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# Opinions and Controversy: Educate the Educator

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Interactive Qualifying Project

# **Educate the Educator**

An Interactive Qualifying Project

Submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

By Christina Lavarn, Giancarlo Feula, Kayli Kacoyannakis, Arjun Mathur

Date:

September 12, 2013

Report submitted to Professor Destin Heilman

Worcester Polytechnic Institute

*This report represents the work of WPI undergraduate students submitted to the faculty as evidence of a degree requirement. WPI routinely publishes these reports on its web site without editorial or peer review. For more information about the projects program at WPI, see <http://www.wpi.edu/Academics/Projects>.*

## **ABSTRACT**

In today's society, educating the general public about complex topics such as science and technology can be a daunting, difficult task. The goal of this project was to gain an understanding of such task and create a method any presenter could use to effectively teach science. The psychology behind learning was explored, manipulated, and implemented into a training DVD for educators in a variety of learning environments. Although teaching science can often cause problems and lead to misconceptions, the method of "multimodal teaching" was found to be the most effective regardless of audience learning diversity through the research and evaluation detailed in this report.

## **ACKNOWLEDGEMENTS**

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## TABLE OF CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGEMENTS .....	iii
AUTHORSHIP .....	iv
TABLE OF CONTENTS.....	v
TABLE OF FIGURES.....	vii
TABLE OF TABLES .....	viii
CHAPTER 1: Introduction .....	1
CHAPTER 2: Purpose, Goals, and Deliverables .....	4
CHAPTER 3: Background.....	5
3.1 Auditory .....	5
3.2 Visual.....	7
3.3 Kinesthetic.....	8
3.4 Multimodal Teaching and Sensory Modality Learning .....	10
3.5 Training DVD Approach.....	13
CHAPTER 4: Methodology.....	14
4.1 Implementation of Learning Modes.....	14
4.1.1 Auditory .....	14
4.1.2 Visual .....	14
4.1.3 Kinesthetic .....	14
4.1.4 Integration of Multimodal Teaching and Sensory Modality Learning.....	15
4.2 Design of Training DVD.....	15
4.2.1 Criteria.....	15
4.2.2 Evaluation.....	16
CHAPTER 5: Analysis and Results .....	17
5.1 Questionnaire.....	17
5.2 Evaluation Scoring Criteria .....	19
5.2.1 Question 1.....	20
5.2.2 Question 2.....	20
5.2.3 Question 3.....	20
5.2.4 Question 4.....	20
5.2.5 Question 5.....	21
5.2.6 Question 6.....	21
5.2.7 Question 7.....	21
5.2.8 Question 8.....	21

5.2.9 Question 9.....	22
5.3 Pre-Implementation of DVD .....	22
5.4 Post-Implementation of DVD.....	22
CHAPTER 6: Conclusion and Recommendations .....	23
6.1 Conclusions .....	23
6.2 Recommendations.....	23
6.2.1 Expansion of Integrated Teaching Method.....	23
6.2.2 Improvement of Training DVD .....	23
References.....	23

## TABLE OF FIGURES

Figure 1: Percentage of learning style diversity amongst test subjects.

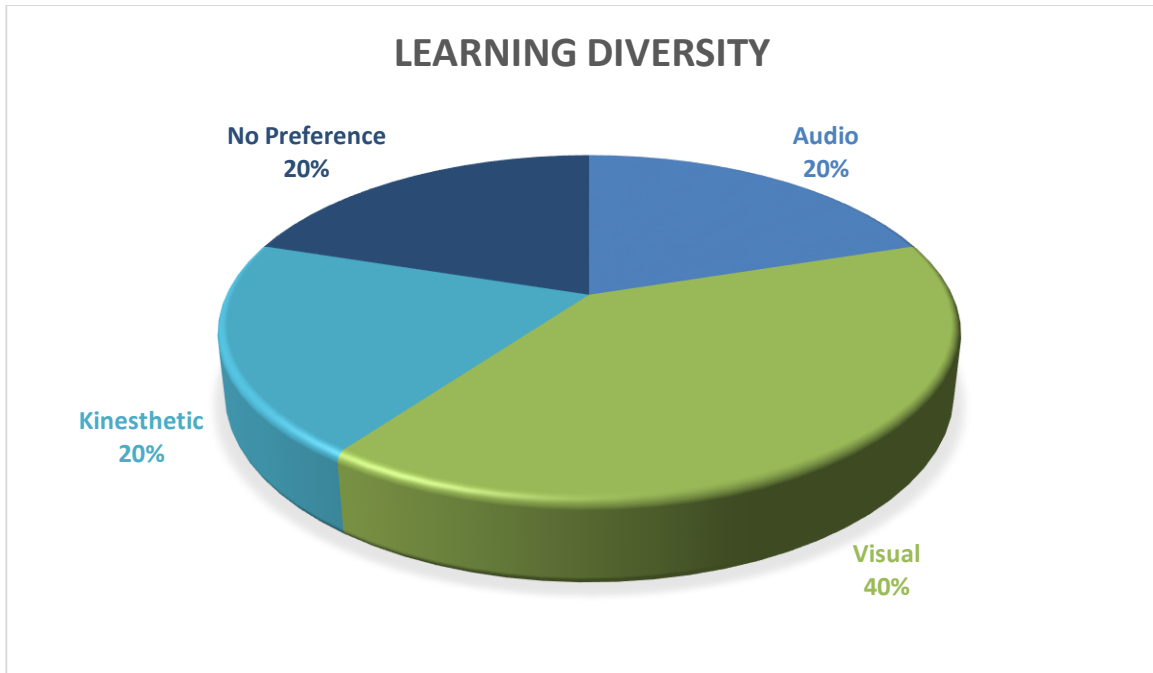
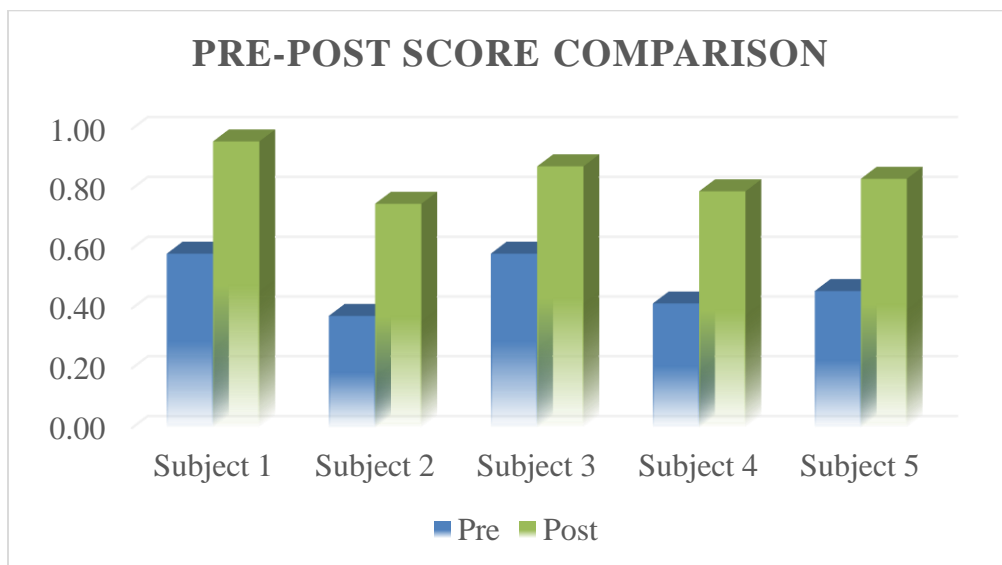


Figure 2: Pre-Post Score Questionnaire Comparison to prove DVD effectiveness.





## TABLE OF TABLES

*Table 1: Summary of Pre-Implementation DVD Questionnaire*

<b>Question</b>	<b>Subject 1</b>	<b>Subject 2</b>	<b>Subject 3</b>	<b>Subject 4</b>	<b>Subject 5</b>
One	A	B	B	D	C
Two	A	B	B	B	D
Three	E	A	E	E	E
Four	A	A	A	C	A
Five	B	B	D	D	D
Six	C	E	C	E	E
Seven	C	C	E	C	E
Eight	B	E	D	B	D
Nine	D	B	D	B	B

*Table 2: Pre-Knowledge of Modes of Learning based off of point system.*

<b>Subject</b>	<b>Score</b>
Subject 1	14/24
Subject 2	9/24
Subject 3	14/24
Subject 4	10/24
Subject 5	11/24

*Table 3: Summary of Post-Implementation of DVD Questionnaire*

<b>Question</b>	<b>Subject 1</b>	<b>Subject 2</b>	<b>Subject 3</b>	<b>Subject 4</b>	<b>Subject 5</b>
One	A	D	B	D	C
Two	D	D	D	B	D

Three	B	B	E	B	E
Four	B	C	C	C	B
Five	B	B	C	C	B
Six	C	A	C	C	C
Seven	C	C	D	C	E
Eight	C	E	D	D	D
Nine	D	D	D	D	E

*Table 4: Post-Knowledge of Modes of Learning based off of point system.*

<b>Subject</b>	<b>Score</b>
Subject 1	23/24
Subject 2	18/24
Subject 3	21/24
Subject 4	19/24
Subject 5	20/24

## **CHAPTER 1: Introduction**

It is the duty of an educator to properly and effectively teach a public audience about, what may be, complicated topics such as science and technology. This audience can be composed of a variety of people who may speak differently, listen differently, and even learn differently. With such a diverse group, it is expected that a presenter's educational impact will exponentially decrease as the lecture goes on. What does this mean to an educator; can such a curve be minimized or even prevented?

To confidently answer such questions a variety of teaching methods within the different modes of learning must be thoroughly explored. There are two general types of learning: verbal and nonverbal. Verbal learning primarily includes words, sounds, and demonstrations while non-verbal utilizes images, objects, actions, and critical thinking. Amongst these two types include more specialized modes of learning such as visual, audio, and tactile. With so many different learning styles, how does one teach science effectively? The use of multimedia systems as a teaching tool appears in various learning environments such as museums, universities, and similar institutions. From interactive exhibits and simulations to live lecture recordings and audio incorporated presentations, the use of such systems has been proven very effective. But which tool or style will improve that learning curve the best? Is there just one or can they become more powerful in combination?

The study of sensory modality extends from a mind's ability to detect, perceive, and interpret the meaning of a variety of patterns caused by stimuli. Auditory learning stands as the sole model of obtaining a form of stimuli that conveys messages to a general public as a verbal system. The modality of audio encompasses an individual's ability to retain information through speaking, listening, and processing signals through the interpretation of pitches, tones, word emphasis, and sound emphasis. The effectiveness of this learning style pertains to a person's ability to receive and recall information under various conditions. The speed at which material is delivered regardless of its complexity, the discrimination between sound patterns, and the length of time from which information is recalled are examples of such conditions. Studies related to audio perceptual learning mostly consist of how the sensory system works relevant to music, such as the

ability to read and play versus listen and play, and the comparison of this learning approach to that of nonverbal styles.

A nonverbal style includes the visual mode of learning. One of the important learning skills the mind possesses is the ability to process visual information into simple, understandable units. From the moment one's eyes open, the human mind is constantly receiving visual input, all of which add to the experiences and understanding of its surroundings. The mind can associate what it sees with a more complex concept while using the visuals as a model to better understand and recall the concept. This can be problematic for more abstract processes that must be interpreted and understood with little to no visualization. By presenting information in a visual manner, it becomes much easier to interpret and is more apt to be retained. Presenting information in this way can also promote visual thinking and understanding, where having a spatial understanding of objects and ideas allows for further exploration. Visual understanding can be a crucial method for many students in the classroom, and also an incredibly useful skill in everyday life. In fact, about sixty-five percent of the US population is said to be visual learners while about five percent are considered tactile or kinesthetic.

Tactile, or kinesthetic, learners are best thought of as “doers” rather than “perceivers.” Although tactile learners make up a small percentage of the average audience, encouraging hands-on actions or experiments can benefit visual as well as auditory learners by promoting a more wholesome learning experience. Because of this, it is important for presenters to incorporate kinesthetic elements into their presentation. In order to best reach out to tactile learners in the audience, the presenter must utilize hands-on activities and ask questions that lead the mind to do work. Asking questions that encourage people to dig through their own experiences, and formulate a solution is an excellent way for a presenter to impact the individual without leaving the stage.

There are many methods to effectively stimulate tactile learners during a presentation. Educators can engage in a demonstration where they interact with a tangible object or simply use gestures to imitate the interaction. Research has shown that some of the same neural pathways that fire when performing hands-on activities are engaged when a person witnesses that action. Because of these mirror neurons, witnessing a demonstration can often translate into hands-on experience that dramatically helps tactile learners. Another effective method is to tell the audience

to close their eyes and verbally paint a scenario. This can help to create a more immersive or kinesthetic experience.

It is apparent that with every person comes a slight variation of learning. Some may only be stimulated through visual tactics while others may retain information through both audio and visual modalities. Because people are differentiated amongst these styles, educating becomes difficult when confronted with an audience of them. Studies posed by the American Psychological Society have shown that most students prefer using different learning modes over a single style. About sixty percent of people actually learn more efficiently and successfully through the use of multimodal learning as well (Fleming). The human mind is simply constructed to take in multiple stimuli in order to interpret the concept. By receiving many stimuli, the human brain is able to draw a stronger, more detailed understanding.

People prefer multimodal learning and are impacted more through sensory modality teaching. When presented with an audience of such individuals it is important to integrate all modes presented here (visual, audio, kinesthetic) so as to keep them engaged and learning. As Plato stated:

*“Do not then train youths to learning by force and harshness, but direct them to it by what amuses their minds so that you may be better able to discover with accuracy the peculiar bent of the genius of each.”*

The research, opinions, and support proposed in this paper will encompass the concept that the integration of multimodal learning and sensory modality teaching is an ultimate teaching tool for any presenter faced with a diverse audience. Support for such a conclusion will stem from an “Educator’s Education” training DVD designed around the research conducted in this project.

## **CHAPTER 2: Purpose, Goals, and Deliverables**

Our team possessed the freedom to explore different avenues on the presented topic of Opinions and Controversy, enabling the creation of our own project purpose.

The overall goal is to gain an understanding of how to properly educate the public and create a method any presenter could use to effectively teach science. Our team decided to investigate the art of presenting from a psychological standpoint. Concepts such as new word introduction, retention rate, and multimodal teaching were researched. Designing these topics into something tangible and useful for an educator to reference was the second half of the project. It was decided that a Training DVD for presenters would be the easiest form of education, something that can be taught once and accessible for future reference. Three goals for the DVD were established:

1. Achieve a basic understanding of the most common presentation skills.
2. Understand a variety of teaching methods within the different modes of learning.
3. Create an all-inclusive teaching method that engages the audience as a whole regardless of its learning diversity.

The first goal was designed with the assumption that there is a basic skill set every educator should possess that most tend to overlook. Things such as eye contact, body language, and voice volume are a few examples of such skills. The second is based off of the research conducted in this report. There are two forms of learning, verbal and nonverbal, that include sensory modes of audio, visual, and kinesthetic. The DVD will introduce the concept that everyone learns differently, known as multimodal learning. It will also present select methods that have been proven effective in catering to each individual mode of learning. Finally, an all-inclusive teaching method supported and created by the research in this report will be proposed. It will be shown that by integrating multimodal learning and sensory modality into one teaching method, a strong foundation of skills can be built and later used in audience gauging. Audience gauging is a term used to describe when one assesses an audience and adjusts the presentation in order to impact the students as much as possible.

This project is intended to help educators educate the public about science through the use of the presented research and produced training DVD.

## **CHAPTER 3: Background**

The learning process is composed of two concepts, detection and interpretation, that are essential to understanding how the mind handles information. The many ways of receiving and processing stimuli affect the categorization of preferred sensory modality within students.

### **3.1 Auditory**

Auditory is one of these categories, or modalities, in which students identify themselves. It is defined by the ability to learn material through verbal activities, such as lectures and discussions that appeal to the sense of hearing. These students are able to recall much of what they hear versus what they may have said, observed, or performed. Auditory learners possess a stronger ability to “interpret the underlying meanings of speech through listening to tone of voice, pitch, speed, and other nuances.” (LdPride) Studies introduced by Dr. Richard Felder have shown that these learners also prefer a verbal explanation over a visual demonstration. In order for an educator to understand the needs of an auditory student, one must be able to recognize the learning style as well as appropriately teach them using methods proven effective in past studies.

According to various studies, the approximate number of auditory learners within an audience ranges from twenty to thirty percent. (VAKL) To an educator, this is a rather large part of the student body thus one must teach accordingly. The Specific Diagnostic Studies of Rockville, Maryland carried out a study in elementary and secondary schools to find the percentage of students associated with a particular learning style. (VAKL) The results showed that thirty-four percent were auditory with the remaining amount divided amongst visual and kinesthetic styles. Unfortunately, the study only represents a physical number of learners in a given sample with minimal variation between the three types of styles chosen. Research stemmed from this study recognized the nearly equal learning style percentiles, thus leading to a more generalized approach to auditory modality.

Rather than explore how auditory students are taught most effectively, Patricia Sanders of Central Connecticut State University dove further into a pupil’s personal learning experience. She found that in order to maximally deliver content to any audience, an educator must instill enthusiasm into their students. (Sanders) Although the techniques addressed possess a business focus, Sanders extends the idea to general methods of cultivating, maintaining, and stimulating the interest of an audience. According to Sanders’ studies, the idea of enthusiasm can be conveyed

through verbal and nonverbal means. The verbal dimension falls under the audio modality, expressed through word selection and vocal delivery. Word selection communicates information along with feelings of enthusiasm through the use of words and phrases such as metaphors, similes, and descriptive statements. Sanders also suggests that varying the use of “pitch, pace, cadence, volume, articulation, and tone of verbal presentation” contributes to the effectiveness of content delivery and understanding for auditory learners. (Sanders)

The use of word selection and feed into the energy level of an educator, important in the retention rate of students. Sanders’ definition of energy level regards the variation of verbal and nonverbal techniques within a presentation. A dynamic speaker who spoke from memory with carefully selected words and voice inflection relayed information with a higher energy level, creating a more memorable learning environment for the audience. (Sanders) Focusing solely on this verbal aspect, Sanders’ research implicates that students who were a part of a dynamic speaker’s audience retained information significantly more than those who listened to a static speaker.

Between most effective teaching methods and creating the best enthusiastic environment, much of the exploration of auditory learning is related to or compared to other styles, more specifically visual. Studies have argued over the visual and audio dimensions, classifying them as a battle between visual and verbal. The conflict stems from the idea that anything written is ultimately a visual form of stimulation as the brain initially interprets it as such. Most abstract concepts expanded upon in lectures that may include projected material or written mathematical equations are considered to be visual stimulations. Although the majority of research supports that visual and auditory learning appear in combination, additional research drawing a different line between the two styles is being conducted. Felder reveals that:

*“Cognitive scientists have established that our brains generally convert written words into their spoken equivalents and process them in the same way that they process spoken words...Written words are therefore not equivalent to real visual information: to a visual learner, a picture is truly worth a thousand words, whether they are spoken or written.”*

Here, Felder supports the idea that both verbal and visual stimuli are processed in very similar way however, introduces the idea that visual learners can still be separated from auditory. Hence, this statement leads to the final conclusion that auditory learners now represent a smaller audience portion of an audience, but can be engaged through both visual and verbal stimuli.



## 3.2 Visual

Utilizing proper visual learning techniques throughout a presentation can be vital to engaging an audience. Visual information makes up the vast majority of stimuli the brain receives (Gilbert), making it the type of information the brain is most adapted to. This fascinating organ is capable of recalling and reproducing mental images it has experienced in the past. These images can simply stand-alone or be associated with sounds, words, and concepts of past experiences in order to create new interpretations of information. (Seitz) The brain is also capable of spatial understanding or the ability to analyze objects and their relations in space, even if they are not present. Taking advantage of conclusions made from research in such processes can allow educators to reach their audiences while leaving a greater impression at the same time.

There are two major categories of visual presentation: active presenting skills and visual aids. Active presentation skills are relative to actions the educator personally does during their presentation, such as dynamic body language and blocking. These skills are used to capture an audience's attention and vary emphasis throughout the demonstration. Active body language encompasses space utilization through movement and blocking in order to focus the audience's attention solely on the educator. Using active body language while presenting allows one to add emphasis to key points and contrast alternatives without losing the attention of the audience. Body language can also be adjusted for audiences of different age groups, as children will react differently to on-stage behavior. Room for improvisation based on the audience is available when using active skills, making them a very beneficial teaching method. Visual aids are generally prepared before the presentation, leaving little room for adjusting to the audience once the presentation begins. For this reason, preparing excellent visual aids such as slide shows and information graphics is a must-have skill for presenters. Visual aids and diagrams can provide enormous benefits over written information, especially when audience diversity may introduce problems such as language barriers and age range. Presenting information visually can also increase the amount of spatial understanding a student will take from the presentation. The mind's ability to imagine and understand objects in space increases with age and experience. Children who were tested on performing tasks after having them presented visually showed improved visual learning with age into the teenage years. (Gilbert) Diagrams can be tailored to specific age groups

if necessary. Appealing to a wide range of ages may require both simple and complex visual accompaniments to fully reach the audience. Knowing how and when to utilize visual aids is crucial to the presentation as it is easy to rely too much on visuals.. Doing so can lead the viewers to distraction or confusion. The key is creating simple and effective visuals that complement the overall presentation as well as benefit the audience’s understanding of the subject matter.

### **3.3 Kinesthetic**

Tactile modality can be the most difficult style to effectively stimulate in a presentation. The educator does not always have an opportunity to interact with each audience member and guide them through kinesthetic activities. Throughout the years, other effective presentation methods have been developed to stimulate a tactile learner without necessarily doing kinesthetic things (Murphy). There are two main ways for the educator to stimulate this kind of learning: asking good questions and giving good demonstrations. Asking the right questions can stimulate audience members' curiosity to encourage them to learn on their own. Giving effective demonstrations allows the audience members to gain experience as if they were performing the tasks themselves, backed up by exciting research on neural networks referred to as “mirror neurons.”

As the modality suggests, the “right” kinds of questions promote actions through which the audience member can learn kinesthetically. Questions that rely on previous knowledge for an answer generally have one “correct” answer and do not promote action or learning. These types of questions are often thought of as “testing” questions and may discourage audience members for fear of answering incorrectly. The “right” types of questions do not rely on prior knowledge, but instead rely on observation and intuition skills. These questions can be further divided into questions that promote action or observation and questions that encourage critical thinking or problem solving.

Children in an audience often respond well to the action and attention-focusing questions. Questions that start with “Can you see....”, or “What happens if...” encourage the audience to go through a tactile mental process in order to provide an answer. This is an excellent way for the an educator to incorporate form of action into their a presentation. These kinds of questions are well suited for children simply because they constantly ask themselves similar things as personal curiosity and intuition develop (Elstgeest). While this may not lead to an immediate kinesthetic

response, it can keep an audience member interested and lead one's mind toward continuing the learning process after the presentation through tactile means. Since these questions do not require prior knowledge and can be answered simply by paying attention, they are great to ask at the beginning of a presentation.

Critical thinking or problem solving questions can work the same way. They do not lead to an immediate kinesthetic response, but they better prepare the audience to continue their learning through tactile means. These types of questions generally require some sort of knowledge on the subject, so they are better asked toward the end of the presentation. They can also be a good way to segue into a demonstration.

Demonstrations are a very important tool in order to reach out to tactile learners. They can give audience members a clear idea to try out on their own or make the concept a lot easier to understand. Tactile demonstrations are also important because they provide a tangible object that the audience members may be able to interact with after the presentation. Even just touching an object after a presentation, especially for children, can drastically impact an audience member's memory (Oliver). The actual demonstration can also provide an opportunity for direct kinesthetic learning.

Even though kinesthetic learning is mostly associated with motion, observation has recently been shown to play a role in the kinesthetic neural pathways associated with imitation. Brain imaging studies have revealed that some of the same neural pathways responsible for kinesthetic motion also fire when a subject imagines themselves performing that action (Ago). Witnessing another perform this action can stimulate these "mirror neurons", allowing the viewer to gain kinesthetic learning experience.

Tactile learners only make up a small percentage of most audiences, so these methods may not be the best way to reach out to the majority of audience members (Fleming). However, these methods are essential to use in combination with teaching methods that stimulate the other sensory modalities. Even if an audience member is not primarily a kinesthetic learner, stimulating tactile learning can still benefit him or her. Many people are also primarily multimodal learners, meaning that they can still learn quite effectively from kinesthetic methods as a secondary mode of learning.

### **3.4 Multimodal Teaching and Sensory Modality Learning**

In order for one to learn, they must be motivated to do so. Motivation is dependent on an infinite amount of things from emotions and actions to one's physical environment. According to Daniel Pink, author of the book *Drive: The Surprising Truth About What Motivates Us*, this infinite possibility is true. When the motivation must lead to learning in particular, Pink states that there are just three factors: autonomy, mastery, and purpose. Such factors have been proven to lead to better performance and personal satisfaction thus effective in paving a path for the individual to learn. Pink defines autonomy as "the desire to be self-directed", something that promotes engagement. A software company out of Australia called Atlassian gives their employees the opportunity to be autonomous for twenty-four hours once a quarter. Employees are allowed to work on any project they desire, whether that be a current job or something entirely new. A variety of debugging solutions and new products have emerged during that time simply because employees were interested and invested in their chosen project, thus motivated to best complete it. Mastery is described as "the urge to be the best at something." When an individual masters a musical instrument or bakes an award-winning cake they feel personal satisfaction. A few examples are the free downloadable computer operating system Linux and a free website called Wikipedia. These two non-profit companies are not motivated by money, but simply by mastery, to create the best version of their idea. In fact, this is a concept that leads to curiosity; it is something that once sparked will lead individuals to search for answers and in the end to learn more than the educator had proposed. This sense of mastery and autonomy equate to the third factor proposed by Pink: purpose. If an individual possesses the desire to further his or her knowledge and is given the opportunity to make their own decisions, it provides a purpose and ultimately a motivation. When an educator is confronted with an audience who has reached their individual senses of purpose, effectively teaching them is no longer a problem but rather an action. (Pink)

An individual can be motivated to learn throughout the entire presentation but proper material must be given in order for that purpose to be put to use. Daniel Pink proposed three factors that allow for a general audience to become engaged in the presenter and motivated about what the topic may be. He has proven in many settings and many studies that the majority of people are motivated in the same way. Unfortunately learning styles cannot be generalized in this manner.

Everyone learns differently, something that psychologists and theorists over the years have not been able to fully explain. (Pink)

In 1927 Carl Jung, a well-known psychologist of the era, published his final work on the “Learning Style Theory”. This theory consists of four types of people; Mastery, Understanding, Self-Expressive, Interpersonal; whose learning is dependent on their individual thinking process as well as personality. According to Jung, the Mastery style learner absorbs information concretely while processing it in a step-by-step fashion. This type of student also “judges the value of learning in terms of its clarity and practicality”. An Understanding style tends to focus more on ideas and learns through questioning or reasoning. The Self-Expressive learner uses images and emotions to construct new ideas. Curiosity and excitement tend to motivate this type of student. Lastly, the interpersonal learner is described as a social learner who “judges learning in terms of its potential use in helping others”. With any theory come limitations. In 1997 a survey was performed by Harvey Silver and Richard Strong to determine the percentage of each learning style. When conducting this survey they found that it was fairly challenging to classify the population into these categories. The problem was announced and people began to search for a solution. (Kress)

In 1983, Howard Gardner published his Multiple Intelligence Theory in his book *Frames of Mind*. Mr. Gardner describes seven intelligences: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal. Each style is supported by a vast array of cognitive research such as childhood development, culture, and brain damage. Although extensive research was done Gardner overlooked the effect of individual personality, something that the Learning Style Theory focuses on. Mr. Gardner did however support the idea that people learn differently based on the content of the material. For example a musical intelligence may need to hear something to play it while another may need to write and then read the notes. These conflicts and limitations within the two theories were filled in by a third theory: *Integration of Learning Styles and Multiple Intelligences* proposed in the book “*Teaching for Multiple Intelligences*” by Harvey Silver and Richard Strong in 1997. By taking two theories that actually solve the limitations of the other and combining them, Silver and Strong reconstructed the cognitive learning world. They proposed that by categorizing the seven intelligences into the four learning styles a list of more detailed modes of learning could be produced. This theory has been widely used as it gives a better glimpse of how to properly teach students as a whole. (Silver)

Along with this Integration Theory many psychologists reference something known as the VAK Theory. In 1987 Neil Fleming created a brand new theory that encompassed many of the already proposed ideals. VAK stands for visual, auditory, and kinesthetic learning styles. Instead of recognizing the personality of the student as the Learning Style Theory does or the way in which the students brain developed as in the Multiple Intelligence Theory, Fleming narrows in on how the information is specifically processed. Each style learns through actions related to a sense such as sight, hearing, or doing/feeling/thinking. These styles coincide with descriptions previously mentioned in this Chapter. (Fleming)

The VAK Theory as well as the Integration Theory proposed by Silver and Strong have resulted in many surveys, evaluations, and overall exploration to prove the effectiveness of each one. It has been shown that the organization of the Integration Theory is too specific and difficult for educators to categorize their students. The VAK Theory appears to be the most used method in the science classroom due to its simple classification and impersonal connection to the person. It is easy for an educator to assess the reactions of their audience to determine the effectiveness of the lecture rather than the individual personalities or experiences that led to the student's type of information processing. The other theories proposed that an individual would fit into only one category while it has been proven that such a concept is not possible. The VAK Theory allows for an individual to become part of multiple styles, as people do indeed learn from single as well as multiple modes. (Fleming)

In 2001 this concept of sensory modality learning was further evaluated and put to the test in a classroom setting. The idea of multimodal teaching became a highly discussed topic across the world. In the book *Multimodal: Teaching and Learning: The Rhetorics of the Science Classroom*, Gunther Kress states that "communication in science classrooms must involve the mapping of all representational and communicative resources available to teachers and learners". This concept is something many others went on to discuss and prove. In 2006, the American Psychological Society conducted a survey of first year medical students across the United States. They found that 63.8% of students learned better through the use of multiple modes. Out of these students, 15.6% prefer using two modes of learning while 20.4% would rather all three VAK modalities. (Kress)

With an overwhelming percentage of students who not only categorize themselves into the VAK sensory modalities but claim to learn better using more than one mode, it is clear that

multimodality teaching is a desired and proven classroom method. The use of multimodal teaching and sensory modality learning in combination with the audience's sense of purpose becomes a concrete teaching method that keeps the audience engaged and learning.

### **3.5 Training DVD Approach**

At the conclusion of this project a Training DVD about how to properly educate an audience about science is expected. In order to do this our team must also properly and effectively educate the educator. Through our research we concluded that people learn differently through three modalities: visual, auditory, and kinesthetic. In order to present our research in an impactful manner we chose to use a metacognitive teaching approach using whiteboard animation, comparative video clips, and thought-provoking narration.

Whiteboard animation can be found in educational tools such as the movie series *School House Rock* and various online tutorials. In a sense, this DVD will be a tutorial for a diverse audience. Whiteboard animation has been proven effective in childhood development due to its visual and audio presentation method. Although our audience will not be children, adult educators learn more effectively through similar childlike techniques. Sparkol® VideoScribe is a whiteboard animation program that has been proven very effective in marketing and video tutorials as well as being user friendly. Such a program is ideal for achieving this childhood teaching style while requiring little software training for our team.

Comparative video clips alongside thought-provoking narration will also be used in the DVD. A popular marketing technique is that of persuasion: a method of leading the viewer to an idea without directly telling them. This is a metacognitive ideal that the DVD will ultimately accomplish when educating the educator. By presenting comparative video clips, viewers will be able to form their own opinions about the differences. These thoughts will then be supported or questioned by the narration leading to a more established and impactful thought. These three methods are ideal for the training DVD.

## **CHAPTER 4: Methodology**

### **4.1 Implementation of Learning Modes**

#### **4.1.1 Auditory**

The training DVD addressed the key concepts of auditory perceptual learning. They were centered on the most prominent presentation skills relative to audio such as pitch, tone, word emphasis, and sound emphasis. Each facet contains subtopics that functioned as the framework for the illustrations. Voice variety, new word introduction, and applications of music are examples of the lessons that were included in the video. The skills presented in the DVD will be essential in avoiding tones of condescendence while relaying the correct idea or points. This will remove focus on the educator's stature and instead focus the audience's attention on forming their own hypotheses upon leaving the presentation. The design of all listed concepts detailed the use of proper voice, volume, and tone when speaking to an audience in contrast with ineffective mediums. This represents the comparison in impact and understanding of good versus bad techniques when teaching an auditory learner.

#### **4.1.2 Visual**

Visual learning methods were addressed in the training DVD by introducing two major categories: active presentation skills and visual aids. The tutorial covered the respective advantages of utilizing both techniques in a successful presentation. They also emphasized how stage utilization can be adjusted during a presentation in order to appeal to a specific audience. Visual aids such as use of proper diagrams and slide organization skills were shown to represent the effective ways of displaying information. The video included examples of presenting data in an understandable manner, effectively describing tangible objects or processes, and how to prevent distraction or confusion by relying too much on visuals. Through demonstrations of both good and bad visual skills, the Training DVD will expose educators to the proper methods of engaging visual learners.

#### **4.1.3 Kinesthetic**

The kinesthetic portion of the DVD focused on providing examples of how to best stimulate tactile learning. Content covered the types of questions presenters should ask to lead the audience towards active learning as well as how to effectively use demonstrations during the



presentation. Contrasting bad examples were included to show the educator some pitfalls to avoid. Good versus bad questions were explained and emphasized through the use of text. Teaching the educator *why* certain questions promote active learning leads to an understanding of metacognition and the ability to ask stimulating questions. Examples and diagrams depicted an actively engaged audience ready to investigate the presentation topic further, allowing presenters to more effectively judge their teaching methods' successfulness. This skill is called audience gauging.

#### **4.1.4 Integration of Multimodal Teaching and Sensory Modality Learning**

Audience gauging is a tool that all presenters must learn to properly use to better impact the diverse learning group before them. The diversity of one's audience has been proven through the introduction of the VAK modes as well as how each style can be taught very differently. A comparison of a student being taught through one mode and another being taught through two or more segueing into this concept of Sensory Modality Learning. Brief facts and studies was shown to support the idea that students are multimodal learners thus multimodal teaching is a highly recommended method. This framework supporting the idea of audience diversity, suggested by research in sensory modality learning, will lead to further discussion of audience gauging. It will prove that due to individual learning styles, audience gauging can be labeled an effective presentation skill. Trainees were given comparative information, time to form personal opinions, and support for any questions they may have. In conclusion, the training DVD provided a logical framework that will convinced the viewer that the integration of multimodal teaching and sensory modality learning is the ultimate teaching style.

## **4.2 Design of Training DVD**

### **4.2.1 Criteria**

This DVD will be created as a guide for any presenter to understand his or her audience in order to appeal and deliver all forms of scientific topics, leaving little room for false interpretations. The DVD must accomplish the three goals outlined in Chapter One of this report as well as effectively educate the educator. Whiteboard animation software Sparkol® VideoScribe. The use of VideoScribe will provide us with the proper tools to illustrate all desired concepts and skills while engaging the trainee audience. By using this method of animation in combination with

voice over narration, the DVD will engage both visual and audio learners, thus effectively teaching the educator and fulfilling the project goals.

#### **4.2.2 Evaluation**

The effectiveness of the Training DVD will be evaluated by a series of questions presented to a sample group of scientific researchers (n=5) before and after watching the Training DVD. The questions are specifically designed to grasp the subject's understanding of when to use each learning style as well as how to properly integrate them. The results from both the pre and post will be compared to determine how much the educator retained versus what they knew prior to the DVD. To establish that the audience is in fact diverse, a learning mode question will be asked and tabulated. Once both questionnaires have been completed and compared, an in-depth discussion on the effectiveness of the Training DVD along with final support of multi-modal teaching will be given.

## CHAPTER 5: Analysis and Results

### 5.1 Questionnaire

- 1.) Which of the following learning styles best describes how *you* learn?
  - a) Auditory - primarily words and explanations
  - b) Visual - rely on diagrams, charts, and graphs
  - c) Kinesthetic - learn best by hands-on activities
  - d) No strong preference
  
- 2.) When designing a presentation, which modality (learning style) should you focus on the most?
  - a) Auditory
  - b) Visual (1pt)
  - c) Whichever one you are strongest at
  - d) All modalities should be focused on approximately equally (3pts)
  
- 3.) How would you tailor a presentation about greenhouse gasses to engage an audience of high school students?
  - a) Colorful cartoon graphics with big simple labels and enthusiastic speaking tone
  - b) Realistic and informative infographics, speaking with a serious tone, and emphasis on the reality of the current situation (3pts)
  - c) Hand out flyers with summary of presentation, links to further reading, and good causes to support
  - d) Present advanced weather data in large tables and charts, talking sparingly
  - e) Relate the subject to the everyday life of a high school student, teaching how they can make an impact as an individual (2pts)
  
- 4.) Dynamic educators possess a series of skills and knowledge of methods which help them create a learning environment most effective for relaying and maintaining information. Choose one of the following in which you feel best describes how a dynamic educator can create such an environment. The educator should:

- a) Bring in a live demonstration or a physical model of the topic
- b) Articulate and emphasize significant words, topics, or steps, leaving few key words on a projected PowerPoint slide (3pt)
- c) Show important images which are relevant to the theme and explain each step of a process (2pt)
- d) Utilize the surrounding space while speaking by using hand gestures or moving around to engage entire audience

5.) You're giving a presentation about the moon. Which of the following would be the *best* question to ask an audience of children to open the presentation?

- a) How many miles away is the moon?
- b) Have you seen the different phases of the moon at night? (3pt)
- c) Why do you think the moon has phases? (2pt)
- d) Where does the moonlight come from? (1pt)
- e) How many days does it take the moon to go through all the phases?

**You're giving a presentation about simple machines.**

6.) What would be the best method to teach a diverse audience about using pulleys?

- a) A brief description accompanied by an animation showing automated pulley systems.
- b) A thorough explanation accompanied by visual aids and diagrams.
- c) A quick demonstration where you use an actual pulley in front of the audience. (3pts)
- d) A clear explanation accompanied by "mimed" gestures for a small visual aid. (2pts)
- e) An animation showing the different components of a pulley and how they fit together.

7.) Which method would you use to teach a class of 10 year-olds how to assemble different machines together?

- a) Explain the assembly process with words and hand gestures
- b) Show animations of simple machines working
- c) Demonstrate the assembly process while the students watch (2pts)
- d) Pass out labeled diagrams of various simple machine (3pts)

e) Give students a parts bin and see what they can create (2pts)

8.) You are giving an informative presentation on dogs. Rather than showing a video, you think it may be a good idea to bring a trained dog for the audience to interact with. However, you are worried this may be too distracting for the audience. Which audience do you think would benefit most from interacting with a real dog rather than a prerecorded video?

- a) All school assembly at a large high school
- b) A group of patients at a physical therapy clinic (1pt)
- c) A small classroom of 3rd graders (3pts)
- d) Recruits at a police training academy (2pts)
- e) Pre-Veterinary society at local university (2pts)

9.) Which of the following methods would you use to prepare a presentation for an audience of unknown age group and diversity?

- a) Design multiple presentations and try to fit the best one to your audience when you see them
- b) Incorporate only elements that would be appropriate for all ages and backgrounds (1pt)
- c) Prepare the presentation as if it was to a group of high school educated adults
- d) Prepare optional elements and incorporate whichever ones best fit your audience when you see them (3pts)
- e) Incorporate small elements into your presentation that are specific to each age group (2pts)

## **5.2 Evaluation Scoring Criteria**

Each response contributes between zero and three points to the subject's raw score. A score of zero on a question indicates no understanding of the concept of multi-modal teaching, while a score of three demonstrates a full understanding of the concept. A score of one or two indicates that the subject understands the concept, but does not have a full understanding of how to best use this skill. This allows for an easy comparison of the pre and post DVD implementation results in order to see if the subjects' comprehension of the key points has improved.

### **5.2.1 Question 1**

This question is primarily meant to prepare the subject to answer all the rest of the questions. If the subject understands which modality best describes him or her, it will be easier to accurately choose which option he or she is most likely to use in reality.

### **5.2.2 Question 2**

Combining all modalities is the optimal way to design a presentation to a general audience. This response was awarded three points while the visual modality was awarded one point, Visual graphics are an essential aid in a presentation, so if one is stressed more than the others, visual is best.

### **5.2.3 Question 3**

With prior knowledge of an audience type, one can format their presentation to this audience. This question tests the subject's ability to format a presentation for a specific audience age group. The most important thing when giving a presentation is keeping your audience engaged, and the format in which information is presented can have a huge effect on this. All the options given are appropriate presentation methods, however they are not all effective methods for teaching high school students. High school students are primarily concerned with themselves and the future, and relating a subject to how it effects them individually is a good way to keep their attention.

### **5.2.4 Question 4**

When viewing a presentation, audience members are able to see and feel the environment in which they are learning – whether it is an energetic one, or monotonous. Through answering this question, the subject is placed in the perspective of an audience member. The choices are to gain a better understanding of the subject's preferred learning style and seeing how or if it changes after viewing the video. The options of 'a' would more likely appeal to kinesthetic learners because of the "hands on experience." The other options show more of an integration of the modalities, but 'b' and 'c' are more specific in their implementation to appeal to the audience.

### **5.2.5 Question 5**

This question is intended to reveal the subject's understanding of productive and reasoning questions, such as what they are and when each type is appropriate to ask. Children respond best to productive questions, since they generally ask these questions themselves. They promote direct action or observation. Option "b" is a productive question because it encourages the children to verify whatever answer is provided by observing the moon that night. If the subject chooses option "c", it shows their understanding that reasoning questions are better than questions that rely on prior knowledge. Because these questions are best asked at the end of a presentation however, it shows that the subject does not possess a full understanding of when it is appropriate to ask these questions. Option "d" is slightly better than the other two, but children may be discouraged from guessing without the phrase "do you think" included in the question.

### **5.2.6 Question 6**

This question is intended to grasp the subject's understanding of demonstrations. Option "c" is the best in this respect while option "d" is the second best due to research on mirror neurons. When humans see a kinesthetic action performed, a percentage of neural pathways associated with performing that same action fire off. This means that witnessing a kinesthetic action can aid in learning to perform or even understanding that same action.

### **5.2.7 Question 7**

Children of this age are developing the ability to think spatially, or being able to visualize and manipulate objects in space without it being there in front of them. Giving blueprint style diagrams of assembled machines lets them see multiple views of the object at the same time with labeled parts, helping the object stay consistent in each view. Developing this ability would allow them to easily assemble the desired machines when the physical objects are presented to them.

### **5.2.8 Question 8**

This question helps determine the subject's ability to gauge the effectiveness that a specific element of a presentation could have on different audiences. Bringing a dog to a presentation about dogs is never necessarily a poor decision, but the effect this can have on the audience is still very dynamic. An important factor in an audience is age. Young audiences

benefit most from being able to physically interact with the subject they are learning about, rather than being shown a picture or video. Other factors the subject may consider are audience size and diversity.

### **5.2.9 Question 9**

If a presenter does not know about their audience before giving a presentation, it is on them to be prepared and able to adjust during the presentation. It would be inefficient to fully prepare for each type of the infinitely diverse audiences there may be. However, it is easy to incorporate elements that benefit each age group. The most beneficial method would be if the presenter can adjust these elements once the presentation has begun, if possible.

## **5.3 Pre-Implementation of DVD**

The pre-evaluation questionnaire results showed that the subjects grasp only partial understanding of multimodal learning methods. The subjects do understand that teaching visually is the best way for an audience to retain information. However, they lack the arsenal of presentation methods to full take advantage of the effectiveness of multimodal learning. The subjects do not consider age to be as important of a factor in audience gauging. They also do not put enough emphasis on the benefits that hands-on learning can have.

## **5.4 Post-Implementation of DVD**

Having taken the pre-evaluation questionnaire, each subject was shown the “Educate the Educator” video. The same questionnaire taken prior to viewing the DVD was given to the subjects in order to see any changes in their understanding of the different modalities as well as how an integral part of educating stems from utilizing the modalities together.

Results from the post-evaluation show common trends among the answers, which is important in showing either the video improved or reinforced the subject’s understanding of modality integration. Noticeably for questions two, six, and nine, the answer variance between the subjects show only one outlier out of the five subjects. When examining these questions, one can see that the common answers are the ones which we assigned at the highest score level of three points. These answers show the method with the best understanding of integrating the modalities, and the significance that the concepts were understood by the subjects.



## **CHAPTER 6: Conclusion and Recommendations**

### **6.1 Conclusions**

All subjects showed an improvement in their raw scores after watching the training DVD. This suggests that the tutorial is an effective method to improve subjects' comprehension of using multimodal learning styles in a presentation. Because the video production was based on the multi-modal method, our results also support the idea that this teaching style is highly effective due to the subjects' retention levels on the information presented. Combined with data that supports multimodal teaching as the optimal method to employ, this concept suggests further that the training DVD approach can improve a subjects' teaching ability. This data is a proof of concept that warrants further investigation into the training DVD approach to educating the educator.

### **6.2 Recommendations**

#### **6.2.1 Expansion of Integrated Teaching Method**

After an in depth exploration of the different modes of learning, it was found that multi-modal teaching is currently the most effective form of education. It encompasses all three learning styles a presenter may be confronted with when standing before an audience. As stated earlier, the training DVD "Educate the Educator" has been proven highly effective in relaying this idea. Further research on the concept of integration is recommended. Over time newer, more effective methods may appear. It is important to keep up on these.

#### **6.2.2 Improvement of Training DVD**

Because newer teaching methods may be discovered, it is also important to continue improving the Training DVD. The use of multiple teaching styles provided by the chosen animation was proven very effective. By using this same type of video production to relay other concepts, perhaps even non-related to teaching, education in a variety of fields can be drastically improved.

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