CASE STUDY

THE 4A METRIC ALGORITHM: A UNIQUE E–LEARNING ENGINEERING SOLUTION DESIGNED VIA NEUROSCIENCE TO COUNTER CHEATING AND REDUCE ITS RECIDIVISM BY MEASURING STUDENT GROWTH THOROUGH SYSTEMIC SEQUENTIAL ONLINE LEARNING

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ABSTRACT

This paper provides a novel instructional methodology that is a unique E-Learning engineered "4A Metric Algorithm" designed to conceptually address the four main challenges faced by 21st century students, who are tempted to cheat in a myriad of higher education settings (face to face, hybrid, and online). The algorithmic online neuroscience supported instructional methodology detailed in the narrative also provides an active solution that when implemented addresses the needs of Colleges and Universities who desire new methods to achieve their academic goals (such as increase student retention and graduation rates, and respond to their high standards of student success without diminishing academic rigor). A case study is presented that details how to effectively and successfully implement the algorithm in an online graduate statistics course. Additional research into the infrastructure of the 4A Metric Algorithm as a dynamic neuroengineering online solution will further advance the 4A Metric Algorithm as a standard for in–depth online instruction that is also an interactive solution designed to effectively counter cheating and reduce its recidivism.

Keywords: 4A Metric©, 4A Metric Algorithm, Cheating, Cheating Recidivism, Eduscience, Educational Science, Instructional [Systems] Design, Learning, Mathematical Model, Mastery Testing, Micro-Level, Online Learning, Neuroscience, Sub-Level.

INTRODUCTION

"Cheating", stating the very word leaves an educator with an unsatisfactory and unsavory feeling. Then there is the terminology that is an antecedent of cheating referred to as "Cheating Recidivism" (or "Repeated Cheating"). "Cheating Recidivism" is a state of affairs in which cheating has become commonplace in the academic environment. This type of "Recidivism" is a true deterrent to discovery, self-growth, and learning that is best described as "offensive, repugnant, and unsatisfying" in all educational institutions, halls of academia, and the entire atmosphere of higher learning. Having to deal with cheating and cheating recidivism and their associated consequences can stifle even the most seasoned and determined educator. Furthermore, those students who choose to participate in cheating can become so embroiled in it, that, like an addiction it transforms into the repetitive compulsion of cheating recidivism. This can lead to terrible consequences for all of those involved and criminal-like penalties for those who perpetrated the act and, unfortunately have selected to violate an intuition's institutional "Academic Honor Code".

On April 27, 2007, the Dean of the Fuqua College of Business at Duke University announced that 24 students, (nearly 10% of the graduating class of 2008) had been caught cheating on a final exam (Conlin, 2007). A year later, the school was still dealing with the fallout from the incident, which included expelling the guilty students, readmitting and counseling the suspended ones, and dealing with the national attention garnered by the event

(Damast, 2008; Simkin & McLeod, 2010). A large body of research suggests that, the student cheating uncovered at Duke is not an isolated event, but rather a microcosm of a pervasive and growing part of worldwide university activity. Perhaps of greatest import is the fact that cheating in college classes is now best described as "rampant" (Simkin & McLeod, 2010).

When cheating on a massive scale at collegiate institutions has had its aftermath and time passed and all has been said and done, the instructor is left to ponder some rather intriguing questions such as, "How could this have been prevented?" and "Could I have done something to stop this in the first place?". Seeking to answer such questions can lead the educator to not just look at their own teaching style but also the systems that are in place that allow cheating and cheating recidivism efficacy. The author through a decade of research in diverse disciplines such as Brain-based Learning, Cognitive Neuroscience, Educational Technology, Instructional Design, and Statistics offers a solution that can be implemented in university Learning Management Systems. This "paradigm shift" places the learning infrastructure from an empowering perspective in the hands of the learner by promoting systemic self-growth. In this manner, the student gains responsibility and the course material is delivered in a way that cheating and cheating recidivism are minimized and cannot occur. Best of all the procedures are neuroscientifically-grounded and supported by a plethora of research.

Interms of innovation, the solution presented in this chapter can be accurately measured and affords the educator with the opportunity to use groundbreaking innovative mathematical metrics that are both empowering and entrepreneurial. Neuroscientific brain–based teaching strategies can best address cheating and cheating recidivism. In addition, there are plethora of mathematically-grounded and statistically-verified tools espoused by the author that can be used to analyze neuroscientific e–learning solutions through "Trioinformatics" (Osler, 2015). In the discipline of "Trioinformatics" the use of "Neuroengineering Neuromathematics Notation" is a novel way of using the parsimony of mathematics through brain–based learning (or cognitive neuroscience) to simplify the procedures used to transition from trichotomous logic to trichotomous instrumentation. Trichotomous instrumentation also known as the "Triple-I" or research "Inventive Investigative Instrument" (Osler 2012a & 2013d) is used in the Tri–Squared Test statistic (Osler, 2012a) to obtain qualitative data and information that will be transformed into quantitative data to validate and determine the initial efficacy of the Trioinformatic trichotomous logically–based research questions and subsequent hypotheses. Much like the mathematical "Proximal Positive Parallel Notation" that was first introduced by the author in the October–December 2013 issue of i-manager's Journal on Mathematics, (Volume 2, Number 4, pp. 21–31). Proximal Positive Parallel Notation is a novel method of expressing mathematical complements, collaborations, and combinations (Osler, 2013c), likewise "Neuroengineering" uses many of the Proximal Positive Parallel Notation conventions to convey the transition from Trioinformatic trichotomous logic to the Triple–I instrumentation and furthermore into the Tri–Squared Test analysis.

1. The Problem: Why Students Cheat?

The rationale for student cheating can be seen in the general "unethical behavior" that permeates not only academia, but society in general. Thus, "unethical behavior" is not something that is particularly unique to academic institutions of higher learning. Presently, it seems as if cheating and unethical behavior have been condoned by society at large and in many instances have become an unfortunate "cultural norm". For example, recent experiences with such financial disasters such as Enron, Worldcom, and Tyco Corporations have led the general public to ask "how can such things happen?" (Gulli, et al., 2007). As a ramification of these cultural and amoral examples of rampant unethical behavior, students are shown that unethical actions are not only condoned but are openly rewarded, often without any subsequent consequences. This provides an important reason as to why college cheating is so extensive-due to the suspected link between such behavior in academia and subsequent unethical behavior in the workplace (Thompson, 2000). A number of studies have found a strong relationship

between "cheating" at college and "unethical behavior" at work. Sims (1993), for example, found a high correlation between these two factors (cheating in college and unethical behavior at work), leading him to conclude that dishonesty was less a matter of "an immediate opportunity to cheat" and more dependent upon "a general attitude about honesty in the workplace." Similarly, Nonis and Swift (2001) found that the tendency to cheat at work was highly correlated with the frequency of cheating in college – a finding echoed by Davis and Ludvigson (1995), Swift, et al. (1998), and Crown and Spiller (1998). Finally, Lawson (2004) found a similar relationship between "unethical workplace behavior" and "college cheating" (Simkin & McLeod, 2010). All of this is a clear indication of how and why cheating has become so prevalent in the academy.

1.1 The Need: Cheating Repeat Offenders Recidivism Factors

The ongoing repetition of cheating in institutions of higher learning (termed here as "recidivism") can primarily be due to four major factors that are also serious concerns (and/or specific challenges) that face most students in general, (and truly adversely effects African American students in particular). The four major recidivism factors are:

- The challenge of preventable health related issues that adversely affect learning (Obesity, Diabetes, ADD/ADHD, High Blood Pressure, etc.) that are a direct result of poor diets and lack of exercise due to the ongoing stress of the academic environment;
- Stress and emotional challenges that stem from environmental circumstances, parent and/or peer pressure and low self–esteem that affect the student's ability to approach both school and life in a most successful and holistic manner;
- The challenge of students acquiring reasoning, constructive problem-solving and decision-making skills (and skill sets), and other higher order (metacognitive) thinking abilities that can be used to navigate through "authentic" settings and the intense pressure and rigor of the academic environment; and
- Indecision and a clear cut goal towards a career path that utilizes individual gifts, talents and natural abilities for the practical application of "high learner locus of control" as it applies to encoding information and data through diverse learning styles and multiple intelligences.

Much of the research done in these areas show that students suffer in three of the four areas at disproportionate levels and have the least amount of resources to address these four cheating recidivism factors/challenges. The pressures of maintaining a balance between interpersonal relationships, academic demands, one's own expectations and maintaining personal relationships can be an extremely daunting task (Lindsey, Reed, Lyons, Hendricks, Mead & Butler, 2011). For example, a study about the sources of stress among African American college students found that, the top five reported sources of stress were: 1) Death of a family member (intrapersonal stress); 2) Low grades (academic stress); 3) Time management (academic stress); 4) Boyfriend/Girlfriend problems (interpersonal stress) and missed classes (academic stress) (Negga, Applewhite & Livingston, 2007). These research studies show that, a strong relationship exists between stress and cognitive abilities and a weakened immune system (Cohen & Herbert, 1996).

Toxic stress impacts the physical architecture of the brain. It leads to quantifiable changes in areas of the brain that are centrally involved in learning, such as the hippocampus, which can result in learning problems (McEwen & Sapolsky 1995; Shonkoff & Phillips, 2000, as cited in Hinton, Fischer, & Glennon, 2012). Toxic stress refers to strong, frequent, or prolonged activation of the body stress management system in the absence of support. Toxic stressors include chronic poverty, abuse, bullying, and trauma without support (Hinton, et al., 2012). Additionally, at four-year colleges, only 33.2% of African American males earn a bachelor's degree within six year-rates that are strikingly lower than those of their White (57.1%), and Asian (64.2%) peers (Digest of Education Statistics, 2012). At two-year colleges, only 32.1% of African American males earn a certificate, degree, or transfer to a four-year institution within six years, compared to 39.8% for White males and 43.4% for Asian males (BPS, 2009).

The mission and goals of many institutions of higher learning, especially Historically Black Colleges and

Universities (HBCUs) are to level the playing field in the areas of: Academic Performance; Student Retention; S.T.E.A.M. (Science, Technology, Engineering, Arts, and Mathematics); Student Graduation and Matriculation (four years or less); and Global Citizens that contribute to society in a positive, productive and innovative manner through leadership, service and successful business creation and professional careers.

The majority of research and studies show the benefits gained by African American students when afforded the opportunities and resources within the right learning environment to achieve and excel at the highest levels of education. The educational environment plays a crucial role in shaping the brain's abilities and determining students' academic achievement. As students learn-in both formal and informal contexts, these experiences shape the architecture of their brains (Hinton, et al., 2012). In order to develop an understanding of the subsequent solutions to be provided later in the chapter, the reader must become familiar with the terminology of neuroscience and neuroengineering. Section 2 provides an in–depth listing of neuroscience and neuroscience-related terms clearly defined and supported by research so that the reader can become fully immersed in neuroscientific concepts.

2. Terminology that Applies to Neuroscientific E–Learning Engineering Solutions

2.1 4A Metric Algorithm

The 4A Metric E–Learning Engineering Algorithm is an E–Learning solution developed by the author after several years of online instruction and research into student growth and development. The Metric itself first appeared in a book entitled, "Infometrics" written by the author and published in 2010 (Osler, 2010a). The Metric as an E-Learning Engineered solution is both systemic and sequential involving a tiered number of levels, sub-levels, and micro-levels designed to take the student from novice to mastery of a specific subject matter. The Algorithm can be used in a variety of instructional settings: face-to-face; hybrid (involving a combination of both online and face-to-face); and purely online (in and of itself that can be either synchronous or asynchronous).

2.2 Algorithm

An "Algorithm" is defined here as a set of procedural rules that solve a problem. In the case of the 4A Metric, it is an algorithm designed through neuroscience and instructional systems design to enhance and empower learning through systemic and sequential student growth.

2.3 Cheating Recidivism

"Cheating Recidivism" is defined by the author as the propensity to repeatedly cheat as an aberrant and negative behavior that occurs (and is likely to reoccur) over and over again.

2.4 E–Learning Engineering

E–Learning Engineering is the process of designing, developing, and deploying effective and empowering online solutions through neuroscientific strategies, quantitative and qualitative instructional systems design measurement and solutions (such as Visualus and the Tri–Squared Test (Osler, 2010b and 2012a), and distance education methodologies techniques (such as Problem-Based and Project-Based Learning).

2.5 Neuroscience

Neuroscience is a branch of science that deals with the anatomy, physiology, biochemistry, or molecular biology of nerves and nervous tissue and especially their relation to behavior and learning (Neuroscience, 1963).

2.6 Neuromathematics

A new terminology first introduced in this research that pertains to the use of brain-based neuroscience in terms of mathematics grounded in the mathematical law of trichotomy (Osler, 2012a) exemplified in the advanced post hoc use of the Tri–Squared Test (Table 1) to analyze and determine the trichotomous: (a) viability; (b) validity; and (c) verifiability of the research hypothesis (also the "alternative hypothesis" = [H1]) and its associated outcomes (see Figures 2, 3, and 4 respectively) (Osler, 2015).

2.7 Neuroeducation/Educational Neuroscience

Neuroeducation or Educational Neuroscience can be defined as a broad interdisciplinary and multidimensional field concerning matters pertaining to mind, brain and education; it is grounded in a variety of interrelated fields including (but not limited to) education, neuroscience,

psychology, and cognitive science (Nouri & Mehrmohammadi, 2012).

2.8 Educational Science

Educational science is the study and application of solutions to improve and enhance the learning environment and learning in general (Osler, 2013a).

2.9 Eduscience

The term "Eduscience" which is a portmanteau of the two terms "Education" and "Science". Eduscience is solution–driven and is actively concerned with the transfer and dissemination of knowledge (Osler, & Waden, 2012b).

2.10 Instructional Design

Instructional design, also known as instructional systems design, is the analysis of learning needs and systematic development of instruction. Instructional designers often use Instructional technology as a method for developing instruction (Merrill, Drake, Lacy, Pratt, & ID2 Research Group, 1996).

2.11 Learning

Learning is a step-by-step process in which an individual experiences permanent, lasting changes in knowledge, behaviors, or ways of processing the world (Goodfriend, 2014).

2.12 Mastery Testing

"Mastery Testing" is defined in the context of the 4A Metric Algorithm as the instructional systems designed repetitive assessment process without penalty for a student obtain a certain score until they achieve mastery of the test content at a specified score predetermined by the instructor. All 4A Metric Algorithm tests are Mastery Tests (some which have "microcredentials" [such as badges] built within them). Mastery Testing by its very nature is the antithesis of cheating (in one of the major areas where cheating occurs) and reduces the likelihood of cheating recidivism.

3. The 4A Metric Algorithm Methodology

The methodology of the 4A Metric Algorithm is illustrated in Figure 1 that illustrate the rationale for the 4A Metric Algorithm in detail.

3.1 Summary of Graphics

The 4A Metric as a solution is actively used by the author to

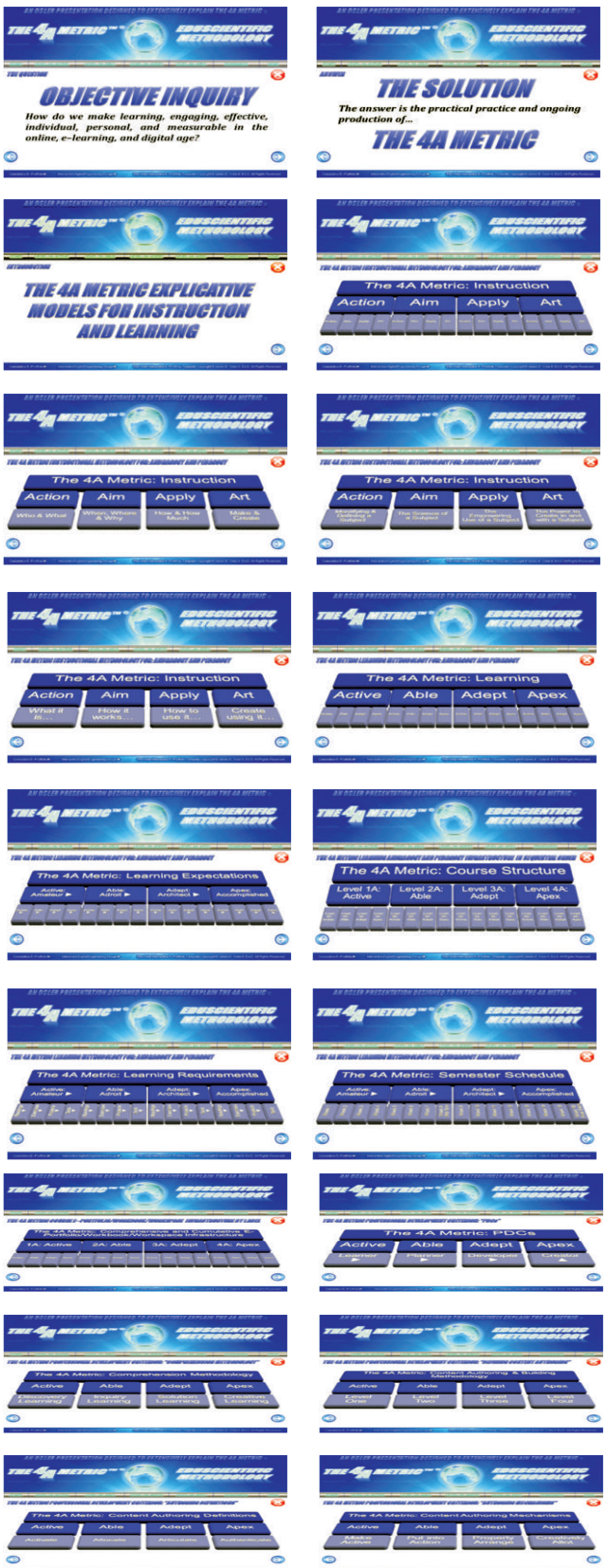

Figure 1. 4A Metric Algorithm Methodology

empower students and crush cheating and cheating recidivism. The use of this systemized methodology is backed by a half decade of research and instructional delivery at the collegiate graduate and undergraduate level. The 4A Metric can be presented top students as their learning environment throughout the quarter, summer session, or semester. It is designed to integrate into a course that is traditional, online, and/or blended/hybrid. It addresses all of the aforementioned issues as it provides course information upfront, allows students to progress at their own pace (while faculty can continue regular progression during regular course meetings), embeds opportunities for credentialing (through course completion "badges" as progression rewards and external certification opportunities as internal course requirements), and delivers course assessments as regular repetitive mastery tests (that the instructor sets as the level of acceptance as: 100%, 90%, etc.). The next section is extracted from a course syllabus that displays the "Professional Development Criterion" or "PDCs" for course that carefully details and explains the 4A Metric in a series of rubrics for all class course assignments, exercises, and tests (including the performance rubric for the final cumulative and comprehensive course 4A Metric e–portfolio).

4. The Significance of the Solution

Educational psychologists have subdivided the area of educational objectives into three domains-the cognitive, affective and psychomotor. The three domains identify and represent the knowledge, beliefs and skills, respectively, of a human performer. Learning can be thought of as occurring in these three domains (Adkins, 2004; Beane, Toepfer, & Alessi, 1986; Gage & Berliner, 1988). A forth domain, the social domain is introduced to accentuate sociocultural processes that accompany thinking, feeling, and sensing/movement (Dettmer, 2006). These four domains are and should be the foundation for holistic learning in any educational learning environment or institution. However, a holistic approach to teaching and learning that promotes self-growth is not always integrated into the instructional design of an educational curriculum or program. There are also significant differences in critical thinking, complex reasoning and writing skills across students from different family backgrounds and racial/ethnic groups (Arum & Roksa, 2010). Learning is not restricted to the confines of a traditional classroom or school hours; rather, it transpires in multiple dimensions of a student's life. Students' brains continuously adapt to the environments where they live and work, including school, home, workplaces, and their community (Hinton, et al, 2012). More importantly, students not only enter college unequal; but inequalities tend to persist, or in the case of African American students, increase during students' enrollment in college (Arum & Roksa, 2010). These conditions set up a chain of events, wherein 60% to 80% of incoming college students do not have a clear course of study in mind as it relates to a college major or a well-defined career goal that utilizes their gifts and talents. As noted by Dr. Fritz Grupe, founder of MyMajors.com, "It is little wonder 50 percent of those who do declare a major, change majors-with many doing so two and three times during their college years" (Ronan, 2005).

The author suggests that, all of these seemingly un-related issues can be attributed to the lack of an approach that considers all of the factors that affect cognition. When addressing the concerns of students who are likely to cheat, the current educational system of instructional delivery through paper without a student "locus of control" process is seriously vulnerable to cheating and antecedent cheating recidivism. Thus, a neuroscientifically – grounded solution that emphasizes student assessment of their learning, promotes discovery, and adds opportunities for "microcredentialing" (via specialized "certifications" and "badges") is an ideal way to address the culture of cheating in higher learning. This chapter's purpose is to introduce an alternative approach to teaching and learning and provide the research to support how the use of the innovative neuroscience and neuroengineering 4A Metric© infrastructure (embedded within a university Course Management System) first introduced in 2010 in the authors book entitled, "Infometrics: Optimal Learning via Instructional Solutions Developed through the Methodology of Technology Engineering".

4.1 The Solution: The Application of the Infometrics© 4A Metric Algorithm©

All assignments in this course are "Professional Development

Tasks". These tasks are hands–on skill–based experiences that use technology to enhance candidate skills. All course outcomes will be evaluated according to the "4A Metric" (Osler, 2010a), a comprehensive Professional Development Measurement System authored by the instructor and covered in detail in the book, "Infometrics: The Systemic Strategic Practice of Empowerment through the Creation of an Ideal Learning Environment via Optimal Instruction" (Osler, 2010a). In terms of course measurement, the 4A Metric Algorithm as an "E–Learning Engineering" solution provides both the instructor and the student with an in-depth and systemically sequential method of measurement detailed in Figure 3.

4.1.1 Figure 2 Summary

Figure 2 illustrates the mathematical matrix as the systemic sequential infrastructure of the 4A Metric Algorithm. The sub-levels of the 4A Metric are indicated by Levels 1A through 4A sequentially. The micro-levels contained within the four sub-levels are displayed as: micro-levels [1A1.1 to 1A1.4] through micro-levels [4A1.1 to 4A1.4] sequentially. The second part of Figure 2 contains the summative scoring of each sub-level of the entire 4A Metric Algorithm as the 4A Metric Sub-Level Product Formula: $\left[\prod_{i=1}^{4}[1A_{1.1}+1A_{4.4}]_{1A...4A}\right]$. Thus, each sub-level is equal to 1.00 (as points quantitatively), and each micro-level item is equal to 0.0625 points respectively. Thus, the entire 4A Metric has a sum total of 4.00 points as a whole. This makes it much easier for an instructor to calculate grades and much easier for a student to know what their grades are at any time during the course. In terms of neuroscience, the trichotomous trifold structure of the human brain leads to the inclusion and rapid acceptance of the carefully constructed 4A Metric as an "E–Learning Engineering Solution" that is a neuroscience–based e–learning algorithm delivered through a university's respective "LMS" or "CMS" (acronyms for "Learning Management System", and "Course Management System").

$$\left[\prod_{i=1}^{4}4A\right]4A=\begin{bmatrix}1A_{1,1} & 1A_{1,2} & 1A_{1,3} & 1A_{1,4}\\ 1A_{2,1} & 1A_{2,2} & 1A_{2,3} & 1A_{2,4}\\ 1A_{3,1} & 1A_{3,2} & 1A_{3,3} & 1A_{3,4}\\ 1A_{4,1} & 1A_{4,2} & 1A_{4,3} & 1A_{4,4}\end{bmatrix}+2A=\begin{bmatrix}2A_{1,1} & 2A_{1,2} & 2A_{1,3} & 2A_{1,4}\\ 2A_{2,1} & 2A_{2,2} & 2A_{2,3} & 2A_{2,4}\\ 2A_{3,1} & 2A_{3,2} & 2A_{3,3} & 2A_{3,4}\\ 2A_{4,1} & 2A_{4,2} & 2A_{4,3} & 2A_{4,4}\end{bmatrix}+3A=\begin{bmatrix}3A_{1,1} & 3A_{1,2} & 3A_{1,3} & 3A_{1,4}\\ 3A_{2,1} & 3A_{2,2} & 3A_{2,3} & 3A_{2,4}\\ 3A_{3,1} & 3A_{3,2} & 3A_{3,3} & 3A_{3,4}\\ 3A_{4,1} & 3A_{4,2} & 3A_{4,3} & 3A_{4,4}\end{bmatrix}+4A=\begin{bmatrix}4A_{1,1} & 4A_{1,2} & 4A_{1,3} & 4A_{1,4}\\ 4A_{2,1} & 4A_{2,2} & 4A_{2,3} & 4A_{2,4}\\ 4A_{3,1} & 4A_{3,2} & 4A_{3,3} & 4A_{3,4}\\ 4A_{4,1} & 4A_{4,2} & 4A_{4,3} & 4A_{4,4}\end{bmatrix}=4.00$$

$$\textit{Where, } 1A_{1.1}...1A_{4.4}=\left[\prod_{i=1}^{4}[1A_{1.1}+1A_{4.4}]_{1A...4A}\right]0.0625=4.00$$

Figure 2. A Detailed Illustration of the 4A Metric Algorithm in Mathematical Algorithmic Format: As the Foundational 4A Metric Matrix with the Systemic Sequential Scoring Scale

The 4A Metric Algorithm is a comprehensive quantitative analysis methodology for the evaluation of candidate skills and growth based upon one of 4 distinct Professional Development Criterion (or "PDCs"). The PDCs are first presented in the 2010 book entitled, "Infometrics©". The PDCs are the reflective outcomes of evidence that clearly illustrate the precise professional level of candidate knowledge and skill. The Metric is designed to measure how well candidates have learned skills and are able to apply them at the most creative, reflective, and rigorous level. The 4A Metric and the method of measuring candidate outcomes are covered in the following analytics as shown in Tables 1-9 (Osler, 2010a).

The 4A Metric "Interval schedule" detailing the candidate "Virtual Locker" Artifacts and Evidence via Screenshots Integrated into the "Final Comprehensive Presentation E–Portfolio" according to the Interval Scales indicating the "Overall Candidate Level of Performance" (via the 4A Metric in a weekly schedule that highlights all course artifacts and evidence completed during the scheduled academic period, i.e. a semester, quarter, summer session, etc.) [Note: The 4A Metric Comprehensive Portfolio cumulating all student completed course work can be an interactive independent presentation or an interactive in-course system constructed in a Forum via the course

Professional Development Criterion Quantitative Levels	Professional Development Criterion Level Definitions
1A= Active	A learner who has recently acquired the required skills, skill sets, and content knowledge; and uses them to create a product
2A= Able	A developing expert of required skills and content knowledge who is capable of applying concepts, methods, and techniques in a meaningful and effective product
3A= Adept	A content developer who creates and builds an original product that is extensible in multiple arenas and areas and fully expresses concepts, methods, and techniques
4A= Apex	An authoritative content producer who creates innovative and dynamic content in an original product as an expression of their unique voice and experiences that completely defines concepts, methods, and techniques

Table 1. 4A Metric: Measuring Content Authoring

Professional Development Criterion Quantitative Levels	Professional Development Criterion Performance Levels : Candidate Hallmark Product Descriptors
1A= Active	Completed minimal course requirements
2A= Able	Completed an Individually Titled Hallmark Product that is a Novel Property with Unique Characteristics
3A= Adept	Completed an Individually Titled Hallmark Product that is a Novel Property with Unique Characteristics; and has a Distinctive Imprint tied to the Hallmark Product that can be replicated in the future and provide Content Ownership
4A= Apex	Completed an Individually Titled Hallmark Product that is a Novel Property with Unique Characteristics; has a Brand tied to the Hall mark Product that can be replicated in the future and provide Content Ownership; and the Hallmark Product is lawfully protected by legal, proper, current Asset Security

Table 2. 4A Metric: Performance Levels Defined by Hallmark Product Descriptions

Active=1	Able=2	Adept=3	Apex=4
Learning Skill Sets	Learning Skill Sets through Artifact Production	Learning Skill Sets through Artifact Production coupled with a Distinctive Stylistic Imprint	Learning and Artifact Production coupled with a Distinctive Stylistic Imprint and an under standing and implem entation of Asset Security

Table 3. 4A Metric: Candidate Outcome Skill Sets and Growth by PDC Level

Professional Development Criterion Quanti tative Levels:	Professional Development Criterion Level Descriptor Authoring Growth Models	Contextual Authoring Growth Definitions
1 = Active	Learner	Learning Skill Sets
2 = Able	Learner → Planner	Learning Skill Sets evidenced in a Hall mark Authentic Artifact
3 = Adept	Learner → Planner → Developer	Learning Skill Sets evidenced in a Hall mark Authentic Artifact with a Distinctive Imprint
4 = Apex	Learner → Planner → Developer → Creator	Learning Skill Sets evidenced in a Hallmark Authentic Artifact with a Distinctive Imprint and Asset Security

Table 4. 4A Metric: Defining the PDC Level According to Level of Development

CMS/LMS]:

4.1.2 Figure 3 Summary

This diagram is a grading rubric that highlights all of the course "reading assignments" (contained within "Level 1A: Active" that has Levels 1A through 4A to master before moving sequentially on to the next Level 2A); "exercises"

Professional Development Criterion Quanti tative Levels:	Professional Development Criterion Level Descriptors	Professional Development Criterion Level Outcome Definitions
1 = Active	Learner	The term Active describes a beginner to a craft or discipline who with proper guidance can deliver professional level work that is recognized in clean, crisp, clear, and concise products
2 = Able	Planner	The term Able describes a learner that has content knowledge and can apply that content knowledge to create a definitive professional Hallmark Product
3 = Adept	Developer	The term Adept describes a content knowledge professional who can create a Hallmark Product with original content that disseminates information and ideas under a Distinctive Imprint
4 = Apex	Creator	The term Author describes a learner who has cultivated and developed content knowledge and displays their knowledge through as evidence through the production of a distinctive and definitive Hallmark Product

Table 5. 4A Metric: Professional Development Criterion Level Descriptor Matrices

Professional Development Criterion Quanti tative Levels	Outcome Type	Professional Development Criterion Level Outcome Definitions
1 = Active	Learner	A clear, concise arrangement that has the highest value, illustrating a mastery of the craft through the application of content knowledge skill sets
2 = Able	Planner	A clear, concise arrangement that has completely new, fresh, delivery of content and elements in dynamic and interesting ways illustrated in a summative outcome: the Hallmark Authentic Artifact
3 = Adept	Developer	A clear, concise arrangement that has completely new, fresh, delivery of content and elements in dynamic and interesting ways building upon original content using concepts, methods, and techniques. Illustrated in a summative outcome: the Distinctive Imprinting of the Hallmark Authentic Artifact
4 = Apex	Creator	An outcome that has clear, concise arrangement that has completely new, fresh, delivery of content and elements in dynamic and interesting ways building upon original content using concepts, methods, and techniques and breaks new ground in a manner that is inventive, inspirational, and pushes forward the body of knowledge as a problem–solving solution. Illustrated in the Asset Securing of the final completed Hallmark Authentic Artifact

Table 6. 4A Metric: Professional Development Criterion Level Hallmark Artifact as Outcomes Description Rubric

Professional Development Criterion Quantitative Levels	Outcome Type	PDC Level Outcome Examples
1 = Active	Learner	Uses newly acquired skill sets in traditional and dynamically bold ways—thoroughly explaining ideas, thoughts, and concepts; providing references where needed
2 = Able	Planner	Uses skill sets in traditional and dynamically bold ways-thoroughly explaining ideas, thoughts, and concepts; providing references where needed. Enlightens the Target Audience by expounding upon existing information
3 = Adept	Developer	Uses skill sets in traditional and dynamically bold ways—thoroughly explaining ideas, thoughts, and concepts; providing references where needed. Enlightens the Target Audience by expounding upon existing information. Uses graphics to tell a story that is relevant, specific, and compelling using content that is specific and engaging
4 = Apex	Creator	Uses skill sets in traditional and dynamically bold ways—thoroughly explaining ideas, thoughts, and concepts; providing references where needed. Enlightens the Target Audience by expounding upon existing information. Uses graphics to tell a story that is relevant, specific, and compelling using content that is specific and engaging. Uses digital tools, metagraphics, and metametrics (Osler, 2010b) to address and solve a problem in inventive and innovative ways

Table 7. 4A Metric: Professional Development Criterion Level Outcome Skill Set Matrices

Professional Development Criterion Quantitative Levels	Professional Development Criterion Level Definitions
1A = Active	A learner who has recently acquired the required skills, skill sets, and content knowledge; and uses them to create a product
2A = Able	A developing expert of required skills and content knowledge who is capable of applying concepts, methods, and techniques in a meaningful and effective product
3A = Adept	A content developer who creates and builds an original product that is extensible in multiple arenas and areas and fully expresses concepts, methods, and techniques
4A = Apex	An authoritative content producer who creates innovative and dynamic content in an original product as an expression of their unique voice and experiences that completely defines concepts, methods, and techniques

Table 8. 4A Metric: Measuring Content Authoring

(contained within "Level 2A: Able" that has Levels 1A through 4A to master before moving sequentially on to the next Level 3A); "in course projects" (contained within "Level 3A: Adept" that has Level 1A through 4A to master before moving sequentially on to the next Level 4A); and "course assessments" [as "mastery tests"] (contained within "Level 4A: Apex" that has Levels 1A through 4A to master to complete the entire course). The next set of Figures provide screenshot imagery of the implementation neuroscience neuroengineered 4A Metric course displayed within a university Learning Management System. The next set of images (in 4l. through 4r. in Figures 4 through 10 respectively) provide an example of the 4A Metric actively

Professional Development Criterion Quantitative Levels	Level of 4A Content Authoring	Author Definitions	Authoring Mechanisms	Definition of 4A Content Level Authoring
1A = Active	Author Level One	Activate	Active	The starting or basic level of content authorship
2A = Able	Author Level Two	Allocate	Action	The level of content authorship above basic level that is more advanced and indicates the ability to create novel and unique products
3A = Adept	Author Level Three	Articulate	Arrange	The level of content authorship above the second level that indicates the ability to create novel and unique products with distinctive characteristics
4A = Apex	Author Level Four	Authenticate	Allot	The highest level of content authorship indicating the ability to create novel and unique products with distinctive characteristics that illustrate the complete use of all relevant skill sets

Table 9. 4A Metric: The Four Levels of Authoring

The Interval Structure and Overall Final Grade Placement of All Virtual Locker and Final Independent Presentation E-Portfolio Scores by Number of Artifact Intervals							
E-Portfolio Grade Interval Eight: Preeminent = 4A Metric Level: Apex [4A]	E-Portfolio Grade Interval Seven: Exemplary = 4A Metric Level: Adept [3A]	E-Portfolio Grade Interval Six: Effective = 4A Metric Level: Adept [3A]	E-Portfolio Grade Interval Five: Progressing = 4A Metric Level: Able [2A]	E-Portfolio Grade Interval Four: Fundamental = 4A Metric Level: Able [2A]	E-Portfolio Grade Interval Three: Impending = 4A Metric Level: Active [1A]	E-Portfolio Grade Interval Two: Insufficient = 4A Metric Level: Active [1A]	E-Portfolio Grade Interval One: Non-Existent = 4A Metric Level: Active [1A]
4A Metric E-Portfolio Final Grade = "A"	4A Metric E-Portfolio Final Grade = "B"	4A Metric E-Portfolio Final Grade = "C"	4A Metric E-Portfolio Final Grade = "D"	4A Metric E-Portfolio Final Grade = "D"	4A Metric E-Portfolio Final Grade = "F"	4A Metric E-Portfolio Final Grade = "F"	4A Metric E-Portfolio Final Grade = "F"
Interval Number of E-Portfolio Artifacts = 57—64	Interval Number of E-Portfolio Artifacts = 49—56	Interval Number of E-Portfolio Artifacts = 41—48	Interval Number of E-Portfolio Artifacts = 33—40	Interval Number of E-Portfolio Artifacts = 25—32	Interval Number of E-Portfolio Artifacts = 17—24	Interval Number of E-Portfolio Artifacts = 9—16	Interval Number of E-Portfolio Artifacts = 1—8
57	49	41	33	25	17	9	1
58	50	42	34	26	18	10	2
59	51	43	35	27	19	11	3
60	52	44	36	28	20	12	4
61	53	45	37	29	21	13	5
62	54	46	38	30	22	14	6
63	55	47	39	31	23	15	7
64 Optimal Score	56 Superlative Score	48 Proficient Score	40 Efficient Score	32 Developing Score	24 Imminent Score	16 Initial Score	8 Non-Existent Score

Figure 3. The 4A Metric Algorithm: Comprehensive Course E–Portfolio

being used in a university statistics course.

4.1.3 Figure 4 Summary

This is the opening webpage of the university Learning Management System [LMS] at an HBCU for the EDGR 5910 Introduction to Statistics Methods course. The 4A Metric components (Weekly Work and E–Portfolio) are available in the course navigation button infrastructure on the far right side (where the navigation button pane is located). This is the opening webpage that students view each time they open and access the course that provides details about upcoming course events in the section entitled, "Announcements".

4.1.4 Figure 5 Summary

This is the second webpage of the university LMS that uses the 4A Metric for online course instruction. In this particular screenshot one can view the 4A Metric: Weekly Work in the EDGR 5910 Introduction to Statistics Methods course (that deploys after the 4A Metric Weekly Work button is pressed on the course LMS webpage, see Figure 4). The various course requirements are broken down into separate folders according to Sub-Levels 1A through 4A in the 16 week semester separated in four week intervals (one week per 4A Metric Level). This is main area where students access their course content (1st week of a given Level has "assigned readings" (generally but not limited to 4) = Level 1A: Active; the second week of a given Level has authentic exercises (based on the readings also generally but not limited to 4)

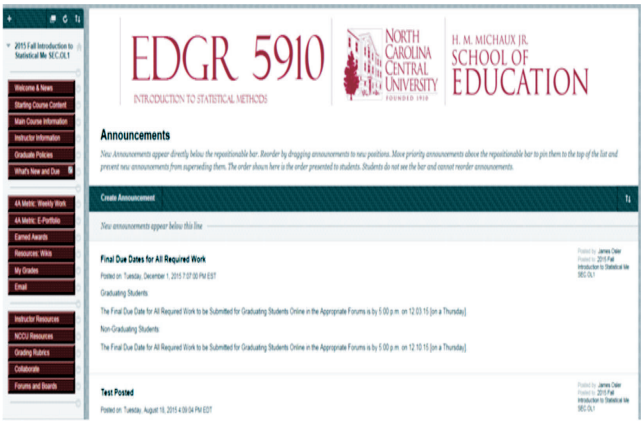

Figure 4. A Case Study–The Implementation of the 4A Metric Algorithm in a Graduate EDGR 5910 Statistics Course

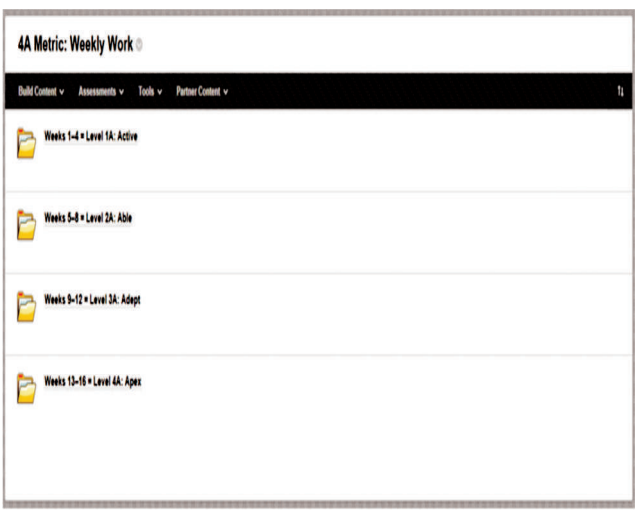

Figure 5. The Case Study Sub-Levels–The 4A Metric Algorithmic Weekly Work for the Graduate EDGR 5910 Statistics Course

= Level 2A: Able and cannot be completed without first completing Level 1A in sequence; the third week of a given Level has "relevant projects" (based on the readings and exercises additionally generally but not limited to 4) = Level 3A: Adept and cannot be completed without first completing Level 2A in sequence; lastly the fourth week of a given Level has the "mastery tests" that must be completed at a given score to progress to the next Level in the 4A Metric (the mastery tests can be taken over and over until the required score is met, this repetition aids the student in learning the material and the test questions through the LMS can be randomized without backtracking so that newly organized tests are made each time the test is taken, this truly aids students in learning the material).

4.1.5 Figure 6 Summary

This is the third webpage of the university LMS that uses the 4A Metric for online course instruction. In this particular screenshot, one can view the 4A Metric: Weeks 1–4 for Level 1A: Active in the EDGR 5910 Introduction to Statistics Methods course (that deploys after the 4A Metric Weekly Work folder is pressed on the course 4A Metric Weekly Work webpage, see Figure 5). This section contains an introductory folder that is first presented and labeled: "Getting Started" (there is a "Getting Started" folder at the beginning of each of the Weekly Work folders per sub-Level). In the "Getting Started" folder there is support material and message of encouragement as positive reinforcement (for the student as they matriculate through the course). One can clearly see the sub-levels that make up Level 1A Active, Able, Adept, and Apex respectively. At the bottom of the page is a course "credential" -the 4A Metric course badge that a student earns after completing Level: 1A: Apex.

4.1.6 Figure 7 Summary

This is the fourth webpage of the university LMS that uses the 4A Metric for online course instruction. In this screenshot, one can view the first micro-level as the 4A Metric: Week 1 = Level 1A: Active in the EDGR 5910 Introduction to Statistics Methods course (this screenshot deploys after the 4A Metric Week 1 folder has been pressed [thus, this is the content contained within the folder appears as it on the course 4A Metric Weekly Work webpage, see Figure 6]. This section contains an introductory Week 1 work which is the assigned readings (chapters 1 through 4 of the assigned course textbook). One can also see that 4 videos have been assigned related to the chapter readings (in this screenshot the assigned "Interactive Statistics Methods ©" videos 1 through 4). At the very top of the page is a checklist of all actives in Week 1 that can be <right clicked> to highlight the completed task(s). In this way, students can keep and maintain a running tabulation of their completed work so that they do not fall behind. A checklist is made available for all students enrolled in Note that the last part of the checklist states that at the completion sequentially of all of the Week One assignments one can then advance to the next Level (this is the pattern which is repeated throughout all courses that have the neuroscience and neuroengineered 4A Metric as the "primary information dissemination operation" used to deliver and convey all course information data, and requirements to students).

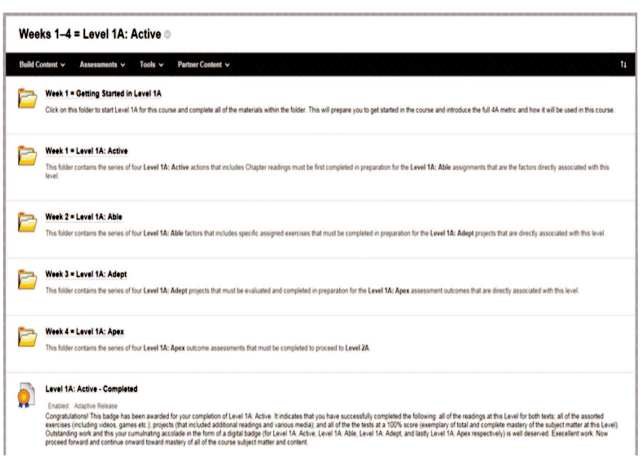

Figure 6. The Case Study First Sub-Level–The 4A Metric Weekly Work for Weeks 1–4 in the Graduate EDGR 5910 Statistics Course

4.1.7 Figure 8 Summary

This is the fifth webpage of the university LMS that uses the 4A Metric for online course instruction. In this screenshot, one can view the 4A Metric: E–Portfolio Access Point made available at the start of the course. The course E–Portfolio is a downloadable Microsoft PowerPoint file that is made available through the 4A Metric E–Portfolio button located in the course LMS (Blackboard Learn 9.1) right hand navigation pane under the 4A Metric Weekly Work button on the opening course webpage. Once the 4A metric E–Portfolio button is pushed, the image above can be seen (which is a screenshot of the E–Portfolio Access

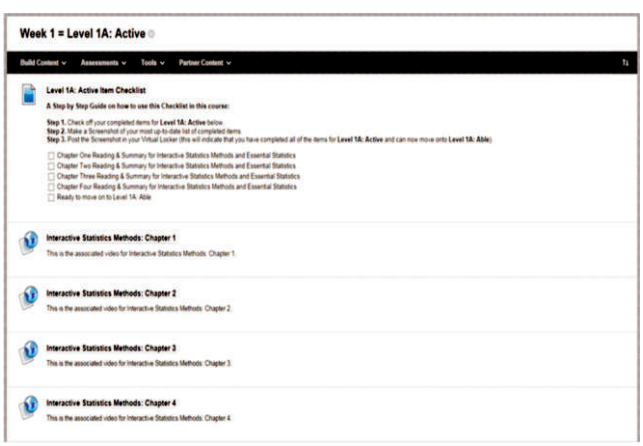

Figure 7. The Case Study First Micro-Level–The 4A Metric Algorithm Week 1 = Level 1A Active in the Graduate EDGR 5910 Statistics Course

Point/webpage). At the top of the webpage is the downloadable standalone Microsoft PowerPoint 4A Metric E–Portfolio, especially designed for this particular course. Students can access the file by <right clicking> on the designated file and downloading it to their computer. Underneath the E–Portfolio file is the university Information Technology website information to purchase and obtain the latest version of the Microsoft Office suite that contains the PowerPoint software. This is the university Microsoft Distribution Program. Through the Program students can purchase at a special rate an affordable copy of the latest version of Microsoft (as needed) from Information Technology. This is of great benefit to students and their instructors as it ensures that university constituents (students, faculty, and staff) have ready and available access to the most updated versions of "industry standard" software at an excellent rate. The Microsoft Distribution Program is not limited to platform or operating system. Thus, users of Personal Computers (PCs) and Apple products (Macs) can obtain the software as needed. The link and all information about the Distribution Program are provided in this area of the university course LMS because the Microsoft PowerPoint software is a necessary and vital tool needed to complete the comprehensive course E–Portfolio.

4.1.8 Figure 9 Summary

This is the sixth webpage of the university LMS that uses the 4A Metric for online course instruction. In this screenshot, one can view the opening of the 4A Metric: E–Portfolio made available at the start of the course. The course cumulative and comprehensive E–Portfolio is a downloadable Microsoft PowerPoint file that is made available through the 4A Metric E–Portfolio button located in the course LMS (Blackboard Learn 9.1) right hand navigation pane under the 4A Metric Weekly Work button on the opening course webpage (as mentioned previously in Figure 8). Once the 4A metric E–Portfolio downloadable file has been <right clicked> and downloaded onto the student's computer, the image above can be seen (which is a screenshot of the opening of the 4A Metric E–Portfolio). The image is a screenshot of standalone Microsoft PowerPoint 4A Metric E–Portfolio especially designed for this particular course. Students are required to complete this particular work at a steady pace throughout the entire academic period that they are enrolled in the course. The E–Portfolio serves as an "industry standard" standalone "micro-course" that parallels the entire online course with checklists, critical reflections on all course activities (using the 4A Metric to display self-growth). The student uses screenshots to complete the E–Portfolio thereby delivering authentic evidence of all completed work throughout the academic period. They are also required to upload these images into a "Virtual Locker" under their name in the Discuss Board section of the course as a backup to the portfolio requirement that allows them to "data warehouse" their work as they matriculate through the course. This provides faculty with an ongoing tabulation of completed tasks and they can actively know if the student is completing the course at their own pace. The E–Portfolio

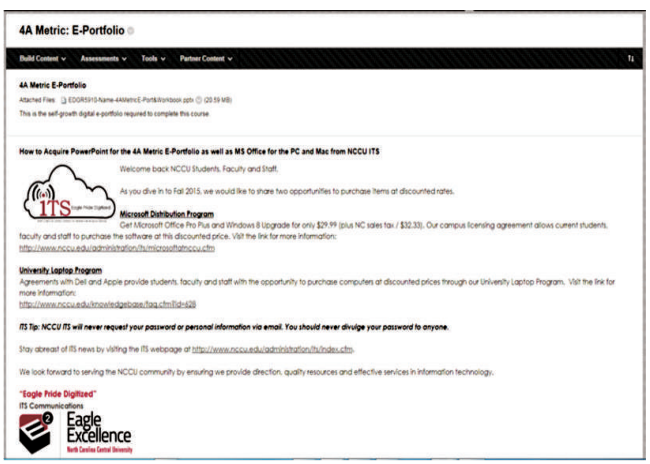

Figure 8. The 4A Metric E–Portfolio Access Point in the Graduate EDGR 5910 Statistics Course

Figure 9. The 4A Metric Cumulative and Comprehensive E–Portfolio in the Graduate EDGR 5910 Statistics Course

can be archived as a pdf file once completed that the student can save as a "professional development" artifact of the progression and completion of the course. This same file can be upload into a university E–Portfolio system for later evidence of course completion when they prepare to graduate and can be presented to an employer demonstrating their level of expertise with the course content. At the end of the course, the student at the end of the E–Portfolio should be able to illustrate the self-growth that occurred from Level 1A to Level 4A where they (upon successful course matriculation through the completion of all required course work) now have obtained a high level of expertise with the course subject matter.

4.1.9 Figure 10 Summary

This is the sixth webpage of the university LMS that uses the 4A Metric for online course instruction. In this screenshot, one can view the 4A Metric Level 4A: Apex course assessment structure that uses "mastery tests". Mastery testing requires that the student completes the test at the level of expertise designated by the instructor. The student has the opportunity to retake the test until the level of mastery is achieved. The tactical advantage of a course structure in a Learning Management System is the ability that the instructor has to restructure subsequent tests so that upon retaking the psychometric, the student will have a novel experience with the same subject matter. This in effect, forces them to study and learn the material. In addition, the repetitiveness of the testing procedure ensures that the subject matter is encoded into both short-term and long-term memory. The more the retakes-the more they learn. The efficacy of Mastery testing has been expounded upon for some time, especially in the discipline of Educational Technology. According to highly regarded Educational Technology researchers Kulik and Kulik mastery testing has many benefits. As they state in their research conducted on mastery testing and student learning, "A meta-analysis of forty-nine comparative studies showed that mastery testing generally has positive effects on student learning" (Kulik & Kulik, 1987). The mastery testing process is used throughout the 4A Metric at the Apex Level on all tests (Weekly, Mid-Term, and the Final Examination). Testing is generally where cheating and cheating recidivism is most prevalent. Through collegiate regimented traditional academic course testing there is often the following three cheating causes: (1) the pressure to succeed; (2) the encouraged competitiveness of the academic environment; and (3) the rigor of high learning course requirements. These are often the reasons that serve as the root causes of systemic collegiate course cheating. Thus, the counterpoint to the root causes (in terms of systemic testing) is the use of the mastery test process and associated mastery test procedures. Mastery testing is a direct counter to the identified three cheating causes. The delivery methodology of the mastery test within the confines of the 4A Metric is the neuroscience and neuroengineering solution that removes all of the aforementioned reasons for cheating (thereby diffusing cheating recidivism as well). The onus is now placed on the student to complete all of the required course work within the empowering framework that is provided by the 4A Metric. An added benefit for the student is that the pressure created by the cheating root causes is now effectively "off" because the primary goal of 4A Metric in terms of mastery testing is to ensure "that all students learn the material with a high level of success". This is the expectation of the faculty and as they matriculate through the 4A Metric–based course, this also becomes the goal of the student.

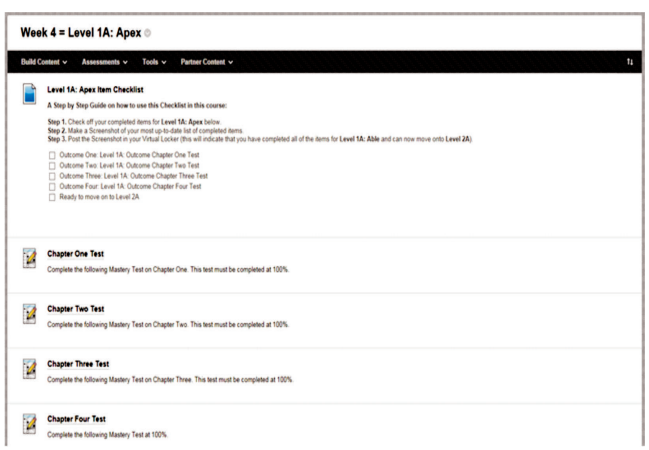

Figure 10. The 4A Metric Level 4A: Apex in the Graduate EDGR 5910 Statistics Course

5. Supportive Research for the 4A Metric Algorithm as a Neuroscience Neuroengineered Solution

There is further research to support the active use of the neuroscience and neuroengineering 4A Metric as a mind

and brain healthy and holistic neuroeducation solution. The "Mind-Brain" connection that results from the dynamic neuroscientifically neuroengineered 4A Metric leads to engaging student self-growth via its use of empowering independent and individualized learning. Dr. John Ratey, Professor of Psychiatry at Harvard Medical School and Author of "A User's Guide to the Brain", notes that neurons that fire together wire together (Weiss, 2001). This basically means that the more we learn or do a particular task, the stronger the neuronal connections get in the area of the brain linked to the learning task. The brain is connected to every part of the human body, and to the outside world, by a communications network dominated by two major components, nerves and messenger chemicals, primarily neurotransmitters and hormones (Lamberg, 2007). A protein in the brain called Brain-Derived Neurotrophic Factor (BDNF) plays a key role in creating and connecting new neurons, which is vital for thinking, learning and higher levels of brain function. Studies show that exercise enhances brain performance and increases the production of BDNF (Perlmutter, 2001). Dr. Carl Cotman, Director of the Institute for Brain Aging and Dementia at the University of California, Irvine showed in his research that exercise sparks the master molecule of the learning process. His research provided a look at the direct biological connection between movement and cognitive function (Ratey, 2008, p. 43).

The new field of "Educational Neuroscience", also called "Neuroeducation", investigates some of the basic processes involved in learning to become literate and numerate; but beyond this it also explores 'learning to learn', cognitive control and flexibility, motivation as well as social and emotional experience (Royal Society, 2011). The concept of 4A Metric© is based on how the mind, brain and education converge to inform the design of dynamic interactive and engaging curricula. Teaching has always involved the creative appropriation of curricula within the situated practice of a given classroom. The curriculum is a cultural tool, and like all such tools, it carries constraints and affordances that always allow creative improvisation in their application (Wertsch, 1998 as cited in Sawyer, 2003). The goal of a truly holistic neuroscience and neuro engineering curriculum or program is to maximize the use of the "whole brain" (conscious, sub-conscious, super-conscious, and left/right hemispheres) to achieve optimal learning and performance success. Achieving what is called, a "Whole-Brain State" is what allows for maximum communication/data flow between the left and right hemispheres of the brain and the alignment of the conscious and sub-conscious beliefs (Fannin & Williams, 2012). The 4A Metric© program using an integrated sequential systemic approach to "brain-based cognitive learning" in a university Course (and/or Learning) Management System ["CMS" and/or "LMS"] helps to achieve a powerful, creative, and appealing "Whole-Brain State".

An additional benefit of the 4A Metric is that it also intrinsically creates collaboration by the nature of its Instructional Design. The features of the 4A Metric are "emergent" because the outcome cannot be predicted in advance, and they are "collaborative" because no single participant can control what emerges; as stated by researcher Sawyer, the outcome (in class discourse and course content online dialog) is collectively determined by all participants (Sawyer, 2003). This process allows for active student engagement, and develops critical thinking, reasoning, and problem-solving skills. This process also encourages dynamic reflection and feedback (an essential requirement of the 4A Metric E–Portfolio and e–portfolio structures in general). When this engaging educational process is properly facilitated, it also creates an environment for the development of effective collaborative communication and social skills.

Students learn from active, empowering, and engaging collaborative discourse because there are multiple perspectives, and this form of learning can only work if the group is improvisational, with no predetermined outcome and no preset script (Sawyer, 2003). The skills gained from the 4A Metric© as a process prepares students for what Pink Daniel (2005) calls this new age we are living in (he refers to as), "The Conceptual Age". Dr. Pink notes that this is the age of what he terms as the, "high concept". The "high concept" requires the ability to detect patterns and opportunities and combine seemingly unrelated ideas into something new (Pink, 2005). In engaging collaborative

classrooms, new knowledge and insights emerge from exploratory discussion among learners (Sawyer, 2003). According to Sawyer (2011), much of the brain is active when you're engaged in these sorts of creative mental processes and the entire brain works in concert to engage in what we call creativity (Sawyer, 2011). This is the ultimate goal of the 4A Metric, where "creativity" is the highest level (Level 4A: Apex, see 4b. Table 1: 4A Metric: "Measuring Content Authoring").

6. Case Study Limitations

Although the 4A Metric Algorithm has unlimited applications beyond the foci of this paper, the author notes that there are some limitations to the methodology as presented in this particular example. The limitations from this particular case study are as follows: (1) The 4A metric is limited to the deployment methodology used by the instructor (in this case the course CMS/LMS); (2) The course subject matter limits the way in which the 4A Metric as systemic sequential problem-solving algorithm can be used (in this case, the details of the statistical information as placed online in the course CMS/LMS by the instructor); and lastly (3) The 4A Metric as an effective course delivery methodology is limited to the time the instructor has to build the entire course (because of its extensive nature, course instructors need time to place and present material into the CMS/LMS even if they are releasing material in a sequential fashion-time is still needed to place material online and in the 4A Metric Algorithmic structure).

7. Recommendations for the Successful Application of the 4A Metric Algorithm

The author makes the following recommendations for the future use of the 4A Metric Algorithm as an E–Learning standard in online course development and deployment: (1) That more course instructor use the 4A Metric methodology in a variety of ways so that the methodology becomes the standard for online instruction; (2) That a student growth mindset be adopted by the field of education in the online learning arena that will actively promote engaging, enhancing, and empowering student-centered learning; and (3) That research into learning to learn, process education, and the implementation of the 4A Metric Algorithm be conducted simultaneously to provide a rich and diverse set of investigative inquiry that supports innovative and active online instruction that will grow the field of distance learning as a whole. These recommendations will thereby aid the field to mature into a dynamically responsive community of learning that immediately addresses student needs and concerns academically while concurrently supporting student growth and reducing cheating and cheating recidivism.

Conclusion

The 4A Metric Algorithm© uses all of the aforementioned measurement methodologies, project–based learning activities (such as the Level 3A: Adept-projects, and the cumulative comprehensive course 4A Metric E–Portfolio), and the interactive collaborative discourses as dynamic approaches at an university (through its LMS) to support college students in their pursuits towards a successful life and future career. The use of these dynamic approaches through the neuroscience and neuroengineered 4A Metric in traditional and non-traditional classrooms completely integrates curricula on a physical, mental, and social level. The use and measurement of the solution through Trioinformatics "Neuromathematical Notation", and the Tri–Squared Test statistic can lead to research outcomes that positively impact the culture of the learning environment in online and face to face delivery, thereby validating the implementation of 4A Metric as a positive answer to the outgrowth of cheating. As such the 4A Metric as a teaching and learning solution, considers every learning domain (affective, cognitive, psychomotor, and social) in the context of authentic and active learning, thereby, creating a nurturing environment that is conducive for the growth and development of college students anywhere.

This research–grounded solution is the engaging inoculation, empowering resolution, and active cure for cheating and cheating recidivism. Through the use of this vibrant and student-centered neuroscience and neuroengineering methodology students are able to combine usable tools, novel technologies, authentic exercises, rigorous assignments, unique experiences, focused projects, and energetic techniques, into an empowering experience with a high student locus of

control. Through the 4A Metric are also able to tap into their natural gifts and talents along with their unique interests. This makes the learning environment highly enriching and actively engaging well beyond the simple delivery of instruction (that is remarkably vulnerable to cheating). In this manner: learning becomes much more personal; sharing and collaborating becomes the classroom cultural norm; the process of discovery thereby enhances knowledge; and the learner is placed at the forefront of the course with cheating and its associated recidivism a long forgotten thing of the past.

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