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Measuring the Effectiveness of Cognitive Training to Improve Adult Learner Outcomes in Online Learning Environments

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Abstract: *Adult learners often experience significant environmental and/or physiological challenges when returning to learning environments not experienced by their younger counterparts. The researcher hypothesized that a one-day workshop covering concepts associated with cognitive functioning is an effective strategy to help adult learners overcome challenges faced in online learning environments. A quasi-experimental study was designed to address these factors through the use of a technology-based instructional unit, while determining if various measurements can be used to gauge successful learning outcomes. Based on the findings of the study, the researcher concluded that a one-day workshop covering concepts associated with cognitive functioning is an effective strategy to help adult learners overcome challenges faced in online learning environments.*

Key Words: *education, online learning, adult learner, e-Learning, cognition, memory improvement*

Introduction

As the prevalence of online learning is increasing each year, adult learners are returning to the classroom in record numbers. Due to gaps in their educational histories, they are often confronted with challenges not experienced by their younger counterparts. This study incorporates a rigorously designed unit of instruction, cognitive knowledge assessments, and statistical measurements – all reinforced by a review of previously published research. The researcher hypothesized that a one-day workshop covering concepts associated with cognitive functioning is an effective strategy to help adult learners overcome challenges faced in online learning environments.

Adult learners, commonly referred to as *nontraditional students*, are generally defined as returning students that are over the age of 24 who have a gap in their education between secondary and post-secondary enrollment (Merriam & Brockett, 2007). Today, nearly 50% of all college enrollees in the U.S. are comprised of adult learners ("National Adult Student Priorities Report," 2008) and will be the fastest growing student segment in the future (Benshoff & Lewis, 1992). Additionally, adult learners have a larger number of educational opportunities available online than ever before and are returning to school in record numbers (Allen & Seaman, 2007).

Problem background. In the process of examining the identified problem background in further detail, a needs analysis was conducted with study participants to better understand the challenges

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faced by adult learners in online classrooms. Participants were asked to complete a Likert survey rating various challenges currently faced by most adult learners as concluded by Merriam & Brockett (2007). Twelve adult learners currently enrolled in at least one college-level course completed the online survey. All of the questions were categorized within the domains of cognition or personal life balance. Students were asked to rate the frequency of challenges they are facing as they complete their individual course of studies. According to collected responses, 75% of the participants have difficult recalling information during testing (cognition), 75% of them scrutinize information while reading at least half of the time (cognition), and nearly 67% have difficulty completing their schoolwork on time as a result of conflicting work or family commitments (personal life balance). Participants were also asked to rank their personal time management skills. Over 58% ranked their skills as average or better. These results indicate that many students may not feel time management skills are an impediment to completing their course of study. When asked to rate the importance of critical thinking, 75% of the respondents felt that critical thinking is always important. Participants were additionally asked to rate their current memory and to gauge if memory digression has caused issues for them during their course of study. Overwhelmingly, participants indicated that their memory has declined or has been adversely affected, as they have gotten older. The finding is similar to other studies. When asked to estimate the number of hours spent on coursework each week, over 83% of respondents indicated that more than 10 hours per week are dedicated to academic pursuits. The responses support the general consensus that adult learners typically are highly motivated students. Alternatively, the responses could signify that learners are struggling with their studies if, for instance, each student is taking a single class versus a full course load. When asked to rank 5 common reasons that might cause participants to withdraw from their academic studies, conflicts with family commitments ranked the highest among respondents. Insufficient time available for studies was another factor that respondents (25%) indicated might cause them to withdraw. The responses could be interpreted that with corrective instruction, many students might avoid withdrawal from school through better time management and/or improved cognitive abilities. The final question of the survey asked participants to rank, in order of importance, which set of skills they would most like to improve if given the opportunity. The question was designed to determine if adult learners might be interested in skills improvement instruction if given the opportunity and to determine the skills they considered most important. Over 40% of respondents selected math as the most important skill they would like to have improved, followed by memory and written skills improvement respectively. Many students struggle with math so the most popular response was expected. Surprisingly, nearly 60% of the respondents ranked time management as the skill they would least like to improve in the provided list.

Literature Review

While a great deal of research has been conducted in the areas of learning and instructional design theory, few studies have been to measure the effectiveness of single-day

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training for adult learners. Instances where principles of neuroscience (cognition, memory digression, etc.) are introduced into a study are virtually non-existent. Nonetheless, several "best practices" were incorporated into the study as appropriate. For instance, the limited number of learners available during the study deemed the use of a control group unfeasible. Because the lack of a control group is the norm rather than the exception in many instructional settings today, it is not uncommon for science educators to use class-average normalized gain and related metrics in order to gauge the effectiveness of training when using pre- and post-testing (Prather, Rudolph, Brissenden, & Schlingman, 2009). Additionally, the effectiveness of training when using pre- and post-testing is typically characterized by using a predefined target objective of 30% for average normalized gain (Hake, 1998). Finally, the use of a paired two-sample *t-test* is commonly considered a valid measure when only a small population exists during a study ("'Student's' t Test (For Paired Samples)," n.d.). Each of these *best practices* was incorporated into the study.

Technological considerations. Fallah & Ubell (2000) conducted a study with traditional and online students at the Stevens Institute of Technology by comparing midterm exam scores between the two groups. The study showed no significant deviations in test scores between the two groups. In a similar study, Ben Arbaugh (2000) found that grades of online and traditional MBA students varied little as well. Additionally, meta-analysis research conducted by Shachar & Neumann (2010) found strong conclusive evidence that distance learning is an effective method for instruction. The research analyzed the findings of 86 experimental and quasi-experimental studies that comprised data collected from more than 15,000 students. Although these studies are not focused specifically on adult learners, they do indicate that online learning itself isn't necessarily the cause of poor performance by adult learners.

When evaluating potential technological barriers, one must also consider the idea that technology *itself* may create obstacles to adult learner success. In the early days of Internet-based instructional delivery, researchers believed that adult learners would struggle with online learning more than their younger counterparts due to family/career commitments and a lack of technological understanding (Dubois, 1996). However, Ke and Xie's (2009) findings concluded that adult learners required no more effort in completing their studies than younger students. Therefore, while challenges do in fact, exist, they are not necessarily due to the technological aspect of online learning.

Environmental considerations. The data collected during the learner analysis phase of the study supports the findings of Merriam & Brockett (2007), who concluded that the typical adult learner must manage work, family, and finances while successfully completing his/her online education. School schedules that conflict with personal or work-related priorities may force adult learners to drop out of their course of study altogether if they are

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unable to manage their time effectively.

Attrition and success rates in distance education have been researched and debated for around seven decades while no clear framework has been established to measure them (Berge & Huange, 2004). With the proliferation of e-learning in recent years, the debate has continued to intensify with conflicting statistics. For instance, some estimate that student attrition rates are 10-20% higher than traditional on-campus enrollments (Carr, 2000), while others have reported attrition rates of up to 80% (Flood, 2002). Two of the most oft-cited reasons that adult learners fail at online learning include the lack of time and money (Merriam & Brockett, 2007). These findings seemingly supports the argument that personal conflicts may play a significant role in the lack of success by adult learners within an educational context if students are not prepared to deal with them in an effective manner. While the reasons for these attrition rates are also subject to debate, they represent a valid concern for adult learners that must manage their careers, families, and/or finances while attempting to successfully complete their education.

Physiological considerations. In addition to the environmental challenges described above, other challenges faced by adult learners may be biological in nature. For instance, *Cognitive Load Theory* is based on the assumption that learning occurs and is processed in working memory (Paas, Renkl, & Sweller, 2003). Working memory is characterized as short-term with relatively low storage capacity and limited information processing ability. As learners process new information, cognitive schemas are developed as individuals mature. Any new information added and processed within working memory is incorporated into the cognitive architecture. The process creates a knowledge structure that incorporates new learning, and ultimately grows as an individual ages. A cognitive architecture, when developed effectively, frees up resources associated with working memory. When a cognitive architecture is underdeveloped or virtually non-existent, the process of learning can cause working memory to quickly become overloaded. As a result of the overload, adult learners experience anxiousness and loss of confidence that effectively shuts down the learning process within the individual. The increased levels of anxiety and/or loss of confidence may ultimately lead to failure for the adult learner in an online learning environment.

Research has conclusively proven that instruction can be used to improve cognitive abilities in adult learners (Ball et al., 2002). Because many adult learners have gaps in their learning, skills such as note-taking, critical thinking, and effectively dealing with change can potentially increase their chances of success in online learning environments. Although adult learners often face a greater number of challenges than their younger counterparts, instruction may be used to assist them in overcoming these challenges, leading ultimately to their success.

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Because adult learners are generally older individuals with unique life experiences, they typically respond to instruction differently than their younger counterparts (Knowles, 1980). The proposed solution associated with this study has been developed in order to accommodate this need. For instance, adult learners may have preconceived notions or beliefs directly resulting from experiences that may hinder their openness to new concepts and/or ideas. Adult learners generally want to use the knowledge they have gained from their experiences and to be acknowledged for doing so.

Malcolm Knowles first introduced the concept known as andragogy in 1968 (Reischmann, 2004). Andragogy principles are unique to adult learners by their very nature. We know, for instance, that adult learners are generally self-directed and autonomous and that teachers of adult learners are facilitators of learning rather than simply presenters of information (Knowles, 1980). Adult learners need to understand why they should learn something and how it will benefit them. The need to understand how the information they are receiving can be used to solve a problem in real-life. Additionally, adults are generally motivated by internal priorities versus external ones (Knowles, 1980). Finally, adult learners are generally life, task, or problem-centered in their learning processes.

Demographic considerations. In a study completed by Hargis (2001), the researcher determined that age has little or no relevance in successful online learning. Despite the findings and the fact that 'adult learners' are classified as such due to their *age*, additional demographics must be taken into consideration when considering factors that may affect academic performance and/or attrition rates. Aside from age, factors such as gender may also play a role in overall academic performance. In a 2010 study conducted by Kaur, Han Tek, & Lee, the researchers concluded that gender does factor into academic performance. Their 5-year study involved 948 Malaysian students and found that female learners are likely to perform better academically due to communication patterns associated with a 'sense of belonging to an online community'. The researchers further concluded that students over the age of 46 might require additional instructional support in order to achieve academic success. In a similar study conducted by Wojciechowski & Palmer (2005), the researchers concluded that there is no correlation between gender and academic performance. Another study conducted by Blum (1999) posited that females are at a disadvantage in online learning environments due to lack of confidence in online learning and technological barriers. The conflicting findings of these studies warrant further investigation into the impact that gender may or may not have on adult learners in online learning environments.

Summary

Although there has been a great deal of research conducted in the area of *online learning* in recent years, studies that address the correlation between adult learning and academic success

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have resulted in conflicting opionions among researchers. A literature review does, however, support the notion that physiological and environmental factors may affect learner outcomes in adult populations. A great deal more research is needed to determine other factors that may affect adult learners in online learning environments. Additionally, previous study results demonstrate a significant divide within the research community regarding the effects that technology and demographics may have on adult learners. Finally, in conducting a literature review, virtually no studies were found that investigate the effects that cognitive training may have on adult learners during an 8-hour training session.

Methodology

The research was conducted as a quasi-experimental pre- and post-test study held at a corporate training facility in Dallas, Texas. The participants comprised 7 adult learners, all between the ages of 30-43 years old, currently enrolled in at least one online, post-secondary level course. Adult learners participating in the study can read and write and have a general education level background at the post-secondary level. Participants are required to have basic level technological skills including the ability to use the Internet. Participants must be able to identify numbers and basic images that are easily recognizable by the learner population when displayed on a computer screen. They generally have no prior knowledge of meta-cognition, memory improvement techniques, or similar concepts, however, they do have the ability to learn them if taught correctly (Ball et al., 2002). Each adult learner likely has recognized a decline in his/her memorization skills however the majority has most likely never received any formal memory improvement training. No additional knowledge or skills were necessary to successfully complete the instructional unit. A subject matter expert was utilized to provide input and insights into the overall instructional design prior to training delivery. Informed consent forms were collected from participants prior to instructional delivery.

Evaluation Methodology. Each of the participants were required to attend a 1-day training workshop (refer to Appendix A), complete both a pre- and post-test, and a post-workshop Likert-scale survey in order to measure training effectiveness. A supplemental website was setup for testing, information, and survey delivery. Quantitative data was collected via pre- and post-tests completed by all subjects.

Reliability and Validity. A 20-question, multiple-choice pre- and post-test was administered to all participants. The 20-questions were delivered in online, random ordered format to each participant. Each of the 20 questions were designed to test cognitive knowledge by all participants. All 20 questions were reviewed by an SME for technical accuracy prior to subject dissemination. By using a random ordering sequence, each learner received a different test however all questions were the same for each subject. The maximum score on each test was 100%. Each participant received identical instructions prior to the state of each test and 30

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minutes was allotted for each test. Pre- and post-test scores were compared to determine the effectiveness of the instructional unit using a pre-defined class average normalized gain of 30% <g> or greater as a justifiable measure of success. In the comparing of the pre- and post-test scores, a paired-samples t-test with an x of 0.05 was used and graphed.

Findings

7 subjects took both the pre-test and the post-test after one-day workshop covering concepts associated with cognitive functioning. Mean test scores improved significantly from 51% to 94% (Figure 1). Absolute gain was 43% and relative gain was 85%. The *class average normalized gain* $\langle g \rangle$ was 87%, and the *average of the single-student normalized gains* $\langle g_i \rangle_{ave}$ was 89%. A predefined target $\langle g \rangle$ of 30% was taken as defining the minimum value at which the educational intervention could be regarded as effective. In this study, the results that $\langle g \rangle$ is equal to 87% > 30%. Also, it is worth noting that the *p-value* for the hypothesis test (paired two-sample *t-test* for means) is 0.00015 and it is less than the *critical p-value* of 0.05, which means we should accept the Null Hypothesis.

Results. Each of the 7 study participants completed both the pre- and post-test. The pre- and post-test scores for all participants are shown below.

Table: 1

Pre- and post-test scores and learning gain (N = 7)

Pre-test scores	**Post-test scores**	**P value***	**Absolute gain**	**Relative gain**	$\langle g \rangle$	$\langle g_i \rangle_{ave}$
51%	94%	0.00015	43%	85%	87%	89%

**P-value for the test was calculated (t-Test: Paired Two Sample for Means)*

The mean test score for a group of 7 students after the one-day workshop covering concepts associated with cognitive functioning, when calculated, is 93.57% (approx. 94%). First we must define *Individual actual gains* G_i = post-test score − pre-test score.

Then, Mean test score of knowledge improvement would be the average of G_i :

$$M = \frac{\sum G_i}{\mathrm{N}} = \frac{\sum G_i}{7} = 42.86\% \approx 43\%$$

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Therefore, on average, the students' scores are better after the workshop (average difference between the post- and pre- scores is 43%).

The absolute gain for the class was calculated as well to support the findings:

$$\textit{Absolute gain } G_A = \frac{average(G_i)}{\text{Maximum score achievable}} = \frac{42.86\%}{100\%} \approx 0.43$$

In percentage, it is 43%.

The relative gain for the class was calculated as well to support the findings:

$$\textit{Relative gain } G_R = \frac{average(G_i)}{\langle \%\ \text{pre-test} \rangle}$$, where $\langle \%\ \text{pre-test} \rangle$ is the initial class average.

$$G_R = \frac{42.86\%}{50.71\%} \approx 85\%$$

Normalized gains for class and single-student improvement were calculated as well. A measure of course effectiveness is the class *Average normalized gain*

$$\langle g \rangle = \frac{\langle \%\ \text{post-test} \rangle - \langle \%\ \text{pre-test} \rangle}{100\% - \langle \%\ \text{pre-test} \rangle}$$

The $\langle g \rangle$ is defined as the average actual gain (by the way it is calculated above) divided by the maximum possible gain, where $\langle \%\ \text{post-test} \rangle$ and $\langle \%\ \text{pre-test} \rangle$ are the final (post) and initial (pre) class averages, and the angle brackets "$\langle \ldots \rangle$" indicate an average of the students taking the tests.

$$\langle g \rangle = \frac{93.57\% - 50.71\%}{100\% - 50.71\%} = \frac{42.86\%}{49.29\%} = 0.8695$$

Therefore, in percentage, $\langle g \rangle = 87\%$

Individual single-student normalized gains $\langle g_i \rangle$ were calculated for all students via the formula (post-test and pre-test values are taken individually this time, no averaging):

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$$\langle g_i \rangle = \frac{\%\ \text{post-test} - \%\ \text{pre-test}}{100\% - \%\ \text{pre-test}}$$

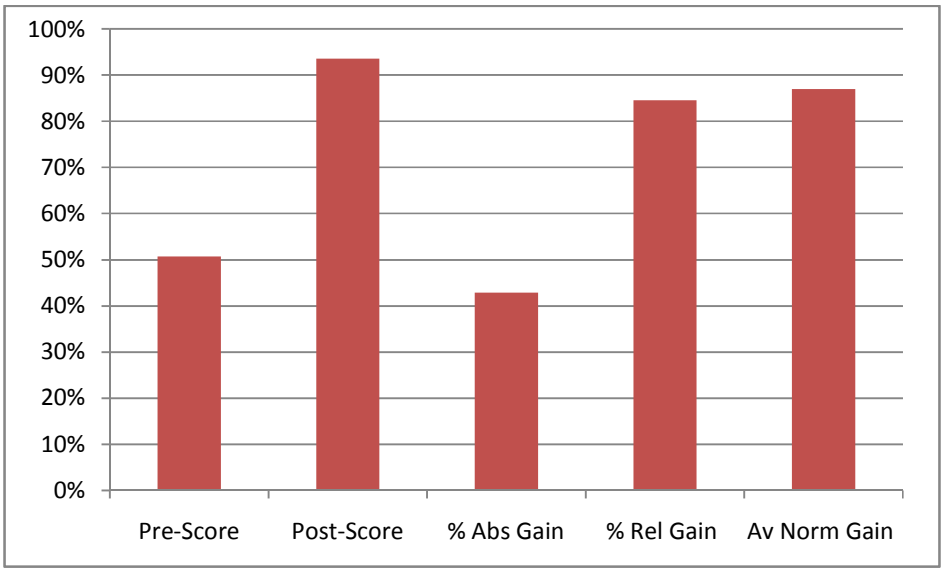
and averaged as:

$$\langle g_i \rangle_{ave} = \frac{\sum_{i=1}^{N} \langle g_i \rangle}{N}$$

where *n* is the number of students taking both the pre- and post-tests (N=7).

$$\langle g_i \rangle_{ave} = \frac{\sum_{i=1}^{N} \langle g_i \rangle}{N} \approx 0.89 \text{ , i.e. } 89\%$$

Figure: 1



Graph representation of pre- and post-test learning gains (N=7)

A 10-question Likert-scale survey was also utilized to evaluate the perceived value of the instructional unit at the conclusion of the course. The online survey used a forced ranking system for the first 9 questions, and each question gave students 5 standard answer options appropriate to each question. The results were collected and each response was calculated generating a mean score for each. The final question was asked in order to collect qualitative data that can be used to improve the course in the future.

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Overall the results of the survey were positive. Mean scores ranged from 3.14/5 to 5/5 (5 was the highest attainable score). The duration of the workshop was the chief complaint of attendees, receiving the lowest mean score of 3.14 with over ½ (57.1) of all participants feeling that the daily format was appropriate. The course duration was indicated as a concern by several respondents in the final question as well. Surprisingly, the use of Lumosity during the workshop was deemed a positive of the instructional unit by almost all of the participants.

Conclusion

Experts generally agree that testing drives successful learning when combined with effective instruction. In the context of this study, the researcher maintains that the pre-/post-test model with appropriate and objective measures of learning is an effective educational intervention that may help adult learners to become more successful in online learning environments. The findings of this study support this conclusion. Although figures vary, experts agree that adults are returning to school in record numbers. As these numbers continue to increase in the future, the likelihood of the obstacles identified in this study gaining prominence is highly likely. If left unanswered, many of these adult learners will fail, thereby decreasing overall retention rates of institutions. Another implication of this study is that educational intervention may be utilized to curtail adult learner failure. Although we can never assure the success of all learners, it is only through additional research and further studies of this nature that we may eventually learn how to most effectively accommodate adult learners in online learning environments while simultaneously giving them the very best chance at achieving academic success.

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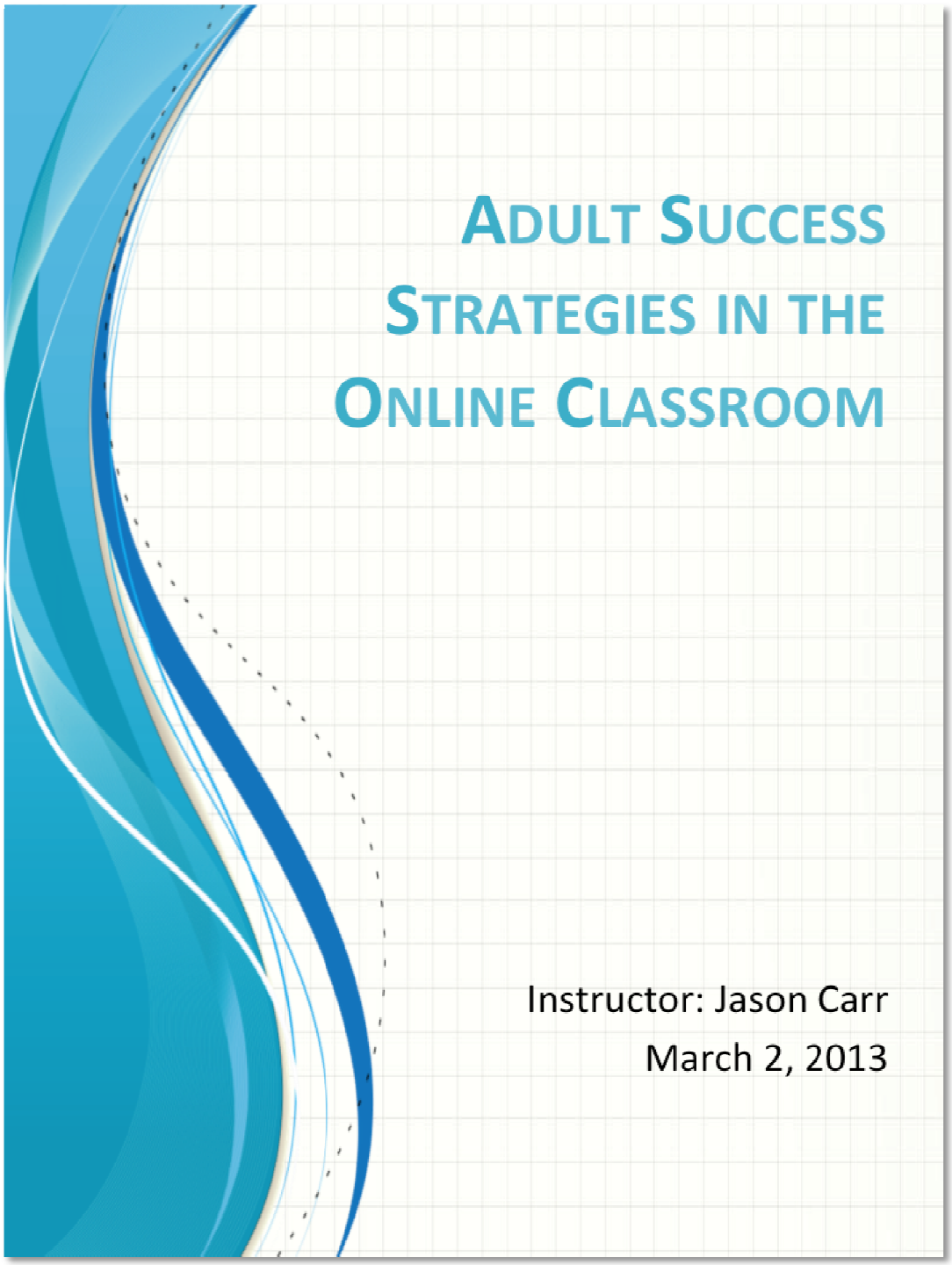
Appendix A



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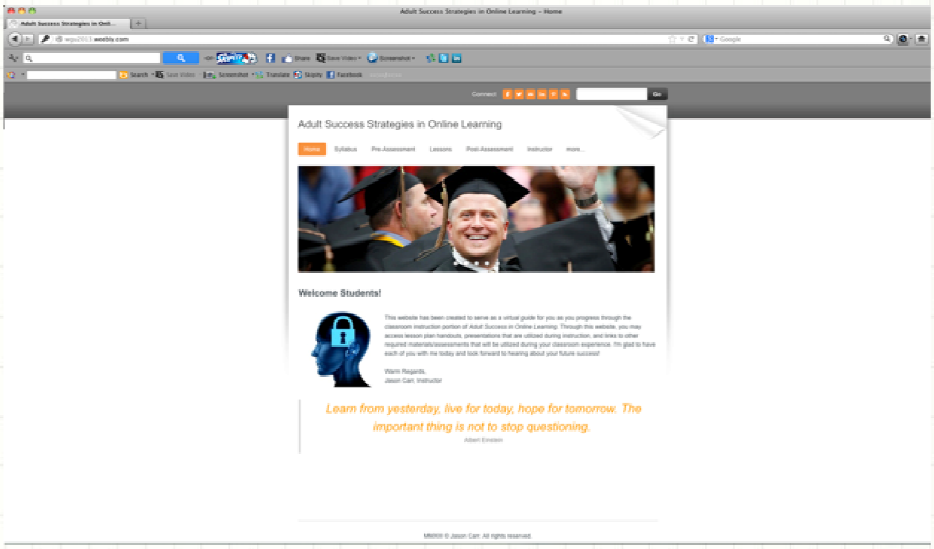
Supplemental Website

A supplemental student website has been setup to accompany this instructional unit.
Website: http://www.wgu2013.weebly.com
Password: wgu2013



Note: This instructional unit is designed for classroom delivery format. The website referenced above has been created to serve as a *virtual guide* for students as they progress through classroom instruction. Through this website, students may access lesson plan handouts, presentations that are utilized during this instruction, and links to other required materials/assessments that will be utilized during their classroom experience. Additionally, students will access pre- and post-assessments as well as the post- instruction research survey.

The following pages comprise the individual lesson plans for the workshop entitled, *Adult Success Strategies in the Online Classroom*. Each lesson plan contains the performance objectives, lesson objectives, material requirements and other related items that correlate to this instructional unit. This guide may be used as a map that works in conjunction with the website and links have been provided where applicable. An instructor's guide has been developed along with this guide and includes all presentations, handouts, and assessments utilized within this workshop.

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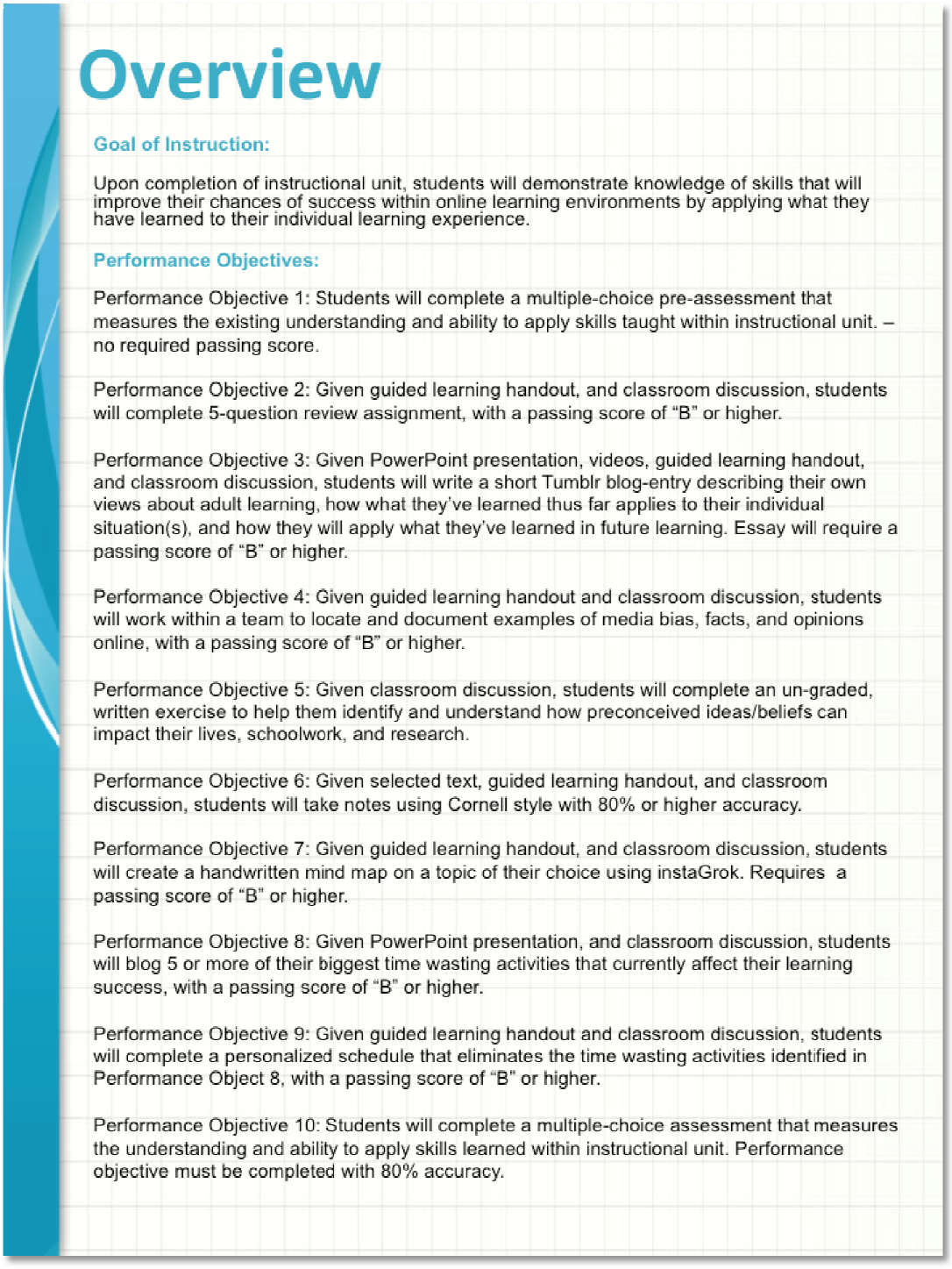

Overview

Goal of Instruction:

Upon completion of instructional unit, students will demonstrate knowledge of skills that will improve their chances of success within online learning environments by applying what they have learned to their individual learning experience.

Performance Objectives:

Performance Objective 1: Students will complete a multiple-choice pre-assessment that measures the existing understanding and ability to apply skills taught within instructional unit. – no required passing score.

Performance Objective 2: Given guided learning handout, and classroom discussion, students will complete 5-question review assignment, with a passing score of "B" or higher.

Performance Objective 3: Given PowerPoint presentation, videos, guided learning handout, and classroom discussion, students will write a short Tumblr blog-entry describing their own views about adult learning, how what they've learned thus far applies to their individual situation(s), and how they will apply what they've learned in future learning. Essay will require a passing score of "B" or higher.

Performance Objective 4: Given guided learning handout and classroom discussion, students will work within a team to locate and document examples of media bias, facts, and opinions online, with a passing score of "B" or higher.

Performance Objective 5: Given classroom discussion, students will complete an un-graded, written exercise to help them identify and understand how preconceived ideas/beliefs can impact their lives, schoolwork, and research.

Performance Objective 6: Given selected text, guided learning handout, and classroom discussion, students will take notes using Cornell style with 80% or higher accuracy.

Performance Objective 7: Given guided learning handout, and classroom discussion, students will create a handwritten mind map on a topic of their choice using instaGrok. Requires a passing score of "B" or higher.

Performance Objective 8: Given PowerPoint presentation, and classroom discussion, students will blog 5 or more of their biggest time wasting activities that currently affect their learning success, with a passing score of "B" or higher.

Performance Objective 9: Given guided learning handout and classroom discussion, students will complete a personalized schedule that eliminates the time wasting activities identified in Performance Object 8, with a passing score of "B" or higher.

Performance Objective 10: Students will complete a multiple-choice assessment that measures the understanding and ability to apply skills learned within instructional unit. Performance objective must be completed with 80% accuracy.

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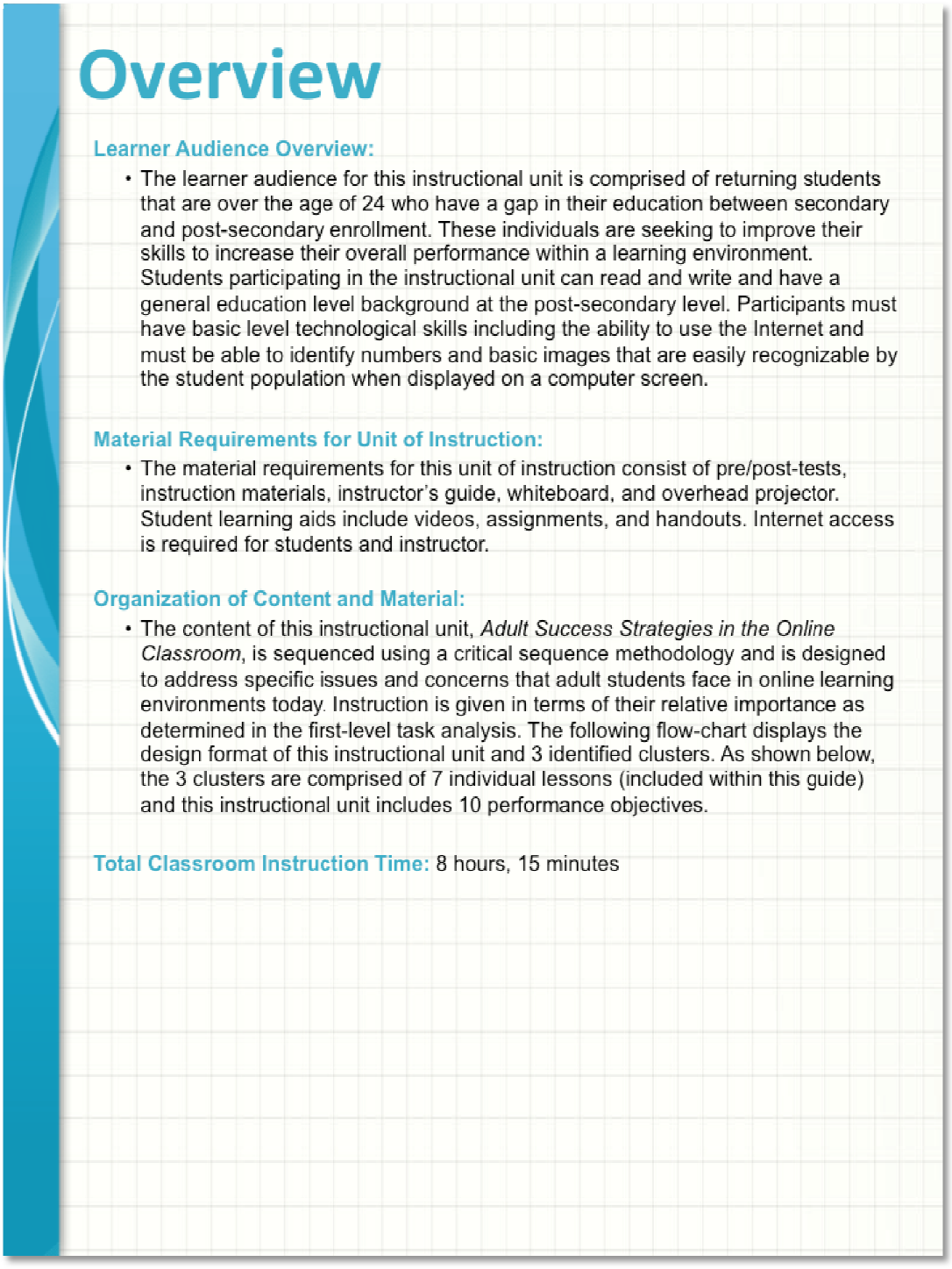

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Lesson 1 – The Aging Brain

Lesson Overview:
Introduce students to basic principles of cognition, discuss the effects that aging has on the human brain, and neurogenesis.

Task 1.0: How Our Brain Affects Our Ability to Learn as We Get Older

1.1 Measure current retention skills

Resources or Materials Needed:

- Instructor: Instructors manual
- Student: Learner handout (terms), pen, notepad, computer with Internet connection

Lesson Objectives:

- Students complete pre-test administered by instructor as defined below.
- Students are introduced to common terms that will be used throughout instructional unit.
- Students discuss their classroom learning successes as well as disasters.
- Students setup Lumosity accounts.

Lesson Duration:
2 hours (includes 30-minute pre-test, 30-minute Lumosity introduction, and 1-hour lecture/discussion).

Pre-instructional activities:

- Students will complete a multiple-choice test that measures the existing understanding and ability to apply skills taught within instructional unit – no required passing score.
- Skills to be measured include basic understanding of cognition, memory, neurogenesis, and related concepts. Pre-test is a 20-question, multiple-choice formatted assessment created in ProProf. Questions are provided to students in random order and results are made available to instructor immediately.

Content presentation:
This lesson is designed to comprise a lecture/discussion format to introduce students to common terms, and to get them to open up about their own experiences and frustration they've experienced within learning environments as they've gotten older.

Student Participation:
Students are provided a handout of common terms that are used throughout the workshop. Students watch a short video as well to facilitate classroom discussion. Additionally, students will complete a personal learning style inventory to better understand how individuals learn in different ways. Finally, students are each asked about their own learning experiences with an emphasis on areas of frustration they've experienced as a result of aging.

Assessment:
Given guided learning handout, and classroom discussion, students complete 5-question review assignment, with a passing score of "B" or higher.

Follow-through activities:

- Students discuss how the lessons learned throughout this instructional unit will benefit them as they progress through school/training in the future.
- Students explore ways that they might "exercise" their brains to promote neurogenesis.
- Students setup individual Lumosity accounts and complete one Lumosity game in the area of "memory".

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Lesson 2 – Thinking About Thinking

Lesson Overview:
Introduce students to meta-cognition – thinking about thinking along with advanced principles of neurogenesis, cognitive thinking, and basic brain function.

Task 2.0: Thinking About Thinking

2.1 The brain and adult learning
2.2 Metacognition
2.3 Advanced principles of cognition, brain functioning, and neurogenesis

Resources or Materials Needed:

- Instructor: Instructor's manual
- PowerPoint presentation (15 slides) – "The Brain and Adult Learning"; Overhead projector; 1 supplemental video
- Student: Pen, notepad, laptop and Internet connection

Lesson Objectives:

- Students become familiar with advanced cognition terms and how the brain functions/changes as we get older from a learning perspective. This builds upon the terms they learned in previous lesson.
- Students gain an understanding of ways they can improve their cognitive/memorization abilities by utilizing the strategies taught in this instructional unit.
- Students gain an understanding of how this will help them improve their own performance within learning environments.
- Students setup individual Tumblr blogs.
- Students complete 1-2 Lumosity memory exercises (10 minutes).

Lesson Duration:
1 hour

Pre-instructional activities:
Students should be familiar with terms learned in Lesson 1 and should have completed pre-test prior to the start of this lesson. Students setup individual Tumblr blogs (10 minutes).

Content presentation:
A 15-slide PowerPoint presentation is used along with 1 video presentation that features a neuroscience experts in the field of adult learning and brain research. This content introduces students to advanced concepts of how the brain remembers information, how and why memory digression occurs as we age, and how this can be overcome using different "brain workout" strategies.

Student Participation:
Students are encouraged to ask questions as the instructor progresses through the PowerPoint presentation. They are also asked to take notes during the lecture and video. Students will also complete a Multiple Intelligences Survey during the lesson.

Assessment:
Students write a short essay on their individual blogs describing their own views about adult learning, how what they've learned thus far applies to their individual situation(s), and how they will apply what they've learned in future learning. Essay requires a passing score of "B" or higher.

Follow-through activities:

- A quick 10-minute verbal quiz is given to class to ensure retention of terms, ideas learned thus far in training. Students are chosen randomly to answer questions. This reinforces learning as well.
- Instructor and students also discuss how the concepts learned thus far apply specifically within online learning environments.
- Students complete 1-2 memory exercises in their Lumosity accounts.

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Lesson 3 – Research & Reference Skills

Lesson Overview:
Introduce students to concepts and skills associated with critical thinking.

Task 3.0: Developing Research and Reference Skills
3.1 Introduction to critical thinking
3.2 Recognizing bias, opinions, and spin in media

Resources or Materials Needed:
- Instructor: Instructor's manual; overhead projector, whiteboard, markers
- Student: 4-page student handout, pen, notepad, Internet access

Lesson Objectives:
- Students become familiar with terms such as bias and spin. instaGrok used to facilitate discussion.
- Students evaluate current media pieces and differentiate between fact/opinion pieces.
- Students understand how to use critical thinking when evaluating the credibility of resources during research.
- Students conceptualize thinking from a number of viewpoints.
- Students gain an understanding of the importance of academic honesty; why plagiarism should be avoided at all costs.

Lesson Duration:
1.5 hours

Pre-instructional activities:
Students are asked to read through provided handout prior to lecture.

Content presentation:
Instructor discusses how bias exists within media today and displays examples available on the Internet to students. Additionally, instructor shows examples of opinion pieces online and how beliefs can affect behaviors. Finally, instructor discusses how (and why) critical thinking can be used to fact-check media and why this is important in not only media evaluation, but during research as well.

Student Participation:
Students are divided into teams to complete 5-page handout that requires them to locate and document examples of media bias, facts, and opinions online. Students also discuss the importance of using credible references during research and watch a short video. Students additionally complete a TED Talks handout that requires them to evaluate a TED Talk video.

Assessment:
Instructor verifies that student handouts have been completed and that they are accurate. Requires a passing score of "B" or higher.

Follow-through activities:
- Instructor and students discuss the relevance of the lessons learned and how they may be applied when writing research papers, conducting academic research, and finding credible references
- Short exercise is completed that helps students understand how their preconceived ideas can impact their own lives and often result in unpleasant outcomes. Discussion in terms of how this might affect their own schoolwork and research.
- Students complete 1 Lumosity memory exercise.