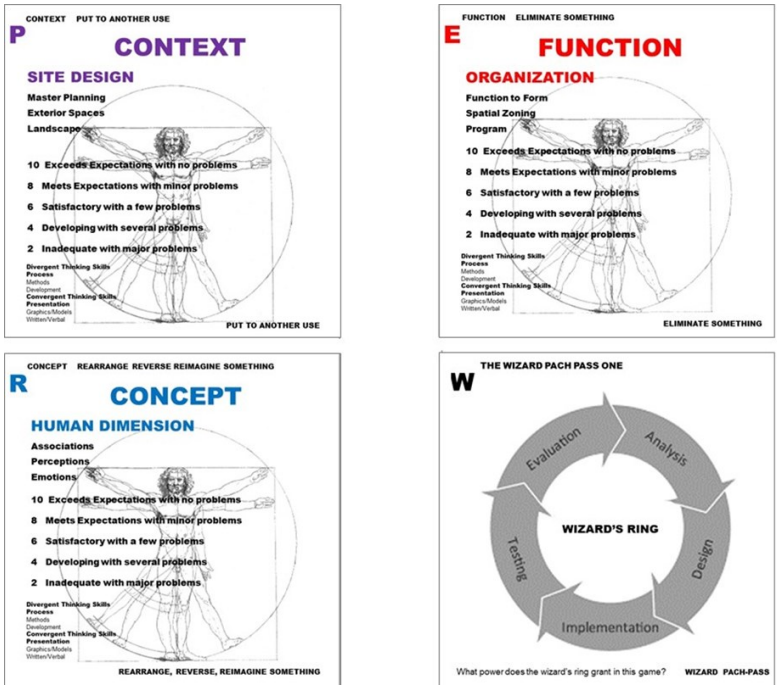

Figure 7. SCAMPER questions apply to design subjects. PACH set includes two wizard passes.

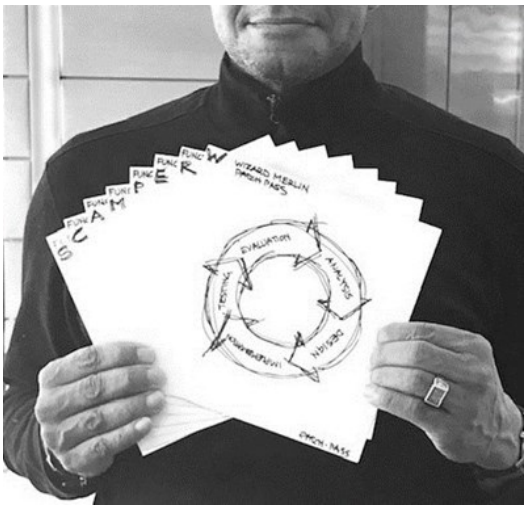

Figure 8. PACH cards are made with cardstock on a copy machine for flexibility. Cards are.large enough to work for sketching and post-it-notes, but small enough to hold during card game play.

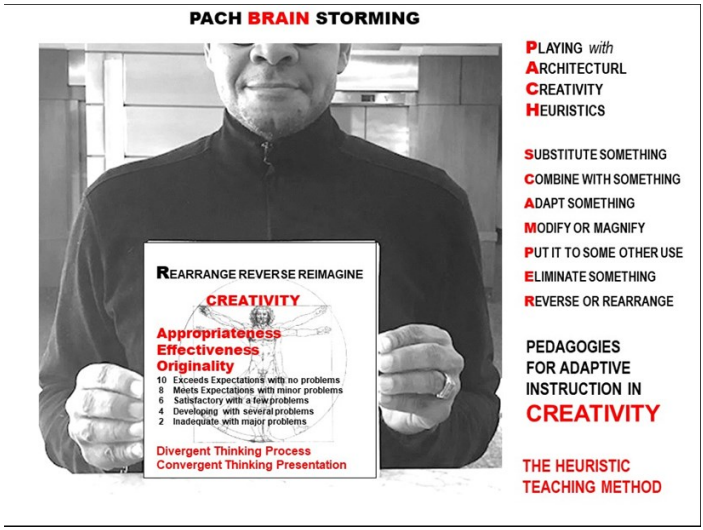

Figure 9. PACH applies SCAMPER heuristics to divergent/convergent skills calculated in each of the five subject-suits. PACH is played like other card games to make learning easy and fun.

PACH SUIT	PACH CATEGORY	PACH SCORE
CONCEPT	Creativity	10
	Human Dimension	10
FORM	3-D Resolution	10
	Composition	10
CONTEXT	Site Design	10
	Zeitgeist	10
FUNCTION	Circulation	10
	Organization	10
PERFORMANCE	Building Systems	10
	Social Systems	10
SKILLS	Divergent Process and Convergent Product Presentation*	
TOTAL MAXIMUM SCORE		100

*Divergent thinking skills utilized during the design process and Convergent thinking skills illustrated during design presentation are included on all cards and factored into each score.

Figure 10. Example of tallying scores with PACH as an assessment tool.

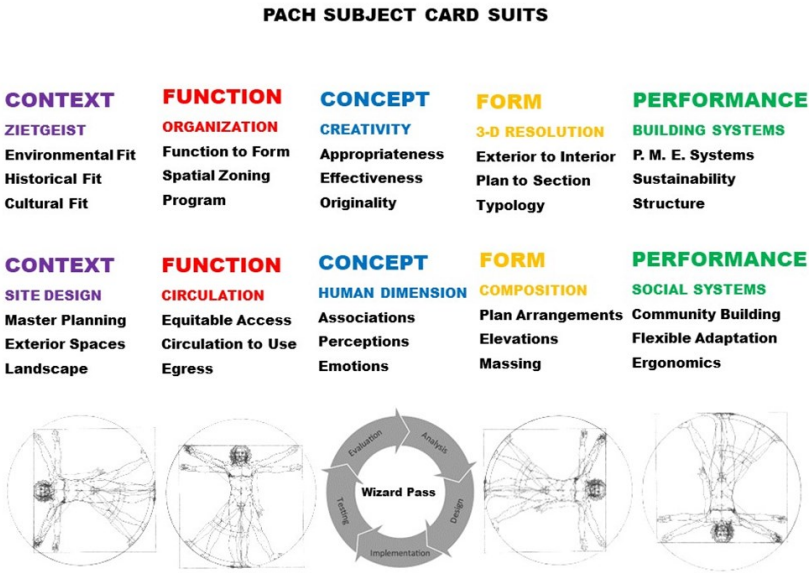

Figure 11. PACH heuristic targets ten categories in five major subjects of architectural design. Two wizard-ring wild-cards make the game unpredictable each time to spark creative thinking. Although PACH is targeted specifically for architectural design students, it can be tailored for other subjects quite easily. The next step is digital application to bring game-play full circle.

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CHAPTER NINE

STANDING ON THE SHOULDERS OF A GIANT: J.P. GUILFORD

DOROTHY A. SISK

Abstract

This chapter focuses on the impact of J.P. Guilford on my life-time work in creativity development. Dr. Guilford's ideas were introduced to me as an undergraduate by Dr. Walter Webb, a Psychology professor at the University of Mount Union in Alliance, Ohio. Following graduation from Mount Union, I taught in a gifted program in Garden Grove, California and developed creative enrichment lessons called Encounter lessons. Dr. Guilford became my mentor when I asked to use his Alternative Uses Test in my dissertation at UCLA. Dr. Guilford guided me and one of his doctoral students, Mary Meeker who applied Guilfords SI theory to education with tests and educational materials, which she called SOI. J.P. advocated for my position at the University of South Florida as a professor teaching gifted and exceptional child education, and I integrated the SI in the gifted teacher training program. J.P. was a Distinguished Lecturer at USF and visited with the faculty and the Saturday enrichment program. He was active with the Creative Education Foundation, and in 1985, he shared his latest objective, 'To write a book on the Creative Personality and to make some changes in the SI'. The primary contribution of Dr. Guilford was paving the way for all of us to view intelligence, not as a single overall ability or global trait, but as being composed of a large number of abilities.

Keywords: creativity, creative personality, patterns of traits, characteristics of creative persons, factor analysis

Standing on the Shoulders of a Giant: J.P. Guilford

J.P. Guilford had a profound effect on a wide audience of psychologists, educators, and college and university students with his Presidential Address to the American Psychological Association (APA) conference in 1950. My undergraduate psychology professor at the University of Mount Union in Alliance, Ohio, Dr. Walter Webb attended the presentation of Dr. Guilford and was particularly intrigued with J. P's statement concerning the lack of correlation between education and creative production. Dr. Webb challenged his undergraduate psychology students to address the two questions presented by Guilford: How can we discover creative promise in our children and youth?

and How can we promote the development of creative personalities. Those two questions became J.P. Guilford's professional passion and it became mine as well over the next fifty years.

My undergraduate project with Dr. Webb included identifying a creative individual, investigating their life and work, noting creative behavior traits such as aptitude, interests, attitudes and temperamental qualities, and most important identifying mentors who helped them discover their creative promise. I chose Shel Silverstein and talked with him at a colloquium at the University of Mount Union. He was intrigued with my questions and we made arrangement to meet for breakfast before he left for his next meeting. Silverstein described himself as being open and in love with nature. As a student, he said he was serious, persistent and able to focus on projects that he chose, and that he was a dreamer, and not his teachers' favorite student. Silverstein said his mentor was Ursula Nordstrom, a book editor who encouraged him to write books for children which resulted in his lovely story for children, *The Giving Tree* which has been translated into 20 different languages. When he addressed the question of how to promote the development of creative personalities, he said students need more time to pursue their own ideas and projects, and time to reflect and dream.

In has APA address Dr. Guilford defined creativity and discussed the creative personality:

> Creativity refers to the abilities that are most characteristic of creative people. Whether or not the individual who has the requisite abilities will actually produce results of a creative nature will depend upon his motivational and temperamental traits....Creative personality is then a matter of those patterns of traits that are characteristics of creative persons....which includes such activities as inventing, designing, contriving, composing, and planning
> (Guildford, 1950, 444).

After graduating from the University of Mount Union, I moved to California and taught elementary, middle and high school gifted students in Garden Grove, California under the supervision of a truly creative mentor Jeanne Delp. As the supervisor of gifted programs in the district, Jeanne developed a program focusing on the development of creativity of gifted students, including visual and auditory creative expression. Jeanne encouraged her teachers to pursue graduate work, and I enrolled at California State University in Long Beach, California, where I studied with Dr. Juliana Gensley, one of the original student participants in the Terman study of 1,000 elementary gifted children identified and followed throughout their life, noting their creative and academic accomplishments. She was concerned about the neglect of the study of creativity by psychologists. Dr. Gensley required her MA students to conduct case studies of creative individuals using the creative traits Guilford identified in his APA presentation: Sensitivity to problems, ideational fluency, flexibility of set, ideational novelty, synthesizing ability, analyzing ability, reorganizing or redefining ability, span of ideational structure, and evaluating ability (Guilford, 1950, p. 454). Dr. Gensley encouraged me to apply to

UCLA for doctoral work in Educational Psychology and helped me secure a graduate fellowship to work with Dr. May Seagoe, Dean of the UCLA College of Education, also a participant in Terman's study.

Dr. Seagoe was particularly interested in the development of the creative potential of diverse economically disadvantaged or low-income students. She agreed with Guilford's statement about the accidental nature of many discoveries and inventions being partly due to the inequality of stimulus or opportunity which is largely a function of the environment rather than of individuals (Guilford, 1950, p. 445). Dr. Seagoe was convinced if these diverse students were identified early in their education and provided active enrichment activities, they would be able to develop their creativity. In a discussion about my proposed dissertation study, I suggested that enrichment lessons I developed as a teacher in Garden Grove could work as both motivation and opportunity for skill development in creativity. Dr. Seagoe agreed with this notion and asked that I meet with J.P. Guilford at the University of Southern California and ask permission to use his *Alternative Uses* creativity test. I called to make an appointment with Dr. Guilford and he graciously agreed to talk to me about my dissertation.

J.P. was intrigued with the idea of testing the students (grade 4) with his *Alternative Uses* test as both a pre and post-test, after the students received enrichment lessons that I called *encounter lessons*. He said he taught 4th grade students in Nebraska and was amazed at their individual differences. I shared with him how my 4th grade students in Garden Grove "blossomed" as individuals after engaging in encounter lessons each morning. Dr. Guilford asked me who was my advisor and I said, "Dr. May Seagoe." At which point, he looked amazed and said, " Aren't you one of our students?" When he realized that I was a student at UCLA, he gave me a wide grin and said he would be happy to help in any way he could, and he gave me a copy of his *Alternative Uses* test. The test asks the respondent to think of as many uses as possible for a simple object, like a brick or a shoe or a paperclip, and it yields a score in fluency, flexibility and originality.

Over the next year, I spent as much time talking and working with J. P. as I did with Dr. Seagoe, and he was elated to learn that the students who received the enrichment Encounter lessons were transferring those creative skills to the regular classroom lessons. The teacher of the students reported that the students were much more interested in their day- to- day work, asked lots of questions and came up with a wide variety of ideas that were truly unique. Guilford nodded when he heard the teacher's report and reiterated his belief in equity of opportunity to develop creativity. Table 1 is an example of an Encounter lesson in which a question is posed to the students to engage their senses in describing their feelings of being an object, in this case a *rock*; followed by a question that provides the students an opportunity to be creative as they change themselves; then a question that asks them to respond to others joining them in "their space"; then a question about risk-taking, of being "skipped" across the water; and finally, an opportunity to make an abstract generalization of their experience. Every student response is acceptable. An extender of this lesson could be to introduce a creative writing activity in which the students would select an inanimate as a character to provide a different point-of-view (Sisk, 2009).

Encounter Lesson: Rocks in a Stream

Setting and Guiding Questions:

1. I want you to become a rock in a stream, what are you seeing, hearing or feeling?
2. As a rock, if you could change yourself, to become more interesting or appealing, what would you change?
3. Wow, someone is throwing in a big box of rocks into our stream, what are you feeling or thinking?
4. Look here comes a group of boys who want to skip rocks across the water, what are you feeling?
5. You have been a rock in this stream for quite a long time, you are an old rock, and you have seen a lot, if you could give folks some

Table 1. Encounter Lesson (Rocks in a Stream)

To provide an opportunity to see the type of response a student might make to these Encounter questions, an example of an encounter lesson with the questions and responses of a 10-year-old gifted boy are listed in Table 2 to illustrate the format of the questions and the student responses. The teacher's statements are designated as T and the student's responses as S. In this encounter, the student is asked to be a "leaf." Much of what this gifted student shared about himself as a leaf is probably true of him as a young man, especially the part about needing friends, since he recently moved to a new school. He does not want to be taken for granted, but to be a part of the world and to give and receive beauty. Friz Perls (1969) said any time we are talking, no matter what we are talking about, we are talking about ourselves. So, when gifted students respond as inanimate objects, they reveal to themselves and to others a pattern of values, interests, and ideas that are an integral part of who they are.

Encounter Lesson: Autumn Fantasy

T: I want you to become a leaf on a tree, it is Autumn. (Setting question or directive)
T: As a leaf on a tree, what are you seeing, feeling or hearing? (Sensory perception question)
S: I am high in a tree, and I see tiny little people below. No one notices me since I am up so high. The wind is blowing and I feel slightly dizzy.
T: There is smoke in the air, do you smell it? What are you feeling? (Fear Question)
S: I'm afraid. Smoke means fire and we are so dry. It would be very easy for a fire to start.
T: There are many leaves being blown around. Some are being blown into our tree; how do you feel about them? (Relating to a Group Question)
S: It is alright if they come here. I need some new friends, maybe we can have some good times. They look friendly.
T: If you could change yourself as a leaf, in what way would you change yourself? (Creativity Question)
S: I would not want to be an Autumn leaf that is about to die, I would be a on a pine tree and live forever. They don't lose their leaves in the fall. They also smell good, and people decorate them for Christmas trees.
T: If you could talk as a leaf, what would you say to the world, from the point- of- view as a tree? (Abstract thought Question)
S: I would tell them to never take trees for granted. Trees are alive and worth a great deal. We are part of this world and give beauty to one another. (Sisk, 1987, p. 275)

Table 2. Encounter Lesson: Autumn Fantasy

The student participants in my doctoral study enjoyed the Encounter lessons and on the post-test the difference from the pre-test was significant at the .01 level. But more important was the change in their classroom behavior, representing transfer of behavior including curiosity, deep listening, willingness to ask questions, and to explore new ideas as reported by the teacher and observed by the principal.

Upon completion of my dissertation, J.P. Guilford wrote a letter of recommendation and endorsement of my experiences in developing creativity in young students to the University of South Florida (USF) Special Education department, and I joined USF as an Assistant Professor, teaching courses in gifted and exceptional child education. Shortly thereafter, I met Mary Meeker, a student of J. P. Guilford at the University of Southern California whose dissertation focused on an application of Guilford's Structure of Intellect theory (SI) to create assessment and curriculum materials for teaching children and adults. In his APA address Guilford said a general theory to be seriously tested would need an investigation of some primary abilities that could be

improved with practice of various kinds and positive transfer effects would be evident (Guilford, 1950, p.440).

Meeker saw the potential of applying SI to education based on two key points: 1) Intelligence can be precisely measured using a test that identifies an individual's aptitude on the multiple intellectual abilities identified in the Guilford SI model; and 2) The individual's intellectual abilities can be remediated or improved using learning materials that target each particular ability. Meeker called her application of Guilford's theory (SOI).

I was particularly interested in Meeker's premises, as we were using Guilford's (SI) in the teacher training program for teachers of the gifted at the University of South Florida, and in the Saturday enrichment program for diverse low- income high potential and gifted students. Dr. Guilford was invited to the University of South Florida as a distinguished lecturer to discuss the topic of C*reativity and its Social Importance*. He shared the enormous economic value of new ideas and the need for individuals with inventive potentialities, and that industry and government agencies are always looking for productive individuals with good judgment, planning ability, and inspiring vison. He said creative productivity depends upon primary traits other than abilities, including motivation factors (interests and attitudes) as well as temperament factors. He discussed the neglect of research on ways creative thinking skills could be developed in education and the impact that this experience could have on students. He shared his research in World War II when he applied factor analytic methodology to study mental abilities, and they identified 25 important mental abilities.

J.P. discussed my study as an example of research to build creative thinking skills, the use of encounter lessons to develop primary creative thinking traits as measured by his *Alternative Uses* test, and noted the transfer of creative skills to the work in the regular classroom. My colleagues at USF were most enthusiastic about his development of the Structure of Intellect (SI), and suggested that he visit the Saturday enrichment classes.

The Saturday morning enrichment classes provided diverse low- income high potential and gifted students enrichment lessons based on the SI theory model that were developed and taught by graduate students. The participating students ages 5-l8 selected three classes from 9:00 a.m. to 12:00 p.m. The classes were small, seldom more than 15 students in a class, which afforded the graduate student teachers ample opportunity to engage with the students in the activities.

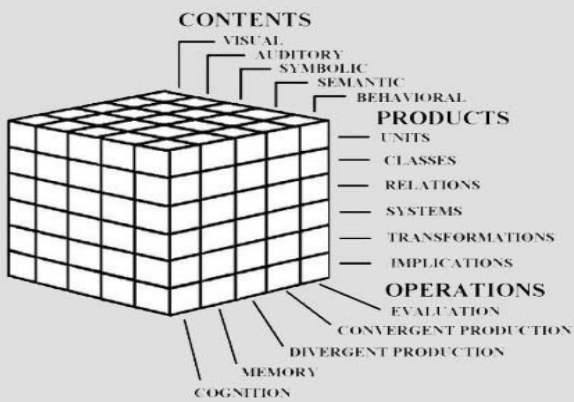
The SI model is a classification of intellectual abilities arranged in a three- way fashion to encompass and organize intellectual aptitude factors. The three dimensions are *operations, content* and *products*. Guilford defined *operations* as being composed of cognition, memory, convergent thinking, divergent thinking and evaluation. Cognition includes understanding, discovery, rediscovery, awareness and comprehension; memory is retention and recall of knowledge; convergent thinking is reorganization of information; divergent thinking is imaginative, spontaneous and fluent self -expression; and evaluation is judging, assessing and evaluation. The *content* dimension is divided into four areas: figural, symbolic, semantic and behavioral. Figural includes objects or forms that are perceived visually, and auditorily -elements such as rhythm and simple sounds, and tactual or kinesthetic materials; sym-

bolic includes signs and other materials that have no meaning in and of themselves, but represent something; semantic includes words that have meaning and relate to an image in a person's mind; and behavioral that includes nonverbal information pertaining to human interaction and evidence of an affective state. The products category is made up of six areas: units, classes, relations, systems, transformations and implications (Sisk, 1987).

Sisk and Rosselli (1987) found that several of the Guilford components were closely related to creative thought, such as divergent thinking ability to produce a variety of responses and transformation to modify or change categories. This aspect of the model was a viable addition to the early work of Alex Osborn and Sidney Parnes in the Creative Education Foundation in their use of brain storming activities to produce a variety of responses, and their definition of originality as a response that is unique and seldom identified by others. Originality in the SI model involves divergent or adaptive flexible responses, and semantic material involves transforming or shifting meaning or form to arrive at clever effective, even startling presentations and conclusions. All of which are complementary to the original five step creative thinking process of Alex Osborn and Sidney Parnes (Sisk & Rosselli, 1987, p. 22-23). Table 3 depicts the SI model of J. P. Guilford, as it appeared in his book *Way Beyond IQ* published in 1977 by the Creative Education Foundation in Buffalo, New York.

The Saturday Enrichment classes implemented the Creative Problem-solving process with the students as they worked through a five- step process of fact finding, problem finding, idea finding, solution finding and acceptance finding.

Structure of the Intellect Model



Guilford, J.P. (1977). Way Beyond IQ
Buffalo, New York: Creative Ed.Foundation

Table 3. Structure of the Intellect Model

Dr. Guilford was able to observe a Saturday morning enrichment session at the University of South Florida with a group of students (Grades 6-8) working on a lesson *A Hero for Tomorrow.* The lesson plan or document included: 1) Characteristics of gifted students; 2) Strategies; 3) Key concepts or big ideas; 4) Levels- primary, intermediate or secondary; 5) Content; 6) Boundary breaking question to create a thoughtful environment; 7) Activities; and 8) Extender follow-up activities. The lesson is depicted in Table 4.

Structure of the Intellect Lesson: A Hero for Tomorrow

Characteristics: Serious Minded, Curiosity, Verbal Skills
Strategies: Futures Study, Role Playing, Higher Level Thinking
Key Concept: Leadership and Community Structure
Levels: Intermediate
Content areas: Social Studies, Language Arts
Boundary Breaker: If you were to be called a hero for something, what would you want to have accomplished to earn that title?

Activities:

Examine the list of names below and circle those that you feel are heroes. (Cognition)

Walt Disney	Dolly Parton	Donald Trump
Michael Jackson	Willie Nelson	Eleanor Roosevelt
Abe Lincoln	Billy Graham	Serena Williams
Pope John Paul	Ronald Reagan	Oprah Winfrey
Bill Clinton	Madonna	Tom Hanks
Margaret Mead	Carl Sagan	Neil Armstrong
Barack Obama	Nancy Reagan	Martin Luther King, Jr.

Compare your list with three other students. Discuss the definition for "Hero" you used. List five qualities of a hero that you can agree on. Are heroes always leaders? Why or why not? (Convergent and Evaluation)

Describe what a hero would be like in each of the following communities. (Evaluation and Convergent)
a. An inner-city area in Boston
b. A resort area in Colorado
c. A border town in California
d. A rural farming community in Iowa

Create a hero for one of the following community structures. Describe the leadership traits s/he would probably have accomplished. (Divergent)
a. A space colony
b. A highly automated underground city
c. A multicultural metropolis
d. A renovated inner city

We can learn more about a society by studying its images of heroes and leaders. Choose one of the following examples and report on the hero types that you find. (Convergent)
a. Films from the 90's
b. Greek myths and fables
c. Tales from the Wild West
d. Science Fiction
e. Harry Potter books
f. Your own choice

Decide as a class what kind of hero will be needed to deal with the following problems: (Evaluation and Convergent)
a. A global war
b. Increased racial tension
c. Increased crime rates
d. Disappearance of the middle class
e. Your own choice

• Extenders-Follow-up Activities:
•Survey the students in your school to find out who are their heroes.
•Make a collage` of current heroes from different magazines.
(Sisk & Rosselli, 1987, p. 47-49)

Table 4. SOI model lesson: A Hero for Tomorrow

J. P. was amazed at how the lesson engaged the different levels of content and he was particularly pleased with the inclusion of " your own choice" and that the teachers told him they thought in "SI" as they designed their lessons using the SI model. He told the teachers that he taught intermediate students in Nebraska and they talked about heroes. The curriculum developed by the graduate students and University of South Florida professors using the five content areas of the SI were widely disseminated throughout the 65 counties in Florida with the support of a $1,000,000 grant to the University of South Florida from the Edyth Bush Foundation in Orlando, Florida. This dissemination ensured that the materials were available to teachers of the gifted across the state of Florida.

J.P. met with the professors at USF in the Department of Ed. Research to discuss the use of factorial methods. He suggested that constructing special tests would be a good place to start and that these tests would need to be implied by any hypothesis. He suggested varying the kind of material in each type of test to explore the scope of generality. He also suggested they review other factorial studies and previous results, and these could be a source of new hypotheses. It was obvious to the professors in the meeting that J. P. thoroughly enjoyed the factorial exploration.

SI and SOI

In 1975, Mary Meeker and her husband Robert Meeker opened the SOI Institute, to produce SOI tests and educational materials. They conducted training in Texas, and I was able to participate in a training session and become a certified SOI diagnostician. The Guilford SOI model suggests the feasibility of accurately matching student and assignment, and selecting educational experiences designed to develop a specific intellectual component as Mary Meeker had envisioned in her dissertation. For example, the figural category in the content dimension deals with sensory material used as it is perceived. It represents a kind of concrete intelligence needed by engineers, artistic painters, musicians, mechanics and machine operators. This intelligence can be detected by selected test items and increased by well-chosen activities (Meeker, 1981).

In the l990's, Mary Meeker worked with Bridges Learning Systems, a commercial enterprise founded by former U. S. Senator William Brock to implement school programs based on Meeker's SOI work and on the Integrated Practice Protocol (IPP) that Mary Meeker developed with Robert Meeker. IPP includes SOI related assessments and learning and teaching materials that incorporate intelligence assessment such as the SOI –LA test for vision assessment and sensory integration.

Bridges Labs

The Bridges Labs are like a gymnasium for the brain, and students enjoy doing the activities in the lab. I worked with a SOI Bridges program in Paris ISD in Paris, Texas as an evaluator. The participating students worked through exercises focused on visual, auditory and sensory motor activities

and on training tasks that consisted of memory exercises, fine motor and perceptual activities, trampoline and balance board exercises and "book work" through individualized program tasks to develop sensory integration and focusing skills. The district provided classroom space for a lab and a specialist to work with the students who received learning development training a minimum of 45 minutes per day, two days per week during the school year. As an evaluator of the Paris program, I found that the program helped students focus, stay on task, and concentrate on their work. As a result, they improved academically and behaviorally.

Standardized test and assessment results showed positive gains for the students, and outcomes, particularly in reading and math were consistently powerful and significant. One sophomore basketball player who had been referred for disorderly behavior and lack of focus, said he not only was not being referred to the principal for behavior, but his foul shots had improved considerably with the visual motor activities in the lab. The teachers also reported that the students took more pride in their work, were asking more questions, and enjoyed the emphasis on being focused and aiming for quality creative work.

Creative Problem-solving Foundation

J.P. was active with the Creative Problem-solving Foundation in Buffalo, New York and published articles in their *Journal of Creative Behavior* and attended the Creative Problem-solving Institutes called CPSI whenever possible. In 1985, J.P. attended one of the division homeroom groups with participants widely known in creativity including John Gowan, George Ainsworth Land, Bea Bleedhorn, Dean Patton, Sidney Parnes, Doris Shallcross and I served as chair of the group. After introductions, I asked each of them to share their next creative intellectual journey, and J.P. who was 85 said he was wondering if some creative thinking was irrational, and that he was considering rethinking the development of the creative personality. His comment about creativity being irrational set off a lively discussion. Sid Parnes said the "Aha" moment was intuitive in creative production and people often say, "I don't where that information came from." Doris Shallcross added that intuition is an inner way of knowing which prompted George Ainsworth Land to share that many artists select their materials intuitively, and many artists use a visual journal with expressive arts to help them intuitively process their inner and outer life. At which point, Sid Parnes said, "As a creative person, I need to recharge myself and to be able to close my eyes and not see a "to do list." Dean Patton spontaneously suggested, "Let's recharge right now with a visualization of light." We all agreed to follow his suggestion and he began by saying:

> Imagine each of your cells as a pinpoint of light. Now picture each tiny light growing brighter and brighter, connecting in a latticework of radiance. See your body flooded with this vibrant light. Feel the light as it covers your body and a sense of calm. See one thin light going to the corners of the room, one on each corner and one extending to your chest. The light reaches out to all of us and surrounds our

> group with a warmth and a feeling of being centered and connected. This light offers you a sense of well- being and energy for your thoughts and work. He paused and said, at your own pleasure, open your eyes and enjoy being connected and energized.

Dean then asked if any of us had any intuitive thoughts that we might want to share. J.P. said he said because memory is both visual and auditory, as in the guided imagery I saw the light and there was a humming sound, and I am thinking of changing the SI. Several of us agreed that we heard the humming as well. J.P. continued, "This guided imagery was visual and auditory, and I think under content properties, I want to add visual and auditory and under operations there would be memory recording and memory retention." All of us were amazed that this remarkable man who had achieved so much in his life was still viewing himself as a productive scholar and scientist, and was willing to engage in mindful practices and thought.

As we listened to J. P., we knew we were truly viewing his indomitable spirit as he continued to march to his own drummer. He published *Creative Talents: Their Nature, Uses and Development* with Bearly Limited under the auspices of the Creative Education Foundation in 1986, and an article was published after his death in the journal *Education Psychology Measurement* in 1988 with the title *Some changes in the Structure of intellect.* The changes included the five areas of *Content* properties (visual, auditory symbolic, semantic and behavioral) and under *Operations* (cognition, memory recording, memory retention, divergent production, convergent production and evaluation) with citations of the research justifying these changes. The model increased from the original model of 120 components to 180 factors.

Primary Contribution of J.P. Guilford

In trying to identify J. P. Guilford's primary contribution, I concluded it was that he paved the way for all of us to think about intelligence, not as single overall ability or global trait, but as being composed of a large number of abilities, and that children could be trained to be smarter. Comrey (1993) said J.P.'s motto was *Intelligence Education is Intelligent Education.* This notion of teaching intelligence reduces the impact of heredity as a limiting factor of intelligence and complements the work of Dweck (2007) who introduced the *growth mindset* concept with the idea that we can continue to develop our abilities, and the work of Howard Gardner (1999) who introduced the concept of multiple *intelligences.*

With the work of Mary Meeker and Robert Meeker, J.P.'s ideas about teaching intelligence have been implemented widely in the United States and internationally. One incredible international example is the work of the International Society for Intelligence Education with its headquarters in Tokyo. This society and its affiliated schools train students at an early age in SOI abilities in thinking and creativity in weekly exercises. Chiba (l988) published *An Odyssey of the SOI Model* as a tribute and recognition of Dr. Guilford's contribution to education. J.P. Guilford was truly an individual

who many educators and psychologists world-wide would agree that they have stood on the shoulders of this giant who was phenomenally gifted and productive.

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CHAPTER TEN

GROWTH IN PRACTICE: TEACHERS' REACTION TO SUPPORTED CHANGE

HEIDI A. ROCHLIN

Abstract

As is evidenced by the results of the study discussed in this chapter, professional development is essential to the improvement of teacher practice, fostering flexibility of thought, and unlocking high-quality educational practices for all students. The overall significant positive effect in all areas of participants' knowledge, buy-in, and application, shown by the study data, prove that professional development is an effective means of improving practice in the classroom. By paying close attention to the design and effectiveness of sessions offered for teaching professionals, researchers can help to support high-quality instruction at all levels, in all subject areas, for all students. This study represents a small step in that direction.

Introduction

Educational researchers have discovered that children bring a constellation of skills, aptitudes, attitudes, and beliefs to the process of learning mathematics and to the instructional environment. What is effective mathematics instruction for one child might be less effective for a child with different skills, aptitudes, and attitudes. Personalizing instruction, by taking individual student strengths and weaknesses into consideration, should contribute to stronger mathematics achievement for children overall (Connor, Mazzocco, Kurz, Crowe, Tighe, Wood, & Morrison, 2018). Teachers can draw on various types of assessment and student data to guide their mathematics instruction, and then use that data within the constructs of various instructional models. Educators need to understand what types of assessment are the most meaningful for informing their instruction on a daily basis, and then what types of instruction have the greatest impact on their students. This cycle of assessment and response provides the foundation for the instructional model of "Intentional Grouping" (IG), which is the instructional model central to the discussion throughout this chapter. In addition to introducing the key elements of the IG Instructional Strategy, this chapter will discuss the extent of application, change in beliefs ("buy-in"), and retention of knowledge for participants who engaged in a professional learning series on the instructional strategy of "Intentional Grouping" (IG), provided by their district. The professional learning series included information on best practices in elementary mathematics assessment and instruction, and the assessment-response cycle.

Understanding Assessment in Mathematics

The types of learners encountered in early elementary classrooms are diverse and unique. Not only are students set apart by their learning needs and styles, but by the unique skills they bring to the classroom (Connor, et al., 2018). Mathematics achievement can be measured in multiple ways, using a myriad of assessment tools. These tools, along with measuring aptitude and mastery, can also assess growth over time.

Learning is not a process of passively absorbing information and neatly storing it away for easy retrieval and practice (Romberg, 1995); rather, it is a process by which students approach new tasks with some prior knowledge, assimilate new information, and construct their own meanings (Resnick, 1987). To guide the instructional programs that teachers provide to students, teachers make frequent decisions about the differentiation of instruction, about the inclusion of topics in a lesson sequence or homework assignments, about the pacing of the coverage of topics, and about the selection of teaching methods. Their decisions are influenced by information obtained from formal and informal assessments of their students (Romberg, 1995).

Why and how teachers in a public-school setting assess their students' mathematical learning, and then how they act on that data, is a constantly evolving process. Instruction and assessment–from whatever source and for whatever purpose–must be integrated so that they support one another. Too often, sharp lines are drawn between assessment and instruction. Assessment, in all forms, should always include some type of instructional follow-up or decision-making by the teacher (Bass, 1993).

Assessment of student understanding usually cannot be inferred from a single response on a single task (Kulm, 2013). Instead, a "variety of tasks are needed to generate a profile of behavioral evidence" (Hiebert & Carpenter, 1992, p. 89). As teachers attempt to navigate and make sense of the relationship between assessment and instruction, many factors come into play. Most learning can be measured in more than one way, which allows teachers to design assessment activities that are both aligned to the intended learning and responsive to the preferences and capacities of learners (Rickabaugh, 2016, p. 83).

Even as early as first-grade, assessment in mathematics can be targeted and meaningful, and has the ability to further the instructional practices of teachers by supplying vital information on student strengths and weaknesses. Once teachers have identified what children need to know and what they need to learn, they will be able to provide appropriate instruction that will give children a solid foundation on which to build, ensuring success for all (Richardson, 2012, p. xvi). Mathematics teachers who can effectively nurture their students' personalized connections to the content (Rickabaugh, 2016) and also support their students' growth and achievement with meaningful assessment and data collection, will most likely result in high achieving, high growth mathematics students.

Assessments can be internal, providing information to teachers about student performance in order to make instructional decisions; or assessments can be external, providing information to state and local agencies which can

then be tied to funding or policy making (Bass, 1993). Assessments classified as external, such as assessments mandated by State or Federal agencies, can also influence instructional decisions in school districts. This type of external influence can have profound effects on district curricular and instructional decisions (Brookhart, 2016). When considering information from both internal and external assessments, teachers and educational leaders must be careful to ensure that assessments are aligned with instructional and curricular goals (Van de Walle, et al., 2018). Assessment that is out of synchronization with curriculum and instruction gives the wrong signals to all those concerned with education (Bass, 1993) and may provide misleading information about student knowledge of concepts.

For the reasons stated above, and to avoid any misconceptions about student performance in mathematics, teachers and administrators must plan carefully for various assessments in the context of the classroom. These assessments are both of and for learning. Without proper planning, assessment can become meaningless. From these carefully planned assessments comes resulting data. This data is individualized by student, but has overarching implications for classroom practice.

Understanding Instructional Models

Considering the needs of a spectrum of learners helps to support desired equity in the classroom (Van de Walle, et al., 2014). The National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* states, "All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study – and support to learn – mathematics" (NCTM, 2000, p. 12). In addition, the NCTM equity principle states, "Excellence in mathematics education requires equity–high expectations and strong support for all students" (NCTM, 2000, p. 12). Two widely used models of instruction are teacher-directed and student-centered (Van de Walle, Lovin, Karp, & Bay-Williams, 2014). Both of these instructional models claim to produce growth and achievement in early elementary mathematics classrooms. This chapter focuses on the novel instructional model of Intentional Grouping (IG), which uses a blend of these strategies. In IG based classrooms, the teacher purposefully groups students based on data, and instructs the students in a small-group setting based on their learning needs using a blend of both teacher-directed and student-centered instructional strategies (see Figure 1).

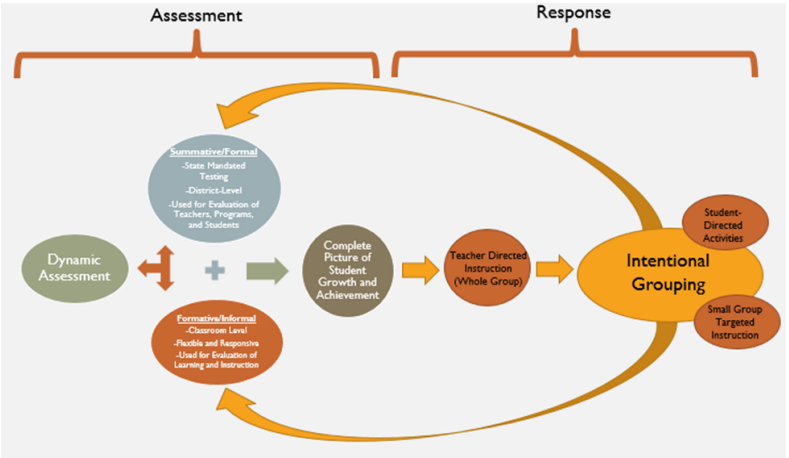

Figure 1: *Flow of Assessment and Response in an IG Classroom*

Accumulating evidence suggests that assessment-informed personalized instruction, tailored to students' individual skills and abilities, is more effective than more one-size-fits-all approaches (Connor, et al., 2018). In accordance with this evidence that every child learns differently; and brings different skills to the classroom, education has shifted from the notion of using tests primarily as a mechanism for sorting and grading students, to using assessment for informing instruction, e.g., gathering data about what students know prior to beginning instruction, gathering data formatively during instruction and to adjust instruction and reteach when necessary to help ensure that all students can be successful in the end (Saphier, Haley-Speca & Gower, 2008). When this type of ongoing and adaptive assessment is put into practice, teachers can discover student needs, and then design instruction to address those needs (Levy, 2008) effectively creating a data-driven and differentiated learning environment for students. This type of learning environment is referred to as a student-centered (Farkas & Maczuga, 2015) and is in stark contrast to a teacher-directed learning environment.

Teacher-directed learning environments consists of teachers presenting definitions and procedures for specific problems, and then having students practice them (Stigler & Hiebert, 1999). It is largely considered an outdated and ineffective instructional practice for students (Brooks, 1993). However, this instructional practice may still hold some merit for some subsets of early elementary learners, when implemented on a learner-specific, as needed basis (Farkas & Maczuga, 2015).

A combination, or hybrid, of these two learning environments, which infuse elements of collaborative, independent, and teacher-directed learning stations are what make up the "Intentional Grouping" (IG) instructional model. The IG instructional model is based on the ideas that student data should be analyzed continuously to identify the student errors that occur most frequently in order to inform whole group (direct) instruction

(Cusumano & Mueller, 2007; Olah, Lawrence, & Riggan, 2010), but also to identify the instructional needs of individual students (Cusumano, et al., 2007; Olah, et al., 2010) in order to plan small group instruction, in a continuous cycle of assessment and response. Thus, the IG Instructional model incorporates elements of both teacher-directed and student-centered instructional strategies (see Figure 2).

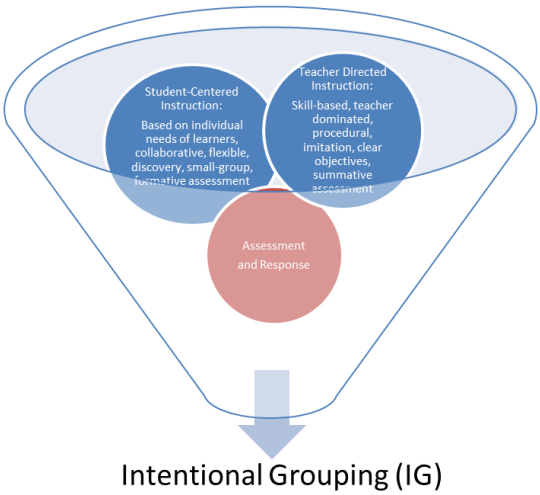

Figure 2: Intentional Grouping (IG) as a Blend of Teacher-Directed and Student-Centered Instructional Strategies

Understanding Professional Development

To support discussion of the IG Instructional Model, and in order for teachers to understand key aspects of the assessment-response cycle, and IG, and implement these aspects, they must engage in professional learning to bridge the gap between theory and practice (Ginsburg, Hyson, Woods & Bredekamp, 2014). This being said, the primary vehicle for teacher professional learning is professional development sessions provided by their district.

Professional development (PD) programs are provided for teachers who are currently in the classroom that focus on changing teacher quality and student achievement (Foster, Toma & Troske, 2013). Professional development is the essential bridge between theory and practice; that is, professional development should help teachers make practical application of the research in their classrooms (Ginsburg, Hyson, Woods & Bredekamp, 2014).

In a 2007 mixed-methods study, presented by Cormas & Barufaldi at the annual meeting of the American Educational Research Association, and later published in a 2011 article in the Journal of Science Teacher Education, Cormas & Barufaldi reported that professional development experiences

that share all or most of the characteristics listed in Table 1, and follow the design framework shown in Figure 3, have positively influenced student achievement and changed curriculum delivery by teachers. Many professional development endeavors have ignored the basic principles, policies, practices, and culture of the school in which the change was to be enacted, and have thus left the core of the culture of the teaching practices unchanged (Cormas & Barufaldi, 2011).

1. Teachers' discipline-specific knowledge is increased
2. Teachers understand how students learn and what are effective teaching strategies within a specific discipline
3. Teachers understand how students learn and what are effective teaching strategies
4. Teacher effectiveness and student achievement outcomes are used to determine whether professional development has worked
5. Requires resources (money and time)
6. Professional development is on-going
7. Professional development occurs in day-to-day contexts of teachers
8. Uses effective teaching strategies
9. Coherent/aligned with school/district/state goals
10. Teachers provide input into professional development design; professional development is engaging and relevant
11. Involves collaboration between teachers and others
12. Generates further collaboration or projects
13. Treats teachers as professionals
14. Promotes teacher self-reflection
15. Uses inquiry as a teaching style
16. Increases teacher ability to meet needs of diverse learners

Table 1: Effective Research-based Characteristics of Professional Development (*Source:* Cormas & Barufaldi (2011))

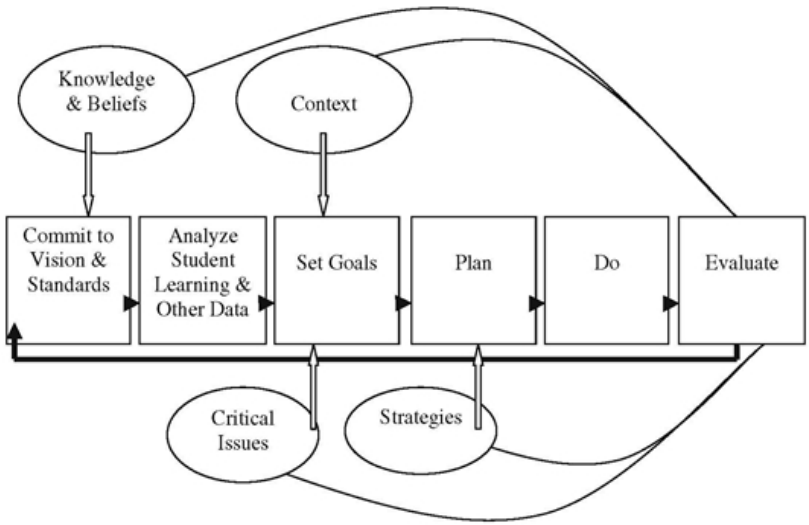

Figure 3: Design Framework for Professional Development in Science and Mathematics (*Source:* Cormas & Barufaldi (2011))

Education reforms of the recent past brought new emphasis to the role of professional development for in-service teachers. These reforms recognized that schools can be no better than the teachers and administrators who work in them (Guskey, 2003). For these reasons, professional development for in-service teachers must be carefully designed and implemented.

A Word about Ineffective Professional Development

There are instances when professional development is not effective, and does not have a positive effect for participants. Teachers frequently feel that their training is not relevant, and does not use their time effectively (Guskey, 2014). A recent study found that even with a large financial investment of almost $20,000 for professional development, per teacher, over the span of 3 years, both teacher practice and student achievement either stayed the same or declined (Darling-Hammond, Hyler, & Gardner, 2017). This is a significant problem facing school districts, administration, and professional development vendors; and highlights the importance of careful consideration of the structure and planning of professional development for in-service teachers.

Why a New Instructional Strategy?

With the implementation of the Common Core State Standards for Mathematics in Pennsylvania, first-grade through fourth-grade (early elementary) students are expected to master concepts that, while more rigorous than in preceding decades, requiring higher-level thinking and problem-solving skills, have been found to be developmentally appropriate (Clements, Fuson, & Sarama, 2017). With students bringing a wide range of abilities and exposure to skills to the mathematics classrooms, it is crucial that teachers use assessment and data in meaningful ways to ensure they are reaching all of their learners at the correct level of difficulty in order to address grade level standards effectively. Student engagement, as well as the strategies that teachers use to ensure that students remain engaged, can be a central predictor in accounting for student achievement (Fredricks, Blumenfeld, & Paris, 2004; Greenwood, Horton, & Utley, 2002). Many instructional strategies and models exist that claim to produce high achievement and growth in elementary students. However, the published research remains sparse and not definitive, especially in early elementary classrooms, with no instructional strategy or model rising to the top.

Previous investigations in mathematics (Desimone &Long, 2010; Guarino et al., 2013; Le et al., 2006; Palardy & Rumberger, 2008) have observed associations between classroom teachers' instructional practices and students' academic achievement (Farkas & Maczuga, 2015). In their 2015 longitudinal study of early elementary student's mathematics achievement, Farkas & Maczuga reported that consistent patterns could be observed in the estimated effects of teacher-driven versus student-centered activities. Additionally, Gump (1969) found greater student involvement during large-group instructional activities, when the teacher was presenting the work, as compared to independent seatwork.

The remainder of this chapter presents and discusses the findings of a research study into the extent to which teachers' content knowledge, buy-in, and instructional practices changed during and after participating in a professional development series focused on the IG instructional model. This chapter also provides valuable data and opportunities for further research on the effects of these IG practices when implemented in early elementary mathematics classrooms. These data and discussion will help to guide teachers' instructional practices, as well as make meaningful adjustments to their classroom environments in order to serve their students more effectively, while also informing school districts of the characteristics of effective professional development series.

The Study

The study detailed here investigated the instructional model of Instructional Grouping (IG), and the effectiveness of a professional development series provided for teachers in several areas: content knowledge, buy-in, and application. In order for teachers to understand key aspects of the assessment-response cycle, and IG, and implement these aspects, they must engage in professional learning that is relevant and ongoing. This study examined the extent of application, change in beliefs ("buy-in"), and retention of knowledge for participants who engaged in a professional learning series on the instructional strategy of "Intentional Grouping" (IG), provided by their district. The professional learning series included information on best practices in elementary mathematics assessment and instruction, and the assessment-response cycle. The professional learning series was offered exclusively online, through ZOOM and Google Classroom, due to COVID-19 restrictions.

This quantitative study used several survey and assessment instruments (detailed in the Tables and Figures included later in this chapter) to explore the extent of effectiveness of the professional development series, as well as any correlations that existed between study variables. The descriptive statistics performed for each assessment and survey revealed increases in all areas of teacher knowledge, buy-in, and application, with large effect sizes for each.

The Participant Group

Participant teachers selected for inclusion in this study met all criteria set forth by the study, i.e. were employed at the study site for the duration of the study, taught mathematics for at least 60 minutes daily in grades one through four (see Table 2). Eleven teachers were invited to participate, and eleven teachers participated in the study, which represents a 100% response rate.

Grade Level Taught	Gender	Years of Teaching Experience	Avg. Yrs. Experience per Grade Level
1	male	9	13
1	female	17	
1	female	13	
2	male	24	17.3
2	female	13	
2	female	15	
3	female	18	15
3	female	12	
4	female	25	17.3
4	female	4	
4	female	23	

Table 2: Demographic Breakdown of Study Participant Group

The participant group represented a collective 173 years of experience in education, with the average years of experience calculated as 15.7. The highest average years of teaching experience were recorded in grades two and four, with an average of 17.3 years. Grades one and three each had an average of 13 and 15 years, respectively. Teachers, who spend their entire careers in education, at the participating site, have an expected average teaching career of 30 – 35 years, and are considered to be "mid-career" at years 15-17. Within the participant group, three teachers fell into the "mid-career" span, while the other teachers, outside of this range in either direction, could be considered "early" or "late" in their careers.

Answers, Insights, and Implications

Exploring the Extent of Application

A foundational question guiding this study addressed the extent to which teachers applied IG instructional strategies, as measured by a self-assessment of classroom practices. This self-assessment was administered once before the start of the professional development series, and then again when the series concluded. Participants were asked to rate themselves, using a 7-point Likert-type scale, as to the degrees that they incorporated (or anticipated incorporating) the IG instructional strategies, with responses ranging from "not at all" to "all the time." The self-assessment was broken into three areas of

instructional practice: management, instructional delivery, and engagement. Within these categories, participants showed the most growth in instructional practice within management and instructional delivery, as is evidenced by responses to three of the survey questions (see Tables 3 and 4).

	Pre-	Post-		
Survey Question	Mean Score	SD	Mean Score	SD
1. [Students are/I anticipate students will be] working in small guided groups	3.5	1.753	4.5	.820
2. Tasks and activities for small groups [are/will be] clearly explained (orally or written)	4.3	1.489	4.7	.905
3. Students [demonstrate/will demonstrate] knowledge of procedures	5.9	.539	6.1	.302
4. Instruction [is/will be] delivered based on student need (informed by data)	3.6	.809	4.5	.688
5. Teacher [is/will be] responsive to students' academic needs during instructional delivery	4.5	.522	5.3	.467
6. Students [are/will be] immersed in the activity/lesson/instruction	4.4	.809	4.7*	.786*
7. Students [are/will be] given appropriate scaffolds when/if needed	5.9	.701	6.1	.539

Table 3: *Self-Assessment of Practice: Mean Scores, SD (pre/post)*
Note (i): Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time.
Note (ii): Significance determined by ANOVA in SPSS, *p<0.05.

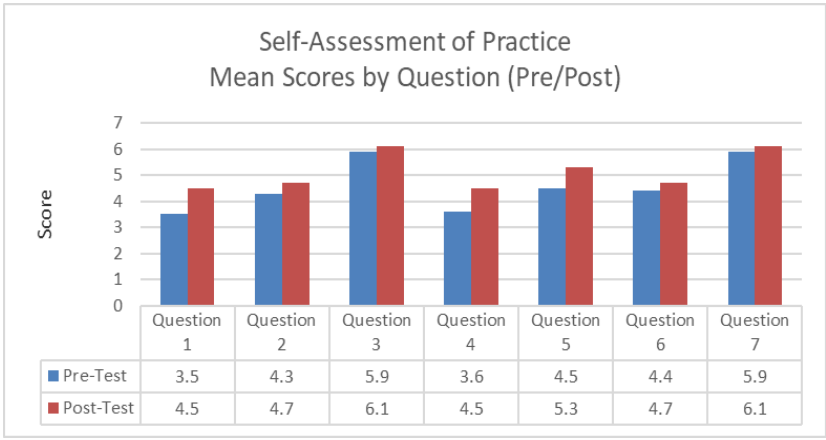

Figure 4: *Self-Assessment of Practice, Mean Scores by Question (pre/post)*
Note: Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time

It is important to note that the largest overall "growth" in mean response was exhibited on Questions 1, 4, and 5; and that all responses indicated growth in practice for every participant. These data indicate a positive response, or reaction, to the treatment. The results of this survey indicate that the professional development series was successful in increasing teacher application of best-practices introduced by the professional development series.

Management

In response to the survey question, "students are working in small guided groups," the mean for participant responses on the pre-assessment was 3.5, which correlates to "rarely" on the 7-point Likert-type scale. The post-assessment revealed that the mean of participant responses rose to 4.5, which correlates to "occasionally." Managing instruction in small groups, within an IG classroom is a foundational competency in the assessment-response cycle for teachers to master. Focusing on classroom organization and behavior is necessary for all students, in order to effectively serve classrooms with increasingly academically diverse populations (Oliver & Reschly, 2007).

The professional development series appears to have been effective in raising the overall application level of IG-Based instructional competencies, pertaining to management strategies. Classroom management strategies were explicitly taught in the final professional development session, only after teachers had been exposed to IG theory, associated assessment practices, and best instructional practices. Participants may have benefitted more if classroom management were addressed throughout the professional development series.

Instructional delivery

In response to the survey question, "instruction is delivered based on student need (informed by data)," the mean for participant responses on the pre-assessment was 3.64, which correlates to a "rarely" on the 7-point Likert-type scale. The mean for participant responses rose to 4.5 on the post-assessment. This score correlates to "occasionally," and signifies growth of practice in this area. In addition, in response to the survey question, "teacher is responsive to students' academic needs during instructional delivery," the mean for participant responses rose by .7 points on the 7-point Likert-type scale, which indicated an increase in responsiveness to student academic needs from "occasionally" to "often."

Participants' self-reported growth in this area indicate that IG concepts presented during professional development sessions had a positive impact on teacher instructional practices. Overall, mean growth was observed across all areas of the self-assessment, indicating that the professional development series was successful in increasing teacher application of IG strategies. Application of IG instructional strategies may differ in practice, when observed by a school-based administrator. Studies have shown that teacher application of strategies in the classroom differ from self-reported behavior (Reddy, et al., 2015; Debnam, et al., 2015). This idea is further discussed later in the chapter as a possibility for future research.

Exploring Teacher Beliefs and Buy-in

Further guiding the study was the question that addressed the extent to which teacher buy-in to the IG strategy changed as measured by the Teacher Beliefs about Mathematics Instruction survey. This survey was administered twice during the study, once before the professional development series began, and then again when the series had concluded. Foundational to this study, and to the IG instructional strategy, is buy-in to the productive beliefs for mathematical instruction outlined by the NCTM (2014) (see Table 4).

Unproductive Beliefs	**Productive Beliefs**
Mathematics learning should focus on practicing procedures and memorizing basic number combinations.	Mathematics learning should focus ondeveloping an understanding of concepts and procedures through problem solving, reasoning, and discourse.
All students need to learn and use the same standard computational algorithms and the same prescribed methods to solve algebraic problems.	All students need to have a range of strategies and approaches from which to choose In solving problems, including but not limited to, general methods, standard algorithms and procedures.
Students can learn to apply mathematics only after they have mastered the basic skills.	Students can learn mathematics through exploring and solving contextual and mathematical problems.
The role of the teacher Is too tell students exactly what definitions, formulae, rules they should know and demonstrate how to use this information to solve mathematics problems.	The role of the teacher Is to engage students In tasks that promote reasoning and problem solving and facilitates discourse that moves students toward shared understanding of mathematics.
The role of the student is to memorize information that is presented and then use it to solve routine problems on homework, quizzes, and tests.	The role of the student is to be actively involved In making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts and experiences and considering the reasoning of others.
An effective teacher makes the mathematics easy for students by guiding them step-by-step through problem-solving and be sure that they are not frustrated or confused.	An effect of teacher provides students with appropriate challenges,encourage perseverance in solving problems, and supports productive struggle in learning mathematics.

Table 4: Beliefs about Teaching and Learning Mathematics
Note: Source-Principles to Action: Ensuring Mathematics Success for All (NCTM, 2014, p. 11)

Teachers were asked to rate their level of alignment with these beliefs on a seven point Likert-type scale, both before and after participating in the professional development series. When analyzing the responses from the surveys, the most significant growth in beliefs, and therefore buy-in, was observed in two areas: collecting data to inform instruction, and facilitating purposeful mathematical discussions (see Table 5 and Figure 5).

	Pre-	**Post-**		
Survey Questions	**Mean Score**	**SD**	**Mean Score**	**SD**
1. To be good at mathematics at school, how important do you think it is for students to…				
a. remember formulas and procedures	5.55	1.214	4.64*	1.433*
b. think in a sequential manner	5.91	1.30	6.27	.905
c. understand mathematical concepts, principles, and strategies	5.82*	.874*	6.36	.809
d. be able to think creatively	5.36	1.362	6.18	1.168
e. understand how mathematics is used in the real-world	6.64	.674	7.00	.000
f. be able to provide reasons to support their solutions	4.82	1.328	5.73	1.009
2. To be an effective mathematics teacher, how important do you think it is for teachers to…				
g. have an understanding of their students	7.00	.000	7.00	.000
h. collect data from assessments to inform instruction	4.55	1.036	6.64	.505
i. tell students exactly what they need to know in order to solve problems in a systematic manner	4.36*	1.286*	3.64	1.206
j. hold the belief that all children can learn mathematics	7.00	.000	7.00	.000
k. provide a numeracy rich environment that promotes mathematical learning	6.64	.505	6.91	.302
l. approach the teaching and learning of mathematics as a constructive process	4.91	1.044	5.45	.934
m. hold the belief that learning at its best is a social process	5.09	.944	6.09	.701
n. hold students responsible for their learning	5.82	.982	6.09	.944
o. facilitate purposeful conversations around mathematics	3.18	1.328	5.36	.924

Table 5: Teacher Beliefs survey: Mean Scores, SD (pre/post)
Note (i): Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time.
Note (ii): Significance determined by ANOVA in SPSS, *p<0.05

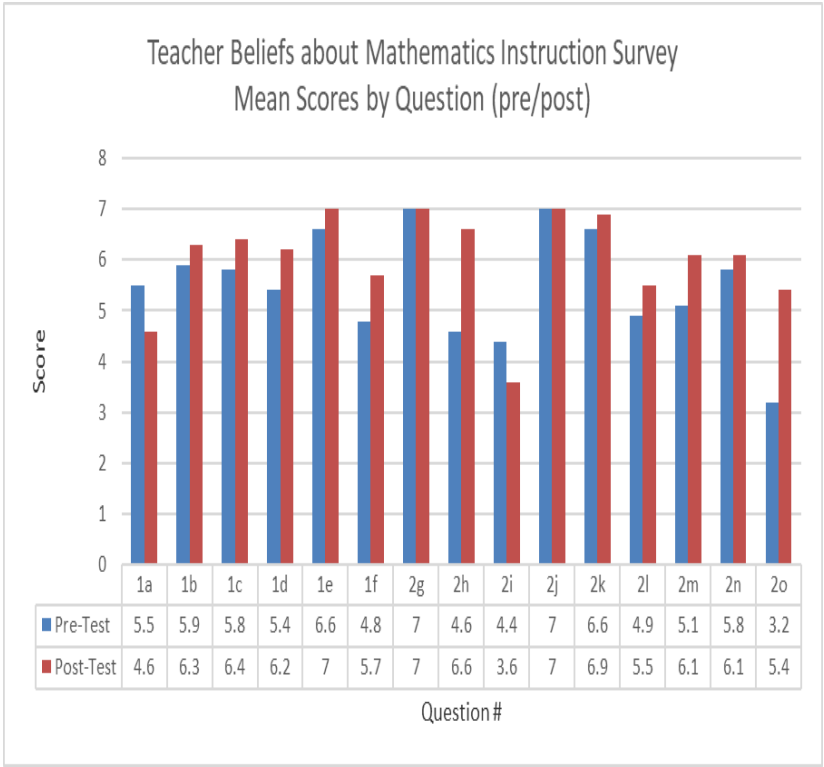

Figure 5: *Teacher Beliefs survey: Mean Scores (pre/post)*
Note: Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time

As is indicated in Figure 5, there was an overall positive effect in teachers' beliefs about the teaching and learning of mathematics, and thus "buy-in" to the IG instructional strategy. Two questions indicated an overall mean difference of zero between the pre- and post- assessment. This lack of change on questions, "2g" and "2j," was due to the fact that both of these questions were rated as a "7" on the Likert-type scale by participants on both the pre- and post- assessments.

Also, of note are the responses to questions "1a" and 2i." While the responses to these questions seem to indicate a negative change, the change in a "negative" direction, actually indicates a growth in beliefs and practice. These questions asked participants to rate the importance of students "remembering formulas and procedures," and teachers "telling students exactly what they need to know in order to solve problems in a systematic manner." For these two questions, movement towards the lower end of the Likert-type scale indicates growth in teacher beliefs. The results of this assessment indicate that the professional development series was successful in increasing the productive mathematical beliefs and buy-in of participants.

Collecting data to inform instruction

The IG instructional strategy incorporates multiple assessments, and uses the data to inform "just right" instruction for students, resulting in a differentiated and personalized learning experience. In order to purposefully group students for instruction, the teacher must assess the strengths and needs for each student, and then act on the data. Without a strong foundation in assessment, and a belief that purposefully using data to inform instruction is necessary, teachers will not find success using the IG instructional model.

When participants were asked to rate their level of belief in the statement, "To be an effective mathematics teacher, how important do you think it is for teachers to collect data to inform instruction," (on a 7-point Likert-type scale) before the professional development series, the mean response was 4.6, which indicates a neutral level of importance, or belief in the concept. After the professional development series, the mean response was 6.64, which indicates that participants, through a better understanding of assessment, placed more importance on the role of assessment in the instructional process. This shift in beliefs is significant as teachers move forward with the personalization of mathematics instruction.

Because of the integral role assessment plays in the IG strategy, the professional development series offered sessions that included the role of assessments, and the use of data, in every session, with the exception of the final session. The emphasis placed on this topic may have played a role in the significant shift in teacher mindset, beliefs, and buy-in associated with assessment.

Facilitating purposeful mathematical discussions

The NCTM standards for mathematical practice state that students should be able to construct viable arguments and critique the reasoning of others (NCTM, 2015), thus bringing to the forefront the importance of student and teacher discussions in the mathematics classroom. When grouping students in an IG classroom, students must be able to engage their peers in mathematical discussions. Teachers must be prepared to guide and spur discussions within the classroom environment. Without a firm belief in the importance of mathematical discussion, the IG instructional strategy has the potential to fall back into a teacher-led model of instruction.

Before the professional development series, participants were asked to rate the level of importance the statement, "To be an effective mathematics teacher, how important do you think it is for teachers to facilitate purposeful conversations around mathematics." The mean response from the participant group was 3.18. On the 7-point Likert-type scale, this mean response indicates a low level of importance. After the professional development series, the mean response was 5.36, which correlates to a "two level" increase of importance on the scale. This increase is significant. Even though the professional development series did not emphasize this productive mathematical belief more or less than any other, the participant group showed immense growth in this area. However, the increase in teacher "buy-in" in this area may have been due to the fact that this area was rated the lowest on the pre-assessment, and therefore had the most room for growth.

Exploring Retention of Knowledge

The final guiding question for this study addressed the extent to which teachers retained knowledge of concepts presented during the IG professional development series. Retention of knowledge was measured by the IG-Based Knowledge assessment, which was given once before the professional development series began, and then again following the final session. One hundred percent of the participants increase their score on the knowledge assessment, indicating that the concepts presented were retained through the duration of the series. While this increase was expected, the researcher anticipated that all participants would have scored consistently higher on the post-assessment. The mean score on the post-assessment was a 15.8, out of a possible 17 points, which correlates to a 93% accuracy rate. The researcher expected a mean post-assessment score of 16.15, which correlates to a 95% accuracy rate. The participant group improved performance on the assessment by an average of 5.3 points, which signifies a mean increase of 3.1% across the participant group (see Table 6 and Figure 6).

IG-Based Content Knowledge Assessment: Scores (pre/post)			
Participant	**Pre-Test Score**	**Post-Test Score**	**Change**
1-Green	10	17	+7.00
1-Blue	14	17	+3.00
1-Red	9	15	+6.00
2-Yellow	10	15	+5.00
2-Orange	8	15	+7.00
2-Magenta	8	13	+5.00
3-Purple	10	17	+7.00
3-Black	12	16	+4.00
4-White	13	17	+4.00
4-Beige	13	17	+4.00
4-Pink	9	15	+6.00

Table 6: Summary of Scores by Participant, IG-based Content Knowledge Assessment
Note: Highest possible score is 17.

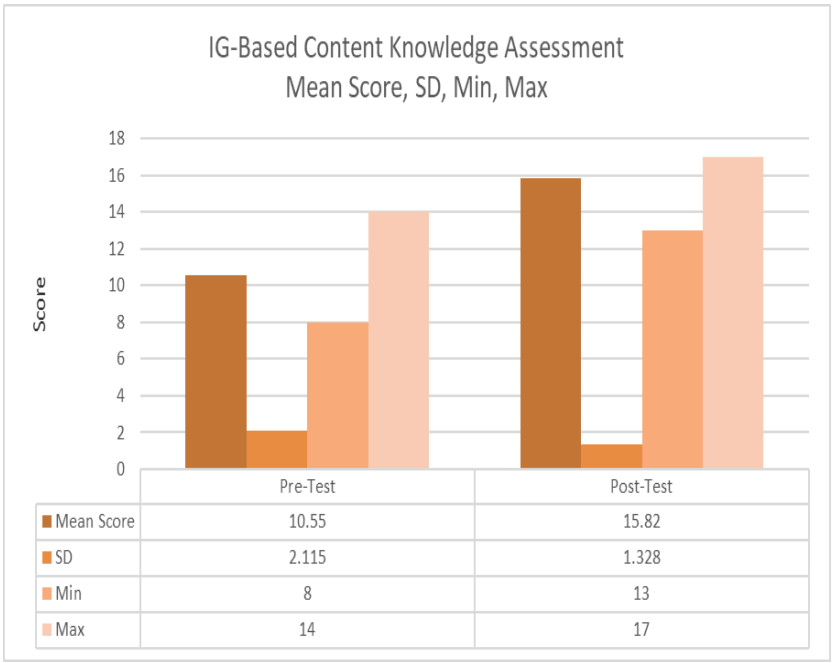

Figure 6: Mean Scores, SD, Min, and Max for the IG-Based Content Knowledge Assessment

The most significant gains in assessment score were attained by three participants: 1-Green, 2-Orange, and 3-purple; each with a 7-point increase from the pre- to the post-assessment. Every participant showed an increase in their score on the post-assessment, indicating that there was an increase in their overall knowledge, and retention of concepts presented by the professional development series. These data indicate a positive response, or reaction, to the treatment. The results of this survey indicate that the professional development series was successful in increasing teacher knowledge of best-practices introduced by the professional development series, and fostering retention of that knowledge throughout the duration of the treatment.

The post-assessment was given immediately following the final professional development session in the series, which may have contributed to the high rate of improvement, since participants had newly learned the concepts, and did not have time to "forget" what they had learned. There is a possibility that participants may not retain the knowledge over an extended period of time. This possibility will be further explored later in the chapter as a topic for further research.

A Discussion of Effect Size

To calculate the effect size, or Cohen's *d*, for each of the assessments and surveys discussed in the previous sections, the researcher used the following formula (see Figure 7).

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s_{pooled}}$$

where

$$s_{pooled} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Figure 7*: Formula for effect size calculation, Cohen's d*

A pooled standard deviation was used in order to account for the variance in the standard deviation for each sample. The results are detailed here:

1. Analysis of the Self-Assessment of Practice, yielded an overall effect size of d=1.499, which is considered to be large. From this analysis, the researcher was able to conclude that a significant positive effect was observed on teacher practice, in terms of self-assessment by participants, after participating in the professional development series.
2. Analysis of the Teacher Beliefs about Mathematics survey, yielded an overall effect size of d=1.839, which is considered to be large. From this analysis, the researcher was able to conclude that a significant positive effect was observed on teacher beliefs and buy-in, in terms of self-assessment by participants, after participating in the professional development series.
3. Analysis of the IG-Based Content Knowledge assessment, yielded an overall effect size of d= 2.986, which is considered to be large. From this analysis, the researcher was able to conclude that a significant positive effect was observed on teacher content knowledge after participating in the professional development series.

Exploring the Impact of Participants' Propensity to Trust

The Propensity to Trust survey was included in the study to assess a participant's trusting nature, as it has been used in previous studies (McKnight, Kacmar & Choudhury, 2004), in order to assess the participants' relationship and ability to trust a person, in this case the professional development facilitator. The propensity to trust was also included in this study to analyze any correlation that may exist between a participant's propensity to trust and the other study variables. Table 7 and Figure 8 provide a summary of scores by question for the Propensity to Trust survey, given to participants one time before the professional development series began.

Survey Questions	Mean Score	SD
1. I usually trust people until they give me a reason not to trust them.	4.00	1.265
2. I generally give people the benefit of the doubt when I first meet them.	4.727	1.421
3. My typical approach is to trust new acquaintances until they prove I should not trust them.	4.182	1.25

Table 7: *Mean Scores, SD for the Propensity to Trust Survey*
Note: Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time

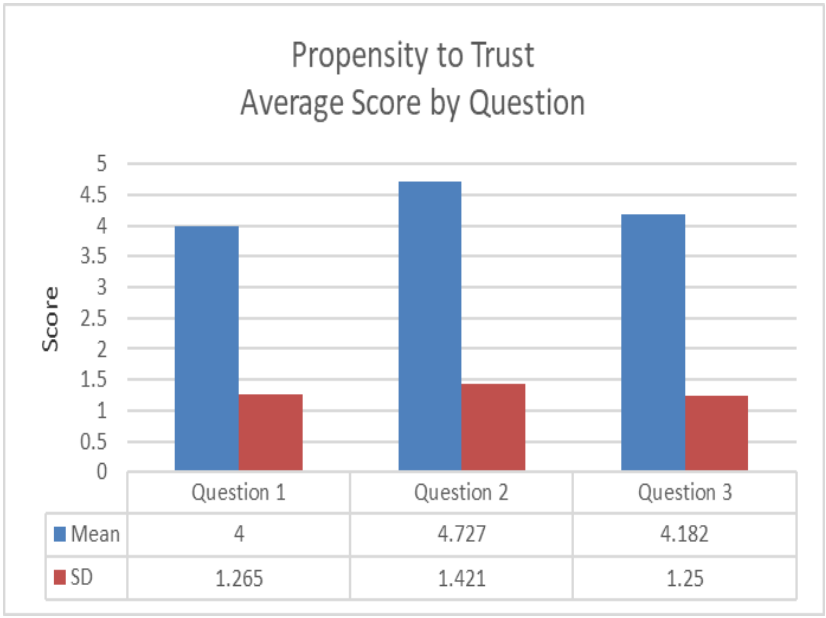

Figure 8: Mean scores, SD for the Propensity to Trust Survey
Note: Responses reported on a 7-point Likert-type scale (1) Never, (7) All the Time

Through descriptive and analytic statistics performed on the sample, no significant correlations were found to exist between a participant's propensity to trust, in this case the professional development presenters, and their change in score on the other surveys and assessments that were administered as part of this study. The researcher expected to find a strong positive correlation between a participant's level of trust and their increase content

knowledge, beliefs, and buy-in. After analysis using Pearson's correlation to analyze the study results, no statistically significant relationship was found.

Exploring Possible Correlations

Digging deeper into the study data, the researcher sought to explore the following correlations:

a) The correlation that may occur between participants' propensity to trust, and the change in participants' score (pre/post) on the IG-Based Content Knowledge Test.

b) The correlation that may occur between the change in participants' score (pre/post) on the IG-Based Content Knowledge Test and the change in score (pre/post) on the Teacher Beliefs about Mathematics Instruction survey.

c) (c) The correlation that may occur between participants' change in score (pre/post) on the Self-Assessment of Practice survey and the change in score (pre/post) on the IG-Based Content Knowledge assessment.

Pearson correlation analyses were completed using SPSS software to explore the correlations outlined and to measure the strength of association between two variables (Creswell, 2015). Data were analyzed using the two-tailed test model to measure for statistically significant correlations at both the 0.05 and 0.01 level. Although small correlations were discovered between the variables, no statistically significant correlations were found when testing at both the 0.05 and 0.01 levels (see Table 8).

	Results	
Survey/Assessment Correlation Investigated	**Pearson Correlation**	**Significance (2-tailed)**
(a) The correlation that may occur between participants' propensity to trust, and the change in participants' score (pre/post) on the IG-Based Content Knowledge Test.	-.235	.486
(b) The correlation that may occur between the change in participants' score (pre/post) on the IG-Based Content Knowledge Test and the change in score (pre/post) on the Teacher Beliefs about Mathematics Instruction survey.	-.048	.890
(c) The correlation that may occur between participants' change in score (pre/post) on the Self-Assessment of Practice survey and the change in score (pre/post) on the IG-Based Content Knowledge assessment.	.288	.391

Table 8: Summary of Pearson Correlation and Significance (2-tailed)
Note: Correlation determined by Pearson correlational analysis, SPSS.
*$p < 0.05$, **$p<0.01$

Implications and Recommendations

The findings from the quantitative study outlined in previous sections, demonstrate that a statistically significant increase (as measured by effect size) in teacher instructional practices, buy-in, and content knowledge occurred after participating in a professional development series on the IG instructional model. The study followed quasi-experimental framework, in which all participants benefitted from the treatment, in this case, the professional development series. Extent of change was measured by pre- and post-assessments and surveys administered uniformly to all participants before and after the treatment.

An attempt to draw conclusions from possible correlations between a participant's propensity to trust and the amount of growth or increase in knowledge of a participant, did not yield any statistically significant correlations, but has opened up possibilities for future research. The following sections outline implications and recommendations for practice and future research as a result of this study.

Implications for Practice

Teaching mathematics in the early (first through fourth grade) elementary grades presents unique challenges to educators. Teachers at this level are tasked with meeting the needs of a myriad of learners, all within one classroom. In order to be effective in the instructional delivery and teaching of mathematics to this population, teachers need to have an understanding of themselves as mathematics educators, and the knowledge to implement effective instructional practices. This self-awareness and content knowledge can be supported by professional development that is targeted, relevant, and ongoing. The study discussed in this chapter produced several implications for practice including modes of professional development, flexibility of teacher beliefs, and teacher education programs.

Modes of professional development

When analyzing the effect size of the professional development series through each of the questions guiding this study, a positive effect was observed in each area. The professional development series offered through this study, due to the COVID-19 pandemic, was offered exclusively online, through the online platforms, ZOOM and Google Classroom. Moving forward, professional development delivered in this manner may be an effective tool for school districts to consider when trying to meet the needs of their teachers. In addition, this mode of professional development has proven to be an effective way of delivering information and instruction in the midst of social-distancing guidelines, when options for face-to-face learning are not available.

Flexibility of teacher beliefs

When examining the data from the pre- and post-Teacher Beliefs about Mathematics Instruction survey, participants' beliefs showed flexibility, as evidenced by the change in pre- and post- survey scores. This change indicates

that teacher beliefs about mathematics education, and therefore buy-in, can be influenced by professional development in targeted areas. Continued in-service education for teachers has the power to influence teacher beliefs and perceptions, and in turn, make them more willing to adjust their instructional practices when new initiatives are introduced.

Teacher education programs

Pre-service and in-service teacher education programs (including college/ university level teacher education programs) are the primary vehicle for delivering teacher education. Most perspective teachers and those already serving as teachers, engage in these programs to further their knowledge, learn about best practices, and further their careers in education. As was evidenced by the low pre-assessment scores of participants, teacher education programs may be lacking in their delivery of the most recent best-practices in instruction, specifically mathematics instruction. School districts may want to consider the implementation of annual best-practices in education updates and education programs, in order to keep teachers apprised of the most recent research and instructional delivery methods and beliefs about teaching and learning.

Recommendations for Future Research

Two topics for future research emerged from the study: degree of application of the IG-based instructional strategy, and retention of knowledge over an extended period of time. This study was limited in its scope in terms of time, as well as access. This study took place during the COVID-19 global pandemic, which did not allow for the researcher to observe classroom instruction to assess the degree to which teachers applied the IG-based instructional strategies. The study was also limited in time, occurring over a time period of one month, which did not allow for the assessment of longer-term retention of knowledge.

Degree of application

Teacher application of the IG-based instructional strategy in the classroom was self-reported by participants. In order to gauge the true level of application in the elementary mathematics classroom, live observations of participants in their classrooms is needed. To truly assess the level of application of IG instructional techniques, observations should be targeted and unscheduled, on a drop-in basis, in order to gain an accurate picture of the level of application of the strategy.

Retention of knowledge

The IG-based knowledge assessment gauged teacher changes in knowledge after the professional development series, specifically the retention of concepts presented. The post-assessment was given immediately after the participants completed the professional development series. In order to gauge the long-term impact of the professional development series on participant knowledge, further assessment is needed over an extended period of time.

Author's Commentary

A large part of my current position as the Curriculum Supervisor for Math and Science, K-12, for an expansive school district in the United States entails researching, designing, and implementing curriculum, instruction, and assessment for our approximately 7,000 students; and designing and implementing professional development for teachers. My daily work in this area has driven me to be reflective on the locally designed and implemented instructional models, and professional development for developing these models in the classroom, provided for our district's teachers. My work has also left me wondering if the professional development we provide has a statistically significant effect on teacher content knowledge, buy-in, and application. In addition to this professional interest in K-12 mathematics instruction, assessment, and professional development. I also am personally invested in this topic as I watch my five children attend school, engage with curriculum, and navigate various instructional environments.

Effect of the COVID-19 Pandemic

This study, and the writing of this chapter, occurred during an unprecedented time in education. In March of 2020, school districts across the world were forced to shut-down all in-person instruction due to the COVID-19 pandemic. Learning as we knew it ended abruptly, and education at all levels changed overnight. The site where this study took place was no different. This brick-and-mortar institution transitioned all aspects of its teaching and learning to online formats. This included professional development for teachers, and thus, the professional development series offered by this study. The participant group made this transition well, though many participants were noticeably under higher amounts of stress due to family obligations, work obligations, and obligations to the study. The participant group contained several teachers who were also parents of school-aged children. Therefore, participants were faced with teaching online to their school students, but also teaching at home to their own children. This new balance of work, family, and school was a topic for discussion at the beginning of many of the professional development sessions. The COVID-19 pandemic forced all of us in K-12 and higher education to take a step back and seriously consider what was working, what wasn't working, and what could surface as creative possibilities for instruction. The pandemic, though tragic in so many ways, may have helped to open the minds of the participants and researcher alike, to the world of possibilities for education that have yet to be explored. The inherent creativity of educators and administrators helped to conquer the pandemic, and will surely be a time-period in history that will be studied by future researchers and scholars. We must continue to adapt, foster flexibility of thought, and practice a growth mindset to rise to this challenge, and those challenges that are sure to present themselves in the future.

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CHAPTER ELEVEN

COMPOSING WITH CHILDREN: CULTIVATING CREATIVITY, CONNECTIONS, AND COMMUNITY

DEBBI PONELLA

Abstract

Despite evidence verifying the value of music composition and inclusion in National Standards, it remains one of the most common concepts omitted by music educators. This chapter analyzes fundamental issues that influence inclusion or omission of music composition in the classroom, as well as strategies for incorporation through innovative methods utilizing resources existing in individuals, families, schools, and communities. Research results are derived from thirteen years of developing Kids Compose, a program that provides classroom instruction to students, training for educators, and facilitates competitions and workshops using music composition as a vehicle for developing individual and collaborative creativity while building community. Additional investigations included one-on-one interviews with students, parents, teachers, and professional composers, as well as observations of, and surveys conducted with, music teachers. Evidence indicates that music composition is a continuum that can occur at varying ages to facilitate individual and group creativity, provide an opportunity for discovery of creative possibilities and identity, and encourage intergenerational and multidisciplinary collaboration.

Keywords: music composition, music education, arts education, creativity, sustainable development, Kids Compose

Introduction

Music composition is included in the National Standards for instruction of K-8th graders by the National Association for Music Educators (NAfME, 2014). Despite evidence verifying the value of music composition in the curriculum, it remains one of the most common concepts omitted by music educators. Reasons for omission stated by music teachers include lack of time, teachers uncomfortable with composition, and a presumed lack of interest by students. I believe that music and creativity, as well as their intersection with music composition, is inherent in all humans and is ultimately either cultivated or squelched. This article follows the journey of developing a program for over thirteen years and culminates with results for students, music teachers, com-

posers, musicians, and the surrounding community. Aspects discussed include: the existing struggle to include music composition in curricula, the institution of a music composition competition including fourteen local schools and the local university, analysis of support desired and effectiveness for music teachers, addition of workshops and other programs supplementing the competition, the long-term value of music composition for individuals and community, and the possibility of expanding the program to other locations.

The Composition Conundrum

As stated above, music composition is a National Standard according to NAfME. Therefore, it was surprising when approximately fifteen years ago I spoke with a friend who is a music educator and learned that they and many of their colleagues avoid the subject. Having been a private music teacher for a decade and a half (and with three kids of my own,) my experience was that music composition happens organically—a valuable tool for learning an instrument, how to express musical ideas, and even reinforce music theory concepts; as for my own children, we could hardly read a poem or look at a work of art without heading to the piano to set it to music. Music composition was a natural extension of experiencing life.

The hesitancy expressed in that first conversation was repeated consistently when speaking with other music educators. I was informed in various ways that just as math teachers may not finish the entire textbook, music composition was put off to the end and often entirely eliminated. When I asked questions, some people became defensive and others awkwardly expressed feeling unable to broach the subject with an overfilled classroom of students, but most were resigned to the fact that it did not work and was less important than many other concepts they needed to cover. There was not enough time, no incentive, and no curriculum or model that seemed accessible.

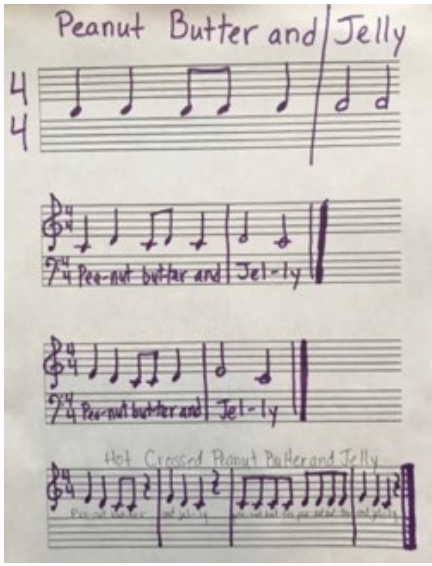
Classroom Strategies

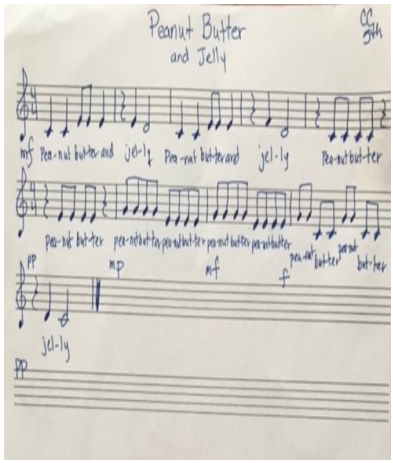
So how does a music teacher with large classes, limited in both time and resources, inspire children to find their creative voice? How can they facilitate the development of compositional skills and help children find a unique path for expressing the music inside of them in the form of a melody? “Inspiration may come from anywhere: moonlight or mathematics; birdsong or Mozart; politics or love” (Adolphe, p. 376, 2019). Though there are many possible approaches to music composition, the challenge is finding what works in a classroom with a diverse group of children. One strategy is to introduce a variety of compositional styles from day one as a collaborative class activity without making it a separate (and sometimes intimidating or overwhelming) concept. If composition is a part of the various materials taught throughout the year, when approached as its own subject, students will already have a toolbox full of compositional techniques awaiting their choice for further exploring on their own.

Pedagogical practices

Institute a quote of the day and have different students say it in various ways to start the class, with the class echoing. Students may make silly sounds, speaking way up high or way down low; variety in pitch gives the opportunity to discuss register—high and low. If a student does something interesting with rhythm, play with it. Make it a rap. String a few of the versions together. The result is collaborative composition—a class melody to start the day, taking limited time, and reinforcing basic music skills through composition techniques. The focus can be on general skills or any skill to reinforce a lesson plan.

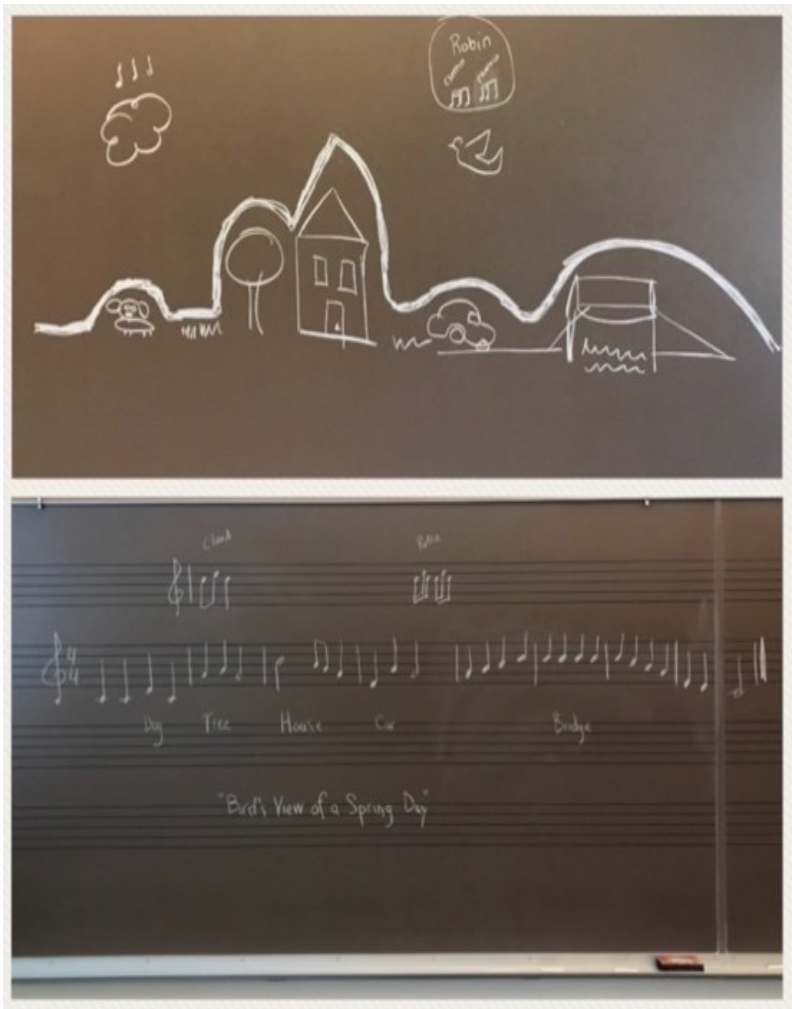
Ask students what they had for lunch. Often an answer is "peanut butter and jelly." Repeat it back to them. Imitate the way they say it. Have them repeat it, then get creative. Depending on the age of the students, experimenting may involve different rhythms, dynamics, or pitch. For older students, make it polyrhythmic, add accents, or syncopation; repeat words or parts of a phrase. Have students take turns adding their own flair; put a melody to it. Let this activity continue as long as there is time and as long as the idea is expanding and growing.





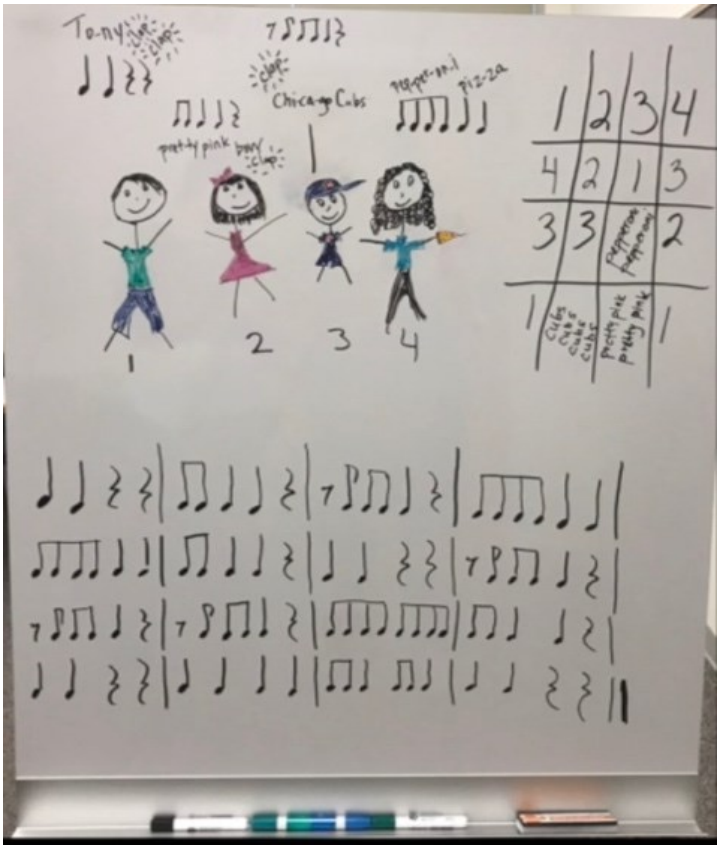
Second and fifth grade class compositions inspired by "Peanut Butter and Jelly"

Have students contribute to a drawing on the board, then vocalize in a way that follows the contour of the picture.



Collaborative contour-inspired composition by a homeschool group of students in third and fourth grades.

Pick a student and choose a four-beat phrase for the student to represent. It can be their name, a logo on their shirt, their favorite color or food or sport. Inspiration can come from anywhere. Do the same with a few other students. Next, have the students stand in the front of the class in a random order. As a class, repeat all of their phrases in the order in which they are standing. Have them switch places as chosen by other students. Should one of the phrases repeat? If so, the student will quickly have to move in time to be repeated. The phrases may be just rhythmic or incorporate a melody.



Example of students representing four-beat phrases combined to create a collaborative rhythmic piece.

There are many ways in which to incorporate music composition; a plethora of new ways are discovered through the exploration with students. It can be a natural, everyday experience. If favorite "hits" are recorded throughout the school year, create a "Top Ten" to enjoy at the beginning of the music composition unit. That gives the opportunity for a "Remember when…" situation, and as the kids start consciously composing, they will realize they have been doing it all along. Since the various ways to approach music composition have been introduced gradually, it is less likely to be overwhelming for the teacher or the student.

Once in classrooms and experimenting with these and other techniques, I was increasingly convinced of the value of music composition as an educational tool. I spoke with Ruth Boshkoff, a classroom music teacher for twenty years and prolific composer. After contemplating ways to support and encourage music teachers in making music composition assessible for teach-

ers and relevant for students, we ultimately introduced *Kids Compose*; a program evolving over the years to include a competition, workshops, open houses, classroom sessions, and teacher training. "The philosophy behind *Kids Compose* is an understanding that music, creativity, and music composition are inherent in each individual. Music composition is a continuum that can happen at different ages and stages. *Kids Compose* facilitates intergenerational and multidisciplinary collaboration using composition as a tool for building connectivity and community" (Ponella, 2019). A key aspect of the program is understanding the needs of each individual situation, enabling appropriate support for music teachers to be provided and opportunities for young people to explore music composition as a creative expression of their unique voice.

Kids Compose Take One

The original form of *Kids Compose* was designed as a competition involving Bloomington area students from grades two through six and various departments of the Indiana University Jacobs school of Music (JSoM).

The format

- Students submit melodies that fit on one page and are less than 1 minute long.
- Selected "finalist" melodies are submitted to the JSoM composition department.
- Eight winners are chosen by JSoM composition faculty members.
- Four JSoM composition students, selected by faculty, are each assigned two of the winning melodies to arrange into a piece (under two minutes in length) to be premiered at either a band or orchestra concert for elementary school children.
    - ◊ Monroe County Community School Corporation (MCCSC) students annually participate in fieldtrips to the IU Musical Arts Center (referred to as the MAC), for band (second graders) and orchestra (fifth graders) concerts.
- Winners join JSoM student composers onstage for the premiere, played before an audience averaging around a thousand fellow students each performance.

The statistics

- *The first year (2006-07).*
    - ◊ 143 submissions from seven public schools, one private school, and a group of homeschoolers.
    - ◊ Winners represented three public schools (2 from one; 1 from each of the others), one private school (3 winners), and one homeschooled student.

- *The second through fourth years (2007-08, 2008-09, 2009-10).*
  - ◊ 252, 280, and 356 submissions respectively.
  - ◊ Eleven public schools, three private schools, and homeschoolers participated.
  - ◊ Teachers asked for assistance in the classroom which was provided in ways from teaching classes to helping students notate their melodies.
  - ◊ Year four winners were from 2 public schools (4 from one; 1 from the other), and one private school (3 winners)

- *The fifth year (2010-11).*
  - ◊ 207 submissions from five public schools, one private school, and one homeschool student
  - ◊ 1 winner each from three public schools and 5 from the private school

Finalists	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
# of student participants	143	252	280	356	207
# of public schools	7	9	9	11	5
# of private schools	1	1	2	2	1
Homeschool	Yes	Yes	No	Yes	Yes

Winners (total 8/year)	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Public school	4	5	6	5	3
Private school	3	2	2	3	5
Homeschool	1	1	0	0	0

Kids Compose Competition at IU JSoM: Participant Statistics Years One through Five

The Reassessment

Overall, the program was a success, as evident by the MCCSC performances. Even when students in the audience were slightly restless during a Beethoven symphony or Granger piece for band, as soon as the Kids Compose students took the stage, silence descended, and full attention was given to what was happening. Peter Jacobi, a columnist for The Herald-Times, reviewed one of the concerts, commenting that: "The audience was amazingly well behaved and courteous throughout, but when those two kids-inspired compositions

came along, the listening silence became more pronounced and the applause more vociferous and also punctuated with cheers" (2007).

The JSoM composition department embraced the opportunity to offer such a unique experience for their students, and when the Dean approved an honorarium for the IU composition majors, it became a recruiting tool. Additionally, families of the elementary student winners were invited, often providing their first experience attending a performance at the MAC.

The beneficial nature of *Kids Compose* was discussed in an article for the *Indiana Alumni Magazine*. "'This has really resonated beyond what we thought,' says Gwyn Richards, dean of the Jacobs School, who sees Kids Compose as a vital outreach program. 'It's another one of those means by which you can engage children with music and an outlet for their creativity, although some won't naturally gravitate to it unless you show them the possibility. This is exactly that. It gives the students the means by which to have a relationship with music as a composer'" (Ruhland, p.23, 2008). One parent reflected about the experience in a column for the local paper: "It's not every day that an elementary student has the honor of hearing a melody she wrote performed by an ensemble from one of the top music schools in the nation… to hear her melody played on the tuba, then jazzed up for the band arrangement. I'm not sure if the significance of this experience has fully sunk in with my daughter yet… it is a wonderful example of the university reaching out to the community in the name of music education" (Evans, 2010). Indiana University composition student Eric Knechtges explained, "'The kids got a lesson in how music is made. It's also such a terrific way to connect the university to the community at large, a great way to reach out. And for me,' he added with a chuckle, 'that audience was way bigger than I've had for anything else I've ever written'" (Jacobi, 2007). The program was beneficial for students, music teachers, IU students, and the greater community.

So why did the number of submissions go down so drastically in the fifth year of the competition?

When asking teachers who participated previously but then stopped, it became clear that our competition was having the opposite effect of what we anticipated. While initially exciting and inspiring the teachers to work with their students to compose for the competition, the fact that winners were primarily coming from a couple of schools was actually discouraging teachers. To complicate matters, one of the music teachers at the private school who had 5 winners the fifth year of the competition was married to a JSoM composition faculty member, so the optics were not good.

To combat this misperception of favoritism, *Kids Compose* instituted a change of policy on two counts. First, at least one melody from each school that participated was chosen as a finalist. This gave encouragement to every music teacher, as well as something to share with their principal and families as an exciting, successful program in which students participate. Second, finalists' melodies were thereafter entered into a music notation program and numbered to present a "blind" judging situation—no names, schools, ages, or any information included except title or musical markings and instructions.

Kids Compose Take Two

The following six years, from 2011-12 through 2016-17, participation again increased as indicated below:

Finalists	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
# of student participants	192	282	278	296	281	323	226	171
# of public schools	6	?	10	8	10	8	7	5
# of private schools	2	?	2	2	1	3	1	1
Home-school	2	?	0	0	2	0	0	1

Winners (total 8/ year)	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
Public school	2	?	7	7	4	5	5	5
Private school	5	?	1	1	3	3	3	3
Home-school	1	?	0	0	1	0	0	0

Kids Compose Competition at IU JSoM: Participant Statistics Years Six through Thirteen

Taking stock

Having eliminated some of the logistical problems, *Kids Compose* settled into a routine—even hitting no snags when I was out of town for the 2012-13 year, other than some statistics falling through the cracks. Adjustments made as suggestions from music teachers via surveys and personal feedback were considered. A major change implemented was moving the annual deadline from fall to spring. Teachers advocated for this change, due to feeling rushed to include composition in their lesson plans from the start of the school year. A spring deadline would allow for developing additional concepts to incorporate into the compositions.

Challenges with the deadline change occurred regarding how the competition and results now wrap around to a new school year for the culminating

performances. This eliminates IU students who would graduate, as it becomes a two-year process. The competition participant age range was also changed to 2nd-5th grades, since 6th graders would be in middle school the following year for the performances and no longer part of the event. In fact, the first year of the new schedule created a situation requiring two deadlines in 2017-18—one in the fall for performance in spring 2018 and one in the spring (only a few weeks after the MAC concerts) for the performances scheduled the following year in spring 2019. Although teacher initiated, there have been fewer submissions by less schools since the change. Teachers insist that it has been difficult to adjust, but they still feel it will be helpful long term. *Kids Compose* will continue to take input from everyone involved and adjust accordingly.

Educational impact

With over thirteen years of *Kids Compose* in the books, there are a plethora of examples showing benefits for fostering creativity through music composition. These have been documented through interviews, newspaper and magazine articles, surveys, correspondence, and personal conversations.

> "Payton is so excited," his mother, Amanda Kay Werner, MS'94, wrote to graduate student David Farrell, who fused Payton's melody with another to create 'Sodium Hydroxide Airplane.' "Having his melody chosen has given him a big dose of self-confidence."
>
> A science enthusiast, Payton was studying molecules when he drew a picture of sodium and hydrogen atoms coming together to make sodium hydroxide. That's when he started to imagine the first two notes of his composition as sodium and hydrogen atoms." (Ruhland, p. 22, 2008)

This is one of many examples demonstrating the diversity of interests and inspiration from students over the years. *Kids Compose* winners have gone on to graduate with a bachelor's degree in chemistry and play soccer for a Big Ten university, in addition to pursuing music and being involved in music throughout their public-school years—some even majoring in music in college.

> "It makes me feel really good, like I did something," said Abbey Armstrong, an 11-year-old from St. Charles Catholic School.
>
> She said her melody, called 'Thunderstorm,' came from working in F minor, a scale that Abbey used to inspire her stormy tune. The music began with a slow rhythm that dropped like rain and then became louder.
>
> Abbey's mother, Julia Armstrong, who attended the performance, was surprised by her daughter's composition. "Abbey is terrified of thunderstorms," she said. "It's great that she could channel her fear into something so amazing."

Finding inspiration from scary moments was how Stav Katz, from Binford Elementary School, was able to compose her melody called 'Danger.'

> She remembers walking into piano lessons with her younger brother, who thought he saw the figure of a man hiding in the shadows. To comfort her little brother, Stav said, "I'll sing a bad song to scare him away."
>
> The result of her song is 'Danger,' a melody with a quick rhythm that sounds like a chase.
>
> As their classmates' compositions were played, the fifth -graders in the audience were captivated. Some sat forward with their chins in their hands, while others lifted their arms to mimic the conductors. (Keck, A1, 2014)

A parent spoke to me a few weeks after her child had participated in a group composition class offered at the public library. She jokingly said that she was mad at me because now her son insisted on always driving with the windows down. The approach taken at the class he attended was to compose using ideas from exploring sounds in nature. Her son had gained a new appreciation for bird songs and other environmental noises and often ran to the piano to experiment/compose after soaking in sounds from the ride home. In reality, the mom appreciated the change of perspective and connection with the world around him.

School board member, Cathy Fuentes-Rower, reflected in a recent email on the experience her children had as *Kids Compose* winners:

> I had 2 of my 4 kids win the Kids Compose opportunity and I am trying to retrieve the memories of the older child. I think Kids Compose was really important for both kids who won. Both Mateo and Javier were the two least likely to let it all go and be creative and open-ended in any activity. Following sheet music, reading directions, being exact is more in their personalities than the right-brain personalities Tomas and Natalia. This was the beginning for Javier in particular, who went on to be quite a jazz musician in school and for whom improvisation shouldn't have come easily but did. I think that was really big… [I] remember that he LOVED having his classmates in the audience during the performance. That was true of Mateo as well—almost the biggest part of the experience was that. If this happened for kids for whom accolades don't usually come, kids who don't have money to have piano teachers, I think that would be amazing. Both Javi and Mateo had piano teachers who were super supportive of the process of creating and helped them with writing what they created. I think sometimes music teachers have done this with children in the schools, but I hope that there are ways of encouraging those kids who don't have the help at home. It was also magical for both

> boys to see their tune transformed by musicians on stage. This is just an amazing program and I'm thrilled that it is going to expand to rural schools, some of which don't even have certified music teachers, I imagine, to give more kids this opportunity. Oh! I did see the music student interact with my youngest. And it was the sweetest thing. What an educational experience.
> (C. Fuentes-Rohwer, personal communication, October 8, 2019).

The sentiment about reaching more students was one which drove expanding educational programming: offering open houses at the IU Jacob School of Music and the public library, and plans to expand beyond Bloomington.

Additionally, over the years I noticed a bothersome trend. There were names that appeared year after year as finalists but were never chosen as winners. Some of the melodies composed by these young aspiring composers were creative, well-thought-through, excellent submissions. Though it was understandable the melodies might not be what the judges were specifically looking for to combine and arrange into fully orchestrated pieces, I was concerned continually trying and never winning could produce an effect opposite of the one intended—the students might have this outlet of creativity squelched, rather than nurtured. That concern was the catalyst for creating a "Runners-Up" category and developing workshops to offer further opportunities.

Kids Compose Workshops

The first *Kids Compose* Runners-Up workshop occurred in December 2017. Four elementary school students participated in this opportunity to continue experimenting with music composition. Local professional musicians and JSoM students volunteered to create a small ensemble that became an audible palette of colors with which the kids were able to create an arrangement of their original melody. After a brief demonstration of each instrument to illustrate the unique timbres and possibilities, students took turns working with the musicians; they decided who played when or which notes (in the case of harmonies or chords). No restrictions were put on the young composers, rather there was freedom to discover preferences—which instrumental sounds, higher or lower registers, combinations of similar or different types of instrument, et cetera.

At the latest workshop in April 2019, prolific American composer Lauren Bernofsky joined the ensemble as a violinist. It was interesting for her to provide the additional perspective as a composer. "Kids Compose is an incredible opportunity for young musicians to try their hand at composing. Not only are they presented with the impetus to write music, but they are also given guidance by professional composers as well as the opportunity to try out their compositions played by different combinations of instruments—a veritable cornucopia of possibilities, and a privilege scarcely available to

even professional composers. Who knows—maybe the next Beethoven is sitting right next to you!" (L. Bernofsky, personal communication, September 18, 2019). Some of the musicians were music education majors, who additionally were inspired by thinking forward to ways of incorporating similar experiences for their future students.

Throughout the workshops, enjoyment has been shared and lessons learned by musicians and young student composers alike. An interesting example was when a young 5th grade boy chose to have the harp play a chromatic scale (e.g., on a piano every black and white key in succession). This 5th grader had previously heard the harp as it is often used, playing a glissando (e.g., drawing a finger across the strings in what is sometimes used as a 'magical' effect), so it seemed to make sense to use the harp for a similar technique. The harpist was a good sport and played the chromatic scale, which was somewhat clunky. This became a learning opportunity for everyone. The strings of a harp represent the white keys on a piano, while each black key (sharp or flat) is produced by changing one of the seven pedals (one for each different note A-G). So, although a glissando works and sounds beautiful, a chromatic scale is not quite so easy. Interestingly, many of the other musicians commented afterward that they had never realized that was how the harp worked; the bonus (unspoken) lesson was that even when something seems to makes sense for an instrument or individual, there could be underlaying reasons it could be better a different way—assumptions should be avoided. This is one of many ways in which understandings and possibilities are broadened as creativity is cultivated in ways that apply far beyond merely composing music.

Limitations

Kids Compose has successfully run for over thirteen years with limited obstacles and extensive benefits. The author understands the advantageous environment from which this program has benefitted. The Indiana University Jacobs School of Music, a world-class music school, had a long running concert series for local elementary students providing an easy way to plug-in—additionally providing faculty judges (and mentors for IU composers), advanced university level music composition students, and an administration and community open to fostering such experiences. Furthermore, with the open houses and workshops, there are a plethora of willing professional composers, teachers, and musicians who are excited to share their art and knowledge. Understandably, this situation does not exist in every community.

Conclusion

Music composition is a natural intersection of music and creativity that can be approached in diverse ways. The value of exploring composition as a creative educational tool is supported by its inclusion in the National Standards for instruction of K-8th graders by the National Association for Music Educators. Various avenues of support and educational opportunities through *Kids Compose* programs have encouraged local music teachers to experiment with in-

clusion of music composition in curriculum, previously a subject often omitted for numerous reasons. Results have shown benefits for students, teachers, composers, musicians, and the surrounding community—individually, collaboratively, and through making connections between each of these groups.

The current challenge for *Kids Compose* is expanding the program to other communities. Though there are not identical resources, part of the beauty of the philosophy that music, creativity, and music composition are inherent in each individual extends to the unique identity and resources each community has to offer. *Kids Compose* and music composition fit any situation. Any school setting for elementary-aged students is required to teach the subject. Offering support to teachers and experiences for students can come through various aspects of the *Kids Compose* programs. Most communities have local musicians; part of the unique identity of a community may offer fiddle or other folk instruments, rather than traditional orchestral instruments. If local musicians are not available, nearby communities can be tapped. Students from differing cultures will bring diverse experiences and ideas to the composition process, further underscoring the unique voice of individuals and communities. Any of the three levels of programming offered by *Kids Compose*—music composition in the classroom, workshops providing students with an opportunity to explore their original compositions with live musicians, and a music composition competition—facilitates creative development and expands understanding of possibilities. Music composition can benefit any and all communities and is sustainable with already existing resources. Nurturing and cultivating these inherent capabilities create connections and builds community.

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CHAPTER TWELVE

ON THE CREATIVE POTENTIAL OF UNCERTAINTY

RONALD A. BEGHETTO

Abstract

In this wrap-up chapter, I briefly share my reflections on the creative potential of uncertainty in light of the Knowledge, Innovation, and Enterprise (KIE) virtual conference and published volume celebrating the 70th anniversary of Guilford's (1950) American Psychological Associations presidential address.

On the Creative Potential of Uncertainty

As of this writing, we are only halfway through the year 2020 and it has already proven to be one of the most profoundly uncertain of years on record. Although uncertainty is an uncomfortable state of being, it can also serve as a catalyst and condition for creative expression. In order to understand how we can realize the creative potential of uncertainty it is first important to briefly discuss our prototypical response to uncertainty.

When we encounter uncertainty, we often seek to resolve it as quickly as possible. One reason why is because the experience of uncertainty is shot through with doubt, lack of stability, and high levels of unpredictability. Although it is true that many of the uncertainties we face in life can be resolved, ignored, put off to a later date, or even accepted as unknowable; not all encounters with uncertainty are experienced in the same way or easily resolvable. Uncertainties we encounter in life can range from what I have elsewhere described (Beghetto, 2020) as *mundane uncertainties* (e.g., what will I make for dinner tonight) to *profound uncertainties* (e.g., grand mysteries of life). In between these extremes is what I call *actionable uncertainty.* Actionable uncertainty involves encounters with states of *genuine doubt,* which signify that new ways of thinking and acting are not only needed, but possible (Beghetto, 2016a; 2020; Dewey, 1910; Peirce, 1958). Consequently, actionable uncertainty presents us with an opportunity and responsibility to creativity respond the complex challenge we are facing.

J.P. Guilford (1950) seemed to recognize the importance of actionable uncertainty. Indeed, his presidential address was focused on the need for researchers to take action by way of helping to resolve the conceptual and empirical uncertainty surrounding creativity. His presidential address thereby became a clarion call for researchers and the burgeoning field of creativity studies. Although much progress has been made in the intervening 70 years

since the publication of Guilford's presidential address, much uncertainty still remains surrounding how creativity researchers can help all people realize their creative potential and take the beautiful risks necessary to use their creative capacity to contribute to the learning and lives of others.

Indeed, as Fredricka Reisman has noted in her introduction (Reisman, Chp. 1), the uncertainties faced in mid-2020 are profoundly challenging, e.g., COVID 19 pandemic, systemic racism, and longstanding inequities and injustices. I join Fredricka in asserting that although the uncertainties we face now and into the foreseeable future are extremely complex, they are also actionable. We thereby are faced with an opportunity and responsibility to work toward addressing these uncertainties through deliberate and principled creative thought and action. The first step in doing so involves helping people broaden their horizon of possibilities. This includes helping people recognize that approaching even the most daunting uncertainties starts with developing a spirit of unshakeable possibility thinking (Beghetto, 2016b). When we approach highly complex and uncertain problems with a spirit of unshakeable possibility thinking we can persist in imagining how we might move from *what currently is* to *what could or should be* and, ultimately, put our creative imagination into action. The need to approach uncertainty with a spirit of possibility thinking could very well be the new clarion call for creativity scholars, educators, and practitioners.

Within this volume, we are provided with several examples of recent and ongoing work that illustrates how scholars are answering the call for creative action in the face of various uncertainties, including: how educators might simultaneously foster students' creative strengths while supporting student's academic learning needs (Severino, Chp. 2); how music educators can support the development of students' individual and collaborative creativity as a core part of students' musical preparation (Wilson & Brown, Chp. 3; Ponella, Chp. 11); how developing students' creative capacity can and should be a core feature of higher education (Corso & Gluth, Chp. 4); how creativity principles introduced by Guilford can be used to develop a pedagogical aid aimed at supporting English language learners (Scott, Chp. 5), how schools can be reimagined to support creativity and innovation (Suss, Chp. 6); how the potential for using big data can be realized in support of creativity research (Kapoor, Tagat, & Prayogshala, Chp. 7); how a creative pedagogical heuristic might be used as a means for supporting creativity in architectural education (Sledge, Chp. 8); how Guilford's ideas and mentoring directly influenced subsequent generations of creative thought and action (Sisk, Chp. 9); and how professional development efforts can support teacher learning (Rochlin, Chp. 10).

The contributions in this volume represent the kinds of steps that are being taken to address longstanding uncertainties about the role creativity can play in learning and life. With each successive step that scholars and practitioners take toward realizing their creative potential the more they can become emboldened to take even larger steps toward addressing even the most seemingly profound local and global uncertainties we and future generations face. Whenever we encounter uncertainty, even seemingly profound uncertainties, we find ourselves at a crossroads. One path involves attempting to

quickly resolve uncertainty by ignoring it, learning to live with it, or attempting to force-fitting old ways of thought and action. The other path involves having the willingness to sit with and explore the possibilities presented by the uncertainties we face (Beghetto, 2015; Dewey, 1910). This also involves being willing to view uncertainty as a signifier that new ways of thinking and acting are needed. Encounters with uncertainty, viewed from this vantage point, can help us develop the confidence and capacity to take action in an effort to make meaningful and lasting creative contribution to the learning and lives of others. This path of creatively engaging with uncertainty is not easy. It requires persistence and principled effort. And, as with any creative endeavor, successful outcomes are not guaranteed. Still, I would argue, by way of Guilford's (1950) closing line to his presidential address, "These ends certainly justify our best efforts" (p. 454).

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CHAPTER THIRTEEN

HAS GUILFORD GROWN U.S. CREATIVITY?

KYUNG HEE KIM

Guilford promoted creativity in his presidential address 70 years ago upon being elected to the president of the American Psychological Association, He challenged the prevailing views of creativity as an aspect of intelligence, positioning it as a distinct psychological construct deserving far more research attention from the psychology field. The speech, published in the *American Psychologist* (Guilford, 1950), had the intended effect of drawing greatly increased attention to creativity from psychologists, educators, and researchers. Despite the common myth that creative geniuses, such as Darwin and Edison, are born, Guilford concluded that creativity can be developed.

The eleven chapters in this book have a common theme of developing creativity in individuals, including students and educators, in K-12 and higher education, with specific cases of architecture, music, mathematics, gifted programs, learning disabled, and English as a second language (ESL). Guilford's ground-breaking insights were the catalyst to a burst of research into individual creativity development. Some chapters also touch upon how cultural and public policy differences influence creative environments in societies to promote or inhibit individual creativity, which is the subject of this chapter.

Guilford (1950) concluded that creative productivity results from individuals' creative personalities, rather than IQ or test scores, and thus focusing on memorization of facts for tests will not lead to their creativity. Many subsequent scholars have affirmed Guilford's conclusion (Feist, 1998; Gough, 1979; Kwang & Rodrigues, 2002; MacKinnon, 1962; Roe, 1952; Simonton, 2000; Stein, 1963). Their research demonstrates that creative personalities are the characteristics that innovators share, that they make creative thinking possible, and are predictors of individuals' future innovation. Kim (2016) has named Guilford's *personalities* as *attitudes*. This is because attitudes are more easily trained than personalities. Research findings have identified 27 distinct attitudes, which Kim (2016, 2017) categorized into the Sun, Storm, Soil, and Space nurturing environments: (a) the optimistic, big-picture, curious, spontaneous, playful, and energetic *Sun* attitudes develop individuals' interest in a topic; (b) the self-disciplined, diligent, self-efficacious, independent, resilient, risk-taking, persistent, and uncertainty-accepting *Storm* attitudes develop expertise in their topic of interest; (c) the bicultural, resourceful, open-minded, complexity-seeking, and mentored *Soil* attitudes develop critical thinking and broaden their expertise by cross-pollinating with others; and (d) the emotional, compassionate, self-reflective,

daydreaming, autonomous, nonconforming, gender-bias-free, and defiant *Space* attitudes sharpen their critical thinking and expand their imagination.

Guilford (1950) urged the psychological community to discover and promote creative attitudes. This book's chapters are filled with ways to embed versions of creative attitudes into current educational methods. It is a call to renew the commitment to creativity at both individual and social levels. Chapters 2, 5, and 9 advocate evaluating students for creative personalities. Chapters 3 and 4 advocate non-conformity and risk taking. Chapter 6 advocates for greater teamwork and resourcefulness. Chapters 8 and 11 seek to restore enthusiasm for learning through playfulness and curiosity.

Guilford (1950) urged U.S. education to focus on nurturing creative attitudes, such as curiosity and nonconformity in children. As a result, creative environments in education flourished in the U.S. between the 1950s and 1980s. The fear of falling behind unleashed by the Soviet Union's 1957 Sputnik served as the catalyst. Guilford provided the roadmap.

Kim (2011), however, reported a decline of creativity in America since the 1990s. Kim used the 1966, 1974, 1984, 1990, 1998, and 2008 norming data sets (N = 272,599) for the *Torrance Tests of Creative Thinking*. Recently, Kim (in press) conducted another study by adding the 2017 norming data set to the previous data sets (N = 273, 441). Kim found that the decline of creativity has gotten worse, especially in originality and among young children. Kim indicated that the worsening decline of creativity is due to American and world education systems' obsession with country rankings on international tests like the *Programme for International Student Assessment* (PISA). Starting in the late 1970s, as Japanese industry challenged America and Europe, fear of Asian industrial competition triggered a search for their source of advantage. They settled on Asian countries' top rankings on various international tests. That compelled education policy makers around the world to make their education systems more test-centric to emulate Asian education systems.

Without Guilford, however, America could have been worse. Kim (in press) developed creative attitude composite scores to track the trends of creativity. The scores use survey questionnaires from the 2015 PISA (The Organisation for Economic Co-operation and Development, 2017). Kim found that Western students, especially American students, displayed more creative attitudes than Asian students, although Asian students outscored Western students on the PISA. The results showed a strong negative relationship (r = -.90) between students' PISA scores and creative attitudes. Both native Asian students and Asian American students outscore non-Asian students on tests.

In the US, Asian American students' high scores help them get jobs. But lack of creativity leads to career stagnation. Asian advancement in the fields, such as law (Chung et al., 2017; Jan, 2017), technology (Gee & Peck, 2017; Gee et al., 2015), finance (Colby, 2017; Hansen, 2018; Sheen, 2018), government (United States Office of Personnel Management, 2018), and academics (Sheen, 2018), is the lowest of all tracked ethnic groups in America. Asian culture is built on Confucianism and a test-centric meritocracy (Kim, 2016, in press). The influences of Confucianism on Asians include a hard-

work ethic and obedience to authorities. That combination makes US based Asians excellent workers but often deprives them of opportunities for managerial career advancement in a culture that generally rewards innovation. Confucianism is based on Confucius' teaching about daily life ethics more than 2500 years ago. Asian test-centric meritocracy began 2000 years ago when China created civil service tests, the first standardized tests in the world. The purpose of the tests was to create deferential acolytes through test-based competition, rather than ambitious challengers to the emperor's rule. Test-centric meritocracy led to rote learning and copying, and pressure to conform, eliminating any creative impulse (Kim, in press). It became ingrained in Chinese culture and copied by its smaller East Asian neighbors, especially Korea, Japan, and Vietnam, that adopted Confucianism into their own cultures. Kim (in press) attributes Asian students' low level of creative attitudes to their test-centric meritocracy.

Guilford (1950) emphasized the importance of curiosity for creativity development. When students are curious about and interested in a topic, they enjoy exploring it and develop passion for it. Kim (in press) found that top-ranking country students, especially Asian students, especially American students, displayed much greater curiosity, interest, or displayed little curiosity about, interest in, or enjoyment of learning; whereas Western students enjoyment. The results showed a strong negative relationship (r = -.77) between students' PISA scores and interest in or enjoyment of learning.

Further, when learning consists of rote memorization, students miss the broader context of facts, making their efforts uninteresting. They miss the fun in learning, how the facts relate to real world observations. For example, Asian science instruction focuses on facts from textbooks, without students' experimentation or exploration. Lacking opportunities to apply what they learned, memories fade quickly after testing. Kim (in press) found that top-ranking country students, especially Asian students, report having few opportunities for or little self-efficacy in knowledge application, whereas Western students, especially American students, reported having many opportunities, leading to self-efficacy. Kim's results showed a strong negative relationship (r = -.65) between students' PISA scores and application of learning. It is thanks to Guilford's research and effort that American students have much higher levels of curiosity from their learning than Asians students.

Guilford (1950) emphasized the importance of nonconformity for creativity development. The foundation of creative thinking is individuals' mastery of a topic of interest, following the rules of the topic. Mastery enables understanding of new needs and deficiencies, making improvement possible. Those willing to challenge the current thinking, breaking the rules, can address the needs and fix the deficiencies. This contributes to making something both valuable and novel. Synthesis of valuable and novel traits creates innovation. To innovate, individuals must challenge the status-quo rather than fitting in. Kim (in press) found that top-ranking country students, especially Asian students, reported having few opportunities to debate with classmates or teachers or draw their own conclusions from their science experiments, whereas Western students, especially American students, reported many opportunities, as they are encouraged to challenge authority and learnings;

whereas Asian students blindly accept authority and learnings. Guilford's insights, together with cultural changes taking place during the 1960s–70s, led American students to develop high levels of nonconformity. The results showed a strong negative relationship (r = -.75) between students' PISA scores and nonconformity.

The chapters in this book highlight various ways to develop creativity in individuals.

In Chapter 2, the author urges educators to focus on the strengths of students' with thee learning disabilities (dyslexia, dysgraphia, and dyscalculia) rather than remediating their weaknesses, by testing students for eleven creativity factors (i.e., fluency, flexibility, elaboration, originality, resistance to premature closure, tolerance of ambiguity, convergent and divergent thinking, risk taking, intrinsic and extrinsic motivation).

In Chapter 3, the authors worry that the increasingly rigid and disciplinary standards in education and reliance on electronic communications for social interactions are constraining creative potential through fear of failure and loss of playfulness, thus threatening the golden age of creativity that followed Guilford's speech.

In Chapter 4, the authors observe that creativity is still seen as predominantly artistic, it has been resisted in other disciplines due to the relative simplicity of structure and rules adherence; they urge that it be embedded in all university coursework to prepare students for a lifetime of learning and instill in them an entrepreneurial mindset.

In Chapter 5, the author shows through the example of ESL education that Guilford's nine factors for creativity (sensitivity to problems, ideational fluency, flexibility of set, ideational novelty, synthesizing ability, analyzing ability, reorganization/redefining ability, span of ideational structure, and evaluating ability) can be used to develop creativity in any field, besides ESL education.

In Chapter 6, the author stresses that to make K-12 education more creative it should move away from individual learning to emphasize sharing and teamwork through project interdisciplinary learning.

In Chapter 7, the authors explore how creativity researchers can leverage the emerging technologies of big data, large volumes of information derived from human interactions, such as social media, mapping applications, search engines, online commerce, and enterprise systems, to understand the causes of creative attitudes.

In Chapter 8, the author emphasizes the need for fun and playfulness in higher education, highlighting how heuristic games, a decision support methodology, improves architecture students' design performance.

Chapter 9 recounts the author's personal experiences with Guilford as mentor and guide for efforts to bring creativity to the education of socio-economically disadvantaged gifted students.

In Chapter 10, the author recommends tailoring mathematics education to individual student's unique learning styles, by analyzing each student continuously to identify individual problems that could affect the whole group.

In chapter 11, the author uses experience from a music composition program to show that composition, the most neglected part of music education, has the greatest potential to foster creativity through self-expression and enjoyment of learning.

Conclusion

The global focus on PISA and other standardized scores and national rankings is worsening a decline in creativity. Starting in the 1980s, Japanese industries, followed by China and other Asian industrial competition challenged American and European domestic industries. Like the 1957 Soviet Sputnik challenge, the Asian challenge motivated a search for the source of Asian industry competitiveness. With the Sputnik challenge, the Western responses were to enhance their educational strengths by making science fun. By contrast, the response to the Asian challenge has been to remediate perceived weaknesses in their education systems, relatively poor scores on standardized tests such as the PISA. In doing so, they are unwittingly killing their strengths in creativity while importing a weakness, test-centric education, that makes for unmotivated, uncurious deferential students. Like the Chinese government officials who implemented the test-centric system millennia ago, stifling creativity and enforcing deference to political authority is popular among modern politicians. It breeds acolytes who align with an ideology without challenging its authority, rather than creative nonconformists. That is observable in the political polarization seen today. As a result, Guilford's inspirational insights are in danger of being lost to the present generation. To renew Guilford's dream, it is imperative to restore to students the sense of play in education, thus reigniting their natural curiosity and eagerness to explore.

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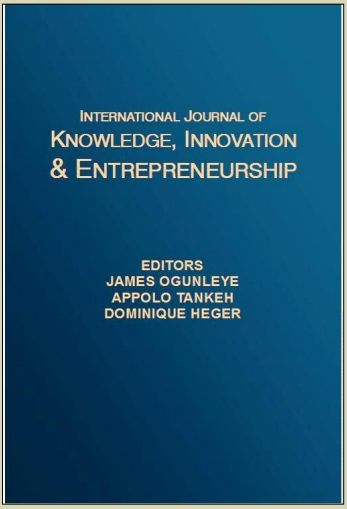

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