The Impact of Thinking Strategies on High Schools Students in the Art Classroom

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Abstract

The ability to think critically is an essential skill all students need to develop. This qualitative research examines how two art teachers used a variety of thinking strategies with their high school students. For the purposes of this study thinking strategies are defined as a pedagogical method that uses *thinking routines* and *the Eight Habits of Mind* (reflect, observe, understand the art world, develop craft, envision, express, and stretch and explore) framework to promote reflective behavior in conjunction with problem solving, problem seeking, and understanding in the visual arts (Hetland, Winner, Veenema, & Sheridan, 2007). The results demonstrate the effectiveness of reflective thinking practices with students in a student-led classroom. Visual Journals are used as an assessment tool to record students' reflective thinking and artistic development during the art making process.

Key Words: Neuroplasticity, thinking strategies, Intelligence, Visual Journals, assessment

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Introduction

The ultimate goal of an educator, which includes the art teacher, is to create a classroom culture based on thought and intellect that will keep students engaged in the learning process. Art is not just about the process of creating and making a final project, but it is a way of thinking about how to approach composition and how that composition evolves as you work. This research will evaluate and explore how current thinking strategies are applied in the high school art classroom.

Thinking strategies are a teaching pedagogy that uses *thinking routines* and *the Eight Habits of Mind* (Hetland, Winner, Veenema, & Sheridan, 2007) structure to promote reflective behavior in conjunction with problem solving, problem seeking, and understanding in the visual arts. Thinking strategies use the following education pedagogies: 1) the Eight Studio Habits of Mind, 2) thinking routines, 3) critical thinking exercises, 4) problem solving, and 5) artful thinking routines. These pedagogies help students realize what perceptions they have about a subject and how they understand it. These strategies foster student thinking and provide them with the tools to take ownership of their education. Thinking strategies are an education pedagogy that use multiple methods in order to identify metacognitive and reflective behaviors.

Education

"In the current climate of educational accountability, arts educators must answer two fundamental questions so that the arts will retain a place within public education: (1) What kinds of thinking skills do arts teachers strive to instill? (2) How can students learn these skills? It is not enough to say that the arts teach "how to paint or draw" or that the arts teach creative expression. We need to go beneath the surface and discover what underlying cognitive and social skills are imparted to students when the arts are taught well" (Winner, 2006, p.2).

Art has not been considered a core subject in many school systems. The core subjects for a high school student on average are English, math, science, and a foreign language (Grove, 2013). The reason that art is not considered a priority is because there is not one uniform method of data collection to track student progress in art. Many art teachers use informal assessments to check for understanding (Monico, 2013). How can we prove that students are learning in the art classroom? Visual journals, written reflections, and critiques not only add to the classroom art experience, but also provide quantifiable data for assessment by the teacher and administrators.

Systems of accountability for schools forced a culture of learning in which math and reading are imposed onto all content area teachers as their main focus, even superseding their own content standards. Because art is considered a subject that is not quantifiable, school leaders encourage art teachers to incorporate math and reading into the art classroom. The District of Columbia Public Schools' (DCPS) individual school sustainability is based on the success of the students' Annual Yearly Progress (AYP) Reports. If a school does not demonstrate sufficient growth, then the fate of the school could be affected. The first option the school faces is a restructuring in which school leadership and teachers can be replaced. A second option is to close the school and transform it into a public charter school. A third option is to replace the entire staff, which leaves a school's future to be determined by the results of citywide testing force of administrators.

When a school fails to meet AYP standards for four consecutive years, one or more specified "corrective actions" must be taken, which include: replacing school staff, implementing a new curriculum, decreasing management authority at the school level, appointing an outside expert to advise the school, or extending the school day or year. Another corrective action –

changing the school's internal organizational structure – can be taken, but must be coupled with replacing school staff and implementation of a new curriculum.

> Schools that fail to meet AYP standards for five consecutive years must be "restructured," which consists of one or more of the following actions: re-opening as a charter school, replacing all or most school staff, state takeover of school operations (if permitted under state law) or other "major restructuring" of school governance. Restructuring of school governance must occur in tandem with re-opening the school as a charter school, replacing all or most of the school staff, and the state takeover of school operations (No Child Left Behind Act[NCLB], 2002) on reference; thereafter (NCLB,2002).

Art has not been labeled as a priority in comparison to other school subjects by non-artist and discouraged art teachers. According to the DCPS teacher evaluation system booklet, known as the Impact report, art teachers are considered to be 'non-value added'; this statement was added to the booklet during the 2009 to 2010 school year. There is no system-wide data that measures the impact art has on student learning.

Robert Stake and April Munson (2008) conducted a qualitative assessment of arts education. The goal of this research was to understand what assessments are used to evaluate the arts and art programs. The research found that both qualitative and quantitative methods are used in arts assessments. The study discusses the role of both the students and teacher in the assessment process. The benefit of the qualitative assessment addressed by this study is best illustrated by the culture of the class as a whole. The quantitative assessment indicated the standards used and how many people achieved a given task. The goal of the research was to demonstrate how research outcomes indicate that if an assessment is not conducted for an arts

program, then the quality of that program is limited. If a teacher is unaware of what the lack of learning taking place in the classroom, then the teacher is unable to take corrective measures to help student growth and development. This research indicates that quality programs need to be sought by a professional practitioner so that the classroom education can be taught without bias toward standards (Munson, 2008).

New methodologies and pedagogies have been introduced to higher education, but many art teachers use outdated information and techniques to teach (Thomas, 1999). Teachers are ill-prepared because of the lack of access to resources and adequate teacher-professional development training. Each school year, professional development dates are identified, but the professional development workshops offered are often directed to the core subject teachers. Depending on the school year and the budget, art teachers as a collective meet for professional development, although the development is not always consistent.

My experience as a teacher in the DCPS system led me to question what other educational opportunities exist. These questions provided me with the opportunity to explore an International Baccalaureate (IB) school for a year. Because the curriculum is less restrictive than public school requirements, accelerated programs have been able to more effectively explore and incorporate thinking strategies. The teacher participants in this research worked in private, independent, or parochial systems for a number of years. These teachers had weekly collaborative meetings to check for misunderstandings and issues in the classroom. These art teachers were both a collective team, as well as part of a larger collaborative team, and were able to consult with colleagues to brainstorm about different ideas and plans. International Baccalaureate schools use Harvard's *Project Zero Thinking Routines* (Ritchhart, Church, & Morrison, 2011). Harvard's Project Zero is a research program within the Graduate School of

Education that utilizes Gardner's multiple intelligences theory. This pedagogy teaches educators how to develop a classroom culture that fosters and harvests student thinking. Implementing visual *Thinking Routines* is the overarching ideology that underpins the structure of lessons an instructor teaches. The approach questions the purpose and goals of the lesson with the intention of supporting the student decisions about learning in the classroom.

Visual Journals

A visual journal is a diary that combines both words and sketches and at times includes other art mediums like collage (Coles, 2008). Visual journals are an effective way for teachers to monitor student understanding of a given topic. The journals illustrate student modifications to ideas, thoughts, and actions to improve the quality of their art assignments. Visual journals, written reflections, and critiques add to the art experience in the classroom and provide assessment data for evaluation by the teacher and administrators.

Through visual journaling students can document experiments, art history, investigations, and other areas they explore. For example, the documenting progress in a visual journal can demonstrate how student thinking impacts personal art projects. Students research, write, and document different thoughts in a visual journal, which can be referenced when classes critique final projects. Students question what they want to accomplish through their experiences in the art making process. The visual journals illustrate the student's voice and attitude (Machina, 2011). Visual journals document the students' prior knowledge and illustrate the growth and understanding gained through their art experiences and research. These thinking strategies empower students to take ownership of their education.

This qualitative research case study examined how visual journals demonstrate high school students' thinking in art. This research was conducted over an eight-week period.

Through the use of observation, the researcher was able to analyze how the teacher and students interacted. The study found that the culture of the classroom changed after use of visual journals was introduced.

Thinking Strategies

In "Accountability in Three Realms: Making Learning Visible Inside and Outside the Classroom" (2010) discusses, Mara Krechevsky discusses new methods of assessing students beyond the standardized test. Her research used an exhibition that demonstrated how children and adults learn, and drew attention to the idea that assumptions about teaching and learning are made by the teachers and administration. The exhibition focused on the practice of accountability of the self, others, and community. Krechevsky asserts that the use of documentation mixes the defined lines of formative and summative assessment, and that the purpose of a thinking pedagogy is not to replace standardized testing but to give alternative methods of data (Krechevsky, 2010).

Thinking routines

Thinking strategies impact student learning in the high school art classroom in various ways. A *thinking routine* is a procedure, process, or pattern of action that is used repeatedly to manage and facilitate specific goals or tasks (Ritchhart, 2011). "*Thinking routines* focus on the establishment of structures that weave thinking into the fabric of the classroom and help make the thinking of everyone in the classroom more visible and apparent" (Perkins, 2004, p.26). Art teachers use *thinking routines* as a way to 'manage' the classroom culture by holding students responsible for their own learning. *Thinking routines* are important because they help the students to understand the choices they make when they answer a question. These strategies help

them gain understanding as to what they know, how they know it, and what steps were used to learn.

The purpose of a routine is to provide a structure that engages students with content, fosters their understanding, and allows them to uncover their thinking in the process. *Thinking routines* are an approach to a lesson that will help to make the thought process more obvious to themselves and others. Students learn more than simply seeking the right answers; using a *thinking routine* compels students to hunt for answers and to understand how ways to critically think about and respond to the results of what they learned. If the results were not the desired ones, then students will consider alternative methods and approaches to the lesson. An example of some of the most commonly used *thinking routines* are Zoom In; See, Think, Wonder; and Think, Puzzle, Explore. The Zoom In *thinking routine* provides the learner with partial information to be interpreted initially. Later, more information is revealed that may change the student's prior hypothesis, or present more questions (Ritchhart, Church, & Morrison, 2011, p. 64-67). Using this thinking strategy in the classroom allows students to create their own lessons based on the problem presented by the teacher. Another example of a visual *thinking routine* is What Makes You Say That? The purpose of this *thinking routine* is to understand the reasoning behind the answers that students give. This routine enables the students to reflect on the answers they give and articulate their understanding of why they have selected these answers.

Professional development provides teachers with ways for teachers to engage in new *thinking routines*. Using these strategies discourages teachers from giving students the answers and encourages students to develop critical thinking skills they will need in college and in life. Thinking strategies provide self-sustainability, allowing students to document their knowledge and understanding in multiple ways, which provides them with a narrative of how their thinking

has changed. As students become autonomous and critical thinkers, they may develop and create independent goals for themselves, which will help to foster and cultivate thinkers of tomorrow.

Literature Review

Standardized Testing

This generation of learners is having difficulty thinking critically because classroom success is measured by performance on standardized tests. Students ask teachers, "What do you want?" rather than asking themselves, "What would I like to learn?" (AZ IN Personal Communication, January 10, 2013). As a result, many students lack creativity and the ability to problem solve. This high-stakes testing has crippled areas not tested, such as the social sciences and the arts that foster creative thinking (Starko, 2013, p. 55).

Standardized tests measure basic knowledge, not strategies for thinking critically. Students lack the thinking strategies needed to survive in today's competitive job market. The Detroit Teachers Union says, "The focus on high stakes testing undermines the United States education system" (Shaeffer, 2012, p36). Standardized testing does not help to create the creative and flexible thinkers of tomorrow (Starko, 2013 p 55). "If schools focus all their efforts on preparing students for tests, they will not be successful in preparing students for life" (Starko, 2013, p55). The genuine learning that takes place with critical thinking is sacrificed for the sake of memorization and teaching to the test. "Test driven policies continue to force educators to sacrifice time needed to help students learn to critically analyze content and instead, focus on teaching to the tests" (Shaeffer, 2013, p 38).

High stakes testing has teachers conflicted about what should happen in their classrooms, leaving teachers feeling the tensions between pressures for high scores on the tests and what is taught to the students (Shaeffer, 2013, p. 38). Schools praise instructors for helping students to

achieve high test scores because teaching positions are often tied to these test scores. When a DCPS teacher has students who score higher on their AYP report, the teacher is eligible for a merit-based performance salary increase. If a teacher receives a plus on their Impact evaluation three years in a row, that teacher can opt out of evaluation for the following school year. A teacher who does not make enough progress on their Impact evaluation will not receive a pay increase for the following school year. It has to be asked – should not educational success be measured when school cultures focus on evaluating certain subjects, a very specific tone is set for those schools. Those subjects that are tested become more important than other content areas. This approach creates a void in the development of well-rounded students and forces them to place more value on those subjects that are tested.

In countries such as China, testing has given way to the realization of the importance of creativity. Research has focused on standardized tests in China where students are doing well on them. Now they are focusing on the innovation and creativity. The "creativity crisis often emphasizes the need to infuse more creative thinking into student's school experiences" (Starko, 2013, p.56).

Problem Solving

"High stakes testing scores don't support flexible thinking" (Schaeffer, 2013, p 40). Problem solving is an important part of both thinking and the creative process; it is the process of moving toward a goal when the path of the goal is unknown. Problem solving is instruction that supports questioning techniques that require students to analyze, synthesize, and evaluate information to find solutions and make decisions (Snyder, 2008, p. 91). It also occurs when one is faced with a task or vision for which an approach is created specifically to address the task. If the task is not achieved, the approach has to be modified and altered to feed the need of the task

presented. To identify whether goals have been met on the task, an evaluation of the outcome must be performed. Problem solving has seven key components (Shibita, 1998, p. 1). The key components are: Purpose, Situation, Problem, Cause, Solvable Cause, Issue, and Solution (Shibita, 1998, p. 1).

The purpose of problem solving is to encourage student participation so that they take and develop an active role in their learning; this also fosters the development of thought processes. Problem solving can help an individual to adapt goals to those that fulfill individual needs (Snyder, 2008). Actively engaging student during the learning process is a more effective method of instruction than lectures and rote memorization. "Teachers should view students as users of information instead of takers of information" (Snyder, 2008, p.97).

Critical Thinking

Our current education system assesses students on their ability to demonstrate specific skills, not their thinking processes or thinking abilities. The current instructional methods used are limited because teachers have not mastered how to teach students to think critically. When teachers create certain mental habits that help students to think more critically, then how students approach their education will most likely change. For instance, a study was recently conducted on teaching critical thinking and problem-solving skills at the secondary level (Snyder, 2008). The purpose of this study was to determine the effectiveness of instructional thinking strategies to engage students in the learning process. Some of the challenges of this study were misperceptions and restraints due to lack of resources and time. The subsequent research uncovered questions around developing a culture of inquiry, in which students are encouraged to think about their thinking. This qualitative research involved project-based assignments that focused on decision-making and conflict resolution. According to the study, when teachers

changed the way they approached instruction, engaging students in constructivist learning through questioning techniques, the quality of student work improved (Snyder, 2008 p. 94).

The educator's goal is to assess student thought and learning development that is demonstrated in final products. The goal of education is teaching students long-term knowledge. Teachers do not omit thinking purposefully, but the pressure on teachers to create students who perform well on identified subject tasks has drastically impacted what students are learning. Many schools talk about the impact that critical thinking and problem solving has on the school and its students, yet teachers have not been properly trained on how to teach students to independently think critically.

Teachers have a lot of content to cover in a limited time. The focus on the content limits the teacher's ability to cover critical thinking and problem solving skills. Lecture-driven lessons allow for faster results. However, it does not assess the students' understanding of the information (McPherson, 2009, p.528-529).

Metacognition

When students can initiate their own critical thinking, they exhibit metacognition as thinkers. Metacognition is the ability to reflect, control, and understand, in a mode of self-awareness, one's learning and cognition (Shaw & Dennison, 1994). Students using metacognitive techniques in education develop a self-awareness of their own experiences (Mumford, 1986). Mumford (1986) states that it is essential to understand that an effective manager of what is learned can become a person who has learned how to learn. When an individual uses metacognition, he actively monitors his own mental processes. Part of developing cognitively is maintaining an awareness of one's own thinking and the ability to direct it consciously and strategically toward desired ends.

Metacognitive strategies help in our learning because they help us to find information, evaluate additional resources, and understand how to use different approaches to the problem (Darling-Hammond, p. 161) The two distinct characteristics of metacognition are metacognitive knowledge, or the awareness of one's thinking, and metacognitive regulation, or the ability to manage one's own thinking processes (Darling-Hammond, p. 159).

In "Thinking About Thinking: Metacognition in the Learning Classroom" John Flavell (1979) describes three kinds of metacognitive knowledge. First is awareness of knowledge, the understanding of what one knows, what one does not know, and what one wants to know. The second is an awareness of thinking, the understanding of cognitive tasks and the nature of what is required to complete them. And third, an awareness of thinking strategies, the understanding of approaches to directing learning (1979).

When students are working on metacognition, they are learning how to self-regulate tasks that are required of them in school (Danuwong, 2006, p. 25). Teachers can help to promote and reflect on what students know and would like to know. The students will take the thinking strategies that their teacher provides and use them accordingly to achieve the goal of the assignment.

The role of the teacher is to create and develop tasks that students can use begin to identify the problem, select a strategy to approach the problem, and predict an outcome. Creating this culture in the classroom prepares the students to have an awareness of their own thinking. "Learning environments that are knowledge centered and learner centered, and that take into account the role of assessment in learning laid the foundation for a reflective classroom" (Danuwong, 2006, p.162).

Metacognition in learning

A metacognitive environment creates reflective opportunities to help with learning. There are eight components used for metacognition in learning: predicting outcomes, evaluating work, questioning by the teacher, self-assessing, self-questioning, selecting strategies (using directed or selective thinking, using discourse) critiquing, and revising.

Predicting outcomes: Most often seen in mathematics or science classes, helps students understand what kinds of information they might need to successfully solve a problem. Prediction also helps students compare their thoughts with the final outcomes of a problem or experiment.

Evaluating work: Students review their work and determine the strengths and weaknesses in their thinking.

Questioning by the teacher: Teacher asks students as they work.

Self-assessing: Students reflect on their learning and determine how well they have learned something or how their skills have developed.

Self-Questioning: Commonly taught for use in reading tasks, but also useful in writing and problem-solving of all kinds, students use questions to check their own knowledge are learning. When students learn to ask questions (for themselves or of others) while they work, they intentionally direct their thinking and clarify the areas where they need assistance.

Selecting strategies: Students decide which strategies are useful for a given task. Strategy selection may depend on understanding one's own learning style and strengths as well as understanding the features of a problem. When using directed or selective thinking, students choose consciously to follow a specific line of thinking or structured approach in order to find an answer. When using discourse, students discuss ideas with each other and their teacher. This

process makes thinking more concrete and helps students learn to ask questions, identify gaps in their own knowledge, and learn from others' thoughts and ideas.

Critiquing: Students provide feedback to other students about their work in a constructive way. This process allows students giving feedback to practice verbalizing their own thinking and students receiving feedback to improve their own thinking process and performance.

Revising: Students return to their work after receiving feedback. This opportunity allows students to update their thinking and check their use of learning strategies. (Darling-Hammond, year, p.163-164)

In researching literature on thinking strategies, it became apparent that the cognitive aspects of gaining knowledge, also shows that there are physical changes that occur in the brain when new thinking skills are activated. The physical change that occurs when new skill is learned is called 'neuroplasticity.' When a person engages in metacognitive thinking, the physical muscle (the brain) adjusts to accommodate the change.

Neuroplasticity

Coyote (2007) states "Initial changes are just temporary". The possibility of changing the brain's structure increases when activities are repeated over time. Neuroplasticity is the brain's ability to reorganize itself by forming new neural connections. The brain is not hardwired at birth; but is forever changing as we grow. Neuroplasticity as a method can be referred to as road-mapping for the brain; road-mapping is a way of rerouting information that is in your brain. The brain constantly rewires itself to become an organ that is physically different from what it was in the previous moment. The National Geographic Series on the Brain asserts that "Learning how you acquire new information about the world, and memory is how you store information the first

time" (National Geographic, 2013). The brain is like a basic map early in life; it is like looking at a Google map; when you first look at the Google map you will see the seven continents then it zooms in on the country, and then the state and the region, giving more detailed information as it narrows down.

Neuroplasticity is enabled by behavioral circumstances. The physical changes that the brain goes through are based on new life experiences. Once a person is comfortable with a task such as learning a new language, neuroplasticity does not play an active role. When you are learning a new task the brain physically alters itself (Battro, Dehaene, Singer 2010 p 24). According to Coyote (2007) Two important components must be in place for neuroplasticity to work; the individual needs to have daily exercise, and also needs to constantly take on new and challenging tasks .

Most of the brain's growth takes place in the cerebral cortex. The cerebral cortex is the outermost casing of the neural tissue of the cerebrum. The cerebrum is located between the spinal cord, and the temporal and occipital lobes. The cerebral cortex controls memory, attention, perceptual awareness, thought, language, and consciousness. New cells are being created every minute, neurons begin to take on specialized roles, to store and file the information and skills that a person obtains (Coyote, 2007).

Neuroplasticity is occurs when one adapts to a new environment. Infants are dependent on others, as the infant grows motor skills are developed to communicate. The brain is able to adapt to our environment. This development activates neuroplasticity. The reason that neuroplasticity is so active at a young age is because an infant is learning a new skill from moment to moment. Between the ages of one to five a child is learning how to walk, talk, identify objects, listen and touch on a daily basis. At such a young age the brain is learning

about itself. As we age, the brain continues learning but not at such a rapid pace. The adolescent brain is prone to do repetitive things so the brain recalls information instead of developing new skills. That is why neuroplasticity is very active at a young age.

The brain has several components that help to activate neuroplasticity. Some of the mechanisms that assist the brain to create new thoughts and growth are neurons, synapses, cells, and neurotransmitters. All of these tools are necessary in order to help with the development of neuroplasticity and metacognition.

Each neuron contains a cell body with a long, tail like fiber called an axon, which sends electrical impulses to other cells. The neuron creates a signal that travels throughout the brain and nervous system. Both the brain and body need regular exercise if neurons' are to remain 'sharp.' Repetition of newly learned tasks helps make neurons' connections stronger with each other.

Neurogenesis is the development and creation of new neurons. As we learn, we develop and grow new neurons. As we age some of the neurons are eliminated because they aren't needed anymore for building a connection to things that relate, which is called synapse. The neurons become stronger as each neuron identifies different aspects of an experience and come together to help us see a whole. When learning new things through vision or sound, neurons are translated into electrical impulses for the brain to understand. This information is transferred from one neuron to the next. As a skill is developed more neurons develop, and multiply making connections faster and easier for the brain to identify.

An example would be learning a new word, like "bacon." You are shown bacon, then you smell it when it is cooking, and you can identify the sound if makes when it is being prepared. The neurons have different roles. Some neurons that are used to identify that object

may be linked to other neurons because you use these several components of the object to identify what it is. One neuron will identify the color of bacon. While another neuron's role will be to identify the smell of the bacon. The next neuron will identify the sound of bacon in the skillet. When the brain creates the connections using these different neurons, the process is referred to as a 'neuron synapse.'

The arrival of a neurotransmitter alters the electric impulse at the edge of the new neurons and sparks a new electrical impulse. Neurotransmitters are brain chemicals that communicate throughout the brain and the body. As impulses make connections in the central nervous system, networks are created for particular functions such as language and other experiences.

Synapses are the pathways that allow neurons to travel through the brain. The growth of more neurons and expansion is bumped up when you have a physically active life. More Synapses are created as new skills are obtained and difficulty levels increases. Once you have acquired a skill, little to no concentration is needed to do the task than little to no neuroplasticity is activated. When a person is focused and paying close attention to obtain a new skill then the brain is changing and adapting to obtain new knowledge (Willis, 2008). These are the physical characteristics of growth that happen within the brain when a person develops new skills. These different parts: neurogenesis, neurotransmitters, synapses, axons, and neurons, all work together to create new skills that develop neuroplasticity.

Piaget's stages of cognitive growth

Neuroplasticity grows at a different rate depending on one's development stage in life. Piaget, a developmental psychologist, believed that there are different stages of cognitive growth. Piaget's original approach to education was to conduct intelligence tests. He realized

that this type of testing limited the amount of information obtained because looking for a right or wrong answer did not explain how children came to their conclusions. He was curious about students' thought processes. Through research he developed offered a new understanding of how children acquire knowledge. "Piaget believes that intelligence starts before school learning begins at birth" (David, 2005, p.40) Piaget identified four stages of cognitive growth and development: Sensorimotor, Preoperational, Concrete Operational, and Formal Operational.

An example of one of Piaget's experiments is the 'liquid test' in the Formal Operations stage (ages eleven to adulthood). A student is given five different liquids and an eye-dropper. Container one has diluted sulfuric acid, container two has water, container three has oxygenated water, container four has thiosulfate (bleach), and container five, potassium iodide. The task was to create the color yellow in any way he or she wished. The student in the formal operations stage states, "I need to write this down" noting their observations of each variable tested, and what combinations are needed to achieve the task they are performing. They test every combination and theory through documentation and the process of elimination, to find an answer (Piaget, 1997 p.114).

Piaget identified that at the Formal Operations stage of cognitive growth, students move from abstract to hypothetical thinking. An example of this transition in thinking is math word problems. When solving word problems, students can compare information; but, when they don't know how to compare, they just guess. This way of thinking develops during the Concrete Operational stage of cognitive growth (ages seven to eleven). The Preoperational stage of cognitive growth occurs during the ages two to seven, when children can create a strategy, plan, and execute it based on the problem that has been presented to them. The students work systematically to test all the possibilities to solving a problem. They will go through the process

of elimination to and organize test their theories. The fourth stage of cognitive growth is the Formal Operations stage (ages eleven to adulthood). In this stage, young people develop the capacity to think systematically on a "purely abstract and hypothetical plane" (Piaget, 1997, p42) and think in terms of mental actions. So if the students are asked to fold clothes, they visualize the act of doing it without having to physically do it. At this stage, it doesn't mean that adolescents possess the formal reasoning of adults, but they could potentially achieve some adult understanding. At this stage, their reasoning is more quantitative and rather than qualitative.

The reasoning capabilities of an adolescent catch up to that of an adult through illogical reasoning. Each parent, teacher, or person who interacts with an adolescent understands this. It is through concrete reasoning that the adolescent becomes aware of "how do I know what I know" (David, 2005, p49). During this phase adolescents demonstrate two different types of reasoning: hypothetical-deductive reasoning and scientific-inductive reasoning. Hypothetical-deductive reasoning occurs when testing a theory and observing the subjects. In scientific inductive reasoning occurs when students are presented with a problem and they are able to create a hypothesis, control, variables, experiments, record effects, and form their results to draw a conclusion. With scientific inductive reasoning students are able to work with a combination of variables. Basically you can study multiple tasks simultaneously. Students are able to create reasoning and the relationships of different variables in an experiment.

Piaget believed that "true learning is not something handed down by the teacher, but something that comes from the child" (Piaget, 1997, p.149). Education is a "process of spontaneous invention and discovery" (Piaget, 1997, p.152). He believed that education should be differentiated to the student's individual level. Instead of adults imposing knowledge on a child, inspire the children to make their own discoveries. To do this, teachers need to employ

instructional strategies that require students to go beyond showing the correct answer. Intelligence involves thinking about what is possible and not possible – in 21st century education this is referred to as critical thinking skills.

Intelligence and the habits of mind

Neuroscientists do not agree on how to define intelligence. How much is genetically inherited? In education IQ tests were used to check one's knowledge of memory rather than the ability to reason. The results of the IQ tests show a predictor of performance in a range of mental exercises.

There are at least 16 identified habits of mind that determine intelligence. Some of the habits identified are: persisting, managing impulsivity, listening and understanding, empathy, thinking flexibly, thinking about thinking (metacognition), striving for accuracy, questioning and posing problems, applying past knowledge to new situations, thinking and communicating with clarity and precision, gathering data through all senses, creating, imagining, innovation, responding with wonderment and awe, taking responsible risks, finding humor, thinking interdependently, and remaining open to continuous learning. Using these 16 *Habits of Mind* as a model, Harvard's Project Zero Framework "Studio Thinking" is structured around eight *Habits of Mind* that should be developed in the art classroom. The eight "*Studio" Habits of Mind* are: develop craft, envision, engage and persist, express, observe, reflect, stretch and explore, and understand the art world.

Table 1.

The Eight "Studio" Habits of Mind

Develop Craft	Learning to use tools, materials; learning artistic conventions; studio

	practice, learning to care for tools, materials, and space.
Engage and Persist	To embrace problems of relevance within the art world and or importance, to develop focus and other mental states conducive to work and persevering at art tasks.
Envision	To learn to picture mentally what cannot be directly observed and imagine possible next steps in making a piece.
Express	To learn to create works that conveys an idea, a feeling, or a personal meaning.
Observe	To learn to attend to visual contexts more closely than ordinary "looking" requires and thereby to see things that otherwise might not be seen.
Reflect	Question And Explain: to learning to think and talk with others about an aspect of one's work and working process. To evaluate learning to judge one's own work and working process, and the work of others, in relation to standards of the field.
Stretch and Explore	To learn to reach beyond one's capabilities, to explore playfully without a preconceived plan, and to embrace the opportunity to learn from mistakes and accidents.
Understand the Art World	Domain learning about art history and current practice.

The *"Studio" Habits of Mind* framework identifies what happens in the art room but does not offer strategies for teachers to know how to implement the thinking. How can we encourage or teach art teachers to foster thinking strategies in the art classroom?

When students are learning a craft they have to become familiar with the tools in regards to what they are creating, as well as how to sustain and improve upon their skills over time. As students are working on art they are creating and finding a problem and must stay committed to the task until it is done, which is persistence. So many of the skills that are used to promote or encourage students' metacognition are interchangeable in both. Studio thinking identifies structures within the arts classroom and how they are implemented. A teacher develops a class with the goal of it being student centered, demonstration led or teacher led. If the classroom is student centered the instructor encourages the students to use the eight components of metacognition or various thinking routines. A teacher-led lesson and demonstration will mainly use thinking routines in the classroom.

How the art is measured with improving test scores

"Perhaps the problem with the outcome measures, and future research should examine more authentic and creative thinking outcomes, such as the ability to find new problems" (Getzels & Csikszentmihalyi, 1976, p.171). In today's information age, thinking skills are viewed as crucial for educated persons to cope with a rapidly changing world. Many educators believe that specific knowledge will not be as important to tomorrow's workers and citizens as the ability to learn and make sense of new information (Gough, 1991).

Although thinking strategies are considered important in education, little has been written to explain how to teach students how to think for themselves. However, most schools would agree that thinking strategies are important for students to be successful in our current society. "If students are to function successfully in a highly technical society, they must be equipped with lifelong learning and thinking skills necessary to acquire and process information in an ever-changing world" (Robinson, 1987 p.16).

Methodology

This qualitative case study research employed ethnographic methods to collect data. Structured interviews were conducted with two high school teachers. I observed the teachers' classes, took observational notes, observed critiques, photographed student work as evidence of critical thinking and audio recorded teacher interviews and student interactions. Collecting data using a variety of methods allowed me to use triangulation in analyzing data.

As the data was collected the information was characterized into several methods: 1) the source of information, 2) ways of assessing growth, 3) what the teachers said in the interviews, 4) how instructional strategies translate into the foundation of the lesson, 5) teachers delivery method, 6) Teacher and students use of the thinking strategies, and 7) Students' use of thinking during the lesson. This investigation of literature with the direction of the initial research questions: How does a teacher set up a learning environment that fosters thinking? How can you assess students' metacognition in visual art? What are the basic components that are needed to make thinking in the art classroom environment work?

Two different teachers were selected for this research. They both teach high school art classes. Teacher A teaches at an independent private school in Washington, DC. Teacher B teaches at a Public charter school in Washington, DC. Both schools have an eight-day schedule cycle where art classes run an hour each session. Students at both schools signed up to take their class. The schools have a diverse student body and English as second language students. The classes observed for both schools were majority female and two male students in each class. Teachers A and B have both taught art for over ten years. The goal of the data collection was to discover what thinking routines, studio habits of mind, and/or problem solving techniques were used and analyzed in the art classroom. The two schools were chosen because of their similarities

in how art courses are scheduled and their pedagogy. Both teachers used thinking strategies in their instruction.

School A, is a private IB school. The supplies and access to art materials are limitless. The school has an art team that gives students an opportunity to access multiple resources of knowledge within the department. The students in the class elected to take a higher level art class in the 10th grade.

Table 2.

School A: Chart Critique One and Two 2013

Code	Gender	Grade	Ethnicity
rl	Female	11	African American
ce	Female	11	Caucasian
ay	Female	11	Caucasian
jn	Male	11	African American
Sg	Female	11	European
JE	Female	11	Hispanic
Isy	Female	11	Hispanic
MA	Female	11	

School B is a Public Charter school with one Art teacher on the high school level. They moved into a new building the previous school year.

Table 3.

School B: Critique One Participant Table at the Public Charter School 2013 [School B CR1 2013]

Gender	Grade	Ethnicity	A1
Male	10	Hispanic	A2
Male	11	Hispanic	A3
Male	10	African American	A4
Female	10	African	A5
Female	11	African	A6
Female	10	African American	A7
Female	10	Caucasian	A8

Female	11	Hispanic	A9
Female	10	Hispanic	A10

Teachers in Schools A and B both received an eight question structured interview. The teachers were asked about their teaching approaches, the thinking strategies used, the eight *Studio Habits of Mind* used, how students' growth was assessed, and the different uses of structure in the classroom. The information collected from the teachers was used to bridge a connection between the two teachers and the relationship created with the students.

Prior to the teacher interviews a rubric was created to see what thinking strategies looked like. Later it was decided that was a good starting place to begin this research. The rubric was limited because it identified the teacher's role. However, it omitted to identify the role of the students and the relationships between the teacher and the students. The interviews included eight open-ended questions and the teachers' methods. The study observed the teachers' use of visual thinking strategies, their impact on the classroom, and how teaching philosophy cultivated the class.

During observations methods of delivery and connections between the two schools were the focus. This structure allows the information that is received to get a fair analysis of the data collected to be analyzed impartially. In addition, the format provides the researcher with the opportunity to engage in a discussion with individual teachers about the teachers' values.

Table 4.

How to Assess Growth

Questions to assess Growth			
Activities	Content	Processes	Habits of Mind
What tasks did you ask the students to complete?	What concepts and understanding did the students achieve?	What processes do I want my students to focus and develop?	What habits of mind did the students exhibit and explore?

How did they make it happen?	How did their habits change as results of the projects that they have worked to complete?	How will I know they are practicing and developing them?	What will I do to support students in their development?
What do I expect them to do with these tasks?	What way did I help them to understand or move forward with these tasks?		How will assess the student's growth in relationship to the habits of mind or intelligence?
	How will you know that they have achieved these concepts?		

A Case Study of Two Different Classrooms

Prospective case studies were used to determine what impact thinking strategies make on the students and how they affect their thinking. Audio recordings of School A and School B were collected from the class critiques. The critiques were recorded at the beginning of the class to understand how the teacher lays the foundation of the lesson. The information was coded and separated into different categories of collection data.

Audio tapes were made of the interviews and class observations after the interviews. A coded instrument was used to rank the interviews, class observations, and visual journals. A new rubric was created and the roles of both the teachers, as well as the students were identified.

While collecting data, three overarching ideas were observed in the classroom: 1) Teacher's curriculum strategies, 2) student strategies and 3) assessment strategies for the teachers and students interaction. Several questions also arose during the research: How does a teacher know when a student's thinking strategies change? What are the differences between thinking strategies? What are the similarities of thinking strategies, problem solving, and critical thinking skills? The analysis will focus on how the teachers use these thinking strategies to activate how students think.

Teachers' instructional strategies led students to ask more questions about their thought processes and perspective. Multiple case studies guided the research to use different forms of documentation to assess student's growth through thinking. The two case studies involved provided comparative information to examine strategies in different settings. The four methods of collecting data for the case studies are: 1. participant interviews, 2. audio recordings of classroom discussions, 3. Critiques, and 4. visual journals (artifacts). These four different methods of data collection help to mold an understanding of what a thinking strategy is: using an audio device in classroom critique discussions as well as photographing students' work in order to assess interviews of how the students and teacher documented their progress. Direct observations of lessons helped to bridge teachers' methods and the students' understanding. This study examined repeated themes in the two art classrooms, which helped to clarify how teachers successfully facilitated students taking ownership of their own learning.

Working as a researcher made it apparent how a teacher lays the foundation that cultivates thinking strategies in the classroom. The interviewer conducted two structured interviews, later expanding on research to observe whether or not the teachers' response to interviews made thinking routines apparent in the classroom.

Audio recordings, photographs of visual journals and interviews during the sessions documented the broader contexts. The audio recordings were used to check for understanding of the students' knowledge. It led to impromptu thinking routines that were addressed in the class. The recordings capture the roles and responsibilities of the teacher as well as the students. The recordings gave an in depth understanding of the rapport between teachers and students. The audio recordings captured the spontaneous culture that evolved in the class during instruction. They also indicated how the pulse of the class changed as each individual shared their thoughts

about the tasks that they embarked on. Visual Journals captured the student's resourcefulness, thoughts, ideas, and influences impacting their artwork.

Data collection methods

During the critiques the students' behavior, speech, and obstacles were a focus to see how students articulated their ideas and how the teacher fostered them. The information was collected from the beginning of the lesson to the end of the lesson. It gave the researcher an opportunity to witness the student's growth. The data also provided a comparison between School A and School B. This comparative data was used to examine how the students adjust their thinking based on the information that was presented to them. This research allowed a better understanding of how the class culture is developed and maintained using the various thinking strategies. Visual journals showed how the students develop their thoughts.

The aim of the case studies was to provide an understanding of thinking strategies that can be used in the high school art classroom. This led to the research question which relates to: teachers setting up the structure to foster thinking, student's development throughout projects and strategies that are commonly used to foster thinking. The ultimate purpose is to provide an overview of how thinking strategies work in the art classroom. Multiple data collection methods were used: structured interviews with two different teachers with similar school environments, critiques, photographed documentation, and observational notes. The data collected from both school A and B were coded and analyzed to identify what strategies were used by the teachers and the students and how it was used.

Table 5.

Thinking Strategies in the High School Art Classroom

Thinking Strategies

Teacher Strategies (curriculum)	Student Strategies (thinking /studio)	Assessment Strategies (student or teacher)
Lesson planning /action to maximize student thinking	Use of problem seeking methods	Visual journals References
Check for progress and understanding	Students planning and execution ideas into tactile form	Oral critique
Response to student's needs (redirection)	Thinking routines developed	Response to open ended questions
Uses of open ended questions	Demonstration of understanding	Reflections with revisions of new thoughts
Goal setting	Goal setting for mastery	
	Self-assessment	
	Students are able articulate thoughts visual, audio and written form	

Results and Discussion

The purpose of this research was to identify what thinking strategies were used in the high school art classroom. Two high schools were selected for comparison. School A is a Private IB school and School B is a Public Charter school. Both schools are located in a major metropolitan city on the east coast. The class observed at each school was majority female. Each teacher observed had over ten years of teaching experience. There were four different methods of data collection: 1) structured interviews with teachers 2) classroom critiques 3) Observation notes 4) Visual Journals. Multiple streams of data allowed for triangulation. Analytic induction led to the formation of three overarching pedagogical ideas: Teacher's curriculum strategies, 2) student strategies and 3) assessment strategies for the teachers and students interaction. Both the students and teachers use of thinking strategies were acknowledged. The direct observations of lessons bridged teachers' roles and students' understanding during the critique. Ethnographic

data collection was the method used to gather information and later analyzed for repeated themes and patterns between the two art classrooms.

Primary Data Collection Methods

Audio recordings, observational notes, and photographs of class sessions were used to document the culture of the class. The data collection resources showed how teachers check for understanding and the impromptu thinking routines that arose during the assignment. The recordings capture the spontaneous culture of growth in the class during instruction and how the direction of the lesson is altered as each individual shares their thoughts about the tasks pursued. The primary goal for the audio recordings was to understand how the teachers created a metacognitive environment. The audio recordings became a tool for listening to and reviewing critiques and identifying thoughts and reflection that occurred during the class.

The visual journals were documented with photographs to show how students' ideas transitioned into a final product and what influences impacted the decisions made. The visual journals documented the students' learning process through written and visual thoughts, brainstorming ideas, and the information that impacted their direction while creating.

School A and B interviews

The interviews provided insight into the teacher's ability to implement instructional strategies in the art classroom that encourage thinking. Using case studies provided an opportunity to gain in depth understanding of how and when students stop looking for correct answers and begin to think about their thinking (AZ IN School A, Jan 2013). The instructional purpose of thinking strategies is to encourage students to develop, understand and recognize how they learn and acquire new knowledge through different guided thinking practices.

Metacognition was assessed through rubrics created by the teachers. Four overarching themes emerged from the structured interviews with teachers: 1) The teachers thinking curriculum, 2) how the teacher's curriculum impacts the students' ability to tap into their own intellectual development, 3) The student's ability to be aware of their own metacognition and understanding of it 4) what thinking routines can be identified between the teachers and the student's? Analyzing the data collected from the interviews, critiques, thinking routines, problem solving, and habits of mind identified how metacognition impacted the behavior of the students, as well as how the teachers fostered the students thinking throughout the development of the art making process. The questions that teachers addressed in the recordings were closely observed to find a common link between what they projected would happen and what actually happened during the critiques. How teacher's executed and implemented the thinking lesson and instruction, and how students' thinking transitions from concept to final draft in a thinking classroom? Following the recordings the information was transcribed and analyzed.

In the interviews both teacher A and B indicated that their classrooms have student-centered instruction. A student-centered environment is one in which the student drives lessons and goals for a task presented by the teacher.

"I don't do demonstration lessons. Since because one of the things is you think you see then 20 or 18 of what you just demonstrated of what is coming right back at you. And, so my observation after doing a lot of years doing it, Teacher-led demonstrations even when they are purely technical, come straight back at you" (Teacher AZ IN school A, February 2013). Teacher AZ believes that teacher demonstrations influence student thinking to such a degree that their approach to an assignment does not reflect their own creative thinking. I believe that students are so conditioned through years of teacher-centered education, to do what they think the teacher

wants, that they don't put much effort into thinking beyond that. They ask, "What is this teacher looking for? Because that is what I am going to give her." If the teacher can convince the students that they are not necessarily looking for anything in particular except to see students growing and learning, then maybe they have a greater opportunity to move forward because they won't be playing that looking for approval game. This can lead to students designing their own classroom interactions.

Teacher AZ recognized one of the many faults of education is students seeking the right answer or approval from the teacher. Teacher-led demonstration methods cripple the students' thought progress when the classroom culture is designed to find the "right" answer. Teacher AZ believes that prescribed lessons limit the students' way of thinking and lack of awareness of their own thoughts. A teacher–centered environment discourages students from thinking for themselves; the goal is to please the instructor and achieve the desired grade.

"No doubt that it is student-centered. It is a little more demanding in the focus that you have to put in the class a little more demanding into the skills that you need to have as a teacher in the class for the teacher to create student centered the engagement and participation you get from the students if worth the effort on your part they take more ownership absolutely they become more engaged the projects that they are working on are very personal" (Teacher B,5 March 2013).

In the interview Teacher B indicates how the use of thinking strategies required more individualized attention for the students. He suggests that when students are catered to, the support took additional time out of class. Teacher B acknowledged that using thinking strategies requires one to be organized enough to juggle diverse assignments.

School A lesson color wheel

The teacher at school A began a classroom critique of students' work and understanding of the color wheel. Teacher AZ gave questions on a Moodle of tasks. The Moodle is an online website where students receive their assignments. The students created a color wheel. The assignment goals were: 1) to create a color wheel that included primary, secondary and tertiary colors; 2) provide examples of different color wheels, students referred to in the visual journals; 3) to document questions and ideas as that arose during the processes. These questions and ideas led to a student-centered assignment that expanded further on the topic of color.

At the beginning of the critique, the teacher asked several open ended questions to check misunderstandings. Several of the students were dissatisfied with the outcomes of the color purple on their color wheel. This is the question the teacher developed in the critique based on the student's frustrations. "Why do you have this notion that violet should be this color?" (Teacher AZ CR1 2013). The purpose of this question was to support the students and it created an awareness of their thinking.

As the art critique progressed, the students developed and discovered why they felt this way and reflected on their own thoughts. When the students worked to create a color wheel several of the students stated that when they mixed the colors the color violet had not turned out as envisioned. The teacher asked the students how they perceived violet and how their perceptions impacted their creative process. The goal of the open-ended question was to activate their thinking. The teacher created multiple questions for impromptu concerns during the critique to create an environment of thinking and discouraging students from taking a passive role by seeking an answer from the teacher. In turn, the students took the questions and reflected on their

motives, their own thoughts, and how they used them to guide them to lead to new directions and discoveries in the art classroom.

"So, as we go around and you start talking about the questions. I want you to think about, was there another way of engaging with this? As I was doing it. Why do I have this notion that violet should be this color?" (Teacher AZ CR1 IN 2013). The teacher responded to the misconceptions that the students had about the color purple. Teacher A asked the students about their thoughts on the color and how this misconception of the color purple had hindered them from accepting the purple color they created. The students had a different perception of the color purple that did not correlate with the actual purple they created. During this critique, the students became aware of themselves and their thinking about the color purple, which in their minds differed from the actual color they created. They questioned the color created instead of questioning the commercial purple they had ingrained in their heads.

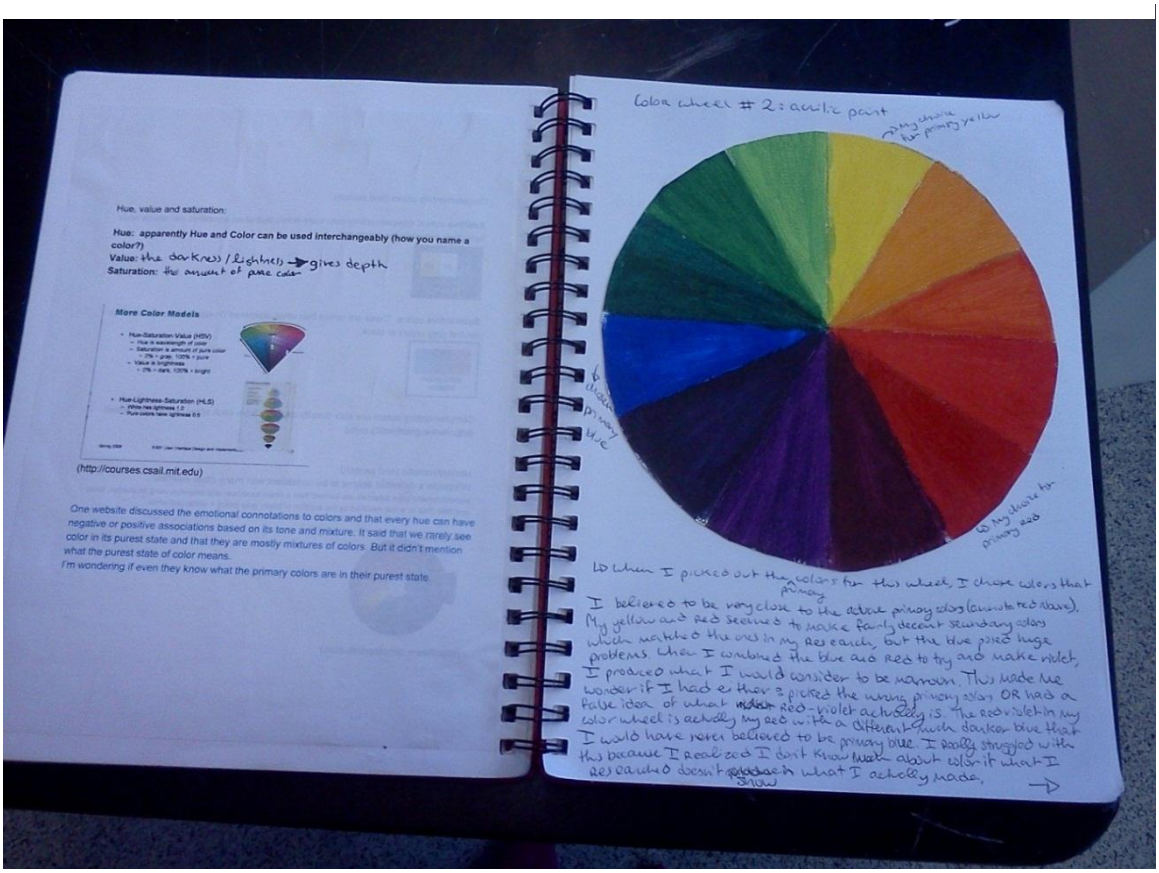
The Micro Lab Protocol or *I used to think, Now I think* (Ritchhart, 2011) are the thinking routines used to check for misunderstandings. Teacher AZ addressed the group about their dissatisfaction with the color purple. This question helped to engage students with what preconceptions they have held and what thoughts emerged during the color wheel assignment. These thinking routines are used to have the students ~~to~~ reflect on their own thoughts and understanding the impact of their approach to the color wheel assignment.

"The reason why we think that violet or a particular color was because when we learned about color theory, we were doing Goethe research on the color wheel. We saw violet in a certain way. So when we were doing the process the one we read about it came out really horribly" (Student CE CR1school a 2013).

This student thought and reflected on why she had come to this conclusion. Student CE came to an awareness of her thoughts. Student CE begun to understand that this frustration had to do with her expectations of the paint and the color it creates. This self-awareness forced the student to acknowledge her own metacognition about color. Student CE used the thinking routine: What I used to think and what I now think? Student CE realized that her perception of violet before the lesson, affected how she perceived purple should look and this is why she was disappointed with the outcome.

Figure 1.

Student RL VJ 2013



Student RL VJ 2013

When I picked out the primary colors for the wheel. I chose colors that I believed to be very close to the actual primary colors.(annotated above) my yellow and red seemed to make fairly decent secondary colors which matched the ones in my research but the blue posed huge problems when I combined blue and red to try and make violet, I produced what I would consider to be maroon. This made me wonder if I had either, picked the wrong primary colors or had a false idea of what red violet actually is. The red-violet in my color wheel is actually my red with a different much darker blue that I would have never believed to be a primary blue. I really struggled with this because I realized I don't know much about color if what I researched doesn't show in what I actually made.

Student RL VJ 2013 describes her predisposed idea of the color purple and how it impacted the frustration that she had with violet. In the RL's visual journal, the student showed the use of the thinking routine *see-think-wonder* (Ricthhart, 2011). RL VJ noticed that the color

blue used was not the ideal primary blue color she believed it to be. The colors used to create the color violet resemble RL's definition of maroon. This made her *Reflec*t (from the eight habits of mind) on the work that she created and what she believed it should be, which neglects the evidence presented from mixing red and blue. This reflection led to her wondering and it led to another thinking routine, *what I used to think* that I know color and *now I think I don't know* much about color (Ritchhart 2011). This led to RL questioning what she really knows about color.

Teacher AZ CR1 2013

> But I think that is another thing that you have to think about in terms of the research which was what color wheel am I looking at and what are the colors that I am seeing here? How many people went to different types of color wheels? Alright, so maybe you can tell me whose color wheels you explored?

Teacher AZ asked another open-ended question that helped the students understand their own metacognition. Teacher AZ CR1 critiqued students with questions to support the students' understanding of their thoughts. The teacher redirected the students with reflection upon the expectations imposed on the color wheel assignment and how it has influenced the understanding of the results. This questioning forces the students to *Zoom in* on their expectations and look at the results with an unbiased eye.

Student 2 CR1 School

> Well I have these two. From 1776 Paris it was like a the other one is from 1810 from Goethe and it is really small but the middle one I wanted some of the ones we use today this is the Harris one and he uses different colors they are completely different this one is more duller colors.

This student reflected on her understanding of the art world. That is an example of one of the eight habits of mind. She reflected on the information that she received. Yet she had new thoughts and questions about the color wheel. The student had omitted the theory that the colors

in Goethe's color wheel may be pigments and that impacts the results achieved. This indicates that the student has created new problems to seek and explore in future lessons.

Teacher AZ CR1

Which one?

CR1 Student 2

It is Goethe's it has a lot more.

Teacher A CR1

And then you have this one as today's example right? So when you were mixing violet were you thinking? Well how are my violets coming out or were you referring to things you can see? Did you say well if this is Goethe? Are my violets turning out more like Goethe's violets? Or did that not enter you head?

Even after the student reflected on the outcome of her color wheel, the teacher pushed the student to continue reflecting on the results and analyzing the results even further.

CRI Student 2

It was kind of a personal judgment. If they are all different then how do we know which one is right? I ended up with three different reds three different blues or um four different the ones that kind of turned out normalish were crimson and cobalt or red I did not refer to any photographs Goethe's because I didn't think any of them were correct I guess?

Through this questioning, it is apparent that Student CE CR1 2013 is still seeking what the teacher would identify as the correct answer. This is an example of teacher AZ's development of a student-led environment to support student development and questioning of what they know. The Teacher AZ provided the students with open-ended questions about their own thoughts. The teacher asked the questions, "Whose brain are you using?" "Are you trying to respond to seek or absorb the information instead of reflecting on what you understand of the assignment?"

Teacher AZ CR12013

This is really interesting. So I think this is really interesting. You keep on saying correct.

Student CR1 2013

But it is not.

Teacher AZ CR12013

What do you mean by correct in this realm? Is it a moving target? Now if you now look at your Goethe's color wheel and you now look at color wheels that you are developing. Do you think that is closer to what he was doing?

Instead of succumbing to the questions the students ask, Teacher AZ redirects the students to reflect on their own understanding of what the color wheel is.

CR 1School B Teacher B

You have the package in front of you this is to enter into your next entry the next entry that we are going to be working on we are going to do some analysis of this image we are going to read some quotes of this artists Robert Rauschenberg. He is going to be who inspires our next entry. What I am going to do is please raise your hand if you want to read one of the quotes. See if you can interpret the quote meaning can you put into your own words what that means to you. There is no right or wrong answer for this there is ways of interpreting and when we start critiquing the piece I also remind you that there isn't any right or wrong answer. There is ways of supporting your statement with evidence. In in evidence is what we are looking for right so will somebody read the first quote you can read the first quote of Robert Rauschenberg thank you.

Teacher B CR1 March 2013

What do you count it for polite for discipline?

Student CR1 2013

No for manners.

Teacher B CR1 March 2013

What does it mean to be undisciplined? Anybody?

In this exchange, Teacher B CR1 2013 is checking for understanding with the students.

Student CR1 2013

You parents don't give you orders right.

Teacher B CR1 2013

That is a vocabulary problem right?

Teacher B has introduced a new concept to the students but is unable to understand without the teacher's assistance. The students in School B cannot use their cellphones during class time and there was not technology within the classroom so the teacher intern becomes the resource for the students. Teacher B has acknowledged that the students' ability to address certain words created a barrier because English is their second language also the lack of technology in the classroom affects the students' ability to be completely independent in the art room.

Teacher B CR1 2013

Undisciplined it means to be like unfocused like. It is like the habits or demands that you use to do better as things.

Teacher B CR1 2013 addressed the misunderstanding buy identifying what word means with guiding questions.

Teacher B CR1 2013

So you learn a lot from habits of work and it is our habits mind to be undisciplined is to be in a sense not to be able to perform those habits or not to be able to perform to be more timely. Or not to be able to do quality work or to do revisions right.

Teacher B CR1 2013 has stated saying right it is very easy to not to be able to do those types of things. To be disciplined it so be consistent with your time and to create high quality work it is against his nature it is against his character.

Teacher B CR1 2013

I have to strain I have to puts myself a little bit to stay on the right track. So it doesn't come naturally for him with those habits he has to push himself. Who can read the third one? Thank you.

Student CR1 2013

I don't think it is a service making art I do what I do painting is a Segway to get along with himself.

Teacher B CR1 2013

What does that mean for you student A2?

Student CR1 2013

He feels like he wants to? He doesn't think of what he is going to do next.

Teacher B CR1 2013

So how do you interpret of think that I do what I do because I want to? And I feel that is the best way I have found to get along with myself. What does it mean to get along with yourself? How do you interpret that? Do you get along with yourself? How? What does it look like when you are getting along with yourself?

Teacher B supported and encouraged students to share their knowledge of their interpretation of the quotes by Rauschenberg and they indicated what it meant.

Student A6 CR1 2013

You are not disappointed by your own actions.

Teacher B CR1 2013

Good way of putting it. So this is a sense of pride towards the things that you do he said that painting is the best way that he has found that in A7 CR1 2013words not to be disappointed. But it is by his own actions. Who can read the next quote?

Student A7 CR1 2013

My art is about paying attention about the scrutiny and possibility that you may be art.

Teacher B CR1 2013

What does that mean for you?

Student A7 CR1 2013

You need to pay attention to what you are doing. And other things around.

Teacher B CR1 2013

So he is making a clue about how everything that I make and do is about paying attention to if I am distracted and that I am somewhere else that doesn't get me anywhere right It is about paying attention that dangerous possibility that you may be art how do you interpret that.

Student A8 CR1 2013

I don't know. Can you be art?

The dialogue between the teacher and the students a7 and A8 the students are giving their interpretation of the statement. Yet they are seeking reassurance. The teacher is encouraging them to participate. Teacher B encourages their understanding by asking questions to help them to develop and foster their own thinking.

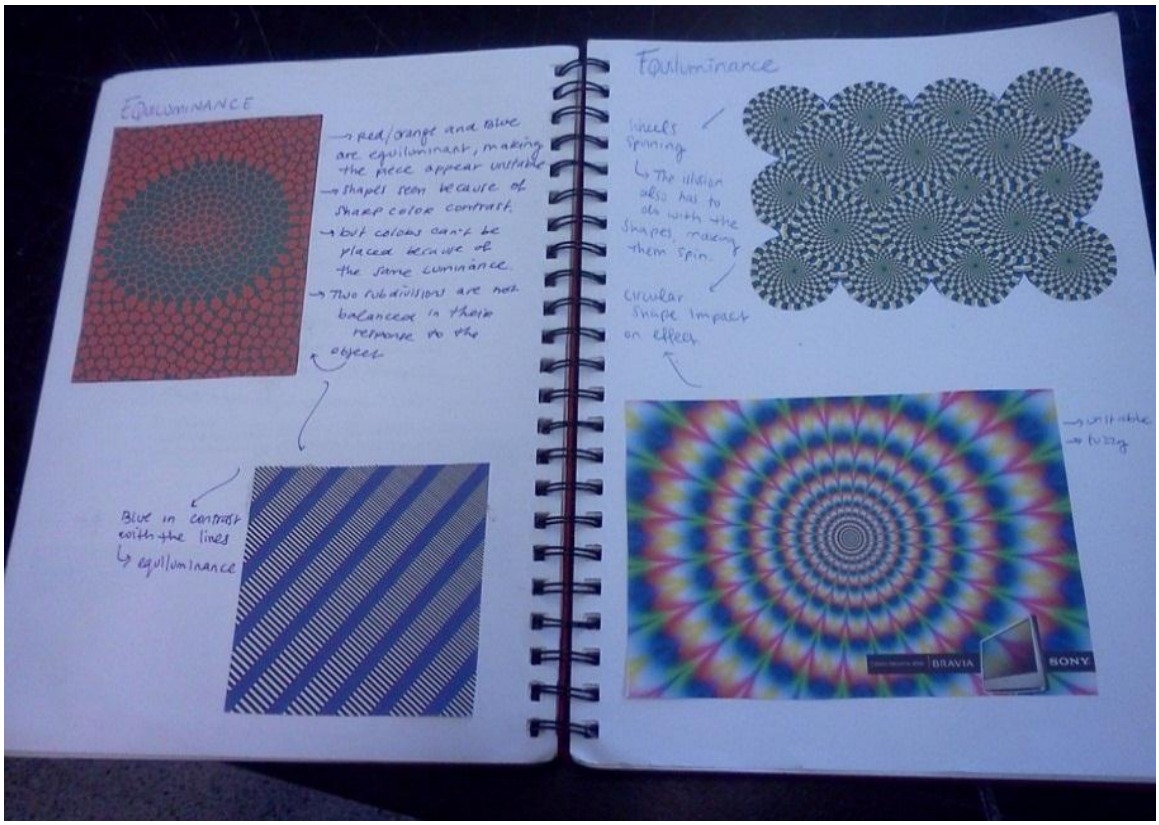
Individual student assessment of themselves and visual journals

School A CR 2 student SG VJ 2013

School A CR 2 Student SG VJ worked with the color wheel personal assignment. She is interested in the equiluminance and how when you put colors side by side show how they create a since of movement. Equiluminance is about the relationship that colors have with one another. In School A CR 2 SG VJ she has identified what the Equiluminance is. Now that she understands what she questioned how this visual color interactions works. She has shown in her journal that spacing, scale and hard and soft edges impact how colors interact.

Figure 2.

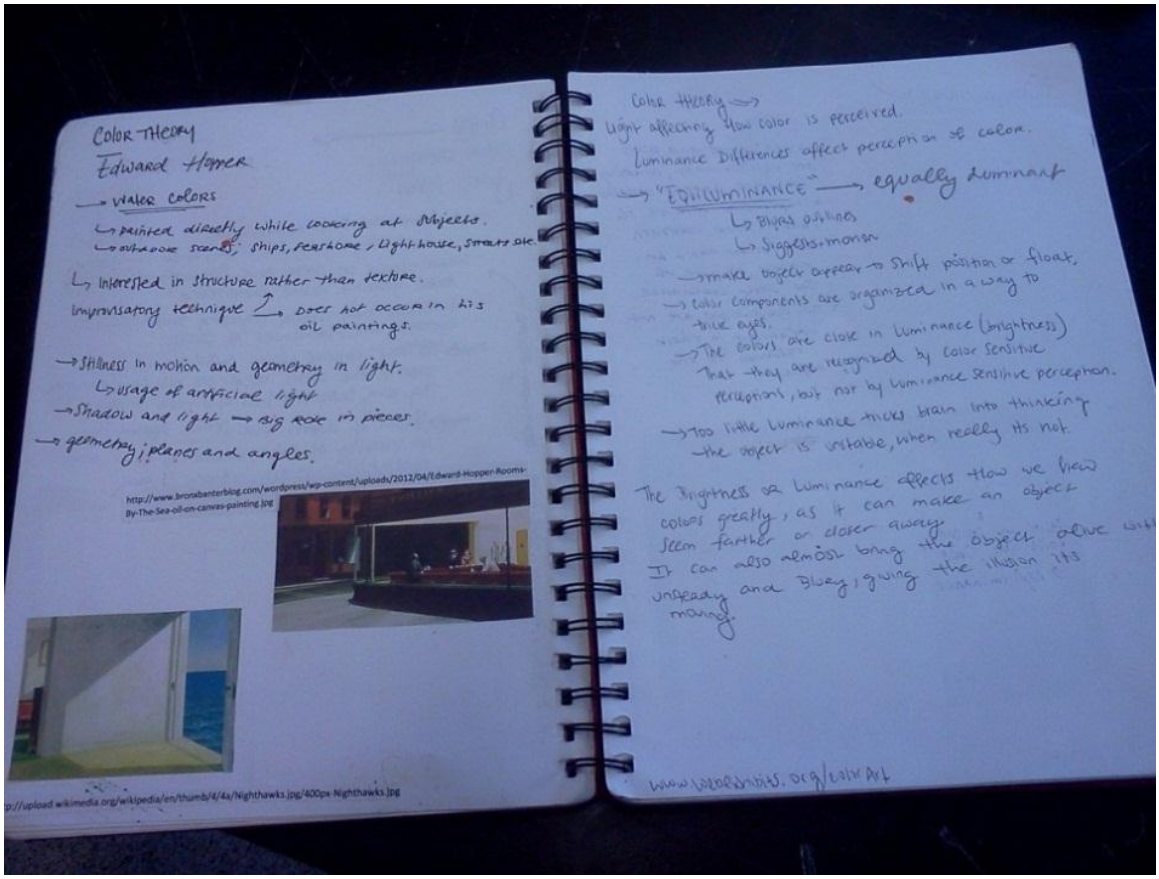
Student SG School A VJ



Red yellow/blue are equiluminant making the piece to be more unstable shapes are seen because of unstable contrast but colors can't be placed because of the same luminance the subdivisions are not balanced in their response to the object. (Student SG school A VJ)

Figure 3.

Student AY School A VJ



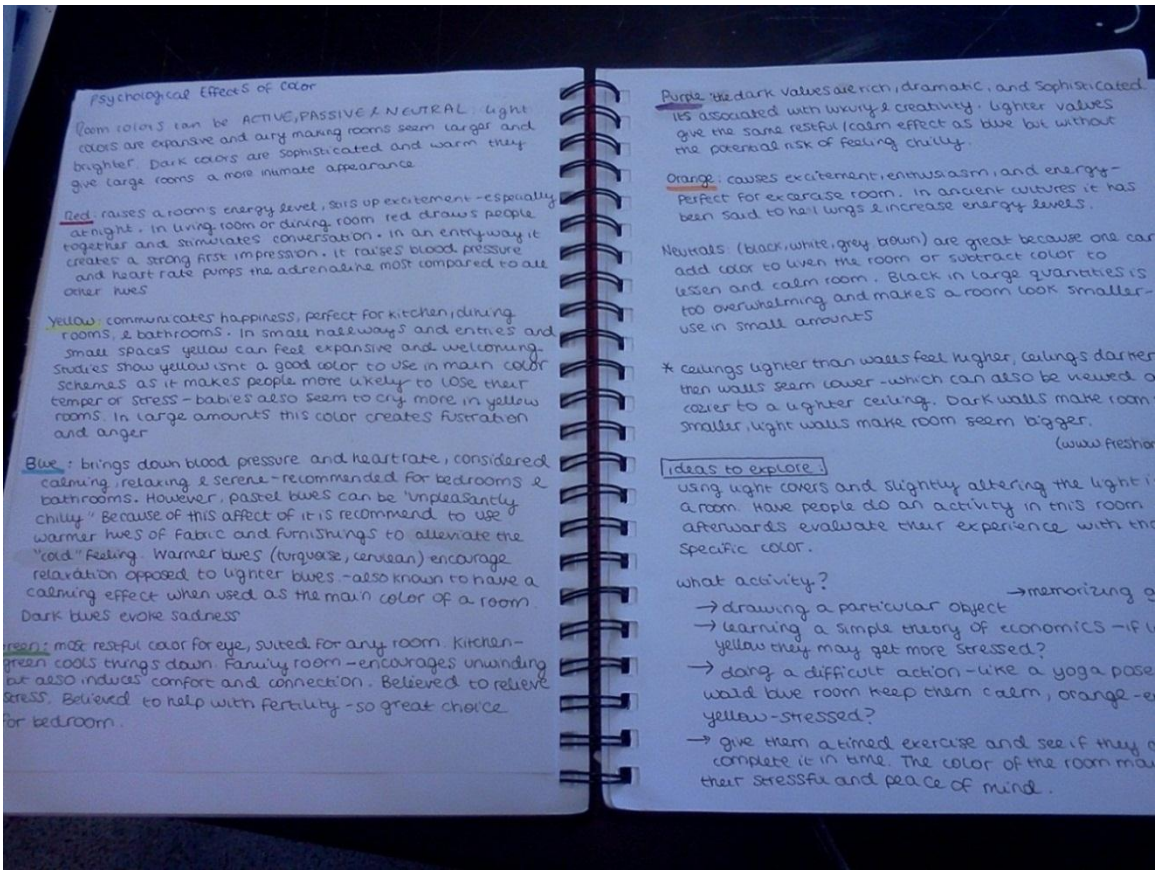
Student AY School CR2 2013

AY worked to see how color impacts an environment. AY visual journal has identified what the different colors are and the cultural meaning behind them. Also in AY VJ identified what she would like to explore based on the information she has received using the thinking routine *think-see-wonder*. The *think-see-wonder* thinking routine from Project Zero has a student take an in-depth observation of something, make an interpretation of it, and then later it prompts personal questions. Student AY used directed thinking in order to guide an approach to color and make it interactive with others. Student AY School A has sought information about

colors to discover what an altered a space with color or used a time exercise to see witness the influence it has on another person.

Figure 4.

Student AY VJ 2013



Since Student AY CR2 2013 has identified the cultural meanings of color she later began to explore the Psychology of color. This shows that she is using her metacognition to self-question the information she has about color but expanding her thoughts into how people interact with color.

Figure 5.

Student AY VJ 2013

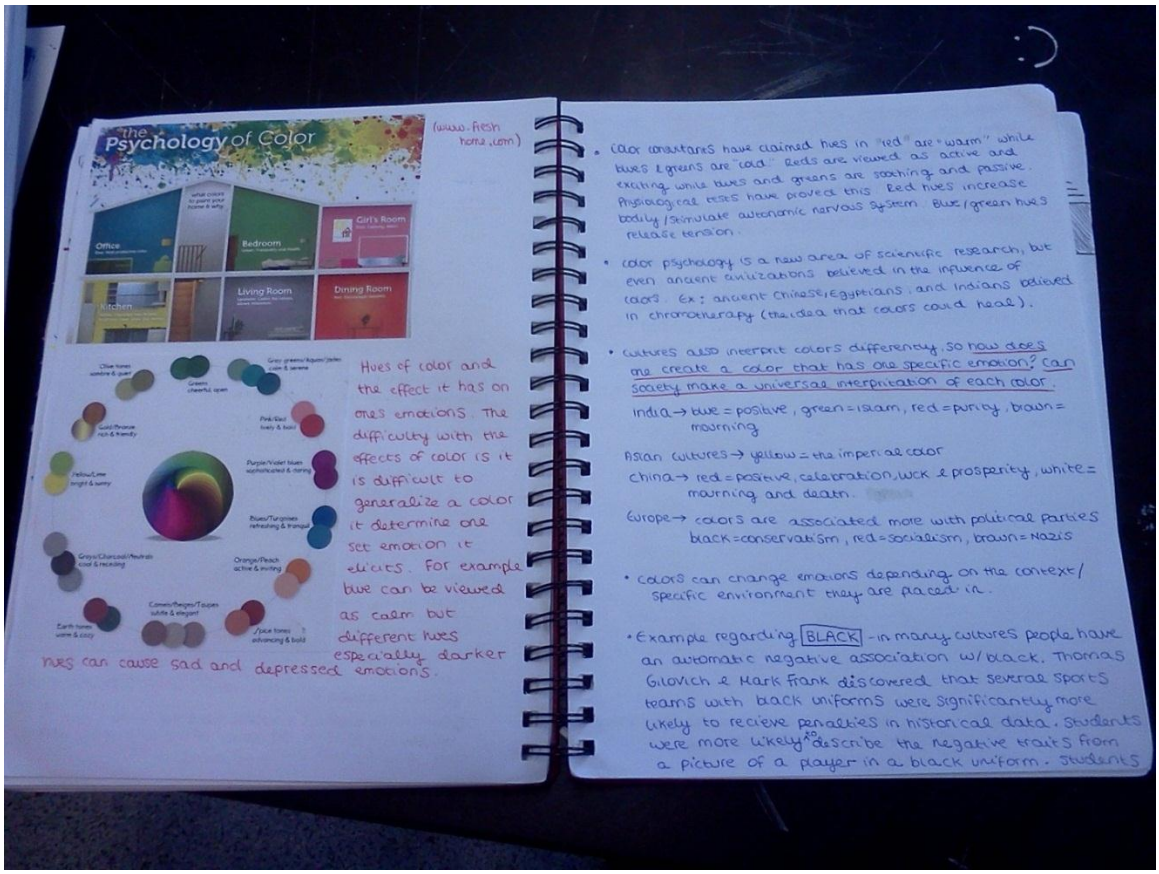
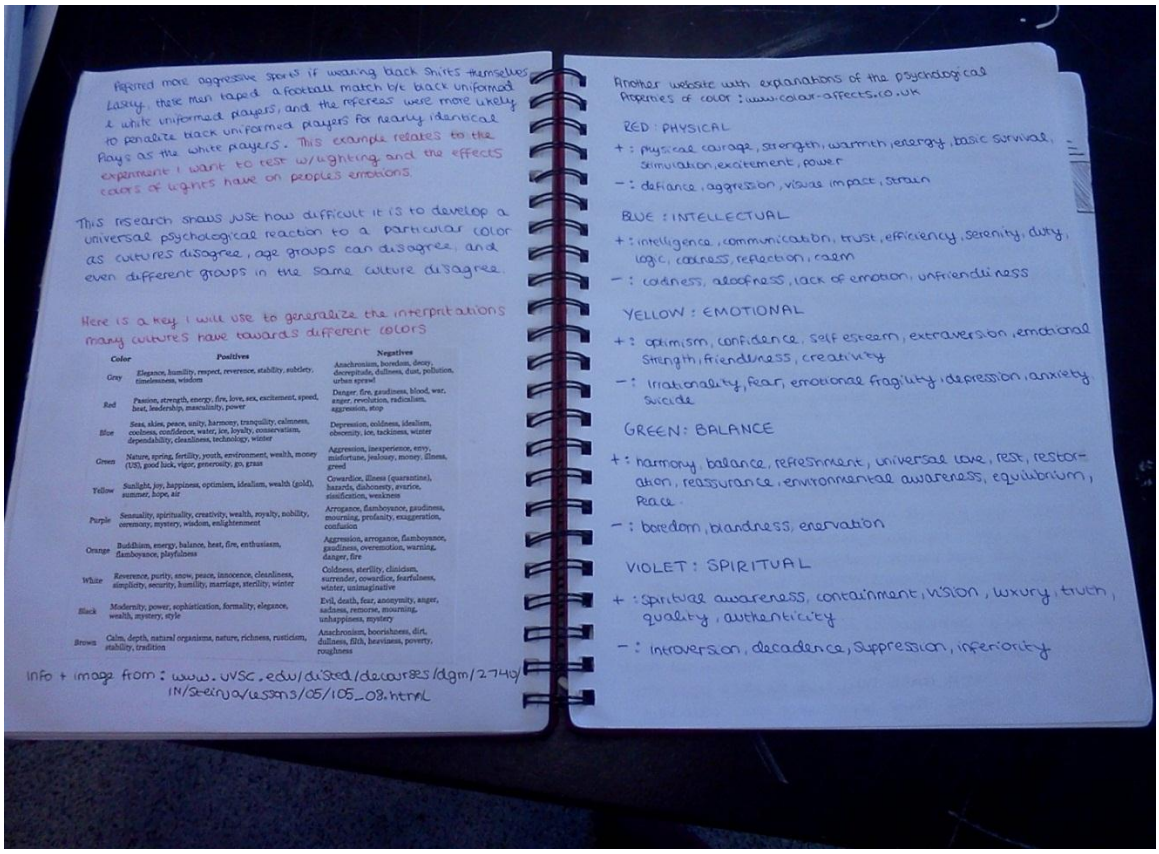


Figure 6.

Student AY VJ 2013



Discussions

The impact that thinking strategies have on a high school art classroom are beneficial when: 1) it is a student-led and teacher supported environment; 2) the opportunities for problem solving and seeking are available; 3) thinking routines and critical thinking are involved; and 4) adequate resources are available to support the classroom. The foundation of the thinking environment is created and supported by the teacher. The teacher prepares a thinking environment while the students create and explore their ideas. Once the foundation of the class culture is identified the responsibility of the assignment is on the students. The culture visibly

shows that what thinking occurs beyond a final product. Students are able to make a statement and support it with the research conducted in the visual journals. The Visual Journal becomes a reference for students to support their thoughts, and ideas. It shows a blue print of how the students have arrived to a certain point in the critique. The journal also serves as a tool to support with assessment in addition to the final product and visually express what was learned.

While working on this research the type of results and level of thinking that occurs is impacted by the school culture. How frequently students attend the class a cycle and also how many years' students are able to take art. The teachers' materials that support the students initiatives make can impact as well.

The limitations of the research are that the schools selected meet with students multiple times during the eight-day cycle. Also the students have taken art for more than one year but in a public school students only are required to take an art class once a week for a semester. School B was only observed laying the foundation of thinking strategies. The final critique was interrupted by standardized testing at the school. So the final critique and work was not captured.

The questions raised in this research study are limited to a school that has art multiple times a school cycle. Can thinking strategies survive in a school culture that heavily test and data drive? How do you show students' growth in schools with limited resources and materials? How does the teacher's level of knowledge and spontaneous responses to students impromptu questions, impact the quality of thinking that students create in the art classroom? How can we encourage teachers to develop a thinking environment while creating a culture for students to seek the right answer? How can we make the art thinking strategies visible to a non-artist and demonstrate the importance of the Visual Journal?

One of the things that I have noticed in working on the impact of thinking strategies in the art classroom is that it is a slow process of information. An awareness of thinking by the teacher and student takes time to develop and create a thinking classroom. The teacher's role as a facilitator is challenging to present a lesson that develops students thinking and supporting it as needed. Using thinking strategies in the art classroom requires each lesson be individually developed. Even though the students are all completing a task there will be multiple versions of the results.

Conclusion

This study stemmed from understanding what thinking strategies occur in the art class. The participants of the two schools have shown that thinking does happen in the art room but it is combination of a structured and an organic environment. The teachers build a lesson that supports the students thinking. The students create an idea, develop it and use the teacher as a resource to assist with impromptu challenges that arise.

My objective was to explore if thinking happens in art and understanding how it can be assessed. After collecting the various methods of data, the research revisited the following questions: Can thinking strategies only exist in a school that has students multiple times a week or is it possible to transcend into all education? Thinking strategies appear more effective when an art teacher has students at least three to four times a week. A teacher will have difficulty supporting and fostering students if resources are lacking and sufficient time to support the curriculum. Thinking strategies do have an impact on an art student in high school. The level of impact is determined by the quality of the teacher and how frequently students have art.

Thinking strategies take time to develop deeper understanding of what the teachers and students learn. To create an environment of thinking, the classroom direction needs to be student-

led and teacher supported. The lesson developed should provide opportunities for students to seek and explore their hypothesis and test theories. Teachers in turn have to be flexible and knowledgeable about how to guide students and not succumb to creating a right or wrong answer classroom.

Teachers need the support of adequate training about different thinking routines, problem solving, and the eight studio habits of mind to use in the classroom. Thinking strategies is not about delivering information on a predetermined method platter for students to play a passive role in their learning. Then expecting students to understand and take ownership of it. Teachers create lessons that foster and impact students to think. Also creating a lesson that has flexibility to grow and develop as the class discovers new thoughts and ideas. Realizing that students will show change but it takes time for it to happen. The students will need time to adjust to this new environment and way of interacting in the classroom. Thinking strategies may be ineffective if the school initiative doesn't support it.

A teacher has to develop their own metacognition and awareness before encouraging the students to do so. Teaching the students to think alters how the teacher will interact with them. An educator will end up developing questions and guiding learning on the spot. Teachers will learn not to pass judgment or impose their personal experience but create guiding questions to facilitate the class. How frequently a teacher has a student impacts how quickly change will happen. The learning can progresses if pupils have art multiple times a week or it will digress if there are long spans between classes. How the school policies of electronic use can limit the students' access to information while in class. Also within this technology driven society students are becoming more removed from tangible resources. It is important for teachers to have adequate, up to date resources to teach the students.

Writing the discussion chapter made me further aware of how my role as a teacher impacts students learning. The audio recordings, critique transcription, and visual journals are important to help deliver the lesson and reflect on the results. These tools show how teachers' goals and expectations impact the classroom culture and students understanding of a concept.

In the discussion chapter examined two different roles 1) teacher, 2) student, 3) the teacher-student connection. What is needed to support a thinking classroom is the backing of all educators and administrator awareness of what backing is required. The use of thinking strategies creates a culture in which the students to stop looking for what is right or wrong and to begin understanding how and why they arrived at certain outcomes with their exploration. Giving students the time to develop a deeper understanding of a concept is the best way to create a thinking environment.

After conducting this study I would like to test this research in other settings to see how authentic this can be in other environments. An example would be to have a series of case studies between schools that have students one day a week versus multiple times a week. What role does teacher professional development have on the growth and of impact the quality of education to the students?

Throughout this study I have emphasized the importance of thinking strategies in the classroom. How these thinking strategies impact the dynamic of the classroom and furthermore make the students thinking more visible. I hope to continue this research and find out more about the physical impact thinking strategies have on the brain. How does neuroplasticity respond to different thinking routines? How frequently do students need to have art to show the brain's physical response to thinking strategies?

While working on the research I discovered the many connections between critical thinking, problem solving, and thinking strategies. How will these methods change the quality of a teacher and how they perceive what knowledge is?

This research is important in art education because it prepares teachers with the adequate tools of what to look for when executing thinking routines in the classroom. While instructions are given students have the opportunity to reflect and analyze. It supports the teachers' awareness of their own intentions and expectations. The benefits are for the student are to be aware of how they see the world and how personal experiences and knowledge help them know what they know. Hopefully it will give them the thinking tools to develop their own thinking.

This research is important to art education because it provides teachers with the tools needed to foster thinking. The role of the teacher is one of facilitator and students become self-reliant understanding what they know and how to access information that they want to know. Teachers have multiple ways to assess the students' growth beyond one final project but the referencing research and ideas help with assessment. Allowing both the teacher and the student to reflect and analyze what expectations that they come to the class with. How the expectations and goals change as knowledge is gained in the art making process.

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Appendix A

Teacher Interview Questions

Teacher A and B Interview Questions

1. What Visual thinking strategies do you use in the classroom?

2. How does the eight habits of mind impact the culture of the classroom?

3. What prompts do you use to activate critical thinking skills?

4. How do you assess the student's growth in critical thinking?

5. How do you assess what growth looks like?

6. Do you instruct from a Teacher Centered, Student centered and Demonstration led lessons?

7. What percentage do you use in the 3 different areas?

Appendix B

School A Teacher Interview with AZ

School A Teacher A Interview (School A TA INT)

Teacher AZ IN 2013: Visual thinking strategies. Umm, I really don't know what visual thinking strategies mean. But I can the project zero what thinking strategies do you use from it or can you name. Okay, well I do use thinking routines…I use *I Used to Think and Now I Think* all the time at reflective moments. Because I think it is an eye opening experience for both the students and the teachers. It shows where they were in terms of understanding. Sometimes as a teacher it shows you their misconceptions of what they have or what they hold. It creates a dialogue between the teacher and the student to expand on how I used to think and now I think.

Reflective thinking routine is excellent it helps both parties work. I think one that is really important is "What makes you say that?" "Which is?" defuses students. It also makes them think about why they hold certain things as true even though. "What makes you say that?" Then it makes them see. They don't have justification for it is a moment. When they go oh of it they have an awareness of themselves how they came to that point. I think that we frequently use thinking routines that aren't labeled as such we never known such themes work in the classroom. We here at School A always use in the classroom, "What was I asked to do? And what did Ii actually do in the classroom?"

I did what you asked to do and I say, "Really think about that. Oh did you really do what was I asked to you do?" What works for them and what is problematic what would I do in the future this is not from the Harvard people this is one of the. I assume most other programs have things like that in place they don't label it things that they ask their students to engage in if you

Reflect and identify it then you can say oh how these things are working what we are going to tweek and change.

Mara: Would you talk a little bit the lesson that you did with TOK ? When you had taped some of the images and they had to do a discussion?

Teacher AZ IN 2013: We were looking at ones definition of what art is and where looking for a working definition. And what we were playing with is how do we make judgments within the arts. A lot the students involved with this are not necessarily within the art program they are from all over the school. What was presented with lots of different images?

We taped over the information about what the artwork that was made of. And how much what the art was estimated to sale for and the interesting thing was Students began to engage with the visual. But when we untapped the information suddenly their perspective changed. What was really interesting was how it changed based on two examples. One of the examples that were where using was made out of chocolate syrup and I thought the students new it was made of chocolate syrup they wouldn't take it as seriously. And the other one was a very crude almost primitive piece made up of a sculptural figure a disproportionate head crudely rendered. It was made out of Styrofoam. It really didn't do anything to my head but the interesting thing that the students it was completely opposite for the way I expected them to act they acted far more negatively to the Styrofoam when they discovered it was Styrofoam and far more positively to the chocolate syrup I was interested in that they were impressed with the skill level of the chocolate syrup pieces they couldn't imagine that it was chocolate syrup you were stressed by the skills level in the large headed sculpture they called it made out of Styrofoam So instantly they were able to start saying oh well skill is an area that we are interested in when it comes to judgment or whereas maybe before they hadn't recognized that the skill was is a manipulation

for the material and so I think um they are beginning to develop a new understanding but once we uncovered the price Once again changed their interaction with the piece and um changed their judgments again and I think that was eye opening for them again. In terms of oh or do we so what are we really judging here are we judging value and in a monetary since are we judging value in terms of the piece in other ways or are we judging skill so when we come to works of what is it that we do to make judgment's I think it developed a very rich dialogue among them I wouldn't say they came to conclusions but at least they began to question how they make judgments.

Not consciously, I think they are imbedded. Okay, I know about them and Lois Heitland and the whole thing so *Studio Habits of Mind*. I have a I just think they are actually embedded in all visual arts classrooms Even if you don't necessarily acknowledge them you know the planning the revising the reflecting the thinking about what works what doesn't work and them remaking to solve issues and stuff like that to active problem solving I think if you have closed ended projects where you have a defined moment when you are expecting that could not actually work for your studio habits of mind. So I think you have to build your projects or your units with open ended outcomes. Even when we do observation drawings, you have to have open-ended. I think if you have close ended projects where you have a defined moment of what you are expecting cannot work actually for studio habits of mind. So I think you have to build your projects.

What I have done recently is instead of setting the still life then tell the students the activity and have the students to set up once they see this is the material I am working with. I think some of the things we do as prompts are like spending five minutes in your journal at the beginning of the class. It is active a prompt to get to them to actually actively thinking being

critical. About what they did last time and where they should go this time. So that reflective moment at the beginning of the class is an active prompt to get them to the beginning to engaging themselves instead of relying on the teacher. One of the things that I have taken to Asking them recently whose brain are they might be using? I know that seems weird but I think as you become more aware of the questions they are asking. You that makes you think why are they asking me that question and what do the necessarily need to do. In order to move their work forward. When you ask or they are reflective in their own questions that gives you a clue as how you need to respond to them to think about stuff. So when they say to you should I do this or can I do this and you say well what's your goal and why are you thinking about that and things like that you are prompting them to take a more active role in it. So when I say to them. Whose brain are you using? I am actually saying is oh that prompts me to think about the questions that would drive me to pushing them into the right directions. So I think it is interactive. So you cannot really say the prompt is only from the teacher but the students actually prompt the teacher to react. So you really have to think about. Why are they asking me these questions and what do these questions mean. There is something that I need to give them or do they need to take on more active thinking for themselves.

To begin with using thinking routines and thinking strategies their initial engagement is a relative thing. But the more they use them the richer those become. If you record those in their journals. So I used to think and now I think? You begin to see this truly active engagement as it rolls through the year. More substantial as it go forward so you can began to document. Where they began and where they move to? And also you can see the students who are not actually engaging them move to them as individuals and work with them on. Can we expand these thoughts? Can we carry these forward? So you can go their writings and say well I was reading

this can you tell me more about this? And you can push those students who might be able to push student themselves into greater critical thinking because they are written reflections. I think that during critiques which are where we put the work up. We share it with each other. The more you do those on a regular basis and actually get students to understand that you are entering into a dialogue about how the work is really seen objectively. That builds as the year goes forward is to see the students participating more cooperatively with each other and once you start the critique as a generally except practice as a in the room then you watch the kids do it to each other as they are working and they begin the dialogue at their tables and maybe between tables without prompting from the teacher.

You can see it in the depth of what's going on. I think you can go beyond that. You can also see it in the development of their visual work. They might be very little content with to leave something at a certain level initially. But I think with the seventh grade work that you did with us it was so evident. That by the end of that they as individuals that had really come into an understanding and it was due to that dialogue that you could see going on between students. Not necessarily between students and teacher and I think that people misunderstand the nature of assessment. Sometimes because you actually then begin to observe the interactions between students and see where there understandings have developed. As a teacher you get as much information from being quiet in the classroom and watching them as you do from questioning them.

Mara: Yes you don't have to because if they have taken it to heart that they did in that particular project they are doing that to each other and you then get to observe the interactions you can see when child is pushing another child. On another getting them to do something they have taken on a whole new understanding I think we sometimes misunderstand how we assess or

how students. Can assess each other or help each other in there growth without being a teacher imposing everything on them or the all know it all Buddha.

Teacher AZ IN 2013: I don't do demonstration lessons. Since because one of the things is you think you see then 20 or 18 of what you just demonstrated. Of what is coming right back at you. And so my observation after doing a lot of year doing it Teacher led demonstrations even when they are purely technical. Come straight back at you. As that is what she is looking for. Because when it is teacher led I think what happens is in all honesty students come into the classroom game they initially play is. What is this teacher looking for? Because that is what I am going to give her and if you can try to stress in them this teacher is not necessarily looking for anything in particular except to see you growing and learning. Maybe they have a greater opportunity to move forward. Because they won't be playing that looking for approval so that when we come back to the notions students designing their own classroom interactions I find it much easier to do with the 11th and 12th graders but I think I would like to move that into the middle school environment. For me that is really difficult middle school environment. They tend to be very they tend to be playing with the teacher all the time. It is the game of middle school. If you could defuse that and let me give the ownership to you and I have begun to do that with behavior. I say to them I am not getting you on behavior. I am not going to be the person to tell you to stop doing that. You are going to come into my classroom and you are going to select where to sit. You are going to select how you interact. Basically but know that you will live with consequences in the end if you don't have anything to show for the assessment. That we are going through then that's the problem that you will have. So giving them much more responsibility. Once I have done that in terms of the behavioral aspect. Then maybe when they realize that. We can introduce the concepts to them and say to them how would you design the

activity for this I am not sure how that will go I think the project zero environment has allowed me to know that I should be giving a lot more control to the students and I can actively see it working in the 11th and 12th grade where I have really introduced it. The big thing is to move it down into the lower grades. To build and environment where students know that when they come they seriously engage in the activity in the classroom. Beyond the extent of doing what the teacher has asked them. And getting into this role why are we investigating this and why is it important. How could I go about doing that it will be fascinating to see? If I can do that with middle school that is something that is rattling in my brain it hasn't actually happened to that extent.

In the 11th and 12th grade it is all student centered. I think in 9th and 10th I set it up in terms this is where I would like us to be thinking. But then I like the students to develop their own path. But it is still relatively teacher centered in middle school. It is teacher centered at the moment. But we could definitely be pushing harder to get them to taking more active roles in designing what should be happening in the classroom.

Appendix C

Code of Identity Thesis for Students

School A Critique 1 and 2 2013 (School A CR1and CR2 2013)

Code	Gender	Grade	Ethnicity
rl	Female	11	African American
ce	Female	11	Caucasian
ay	Female	11	Caucasian
jn	Male	11	African American
Sg	Female	11	European
JE	Female	11	Hispanic
Isy	Female	11	Hispanic
MA	Female	11	

Appendix D

School A Critique 1 Color Wheel

Teacher AZ CR 1 2013: What I asked that you would do is that as you did the task that you would develop questions and I saw the questions were developing while you were doing the task. that you One of the things that I became aware of was that you were looking for right answers but not because, I think that I indicated there where right answers to the task cause I just thought they would develop questions but you had in your heads you held information in your heads and I think you have had them in there for a long time you don't know why it is there so you hold in your head a notion of violet that when you started mixing what happened was You kept on saying that's not violet because you held something in your head instead of saying why do I hold this notion of violet you kept on saying there something is wrong with the mixing. So you were coming up with questions but I am not sure how you are developing the questions because I can see this happening around the room. So as we go around and you start talking about the questions I want you then I want you think about was there another way of engaging with this as I was doing it? Why do I have this notion that violet should be this color?

Student CE Cr1 School A: The reasons why we think that violet or a particular color was because when learned about color theory we were doing Goethe research on the color wheel we saw violet in a certain way. SO when we were doing the process the one we read about it came out really horribly

Teacher AZ CR1 School A: But I think that is another thing that you have to think about in terms of the research which was what color wheel am I looking at and what are the colors that I am seeing here? …..How many people went to different types of color wheels? Alright so maybe you can tell me whose color wheels you explored?

Student JE CR1 School A: Well I have these two. From 1776 Paris it was like a the other one is from 1810 from Goethe and it is really small but the middle one I wanted some of the ones we use today this is the Harris on and he uses different colors they are completely different one is more this one is more duller colors

Teacher AZ CR1 School A: Which one?

Student JE CR1 School A: It is Goethe's it has a lot more

Teacher AZ CR1 School A: And then you have this one as todays example write? So when you were mixing violet where you thinking well how are my violets coming or where you referring to things you can see? Did you say well if this is Goethe? Are my violets turning out more like Goethe's violets? Or did that not enter you head?

Student JE CR1 School A: It was kind of a personal judgment. If they are all different then how do we know which one is right? I ended up with three different reds three different blues or um four different the ones that kind of turned out normalish where crimson and cobalt blue or red I didn't really refer to any photo graphs Goethe's because I didn't think any of them where correct I guess?

Teacher AZ CR1 School A: This is really interesting. So I think this is really interesting. You keep on saying correct.

Student JE CR1 School A: But it is not.

Teacher AZ CR1 School A: What do you mean by correct in this realm? Is it a moving target? Now if you now look at your Goethe color wheel and you now look at color wheels that you are developing. Do you think that is closer to what he was doing?

Student JE CR1 School A: There is a few with color and there is a few that look like todays you have to decide what color You have to decide what color you are going for because I

feel like a duller one look more like Goethe. It is not correct but I think if there was a correct there wouldn't be three different color wheels. I feel like it is always changing

Student ISY CR1: Isn't art Goethe's colors duller?

Teacher AZ CR1 School A: Are they? Are Goethe's colors duller because they old or are the duller because they are old are they duller because they are.

Student CE CR1: So, no one knows the answer to that.

Teacher AZ CR1: So, if you start engaging with that and thinking about it you could think Goethe's colors are duller because they are old, and if you use your own experience.

Student ISY CR 1: They both wait from my experiences they both because mixing colors that is what you get and from my experience they are duller colors so it is a mix…I found that I had to find information about what we were doing the same read about thinking about make your color wheel. I never knew about the base colors I looked at that and I also IF you have two colors that are considered warm yellow and red and both have cool base colors what color does it create is it cool is it warm would you be able to determine if it is a cool or a warm color.

Teacher A CR1 School A: So what questions have you developed?

Student 1 CR1 School A: I said is it even possible to have a color without an underline color because it isn't a pure color but that one has an underline base color except for the philo-blue but I feel as if you can say that has a slight tent to it to this color you know what I mean.

Teacher A CR1 School A: So you are saying that these colors don't actually read as pure colors?

Student 1 CR1 School A: What kind of knowledge do you have to know to have a pure color? How would you absolutely know if it doesn't have a base color? How much do you need

to know to determine about the warm colors can you determine the colors that are only warm and colors that are only cool and using these warm colors with cool base colors?

Teacher A CR1 School A: But if you but I think that is another thing that you have think about in terms of the research which was. What color wheel am I looking at? And what are the colors that I was seeing. How many people went to different sights for color? Alright so maybe you can tell me what sights you have explored? What color wheels did you explore?

Teacher A CR1 School A: So, which one is that? And then you have on as today's example. So when you were mixing violet where you thinking well how are my violets coming out where you referring to things that so did you say if this is Goethe's are my violets turning out more like or did that note enter into this?

Student 3 CR1 School A: Oh, I was just kind of…right so I ended up but these are the different purples and three different reds ones that kind of came out normalish are the ones that…

Student CR1 School A: It was kind of like…I feel like the duller ones look more like Goethe but it is not correct.

Teacher AZ CR1 School A: Are Goethe's colors dull because they are old? Or are they duller because if you start engaging in and thinking about it you could think Goethe's colors are duller because they are old you use your own experience?

Student ISY CR1 School A: Well both…from my experience in mixing colors they are duller because that is what you get and from my experience of old colors they are duller.

Teacher AZ CR1 School A: But you expected to get something different when you started mixing you got Goethe like colors.

Student CE CR1 School A: Yeah, cuz we got a bunch of olive greens, which is kind of odd business.

Teacher AZ CR1 School A: You hadn't been expecting that but when you started asking questions about it you were saying there is something wrong with the color by it mixed as opposed to looking at Goethe's why are these colors this way? So how do you ask the questions? I gave you the tasks right can someone describes to me the tasks that you had to do? Just run through the tasks.

Student MA CR1 School A: You asked us to give you a couple of definitions like complementary colors create swatches look up a couple of artist you have to choose one aspect and do a personal investigation and come up with our own questions of how we had to look up artist we had to look at one aspect having personal investigation and create questions.

Teacher AZ CR1 School A: You have to come up with your own questions on the subject? How did you begin to develop your questions ask your questions on the subject?

Student ay CR1 School A: I feel like I need to find information about the color wheel make your color wheel and see all.

Teacher AZ CR1: Can you tell me what some of your questions are?

Student AY CR1 School A: I didn't know about the base colors that you had spoken about. So I looked at that I was also looking at warm and cool colors. If you have two colors that are considered warm um, like yellow and red, they both have cool base colors. What is the color that they create? If it is warm, would you be able to determine if it is a cool or warm color? You know what I mean? Does that make sense?

Teacher AZ CR1 School A: So what sort of questions did you develop?

Student AY CR1 School A: I mean so I said, “Is it possible to have a color with an underline base is a pure color every color in oh that one has an underline base color except for philo blue but I feel that you can say it has a slight tint of this color?” Do you know what I mean?

Teacher AZ CR1 School A: So what you are saying is that these colors don’t actually read as pure colors.

Students AY CR1 School A: But then also what kind of knowledge do you have to know but then also how would you tell what kind of knowledge would you have to know in order for it to be a pure color or not? Is that even impossible? How would you be absolutely sure if it doesn’t have a base color? To what extent and base knowledge would you need to know to determine that? Then about the warm colors would you really determine the colors that are only warm except colors that are only cool if you are using these warm colors which have cool based colors?

Teacher AZ CR1 School A: Let’s use blue as the example.

Student AY CR1 School A: I used blue….I used cenaculum red, which is blue based then I use hansa yellow. It is pale, which is also blue based and so the blue based is a cool color but then the yellow and red are warm colors and so it produced that orange color I didn’t know if you would be able to tell oh would that still considered a warm color even though the colors are blue based. I didn’t know if it would be a cool color.

Teacher AZ CR1 School A: So what do you think when you see it when perception comes into play?

Student AY CR1 School A: I will look at it obviously and say it’s orange. It’s a warm color, but is it really?

Teacher AZ CR1 School A: So how do other people understand those notions because you had to produce warm and cool swatches? Have people got those? Have you got warm and cool swatches? Would you get those out so we can have a discussion about that? Is that not one of the things that I asked you to do?

Student ML CR1 School A: Yes that is it is one of them. It is the third question.

Teacher AZ CR1 School A: How many people did demonstrate warm and cool colors? Two people warm not cool you didn't get that SO that is interesting. Why didn't you get that?

Student AY CR1 School A: I started off like everyone else did. I did a practice color wheel on regular paper I spent a lot of time I used the three primary colors pencils to make all the other colors and so I spent a lot more time to get the right shade of green.

Teacher AZ CR1 School A: So what was this right you were looking for?

Student AY CR1 School A: The conventional idea of what I was trying to get the color that I say on the color wheel that I had been referring to. And so I spent a lot of time doing that because I was trying to match that color wheel.

Teacher AZ CR1 School A: And where did you find that color wheel?

Student AY CR1 School A: On google.

Teacher AZ CR1 School A: So where were you seeing it?

Student AY CR1 School A: What do you mean?

Teacher AY CR1 School A: Where were you seeing it? On a computer screen?

Student AY CR1 School A: Actually on my phone.

Teacher AZ CR1 School A: So do you think that was a problem? Why was that a problem?

Student AY CR1 School A: I think it looks different like the colors.

Student b CR1 School A: The computer sometimes has different colors.

Student CE CR1 School A: Brighter I think. The computer uses a different color wheel. I think there is a problem with the conventional colors because the sights I went to where about the pigments so it was a painting sight and so when they had a color wheel it shows what you are supposed to be referring to. It's not really dealing with computer color theory.

Teacher AZ CR1 School A: Instantly we are bringing up a new issue. Which is if you are viewing a color wheel on the computer did you began to ask yourself why is this different one like a pigment one for paint based one or a color pencil based one or a colored paper based one why is it different? Did you push yourself into asking those questions? Anybody ask those questions? You are seeing this color wheel?

Student AY CR1 School A: Remember when we were like doing colored pencils and you were like, "Why are you doing colored pencils you should just paint and we were like what you can use paint?"

Student RL CR1 School A: So everyone followed what the first person did that's my observation of what everyone did.

Teacher AY CR1 School A: So instantly student RL says that everyone followed what other students did.

Student AY CR1 School A: Everyone did that because you said everyone look at these new pencils we got and you put them on your table.

Student AY CR1 School A: But you didn't have to use them? Did you do that on purpose? It was a test all along.

Teacher AZ CR1 School A: To see who was going to be a sheep. Alright so here I am If I asked the questions then they are my questions If I give you tasks to do and I ask you to develop

questions How did you engage with the tasks I think that is really important I think in this conversation I find that you need to pay attention to the notion to I was looking for the right I was looking for the answer I was looking for the did anybody notice that SO what is the implication of that? I know that it is very frustrating isn't it?

Student AL CR1 School A: I didn't um like the question before and actually start questioning the initialized color but questions the color wheel but started questioning color theory itself. But I found out that the original color theory was based on lights and how the whole color and spectrum is based on lights and I so I think It is very similar on the computer materials we are using and so I thought it was a really good thought if you can identify what a pure color to idealize this whole theory to especially if you are using paint that makes all these different colors it's not going to turn out like that color It is not like a natural color wheel where you use vernacular yellow you would have to use something that is related to what I was saying is that I noticed that everyone's color wheel when they were using paint is different from each other's If you look at them they all look the same but if you really look at them they all look some peoples orange is brighter or a little more dull than others and I thought it was interesting and also going back to the pencils q and I also did the same process yet ours came out differently I think to a certain extent you can't really like everyone said you can't really I refer back to any kind of color wheel In the end it is based your on perception You have an idea in you head of what that color is going to look like what you did with the blue powder and you asked if we could remember it we all have an idea in our head of what blue green looks like and what orange no matter how different the color wheels look like in the end its always going to be us who judges oh I think that looks like orange.

Student ISY CR1 School A: Back to what student CE was saying like if you have a color wheel like what I discovered is that the color you get is all in relation. I don't think there is a right orange I think the right orange is when you get pure red or pure yellow but don't know if there is such a thing because all the reds are like blue based or yellow based and so that is going to affect your orange yes there are a bunch of oranges if you by the principles of color theory that saying mixing red with orange I mean saying red with yellow will get you orange that no matter it shouldn't that it should be no matter what red or what yellow you mix it's just going to be orange instead of a different type of orange but that is back to what I was saying. If you are going to have like a different bunch of if you are going to make your oranges with a certain reds and certain yellows and your greens with a different yellows and blues and a different purples with different reds and blues you are going to have different red blues and yellows. For the whole I don't think it…you are claiming that you are making these colors but you're not claiming your making them with the same.

Teacher AZ CR1 School A: So you are saying you are not mixing them you are saying that the concept it that you can produce these colors based on mixing.

Student ISY CR1 School A: I so I guess you like you have like accurate orange greens and blues TO make it accurate you are going to have to make a color wheel specific to orange and a color wheel specific to blues and a color wheel specific to greens basing them on like.

Student SG CR1 School A: I agree with AL because they say you can make green orange purple from primary colors but that's not really true you have to use different types of red blue and yellow to produce those colors but technically you are not using the same colors they are different colors I feel like color theory is skewed a little in a sense because you are not using the same color to produce those colors.

Teacher AZ CR1 School A: So I am going to come back to a comment from CE, which was that she didn't began to question things initially but she was looking at color theory. And she understood that in terms of light I think that is an interesting concept and I am going to ask CE. Why she never played with light?

Student CE CR1 School A: I just haven't gotten around to it yet but the thing is like one thing that everyone is doing is they had different red and different yellows is that they had this image of what is but I don't think that color theory should be applied If you are going to define a color wheel then you have mixed a particular version of those colors together to see what colors they make at the same time they she also has the same idea of a pure yellow or a pure blue I don't know how to define your blue and more because is it based off of what we think is supposed to look like or based off of what colors it can produce.

Teacher AZ CR1 School A: Is that a question that you are now asking? So how do you think you can go ahead and explore with that further?

Student CE CR1 School A: How do I think I can go on further? That is a good question.

Teacher AZ CR1 School A: Who determines what is a pure yellow and a pure blue?

Student CE CR1 School A: How do you define a color?

Teacher AZ CR1 School A: Versus for example like a lemon. Would you consider that a pure yellow? That shade of yellow on a lemon or would you say that who determines what shade of yellow is a pure yellow?

Student CE CR1 School A: Is it based off of what you recognize conventionally or is it the product that you mix with the colors for example would a pure yellow mixed with a pure blue make a pure green? Would that make the colors pure?

Teacher AZ CR1 School A: One of the strange things was to watch people in here being dissatisfied with mixed colors. How many of you would say you were dissatisfied by the mixed colors? But could you tell me why you were dissatisfied with them? So JN why where you dissatisfied with your mixed colors?

Student JN CR1 School A: I know why with colors specifically I made three different color wheels.

Teacher AZ CR1 School A: So could you show us?

Student JN CR1 School A: So like I did a primary color wheel and then like a secondary color wheel the tertiary color wheel is where I ran into trouble with because of the time. I basically chose the colors that were the most like what I thought were primary blue and primary reds. Then I mixed those and it came out like a gray green a gray orange but then I think the purple I feel is too dark for it originally. So that kind of proves that these aren't the true primary colors.

Teacher AZ CR1 School A: Is that what it proves? Does it prove that that violet or purple is not the image that you held in your head as being violet? So that question is what is the violet that you hold in your head?

Student JN CR1 School A: Are you actually asking? I guess what is bothering me is that I don't much about paint.

Teacher AZ CR1 School A: I don't think you put down too much paint.

Student ISY CR1 School A: Maybe you should add water.

Student CE CR1 School A: So how do you define what is pure? Cuz maybe that is what is pure? But it is not what you envisioned in your head.

Teacher AZ CR1 School A: So what happened with the secondary and tertiary?

Student JN CR1 School A: So because I wanted to use the same red and blue and yellow but they didn't produce the right tertiary colors and tones and the colors that I want to produce.

Teacher AZ CR1 School A: So what do you mean by right?

Student JN CR1 School A: So with the tertiary like in a sequence. So it is like supposed to be from lightest to darkest. So the tones were different from what I really wanted.

Teacher AZ CR1 School A: So be very specific about it Give me an example of a tertiary color.

Student JN CR1 School A: Red-orange.

Teacher AZ CR1 School A: Red-orange. So what was wrong with the red-orange you produced?

Student JN CR1 School A: It was too dark because it was too dark in comparison to the colors surrounding it.

Teacher AZ CR1 School A: You have mixed your secondary color which is orange with the red that you had.

Student JN CR1 School A: That's correct.

Teacher AZ CR1 School A: Then you would have red-orange, but when you saw it you made some sort of judgment about it. You just told me it is too dark why do you think it was too dark?

Student JN CR1 School A: Cuz I had this image into my head of the way red-orange should be.

Teacher AZ CR1 School A: That is absolutely fascinating…we hold colors in our heads.

Student RL CR1 School A: I used pencil for my color not to figure it out but because when I was doing it everyone else they didn't have colors that they were satisfied with the color

that they say I used pencil to show you can actually see on my color wheel the combination that I used for each one.

Teacher AZ CR1 School A: Will you show it to us?

Student RL CR1 School A: Well for the first one I assumed it was wrong for purple. I just mixed…I didn't use the primary colors. I used the already purple because it already said purple and then I realized that was wrong. Because that is not actually the purple I used for my color wheel. My primary colors did not make that purple. So, I did another one, which you can see the combination of the primary colors to make each the secondary colors.

Teacher AZ CR1 School A: You chose colored pencils for a reason?

Student RL CR1 School A: Because they would not mix the way paint does. Because you cannot see the combination exactly

Teacher AZ CR1 School A: You would actually like people to see what the original colors were like to see them present with the color pencil color wheel. So you can see the blue and the red present in the violet color that you have mixed? So that is actually a different thought isn't it? Because when you mix the paint they disappear? And they do become something else.

Student ISY CR1 School A: I just wanted to say I agree with what RL had to say. It makes a difference, I think,

Student CE CR1 School A: But at the same time you can see the layers of the original colors you use.

Teacher AZ CR1 School A: But when you went to paint mixing, did it become similar or more complex? What did that do to you of asking more questions?

Student CE CR1 School A: I just made things…it made me questions more things I wouldn't question. We have things that we are…have complex things we are not even aware of they are so deeper than it's like a whole different thing. it is like a fact, but I see as truth but I started questioning what I see.

Teacher AZ CR1 School A: I am going to go over here.

Students SG CR1 School A: I was actually thinking about light, too, and how it affected color and how we perceive that. I thought it was really cool because the image is moving and it becomes blurry because there are two different lenses into the color itself that tricks your brain into I guess compromising those colors. And there are two colors in the…I thought was really cool but I guess you have to see in pictures in like on the computer. You can see the difference between when it really bright almost like…it's really confusing. It is really bright it almost like the image is coming at you and if…it is not it goes deeper into…

Teacher AZ CR1 School A: It recedes?

Student SG CR1 School A: Right.

Teacher AZ CR1 School A: So, is that…

Student SG CR1 School A: But that is light. It is dangling you can move it up and down and if you move it.

Teacher AZ CR1 School A: A slider?

Student RL CR1 School A: Yes, a slider. It shows the difference and it is really light.

Teacher AZ CR1 School A: Can you find it on my computer?

Student SG CR1 School A: Yeah.

Teacher AZ CR1 School A: So people could experience that?

Student CR1 School A:

Teacher CR1 School A: So are you asking or telling me about it?

Student RL CR1 School A: I saw it on the websites. He had square paintings and they went down in size. They were one color in yellow the shade got darker and as the shade got darker the middle square felt like it was going further away from you then the one next to it has it felt like it was towards next to you.

Teacher AZ CR1 School A: Okay. Playing with the colors to make things come forward and recede. Do you know anything more about that? What he can maybe show you about color? Do you know anything else that other might notice?

Student RL CR1 School A: He did some of the like that kind of thing where he I thought it was like tricking your brain. IF you look at something for a period of time, you could look away and the shading and the color and the way connect to the color right next to it.

Teacher AZ CR1 School A: Does anyone else have more information about Albert's?

Student JE CR1 School A: Optical effect can be achieved even when the colors are complementary. I have like some examples.

Teacher AZ CR1 School A: So what is optical effect?

Student SG CR1 School A: Just like what I talked about…how it goes deeper. He has these square and he makes it appear that the squares are going in with the colors he uses.

Teacher AZ CR1 School A: He actually published a book called *Color Interaction.*

Student AY CR1 School A: I looked that up, but I couldn't see anything.

Teacher AZ CR1 School A: So you looked that up but…

Student CR1 School A: I couldn't get a preview.

Teacher AZ CR1 School A: So, you couldn't get a preview. That is because it is out of print.

Student CR1 School A: Why?

Teacher CR1 School A: Why? Because it is a hand printed book and it is loose leaf and it shows you in the book hand silk screened pieces. And it shows you the interaction of color. It is really mind blowing. So what it takes is he will show one color. So let's say green and he will take a square of that an inch by inch square and he will put it into a different field and so he will but green on top of blue and then he will put green on top of red and they will look like completely different greens. Even though you know they are the exactly the same color but you perceive is entirely different. So I think that comes back a little bit to our notion of the right color that we are holding in our head with some of the mixing we have done.

Student MA CR1 School A: I was thinking about what we consider pure colors I basically came to the conclusion that color theory is too narrow minded and it's not elaborate enough on this and I kind of came up with my own color wheel where you kind of have to use a red that is yellow based and yellow that is red based to get like pure oranges. They don't have any blue. They are as bright as the can get and the same is for green and purpled.

Teacher AZ CR1 School A: So, you are changing the reds and you started mixing them?

Student MA CR1 School A: So at least you will have two of each and I have kind of started a color wheel that has three yellows three reds and three blues. In the blues it is kind of obvious which ones are the brightest these are pale and ultramarine and surelium and that is yellow based and this is blue based and they make the realist and brightest green. Having a pure color slims down having the right based colors they don't have all the primary colors.

Teacher AZ CR1 School A: So, you began to question the theory itself is my understanding. You think that you develop a theory of color theory that you are doing in a sort of…how would you describe your color wheel?

Student MA CR1 School A: The new color wheel.

Teacher AZ CR1 School A: Yes the new one.

Student MA CR1 School A: More art more rich more…

Teacher AZ CR1 School A: How about the extended color wheel? How about extending the information known by others? And you are extending the notion of what yellow is? Extending the notion of what blue is?

Student MA CR1 School A: I think you use it will examples but I really think with yellow based blue or…

Teacher AZ CR1 School A: So you have moved beyond the color wheels you are using? And saying these are not satisfying?

Student MA CR1 School A: They only really work for one secondary colors they make the most vibrant of the once we know how to use or understand this the relationship between the different yellows and the different blues then we can use them to create like duller colors to create shares or whatever now that we are kind of faced with it is important to…

Teacher AZ CR1 School A: For me this develops a question depending on what my practices are going to be as an artist. Will I have to develop my own thoughts about how things should be structured? But if I am going to work with color, is that something that I am going to do? But if I am going to print color off a computer, would I have to develop theories about color – first of all about the computer and also the printer? So I couldn't say this is the answer but I have to always struggle to find answers through the experiences that I have. So have you began to develop questions so now you can start to develop ways of working or ways of practicing?

Student SG CR1 School A: I found it.

Teacher AZ CR1 School A: Has anyone gotten that out of this exercise? Because I cannot tell you what your practice will be and because they talk about color theory. Everyone wants to have the right answer to this and I think that I have to point out this notion of right answer it makes me wonder why you want it?

Student ISY CR1 School A: I feel like color theory claims a right answer. I think that is why we are looking for it because color theory is the one that puts it out there in the first place and by doing this project we are challenging the concepts of color theory and we are saying both. It doesn't actually work that way.

Teacher AZ CR1 School A: My big question is this – is color theory as it is presented to us relevant to our time?

Student CE CR1 School A: You are saying is relevant to our time, but was it ever really relevant? It is not that paint has necessarily changed and we are actually represent the unknown and make the idealized colors on the computer. Is it even less relevant back when they had all those pigments?

Teacher AZ CR1 School A: So, when we are looking at Goethe's color wheel do you wonder what his reactions were to the colors he was getting?

Student CR1 School A: Yeah, what he thought about them. I am amazed.

Teacher AZ CR1 School A: So you think he sat around and said I am amazed? Or do you think he was also disappointed?

Student ISY CR1 School A: But he didn't have like a previous idea.

Teacher AZ CR1 School A: What makes you think he didn't have a previous idea?

Student ISY CR1 School A: Because he…

Student JN CR1 School A: He has it or he wouldn't have done it otherwise in the first place?

Teacher AZ CR1 School A: So he did have an idea?

Student JN CR1 School A: Yes.

Student CE CR1 School A: Or maybe he was just experimenting.

Student CE CR1 School A: Yeah, and maybe he stumbled upon some stuff.

Student ISY CR1 School A: Maybe he was the creator of orange?

Student CR1 School A: Who determines the best ideas?

Teacher AZ CR1 School A: Isn't this project of what you should have been exploring? So have you been exploring that?

Student AY CR1 School A: Who created it and how it started?

Teacher AZ CR1 School A: What is your understanding of it and if you actually did that and you went through all those steps what is your current understanding of this whole process? Of color theory?

Student AY CR1 School A: What is the question? How I started?

Teacher AZ CR1 School A: Where you started and where you have come to in this process.

Student AY CR1 School A: I really didn't. I knew that after researching that a huge distinction and how you perceive color the physics aspects and I like. I didn't get into that. I tried to but it was so confusing just because I didn't get to it and understand it. I looked more on Goethe. I knew the basics of the color wheel. You got your primary colors and you split it up but I guess I didn't know the reasoning behind it. I looked at the reasoning as to why and why he did that. I looked at lights and found this article on scientific education and they were talking about

how you can make but I tried to this but we didn't have the colors philo blue is the closest to what people consider pure blue with philo blue pudding. You can with hansa or Aquinnah. You can make a red or blue with different quantities of puddy and then we didn't have it in magenta and violet.

Teacher AZ CR1 School A: We have it in red.

Student AY CR1 School A: Yeah, but it wasn't in magenta. And then on the same website it said that California science frameworks debated that we must stop teaching color theory based on the false thing that primary colors and that we shouldn't be afraid to spread the truth. Because this is an important lesson to teach the students that since you can make blue red and yellow the colors. That I stated they aren't primary colors the primary colors are magenta cyan and yellow. I am going to work more on that but I didn't have the puddy.

Teacher AZ CR1 School A: That is only with light right?

Student AY CR1 School A: No, I was talking about in general.

Teacher AZ CR1 School A: Is it in general if we actually went out and bought those colors we could mix and make red?

Student AY CR1 School A: That's why I would like to see if it is true.

Teacher AZ CR1 School A: So, we should buy them? Let's do it.

Students AY CR1 School A: So, we can buy them?

Teacher AZ CR1 School A: Let's totally do it. You give me the list and we can totally buy it.

Students CR1 School A: We talked about it. It also said that these colors should be taught throughout all the subjects so they should be the primary colors cyan magenta and hansa yellow.

Teacher AZ CR1 School A: So you went on a site and saw misinformation in the world about color theory and we are getting misinformation. It is all being fed into it us. And why didn't you say I need those colors?

Student AY CR1 School A: I don't know. I just did not want to but I didn't think that you would have to have a reason why,

Teacher AZ CR1 School A: No I am absolutely excited to do it. That would be really important. And does that apply to physics?

Student AY CR1 School A: Well it said all subject areas.

Teacher AZ CR1 School A: All subject areas?

Student ISY AZ CR1 School A: But maybe you can, but in my mind, a primary color. You can't make a primary color so even if you do get red it is now a primary color.

Student AY CR1 School A: Yes, but they are saying that you got to stop teaching this because that they are primary colors because you can make them. If you can make a red then you can't teach people that it is primary color.

Student ISY CR1 School A: So are you saying that you cannot make a magenta?

Student CE CR1 School A: No they are saying that you can make a magenta, or a red which is a primary color.

Student CR1 School A: So, what are the colors that you would make to make those primary colors because obviously they would be the primary colors?

Student CR1 School A: Are they saying that there are no primary colors?

Student JN CR1 School A: That would make the most sense. How would they be a color that you can't make?

Student JE CR1 School A: Primary colors or like red yellow and blue. In that article it says magenta cyan and yellow and so if those colors say make red yellow and blue make the secondary colors and them mix those to make tertiary colors. Since those are the primary colors and you can make red yellow and blue would that not be…

Student AY CR1 School A: So, that would be different. I still feel like you would get the same problems if magenta was the primary color. How do you make magenta? How do you make sure it is pure? Is the underline basis you would still have all the underline problems I am just saying?

Teacher AZ CR1 School A: What you believe is right you are putting forward. This works with physics. This works with lights with the primary colors. Does anybody know if the color theory is additive or subtractive? And does anybody know if mixing paints like this is additive or subtractive? Did anybody get to those types of thoughts?

Student CR1 School A: Lights are additive and pigments are subtractive.

Teacher AZ CR1 School A: So what does that mean?

Student JN CR1 School A: Light adds color.

Student CE CR1 School A: Additive colors are a mixture of light they are more different colors. The primary colors are red green and blue. And when all these colors of the additive colors are mixed up you get white.

Teacher AZ CR1 School A: So, the absence of them all is?

Students CR1 School A: Black.

Student JE CR1 School A:It begins with no light black and then it mixes with the presence of light.

Teacher AZ CR1 School A: So what are the primary colors of light?

Student JE CR1 School A: Magenta, cyan, and yellow.

Teacher AZ CR1 School A: When you mix magenta and cyan what do you get?

Students JE CR1 School A: Red, blue, and green.

Appendix E

School A Critique 2

Teacher AZ CR2 School A: I would like you to use this thinking routine, *I Used to Think and Now I Think*, which would explain the new understanding that you have come to and why you are proposing your studio work. Does that make any sense? So I used to think about color and now I think about color. I am going to start with ML.

Student ML CR2 School A: Prior to my investigation, I used to think there was one kind of contrast with colors I thought it was contrast of complements that complementary colors complement each other as well but then after researching Johannes itching I thought there were more because of saturation between light darks extension is something that I experimented on I researched him and it basically talks about how much of each color should be used were balanced or unbalanced It shows different proportions of color it juxtaposition with its complementary Here I guess is a three to one ratio of purple to yellow a two to one ratio between the orange and blue and one to one ratio so it appears more balanced in nature in my pieces I wanted to combine contrasted saturation with contrast of extension to actually see if I can make a balanced piece in the end.

Teacher AZ CR2 School A: So what is your proposal for that first piece Student ML? What do you think it is that you are actually going to do?

Student ML CR2 School A: I want to have big paper strips. I guess getting bigger instead of smaller. And then those strips, let's say, I can have here you have pink and gets lighter and lighter and the saturation changes to have a highly unsaturated pink at the top and have it get lighter and lighter as it goes to the bottom and have it yellow and unsaturated and lighter towards the middle. Then have these lines or spaces bigger and get smaller and smaller.

Teacher AZ CR2 School A: Okay. So, one of the things I began to notice about your experiments was that you painted one color over another.

Student ML CR2 School A: Where?

Teacher AZ CR2 School A: And do you think that is problematic? Do you think you should do that?

Student ML CR2 School A: One color over another?

Teacher AZ CR2 School A: Yes.

Student ML CR2 School A: I actually didn't. It looks that way because the green is kind of muddy.

Teacher AZ CR2 School A: I was watching you do it.

Student CR2 School A: I put a strip of tape there and peeled it off. It just looks like that because I dragged it some of the paint got over the purple.

Teacher AZ CR2 School A: So, making sure everything is dry first?

Student ML CR2 School A: Yeah.

Teacher AZ CR2 School A: Did you get any leaking?

Student ML CR2 School A: A bit not that much.

Teacher AZ CR2 School A: Because of the tape. So would it be best to start with the lighter colors?

Student CE CR2 School A: I was just kind of curious about the balance he says do you think that the artist achieved that…

Student ML CR2 School A: Well, these are the examples one of them I think this one. So if you look at this is like another theory that it is talking about it is called radiation it is when the edges of the composition tend to blend and if you look at this the colors don't look like that

because it's on paper. On the computer its more vibrant but when you look that it is very tiring on the eyes and the colors do end up blending together and you get this glowing feeling and in that case it wouldn't be balanced because your eyes don't know where to focus but then here its more defined and it does seem more balanced.

Teacher AZ CR2 School A: Can you share that with the rest of the room?

Student ML CR2 School A: And I also looked at like these 60s posters for bands and a lot of them used this theory of when complimentary colors to have brightness and they emphasize each other in a way that it causes irradiation it almost looks like some vibration on the edges of the color so you can't actually read that vibrant color.

Teacher AZ CR2 School A: So, how big do you think that your paintings are going to be?

Student ML CR2 School A: Ahhh four feet by three feet…..that's what I was thinking.

Teacher AZ CR2 School A: Three by four?

Student ML CR2 School A: Yes.

Teacher AZ CR2 School A: Nice and big then. Are you going to stretch canvas?

Student ML CR2 School A: So far the paper I need to seep different qualities of paper and canvas and how they react with the paints that I am using.

Teacher AZ CR2 School A: So one of the things that we know about paper is it tends to wave and buckle. Do you think that will have an effect on extension?

Student ML CR2 School A: What? The extention? I think that it would. If it does buckle, then it would be the spaces. You won't be able to differentiate the how big they are.

Teacher AZ CR2 School A: Maybe canvas is the way to go. So maybe it should be stretched so it is nice and tight. So that is something that will have to prepare to move forward.

Student ML CR2 School A: So to have the lines perfectly straight?

Teacher AZ CR2 School A: And so this understanding of color came from your investigative research iron was working on?

Student ML CR2 School A: Yeah.

Teacher AZ CR2 School A: When was it on?

Student ML CR2 School A: He began in the 20s, but then he furthered his research but he kind of left art school and wrote a book *The Art of Color*. He wrote two *The Art of Color* and *Interactions of Color.*

Teacher AZ CR2 School A: Thank you very much. Are there any other questions for M? Did anything else come up in your research?

Student ML CR2 School A: Yes, Mark Tansi. He uses monochromatic and it kind of led to my use of monochromatic and how the progress of it. How he can depict an entire scene with such detail and only using one color and he was able to show uh shadows and stuff which is pretty interesting.

Teacher AZ CR2 School A: So, Student MA CR1 School A has question.

Student MA CR1 School A: What do you use as your definition?

Student ML CR2 School A: Well, it talked about on line the light colors need to pop out more compared to the dark colors dark colors recede I mean cool colors tend to recede and then the warm colors can pop out since this is a warm color and this is a cool color they have equal amount of both they both seem to be in balance visually.

Student MA CR2 School A:

Student ML CR2 School A: It depends if they are warm or cool. The cool color has the warm color. It has more if that a warm color or a color that's more this warm color tends to pop out more it kind of relates to this. Once again colors on the paper they don't actually reflect the

colors that on the screen these actually tend to be more neon. That's why the greens pop out more.

Teacher AZ CR2 School A: Thanks, ML CR2 School A, Using the thinking routines *I used to think and now I think…*

Student SG CR2 School A: I used to think and I kind of go back and forth.

Teacher AZ CR2 School A: So why did that happen to you?

Student SG CR2 School A: At first I didn't know that much about the color wheel but then I just assumed it worked. But then I realized that you cannot make every single color. You cannot make the color you want like with the exact red or the exact yellow or the exact blue. Well then I thought maybe it is kind of skewed. You can't make the color you want, but then I looked into it more and I realized that it is still the color but we just don't think of that. It is still the color in our minds, but it is still the same color it is still a green and still a yellow and still an orange. So the color theory is applied to it.

Teacher AZ CR2 School A: And how is that leading to your developing some studio work?

Student SG CR2 School A: With that I also looked into Equiluminance I kinda of want to do my studio on that because I found it really interesting how colors can make illusions

Teacher AZ CR2 School A: So can you explain Equiluminance

Student SG CR2 School A: I have some examples here. It is where two colors have illuminance are equal and your brain can't process what you see. It's that because of the shapes of the strong color contrast but the colors can't be placed because they have the same luminance so it makes the image blurred because your brain can't put it together so I thought it was really interesting so if you look at this one.

Teacher AZ CR2 School A: Can you show it to the people over here? Which one?

Student SG CR2 School A: Like this one it should be like moving? And this one is like yeah I want to look into that and recreate that with…

Teacher AZ CR2 School A: With the pigment.

Student CR 2: Yes.

Teacher AZ CR2 School A: And how do you propose to do it?

Student SG CR2 School A: I guess paint is the best option but if that doesn't work I was even thinking of going on the computer and see if I can do it digitally.

Teacher AZ CR2 School A: So what size do you think those things will be if you painted them?

Student SG CR2 School A: Pretty big I guess. I would have to research and look into that more I guess the biggest is better.

Teacher AZ CR2 School A: Why do you think big is better?

Student SG CR2 School A: I don't know. I guess you will have to look at it on the wall. I think it will have a stronger affect.

Teacher AZ CR2 School A: And what are the implications if you have to be complicated like that top piece that you just showed us their of the painting so think about the medium and think about how to go about it in the physical?

Student SG CR2 School A: That's the thing I thought was so difficult. I mean I think that the paint would have to be specific pigments. I would have to know how to balance it exactly to make it work and I would have to measure exactly the paints so I can contrast them.

Teacher AZ CR2 School A: How do you know that you have colors with equiluminance?

Student SG CR2 School A: I am assuming that it has the be the same amount of in each color otherwise I would have to be very precise.

Teacher AZ CR2 School A: So you still have a little investigation that you need to do before you actually begin creating scales of the works?

Student SG CR2 School A: I also thought of that because on the computer they have numbers and I guess it is easier to find the number and see if I can recreate it with actual paints but on the computer its more precise it has numbers you can add more specifically or precisely how much paint exactly or how much color pigment exactly and then I can recreate it in real life.

Teacher AZ CR2 School A: Okay let's see how that goes. Does anyone anticipate any problems with this notion?

Student ISY CR2 School A: If you do paint. For that would show movement like how it is digital how the computer makes it like it was there not shiny.

Teacher AZ CR2 School A: The computer is matte.

Student ISY CR2 School A: No the paint is matte.

Teacher JN AZ CR2 School A : Not always. Not necessarily.

Student CR2 School A: That's how I feel.

Teacher AZ CR2 School A: It depends on the paint you use.

Student CE CR2 School A: Also does some of it have to do with the shapes that you have to make?

Student SG CR2 School A: I guess that is a really big part of it like different ones like this one this one is the same thing. I guess it depends on the shape to also on the color wheel.

Teacher AZ CR2 School A: So it is also proportioned on how much of one color to another. This is a little bit of my thought.

Student MA CR2 School A: If you put it on a wall, wouldn't you have to be kind of far away to see it?

Student SG CR2 School A: I was debating it but I can do it small. But I guess it depends on what size the shape it.

Teacher AZ CR2 School A: So there are multiple things to consider here. So students we are waiting for you. We are using the thinking routine *I used to think and now I think* about our color theory research and how that is leading us to our proposed studio piece.

Student OA CR2 School A: I really didn't think about colors before with colored pencils or paints tie dye or spray painting I first started with the colored pencils and use a to create a color wheel, but then after doing research there is visible and non-visible light so basically how we can't see radio waves. No, that we can't see ultraviolet waves or inferred waves microwaves. So basically my color wheel…instead of doing a color wheel…I made that which is physical light waves using paints of what we have a lot more colors than I could inside of the color wheel because I wanted to see the transition between colors after that I chose a few primary colors. I also learned that when you look at them for a while and you look at white right next to it so when you look at the color our eyes get tired of looking at it and then it produces the complementary colors but in a more vibrant way and with that everything that I want to follow up and figure out how to make the pigment crème and a misty color and see that complementary color by looking at it beside it see if that has the same effect as the primary colors and seeing that color if you look at that and go back to the same color I just wanted to know if it can and then also I was looking up warm and cool colors and I did that and it got stuck on yellow because they were two colors cadmium yellow pure and pure cadium yellow medium they look to me to be warm but

then the cadium yellow and hansa yellow they kind of seemed cool and so I put them in relations to other things I feel as though It also depends on where the color is next to.

Teacher AZ CR2 School A: Whether it seems warm or cool.

Student OA CR2 School A: Yes and so I also learned about that. Oh yellow is warm.

Teacher AZ CR2 School A: Well I have a question. What is skin color?

Student OA CR2 School A: So skin color is crème.

Teacher AZ CR2 School A: Why have you chosen crème?

Student OA CR2 School A: Because it is so neutral and the colors like the complementary colors are so vibrant I see them as complementary…and dull.

Teacher AZ CR2 School A: So what do you think the complementary color to crème is?

Student CR2 School A:

Teacher AZ CR2 School A: So you think it is a violet color?

Student JN CR2 School A: Like a mat violet?

Teacher AZ CR2 School A: Like a light violet.

Student JE CR2 School A: Maybe like blue?

Teacher AZ CR2 School A: Why blue?

Student CE CR2 School A: Figure out how to make crème and then you will know the component colors of crème are, then figure it out from there. We have white and its opposite color is black.

Student CR2 School A: So if you mix black and violet because white is the complement of black and violet is the compliment of yellow or a darker shade?

Teacher AZ CR2 School A: Why would you do that ML?

Student CR2 School A: Because you are taking both complimentary colors to opposing the colors that make up the color of crème.

Teacher AZ CR2 School A: So ML is thinking that both colors that are opposite of.

Student OA CR2 School A: Will that work?

Teacher OA CR2 School A: The colors in crème, which would be white and yellow. He is mixing those to he is mixing black and violet.

Student ML CR2 School A: I think if you add black and violet, it will change the shade of violet.

Teacher AZ CR2 School A: It will change the shade of violet.

Student AL CR2 School A: Wouldn't their also be a shade of red in it?

Teacher AZ CR2 School A: AL is saying isn't that what you are doing to yellow anyway because you are making it you are adding white to yellow you are making it less yellow and it becomes this crème color these are fascinating questions are they not. So how do you propose to show us this?

Student OA CR2 School A: I plan to so the same thing to the primary colors if I could do that.

Teacher AZ CR2 School A: And you will do it on that scale?

Student OA CR2 School A: Yes.

Teacher AZ CR2 School A: What patches of color are on an 18 by 24? Do you think working on paper is a good idea or do you think you should maybe change that? What do you think the issues are with working on paper?

Student CR2 School A: It kind of crumples.

Teacher CR2 School A: Are there any other technical issues?

Student ML CR2 School A: the white paper.

Teacher AZ CR2 School A: When we are looking at the big blue patch over there on the paper.

Student ML CR2 School A: The white…the white.

Teacher AZ CR2 School A: The paints. Why is that because the surface of the…?

Student OA CR2 School A: It's crumpled.

Teacher AZ CR2 School A: It is kind of crumpled on the paper. The paper is kind of. So it might need to be on canvas. Those are the sorts of things that maybe we all need to be thinking about. We all need to be thinking about not only the consequences, how am I going to carry it out and what are the consequences of my choice? Whether it is paper, whether it is canvas, whether it is wet pigment or dry pigment, all of those implications need to be thought through. Thank you, OA. Do you have anything else to tell us about your work about your research?

Student OA CR2 School A: I did Andy Warhol. So if you don't know about him he has Marilyn Monroe's face and he puts colors on her face like her lips and her eyes and on her hair. He uses triadic colors for the lips eyes and the hair and then also like the color he uses are like opposite so like if he has a yellow shadow he will add lilac to increase the…

Teacher AZ CR2 School A: Did you come up with anything else?

Student OA CR2 School A:

Teacher AZ CR2 School A: So you have come to the conclusion that color is about relationship you almost rarely see them by themselves?

Teacher AZ CR2 School A: Who would like to volunteer to go next? MA is going to.

Student MA CR2 School A: I was thinking that color was pretty simple the color wheel and stuff is pretty basic. Now I am confused with color there is so much going on I was trying

researching a bunch of stuff but their isn't so much. I didn't really focus on. The thing that interested me the most is the color being inside your mind. The color in reality is something that your eye translates and it isn't like something you can touch. It all exist in your eyes then I thought of the different ways of mixing colors lights and I sort of got interested in how the different colors look on screen and on paper and so I can maybe show you on a thumb drive I have a drawing that the yellows and the blues all together when you look at it far away it looks like green and I would like to experiment with that on paper and see how different luminance changes on paper that blend together.

Teacher AZ CR2 School A: So, you are suggesting the speck that you can get on the computer can be reproduced with a wet pigment?

Student MA CR2 School A: I would like to see if it has to have different colors and see how does it work?

Teacher AZ CR2 School A: Has anyone else come up with anything unique in their travels through color? Anything that has been said today that has surprised you? No? Everybody has recognized the words that have been used and understands what people are talking about? Do I quiz you guys?

Student MA CR2 School A: Well, no.

Teacher AZ CR2 School A: So MA is going to show you something.

Student MA CR2 School A: At first I did this one…I found the blues that I used was real strong.

Teacher AZ CR2 School A: Wow, it looks black and white to me.

Student MA CR2 School A: It just didn't work. So…

Student AY CR2 School A: Oh, it's yellow.

Student MA CR2 School A: It's yellow.

Student JN CR2 School A: I didn't see that.

Student CR2 School A: .I think the contrast. It's so big, too. So I did another one. The blue is a tad lighter.

Teacher AZ CR2 School A: What did you change?

Student MA CR2 School A: Blue.

Teacher AZ CR2 School A: And you changed what of the blue?

Student MA CR2 School A: I did this roughly on drawing but I would like but I want it to be more depth.

Teacher AZ CR2 School A: So what do you think you changed about blue?

Student MA CR2 School A: I think it is a different blue completely.

Teacher AZ CR2 School A: So you think it is a different blue?

Student MA CR2 School A: The other one was red based like ultramarine and this one is like aquiline blue. It is more like a…

Teacher AZ CR2 School A: Alright. Suddenly MA is giving an explanation of the blue in terms of the wet pigments that we have been using so she said the other one was closer to ultramarine blue and which is a warmer blue and this one she chose here is closer to cerulean paint.

Student MA CR2 School A: The first one was like this and the second one was more like this. So I wanted to express different combinations.

Teacher AZ CR2 School A: CE has her hand up.

Student CE CR2 School A: Did you change the yellow on it?

Student MA CR2 School A: So that is an example of how the yellow looks different. I changed the yellow depending on what.

Teacher AZ CR2 School A: Did you change the proportions or the amount of lines?

Student MA CR2 School A: The blue and the yellow are about the same but they might be thicker. In this one I think they are thinner in the space but the blue and yellow strips are. I am sure they look the same.

Teacher AZ CR2 School A: So now you are thinking about translating that into a painting?

Student MA CR2 School A: I think that I want to experiment with the computer first and see. I don't know yet.

Teacher AZ CR2 School A: And how big do you think you will show this to people do you think you will keep them on the computer or will you show them off the computer? Print them out?

Student MA CR2 School A: Well if I print them out I don't have a projector and with a projector I don't have the…

Teacher AZ CR2 School A: So you have a lot of things to think about in terms of how to actually produce these

Student MA CR2 School A: And if I do make them paint they should be sort of thick but not too much to see them from far away and not .

Teacher AZ CR2 School A: So any of your research acts as where you actually are as mixing the colors?

Student MA CR2 School A: Not really I think that is a big flaw I think that patterns we use as an influence on.

Teacher AZ CR2 School A: Going back in history and the thought of impressionism where they were actually using colors in small strokes and dabs putting down pure colors and then having those mix within the within the eye and some of the people who were working in or around that movement who were thinking about how pointillism works. And things like that. That might be a place that you want to look because it might feed you information about how you might want to create these works. Is there anything else that people think would be important or MA to think about to consider? Thank you, MA. How about you?

Student JE CR2 School A: So this is what I used to think It was kind of superficial vague like color wheel they were complementary colors. I didn't know that it was so much more to it. Like when we first started the project. Once I tried some research to try and prove it wrong because I couldn't completely understand why the colors that I looked at or are used to was the right kind of color didn't come out by using the three basic primary colors . Then I looked into like. Now I think it is theoretically right but I should actually try to do it isn't as blue as I am used to.

Teacher AZ CR2 School A: So after some exploration you come to the conclusion that you theoretically is right but in practice you can't use the three primary colors to come up with a set of secondary that are what you want. So you would have to actually play with your primaries I am going to use a different blue.

Student JE CR2 School A: There isn't no paint that get a different blue or red because they have different basis but then I looked into optical illusions color interaction and how they interaction and how they I found out that there are many different things you can do with three like chromatic adaptation.

Teacher AZ CR2 School A: What's that?

Student JE CR2 School A: Basically its allows for color sensitivity like a particular stimuli It's how you interpret a color within the context of interaction There was an example of a square half of it was cyan and half of it was yellow there is a…in the middle and when you looked the picture and half of it was tented and half of it was like when you look at it for like 30 seconds it was like all the same color and not two different colors because that is because our eyes adapt to what was going with the image and the surroundings and they kind of make you see…

Teacher AZ CR2 School A: What do you mean our eyes adapt?

Student JE CR2 School A: It is like they get tired in a way depending on the context they get used to what they are seeing. Once you look at something else it is actually different than what it actually is.

Teacher AZ CR2 School A: If you reference O experimental notes is it the same sort of notions. Where she's got red when she stares at that for 30 seconds then you look at the white block next to it you get a different color. So O, why does that happen?

Student OA CR2 School A: Because your eyes get tired of seeing the colors that they are seeing.

Teacher AZ CR2 School A: So what do you mean by that – that your eyes get tired looking at the colors?

Student OA CR2 School A: So they are rods and cones on our retina right and they are color receptors so the stimulants get used to them.

Teacher AZ CR2 School A : So if we are looking at the red one the cones that fire for red get tired and shut down so when we look at the white square so where is this leading you ?

Student JE CR2 School A: There are a bunch of methods and solutions that this will lead you to. I experiment. I want to see how illusions the elements on the computer create something different so I want to see if the same thing happens with paint.

Teacher AZ CR2 School A: Do you know what that is going to look like? Have you got any thoughts about how to develop the studio piece?

Student JE CR2 School A: There are some techniques like there is this thing called lithering it is mainly done on the computer because it makes you see more colors than there actually are. And if you can zoom into an image you can see how the primary colors make up the actual full image that kind of intrigued me.

Teacher AZ CR2 School A: So do you think that actually takes you back to the thought of looking at the pointillists who were working at the time of the impressionist have you done any research on that era?

Student JE CR2 School A: There is a whole movement on off art. And like Joseph Albert's was part of it slightly. I thought it was pretty cool in how they could do that so Joseph Albert who paints and stuff.

Teacher AZ CR2 School A: And there is a woman in that movement and her name is Bridgett Riley. You might want to look at her work. I think she is still working I think she is maybe I her 70s it might be great to investigate what she is working with. Who would like to volunteer to go next?

Student CR2 School A: I used to think that the color wheel was pretty basic you have the complimentary colors and the tertiary colors I never really thought about it so I didn't think I had to think that much and now it is super complex I had trouble focusing on one main aspect so when I thought about things there where so many other elements and I didn't know which

direction to go in that I talk to you about interior design I am really into interior design and how that relates to color theory all about how the colors are used in how that relates to color theory So I am interested in how colors relate to the themes what respect that color has in a specific scene that was difficult because they have positive and negative you don't necessarily always know if positive of negative effects are going to happen with a person. So investigated when so if you are in a red room how will you know if you are going to have a positive or negative affect I found that it is about how much is used if you are in a big room I don't have the affects memorized. You are going to feel aggression and anger if it were in a smaller room if it was with other colors and it isn't red if it were a wall with red you would feel more passion and strength your heart rate would be faster so I looked a few websites so I have a broad understanding of the effects of color in a room and it no the less color phycology I thought it could be cool to change that to change it a bunch of times so that I can have a broader effects of what people feel in it I decided to use cyan and at first I was going to use gel tubing in the computer room so you could slip on tubes that would be too expensive so we thought to put under the light and it changes the color of the room I want students or random people I am going to set the color and have them do specific activities and see how they feel afterwards and do it with different colors and so I picked this peachy yellow and that induces stress I would like to do an activity that would cause stress or how stressed they got about it but then I also use blue but then I used a lighter the darker blue can be kind of depressing and lighter blue is more calm and I am going to use that then we got a red that will boost your heart rate and your blood pressure and then orange because I am more in to trying it Some of the activities that I have to try are I have a bunch of different activities because I want to have as much understanding of the affects as possible as One activity that I thought of was Students have a certain time limit to trace a

geometric design and then I was going to look in and see the tracing to see how well it was done because you can kind of tell if they were rushing and if it is not completely perfect and see if in the yellow room if the tracing is less accurate as in the blue room and then the one idea and I wanted them to do an advance yoga poise oranges are associated with gyms and exercises and being associated with I wanted to see if they are more able to do a yoga poise in an orange room. As opposed to another color and then having kids memorizing a certain amount of notes in a short limit of time and see which room they are able to memorize the most words and then I also thought about playing music and a different frequency and seeing their reaction to the music I don't know they might dance in one room I may pick certain music and find it really annoying in the same room with a different color and yes I was doing research on different experiments that people did with the effects of color on emotions and I found that this one firm used this they packed these big pipes in these big black boxes and people being enclosed complained about how heavy the boxes where so suggested to change the boxes to light green and they were delighted with the newly light green and it changed a sense of color so I wanted to try that that is why I am painting boxes over there and try black and green and have the same amount in each and ask people to transport them one at a time up a flight of stairs oh is that ok or sorry or how was it I wanted to try as many experiments as I can.

Teacher AZ CR2 School A: Thank you, A. Do you think of anything in terms of artist production is going to come out of this?

Student CR2 School A: I am worried about that It's hard to come up with like a studio piece so I am not quite sure of where I might go with this but that's why I think I need to come up with those results about how people felt after doing this and make a complete studio piece.

Me: How do you plan on documenting it?

Student CR2 School A: I am going to ask them questions afterwards about how they felt about this I am going to watch them so like when they are memorizing words I will be in there so I will be like this is so I will know like I can see but I will also ask them questions afterwards.

Me: Is it possible for you to record it?

Student CR2 School A: Yeah, I could.

Teacher AZ CR2 School A: So maybe if you videoed it maybe that could also maybe the studio piece can maybe watching these poor people in the room.

Student CR2 School A: I don't want to do a video because when you know that people are recording you act a little differently. So I guess I would have to hide the camera.

Teacher AZ CR2 School A: So that sounds interesting A, thank you. So did anything come up during your research?

Student CR2 School A: I was really interested in the impact the colors can make reflect on the functioning of experiments like hospitals they have the outfits yellows or light blues because they produce calmness. So when you into surgery you are not freaking out as much or as if you have a bright yellow you probably wouldn't feel as comfortable so different things like that I found interesting I never really thought about it.

Teacher AZ CR2 School A: So it is quite conscious in some places how they use color.

Student CR2 School A: I actually read this article about warm colors and cool colors can actually make people feel warmer and cooler based on the temperature in the actual room so I think if it was at 57 degrees warm colors would actually make people feel warmer and I think it was actually 54 degrees it made people feel a lot colder with warm colors being painted on the wall. They actually felt a significant difference in degrees.

Teacher AZ CR2 School A: I thought you were saying 77.

Student CR2 School A: No it was 57.

Teacher AZ CR2 School A: So it is quite a cool room.

Student CR2 School A: Yes and they experience it being much much colder.

Teacher AZ CR2 School A: At 54.

Student CR2 School A: Based on the colors.

Teacher AZ CR2 School A: Based on the colors.

Me: Did some of the theories change over time as far as the colors and different meanings? So saying like the 80s versus the 2000s…

Student CR2 School A: About the color theory thing?

Me : Yeah like you said the hospitals have the yellow jackets like that was there a time with different colors and was there a time when…

Student CR2 School A: I didn't have any research concerning that. There could be I guess. I would have to research that.

Teacher AZ CR2 School A: What about in different functions A?

Student CR2 School A: Oh I did research how different cultures have a different ideas of what different colors mean so sometimes it is really hard to generalize I know it can be stressful it can mean something in other countries for example red 5314 it increases your heart rate and your blood pressure in china it equals celebration and luck in Europe they use more colors with political meaning so that equals socialism and things like that white is equal to war and death in India brown equals people in morning but these things are equal to the same thing. It is really hard to understand which colors are…

Teacher AZ CR2 School A: So do you think different experiments will work differently in different places so if we did this experiment in china that you are suggesting so where would it be?

Student CR2 School A: It would exhibit different responses I thinks so because they are used to knowing that color is associated with something different they know that red is equal to purity that is kind of a symbol of theirs.

Teacher AZ CR2 School A: So they will have a different response I think it is kind of fascinating actually. So we actually have a Chinese exchanged student and maybe it will be fun to bring her up here and see here responses.

Student CR2 School A: She would love it.

Teacher AZ CR2 School A: She wouldn't want to.

Student CR2 School A: She would love it.

Teacher AZ CR2 School A: And don't tell her what is going on.

Student CR2 School A: I don't know who I am going to choose it would be difficult but I would definitely add

Student CR2 School A: Do you think her reaction to color will be what we were taught to believe?

Student CR2 School A: I am not sure I think if I said like blue people would think like calmness or sadness I think there is some awareness of know what that colors means. I don't think what when you ask someone to do this I sure your true emotions will come out.

Student CR2 School A: Like blues for boats when people like see sick they see the blue and it like calms their eyes down.

Teacher AZ CR2 School A: Interiors of boats?

Student CR2 School A: Yes.

Teacher AZ CR2 School A: And where did you get that information from?

Student CR2 School A: From a TV show

Teacher AZ CR1 School A: A TV show.

Me : All of the elementary schools in DCPS have had the same paint of blue since I was a kid and it has been there a longtime and the same buckets; so if there is damage on the wall they get the exact same color on top of that so definitely it is interesting to see.

Student CR2 School A: Elementary school has blue on the wall.

Teacher AZ CR2 School A: Is it?

Student CR2 School A: They have red and yellow on the floor.

Teacher AZ CR2 School A: I think it is all quite fascinating after you do your research I think you look at the colors around the school and look at and wonder how those work.

Teacher CR2 School A: Oh, you said what is the different between Europe and the US and wouldn't there be more difference in Europe itself? I was thinking how different these countries are. I am pretty sure it is different in Russia or if you grew up in like France.

Student CR2 School A: Yes, it probably is. I was…I just found a website that just has India china Europe and Asia and I just took that information. With your experiments some of them don't you think they will read on the persons themselves the exercise what if they are not fit are you trying to test them. That is why I said it is very difficult to choose people because you have to be very careful with that music makes people feel different things like when you are shopping they put on fast music because they want to make you buy stuff really quickly without thinking about it and it also depends on people like for example like hip hop music will make me want to kill myself I would then I would like have an average of the data.

Appendix F

School B Teacher B Interview

I use a format that is somehow influenced by the structure VTS like the whole program it is influenced by but it is not the exact VTS strategies per say as the way they have it formatted. But I pick and choose from that structure and I mainly use I use a more clear connection with the regular VTS for when we are looking at conceptual aspects of the piece. So when we are analyzing the pieces in a formal way or in a technical way I use a different structure and approaches because VTS it fits more in the understanding of the narrative of the stories or the narrative of the paintings the work of art that you are looking at versus analyzing them from a technical point of view but I like the format I feel that it is a way of making it systematic of every time you are looking at a work of art there is a consistent approach so the students can make sense out of how do you interact with art or with visual information.

I think that again it goes back to redirecting the students with their areas of weakness and also kind of empowering them in the areas of strength with the eight habits of mind. SO if you see a student distracted of being kind of vague in relationship of you not doing your work or you are not finishing your things. It is like diagnosing in a more specific way. It allows you to pin point in a the problem and address it in a way that is not where a student won't take it personal in a way so I see that you are problems with envisioning your piece more that you are not doing your piece if you are to do it envisioning means this do you think that is an inaccurate diagnosis so do you think the problem has to do with something else I don't think that is the clearest connection that I can make that I see and how I been using it in the classroom well the problem here is that you are lacking the technical skills the ideas are great or the interactions that you are

having with the exercise is great but you are lacking the technical skills of less address that way we are able to resolve that.

So a lot of that has to do with getting that understanding of the artist that we are looking at and a lot to do with comparing and contrasting work. Work sometimes from the same artist and sometimes from different artist who can be dealing with similar concepts or different artist who are dealing with similar formal aspects I think that it has to do with first developing and clear understanding of formal, technical and conceptual aspects of the specific artist and that creates the ground of the foundation of the student to see in order to interact with that type of art you need to know more that you thought and once you know more that allows you to by analogy apply that to other artist and apply that to the comparing and contrasting so I think it has to do with this idea of depth over breath they are really laying down the as far as you can as an artist is doing the reasons for what the artist is doing and things and how he is doing it and how some of the things connect formal choices and technical choices artwork and the direction of the concept and that formal choice to the concept in a technical choice should support the concept and the three of them are somehow tangled up and are intertwined that way (zoom in thinking strategy).

Well I have what I do and this is a format that allows me to track their progress and have evidence of it and VTS usually has an oral format. So what we do is some VTS in a written format when after we have introduced the artist for the first time we will look at still images at the beginning and do the oral VTS with those and then we might look at a video or we might look at a short or an interview or an interview of the artist and then use VTS in a written format which is the one that I kind of use as evidence then to kind of like track their progress even thought I am taking notes at the time I am doing VTS orally it allows me to give them the paper back and also to look at some models that we can project then and sort of like debrief them this is

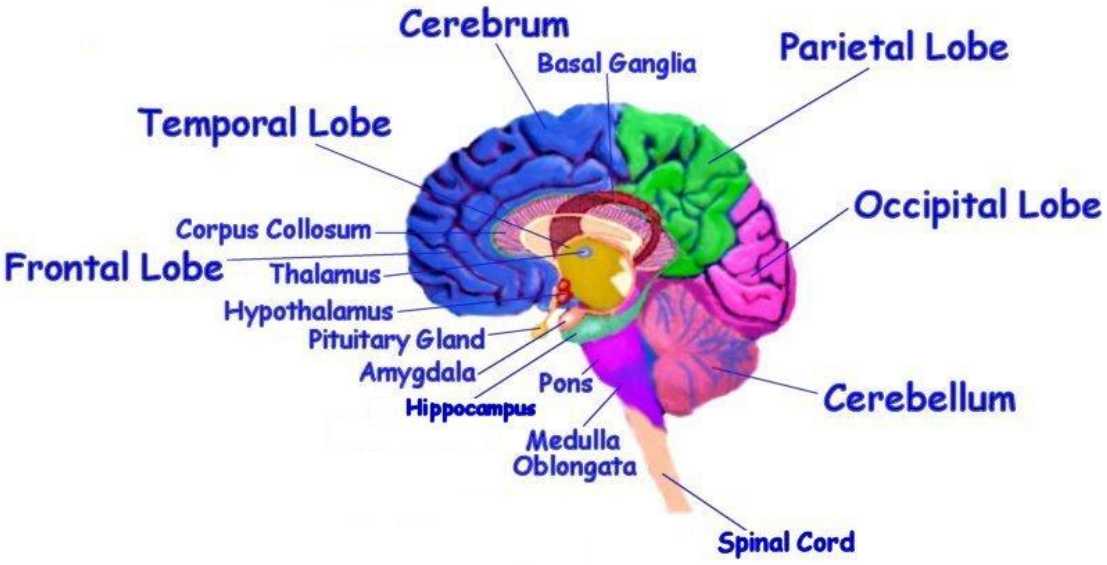
a good technical comment This is a good conceptual comment in relationship with this piece why do think that is or why do you not think that is the case at the time they are doing VTS I am tallying the participation I also have a set of symbols where I can somehow that they have shown evidence that they are clearly understanding conceptual elements of that 906 or that the comment was used in extended vocabulary. So I have a way of tallying that while they are talking but it becomes more evidence when you use the more written format which is something that I have added.

No doubt that it is student centered. It is a little more demanding in the focus that you have to put in the class a little more demanding into the skills that you need to have as a teacher in the class for the teacher to create student centered the engagement and participation you get from the students if worth the effort on your part they take more ownership absolutely they become more engaged the projects that they are working on are very personal.

I would say that student centered is heavily into it is like 70 percent of what I do there is probably a 20 percent of demonstration and 10 percent is teacher centered and that has conceptual reasoning on my part and it is very intentional that choice but yes that is heavily into the children centered and the demonstration.

Appendix G

Parts of the Brain



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