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# The Art of Science: An Integrative Curriculum

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ABSTRACT

THE ART OF SCIENCE:

AN INTEGRATIVE CURRICULUM

By

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This project shows the development of an integrated, interdisciplinary curriculum which combines the visual arts with the physical, life and health sciences at the sixth grade level. The integrated curriculum sample identifies and aligns with the Essential Academic Learning Requirements of Washington state. In addition, the sample lessons maintain the integrity of both art and science, the two subjects being integrated, demonstrating how integration can take place while allowing both subjects to maintain their value as individual disciplines. The review of literature gives background on issues revolving around integration in general, as well as integration involving the arts.

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# CHAPTER ONE: INTRODUCTION

## Need for the Project

In schools across the nation, there is a renewed and growing interest in integrated curriculum as districts search for ways to successfully educate and train students for the twenty-first century (Shoemaker, 1991, p. 793). Educators are "concerned about the fragmentation of the current curriculum and the compartmentalization of knowledge with its accompanying specialization and frequent irrelevance to real-world problems" (Shoemaker, 1989, p. 1). In addition, many teachers feel that there is already too much to teach and not enough hours or days to adequately address all the issues. There is also the issue of how student learning occurs and what method is the best to accurately assess student understanding and comprehension (Groth, 1997). Shoemaker (1989) believes that "Many see integrative approaches as effective ways of addressing issues related to the overcrowding and fragmentation of current educational curricula. Integrative programs have the potential for providing a more effective approach to instruction" (p. 17).

There is a need for a change. Educators need to help students connect their learning and give them an opportunity to demonstrate their learning through various modes. "Proponents of curriculum integration maintain that this concept can curb fragmentation in school organization and invigorate the curriculum with greater relevance" (Arnold & Schell, 1999, p. 88). In addition, integration proponents contend that "integration may help solve the problem of a never ending growth of information by teaching students to solve problems through the acquisition of information from a variety of sources" (Arnold & Schell, 1999, p. 88). It is time for effective schools to

design and implement integrated curriculum and use an integrative instruction method.

## Purpose of the Project

The purpose of this project was to develop an interdisciplinary curriculum to combine the visual arts with the physical, life and health sciences. The project includes a sample curriculum that accomplishes this integration, aligns with Essential Academic Learning Requirements (EALRs) (Washington State Commission on Student Learning, 1998) and has possible assessment options. Specific lessons integrating art and science are designed, collected and put together in a ready-to-use format so that teachers at the middle school level can implement them into their existing science curriculum. The integrity of both art and science remain intact and are not lost or compromised simply for the sake of integration.

## Definition of Terms

In their study on perceptions of curriculum integration, Arnold and Schell (1999) stated that "educational professionals have different perceptions of what integrated curriculum actually is" (p. 89). Through the research, it was obvious that the various authors had differing interpretations of the meaning and implementation of integrative curriculum. Often the terms such as integration, interdisciplinary, thematic, and holistic were used interchangeably as if they generally had the same meaning, although there may be slight differences in the actual definition of the word. Even Shoemaker (1989) stated in her survey of definitions that the definition of integrated curriculum (as stated below) "equates integration with [the definition of] interdisciplinary [curriculum]" (p. 2).

Therefore, in the remaining sections of this project, the terms integrative and interdisciplinary interchangeably.

**Curriculum:**

A series of events intended to have educational consequences, often conceived as a set of plans or materials (Eisner, 1984, p. 259).

**Integrated Curriculum:**

A curriculum organization which cuts across subject-matter lines to focus upon comprehensive life problems or broad areas of study that bring together the various segments of the curriculum into meaningful association (Shoemaker, 1989, p. 2).

**Interdisciplinary Curriculum:**

a) Involving two or more academic, scientific, or artistic disciplines (Merriam Webster Dictionary, 1994, p. 391).

b) An approach that maintains traditional subject boundaries while aligning content and concepts from one discipline with those of another (Shoemaker, 1991, p. 793).

## Scope of the Project

This project focuses on integrating art into sixth grade science curricula. The sample curriculum includes specific lessons integrating basic art concepts with the general concepts covered in the physical, life and health science curriculum. These lessons are designed to be implemented into existing science curriculum at the sixth grade level. In addition, the project includes sample assessments that can be used with the lessons or changed to fit the specific needs of the teachers and students using the integrated curriculum. Although the included lessons and assessments were

targeted specifically at sixth grade, conceptually the lessons could be adapted and used at various grade levels within a given middle school setting. The EALRs have been identified within each of the integrated lessons, specifically showing the art, science, and health requirements being met through the use of each lesson.

There are five main sections in this project. Chapter one includes an introduction and statement of the problem. Chapter two includes review of the literature related to art and curriculum integration. Chapter three describes the methods and procedures used for creating this project. Chapter four consists of the sample integrated curriculum model. Chapter five concludes with a summary and recommendations.

# CHAPTER TWO: REVIEW OF LITERATURE

## Introduction

The following literature review is divided into six major sections: (a) historical perspectives, (b) rationale for art integration, (c) concerns with art integration, (d) integrative models and benefits, (e) the science and art connection, and (f) a summary.

After looking back on the historical development of integration, the review of literature examines previous studies that address the integration of art not only in science, but also in other core curriculums. Literature about various learning styles and instructional modes, as well as concerns with art integration are also included in the review. In addition, the relationship between the use of art integration and the assumed improvement in student learning is explored and evaluated. Overall, the literature review builds a strong case for integrating art into core curriculums and using art as a tool for enhancing student learning.

## Historical Perspectives

Those who have been in the educational field for a significant length of time are often wary of new trends and changes regarding education. Many see the current trends or changes as simply old procedures with new names (Vars, 1991). Schools are often a reflection of society, and as demands and expectations of society change, so do the procedures and techniques used by teachers in the classroom (Shoemaker, 1989). It is true that the educational pendulum continues to swing from one side to the other over time in regards to various issues in education. Curriculum integration is an idea that has been around a long time and like other ideas, has witnessed a rise and fall in its importance and emphasis over the years (Vars, 1991).

For many years, people involved in curriculum development have disagreed about choosing the content of school curricula and how to best organize the curricula (Shoemaker, 1989). Some curricularists argue for subject-centered curricula while others defend the problem-centered curricula, leaving yet others standing up for student-centered curricular designs (Shoemaker, 1989). Although the debate around curricular designs continues to exist, some common ground appears to be emerging in the area of curriculum integration. According to Shoemaker (1989), there seems to be "an increasing interest in integrated curriculum at all levels of schooling" (p. 1). However, further study reveals that there are "wide differences in interpretation of what integration actually means and how it can be accomplished within the school setting" (p. 1). Therefore, it is critical to establish some working definitions.

Eisner (1984) defines curriculum as "a series of events intended to have educational consequences, often conceived as a set of plans or materials" (p. 259). Under this definition, "Subject matters must be converted into educational events in order to have the status of curriculum. Curriculum in its operational meaning is what transpires in classrooms as a series of events that are intentionally educational" (p. 259). Integrated curriculum is defined by Shoemaker (1989) as a "curriculum organization which cuts across subject-matter lines to focus upon comprehensive life problems or broad areas of study that bring together the various segments of the curriculum into meaningful association" (p. 2).

The ideas of integrated curriculum or interdisciplinary teaching are not new topics in the educational field, and are often used interchangeably when describing the process (Shoemaker, 1989). Historically, evidence of curriculum integration can

be traced back to the 1800s, as seen in the writings of Spencer (as cited in Vars, 1991). Educational interdisciplinary movements continued into the twentieth century. According to Faunce and Bossing (as quoted in Vars, 1991), there were "'a variety of state and national curriculum reform efforts [in] the 1930s and 1940s'" (p. 14). Integrative, student-centered teaching methods were the focus of these past reforms.

The launching of Sputnik I in 1957 was the beginning of more purposeful acts by the government to strengthen programs in American schools. Since then the government has passed acts in an effort to help America be more competitive in world markets. In the 1960s and 1970s, there were curriculum reforms that led to numerous new and expanded curriculum programs. Even today, there continue to be many additional programs and demands, such as career and multicultural education, and HIV awareness, placed on the current school curriculum. This has caused educators to feel like there is too much to teach and too little time to teach it (Shoemaker, 1989).

For many, it is the feeling of being overwhelmed with too much content matter to teach, as well as the frustration with the fragmentation of subject matter, that has led many teachers to seriously consider and begin implementing integration strategies (Shoemaker, 1989). At this point, since the possibilities for curriculum integration are endless, the focus of curriculum integration addressed in this literature review has been narrowed down to art integration. Like curriculum integration in general, the process of integrating art has seen its ups and downs over time (Freyberger, 1985).

In the 1940s and 1950s, schools that were considered progressive, had integrated programs. More programs were being developed to integrate art with all types of experiences. Art teachers were working hard to show the value of art and how

it could help promote educational objectives in other subject areas. Art was enhancing each discipline it was being integrated with. However, as time went on, art seemed to always be in the background, while the subject it was enhancing, earned all the recognition. Therefore, art educators began fighting for art to be taught as a separate discipline. They fought for programs to be reestablished so that art concepts could be addressed and students could learn the fundamentals of art (Freyberger, 1985). There was a strong belief in the 1940s and 1950s that art educators "had a corner on the market of creativity" and that creativity was the ultimate goal in art education (Eisner, 1997, p. 16).

Looking back, Eisner stated that "if anything has changed in the conceptualization of objectives for art education, it has been the move away from, not toward creativity as a unique goal for which the field has a particular responsibility" (1997, p. 16). Despite a great deal of solid, supportive research, the use of "integrative programs waxes and wanes from year to year, as education shifts primary attention from student concerns to subject matter acquisition to social problems and back again" (Vars, 1991, p. 15).

## Rationale for Art Integration

Today in America, there is a growing interest in "making the arts a critical element in interdisciplinary programs for K-12 schools" (Phillips & Bickley-Green, 1998, p. 46). The Center for Arts in the Basic Curriculum would like to see schools "viewed as integrated learning organizations in which the arts can illuminate other disciplines" (Phillips & Bickley-Green, 1998, p. 46 quoting Oddeifson, 1994). The Goals 2000 Arts Education Partnership challenges art educators to create curricula

that overlaps and includes other content areas, showing how art can improve learning in that discipline (Phillips & Bickley-Green, 1998).

Art is being integrated into core curricula more often for a variety of reasons. In some schools, art is being integrated simply because of school budget cuts, while in other schools, art integration is occurring more often because educators are realizing the value and benefits of art education (Shoemaker, 1991).

Many educators, art educators included, believe that integrating art with other disciplines and helping students to make connections with other classes is an excellent teaching strategy. Integration helps students take information they learn in one area and apply it in a new way, which is what true problem solving is all about. By integrating art across the curriculum, teachers help students to be problem solvers. Galwin (1997) states of students, "It is when they begin dealing with challenges using solutions drawn from across the spectrum of courses that they really begin to learn" (p. 12).

Integration helps students to express what they know in more than one way. In a traditional school setting, there are often limits on how students are allowed to demonstrate what they know or have learned. Groth (1997), a middle school teacher, said:

> Sometimes we don't give students an opportunity to share with us what they do know because we restrict the vehicle that they use to express it. In other words, if I accept knowledge-what they know about the Bill of Rights, for instance-only in a written form, I've ignored the fact that there may be children who know something but want to share that information in a picture or a

drama or another alternate mode. (p. 43)

Learning is strengthened when students have an opportunity to express information in a variety of forms and the arts are natural "integrative and interactive" forms of expression (Groth, 1997).

The idea of interdisciplinary teaching and curriculum integration is strongly supported through the work of Gardner and his study of the multiple intelligences. In an interview conducted by Checkley (1997), Gardner refers to intelligence as "the human ability to solve problems or to make something that is valued in one or more cultures" (p. 8). Gardner (1989) claims that there are at least seven ways that human beings know, or process information. These forms of processing, also known as intelligences, include linguistic, logical-mathematical, spatial, bodily kinesthetic, musical, interpersonal, and intrapersonal. When referring to the intelligences, Gardner went on to say that "we don't all have the same strength in each intelligence area, and we don't have the same amalgam of intelligences" (Checkley, 1997, p. 9). This belief leads to important implications in education.

By limiting the way information is taught, learned, and assessed, educators assume everyone is the same, and therefore, only cater to one or two areas of intelligence. This is obviously a disadvantage for those who are weaker in the intelligence area being used. Gardner (1995) believes that when educators give students opportunities to approach topics from various perspectives, then more students will learn and be able to successfully demonstrate their learning. This type of situation is described by Gardner (1995) as "multiple windows leading into the same room" (p. 208). Although he is convinced there is more than one way to learn a

concept, Gardner (1995) also realizes that "there is no point in assuming that every topic can be effectively approached in at least seven ways, and it is a waste of effort and time to attempt to do" (p. 206).

When asked about how educators can implement multiple intelligences, Gardner responds, "it's very important that a teacher take individual differences among kids very seriously...know each child" (Checkley, 1997, p. 11). Multiple intelligences need to be linked with a curriculum focused on understanding, where students connect ideas and apply their learning in new situations. When assessing students, teachers need to allow students to demonstrate their understanding by using a variety of methods, and not to rely on just one measurement tool. Interdisciplinary teaching, curriculum integration, and multiple intelligences can be woven together to create more effective student learning (Checkley, 1997).

Because of a renewed interest in integrative curriculum, some universities have begun to offer and even require graduate and undergraduate education students to take courses on interdisciplinary teaching, in order to better prepare them to design and implement integrated curriculum. In some states, certain additional funding is even contingent upon schools having interdisciplinary instruction (Thompson, 1995).

## Concerns with Art Integration

However, despite the support for art integration, there are art educators who are wary and continue to argue about "the merits of such integration" (Hurley & Eisan, 1997, p. 1). Some art educators today raise the same concern of art educators in the past when it comes to the idea of art integration. Eisner (1987) states "The visual arts often suffer when they are taught exclusively in an integrated form...their distinctive

contributions neglected or overlooked" (p. 21). With the integration movement, art educators do not want art instruction to lose its integrity or identity as a separate discipline. Thompson (1995) stated that:

> Quality of art must not be compromised in an effort to be a part of the interdisciplinary movement. Explaining the difference between activities that use art materials and quality art instruction is the responsibility of the art educator who works in an interdisciplinary setting. Often, educators from other fields assume any lesson that uses art media is an art lesson. 'Activities that use art materials,' [can] teach valuable lessons in an effective manner. I ask only that such projects be taught in addition to, not instead of quality art instruction. (p. 39)

As an art educator herself, Thompson (1995) had to deal with the challenge of keeping the integrity of art while working within the interdisciplinary setting. Therefore, she developed a criteria for herself and others to use when designing interdisciplinary art lessons. A summary of Thompson's (1995) criteria includes, allowing students to express their own individuality, ensuring that art skills and aesthetic development are emphasized, including art history and art criticism information, and making sure that interdisciplinary art instruction is not the only art instruction that students receive.

Although the debate surrounding art integration continues, there are natural strengths and benefits in using an interdisciplinary approach. When steps are taken to ensure the quality of art within another discipline, the results can be astounding (Freyberger, 1985).

## Integration Models and Benefits

There are various integrative models successfully operating at the middle school level. Shoemaker (1989) suggests that the most common model is the interdisciplinary approach, where concepts from two separate subjects align with each other while still maintaining clear boundaries between the two subjects. Bondi (as cited by Shoemaker, 1989) goes on to describe his interdisciplinary model. The model suggests that integration or interdisciplinary models can take any one or more of the following directions:

> (1) identifying a theme and its related concepts from each discipline and teaching them at the same time, (2) having each discipline teach a topic at one time, (3) two or more disciplines sharing an activity or project, (4) each discipline emphasizing certain skills common to itself and others, and (5) some concepts common to two or more disciplines receiving simultaneous treatment. (p. 5)

"Bondi maintains that a middle school curriculum composed of interdisciplinary topics centered around themes and emphasizing projects and problem-solving characterizes a successful, desirable program" (Shoemaker, 1989, p. 6).

Educators often speak of the advantages of curriculum integration. Ruth Freyberger (1985) stated that "Integration provides more meaningful experiences than can be achieved through a separate study of narrowly defined subjects" (p. 8). More specifically, Lowenfeld (as quoted in Freyberger, 1985), stated that "'in art education, integration takes place when the single components that lead to a creative experience

become an inseparable whole, one in which no single experience remains an isolated factor'" (p. 8).

Learning can be enhanced when teachers of different disciplines work together. For example, educators in the East Carolina Math/Art Project are doing a study "to determine the effect of interdisciplinary art and math lessons on learning in both content areas" (Phillips & Bickley-Green, 1998, p. 48). The study included students ranging in grades three through seven. Ten math concepts were targeted. Then each lesson was taught as "a hands-on manipulative art experience based on a specific math concept, allowing the students to visualize the application of that concept" (Phillips & Bickley-Green, 1998, p. 48). Currently, only the impact in math has been measured, but overall results show higher math scores for students participating in the integrated program compared to those not in the program.

Another study done by Willett and Parks (1992), showed a rise in test scores for fifth grade students participating in a program integrating art and reading as well as art and mathematics. Students were given pretests and posttests to determine their achievement level in targeted areas. Some students received instruction from an art teacher while other students received instruction from their regular classroom teachers. In most targeted areas, the students in the treatment group, receiving instruction from the art teacher, made more significant gains in their posttest scores than those students in the comparison group. "Based on the results of this study, the strategy of using art as a vehicle for teaching selected concepts appears to be an appropriate one to use to enhance learning" (Willett & Parks, 1992, p. 13).

Furthermore, a survey of seventh and eighth grade students was done at Campus Middle School in Englewood, Colorado to find out from students what their most memorable school work was. Among other things, students cited "activities in which they were directly involved in learning" (Wasserstein, 1995, p. 41). The research showed that "students crave hands-on work across content areas, and, even better, they love to pursue their own areas of interest" (Wasserstein, 1995, p. 42). Integrating art into curriculum, and allowing student choice would therefore provide a chance for students to feel empowered, leading them to feel a sense of satisfaction.

Another example of an integrated program in action is a program called SUAVE (Socios Unidos para Artes Via Educacio'n). SUAVE is "an arts-integrated approach to teaching and learning in multicultural and multilingual settings" (Goldberg & Bossenmeyer, 1998, p. 56). The program helps teachers discover ways to integrate the arts into math, science, language arts and social studies, while also showing teachers how to teach art as a discipline in itself. Schools using the SUAVE program are reporting numerous benefits believed to be a result of implementing art across the curriculum. Reported benefits include: Increase in students' self esteem, confidence, motivation to learn, rise in standardized test scores, and teachers feel they have a chance to assess student achievement from different perspectives, they have more evidence of individual student learning (Goldberg & Bossenmeyer, 1998).

In 1985, Greenberg and Patterson (1998) developed a program and curriculum that integrated art and chemistry. The curriculum, *Art in Chemistry* is "a one-year high school course in applied chemistry and introductory art....students complete projects in the art class and carry out experiments in the chemistry class" (Greenberg, 1988, p.

148). From the beginning, the class was an instant success. The teachers found that "Student interest and alertness increased...[in addition] the learning of chemistry came painlessly when associated with artwork, and art assignments had a new and deeper meaning" (Greenberg & Patterson, 1998, p. xi). Because of the abstract nature of chemistry, part of the program's success came from the fact that art was used as a tool to express the abstraction, leading to greater student insight and understanding of abstract theories. Another must for the success of the course is the "joint planning and interaction between the art and chemistry teachers who team teach the course" (Greenberg, 1988, p. 149). Unterberg (1979) points out that "art maintains its own standards of importance and development. Yet, it gains a more varied understanding and appreciation when students are awakened to art in the sciences...and other subject areas" (p. 34).

Arts in education can help to meet the needs of all types of students. Students learning English as second language (ESL) can benefit greatly when allowed to use art as a communication tool; as a way to demonstrate understanding of a concept without allowing language to be a barrier. The arts can help students go beyond their areas of struggle or deficiency, breaking through the language or cultural barriers. For instance, students like Juan, "who spoke very little English, were still able to communicate what they were learning through the arts" (Schubert & Melnick, 1997, p. 6). For Juan, "drawing, modeling, painting and constructing were his passions and his way of showing just what he was learning" (Schubert & Melnick, 1997, p. 6). However, using art as an expression of comprehension should not be limited to just ESL students. All students need a chance to demonstrate understanding in a variety

of ways, as discussed by Gardner, and the arts provide a natural opportunity for that to occur (Goldberg & Bossenmeyer, 1998).

Many resources exist that provide suggestions for integrating art across disciplines. Ideas to combine art with social studies, language arts, math and science are offered by Maxfield (1995a; 1995b). Olshansky (1995) has a program that integrates "visual imagery at every stage of the writing process" (p. 44). In addition, Weigand (1985) shares lessons that "enable the student to focus on a natural phenomenon, to understand it in scientific terms, and to develop a drawing or painting based upon it" (p. 21).

## The Art and Science Connection

In narrowing down the possibilities for integration, Weigand (1985) turns the focus to art and science saying, that there is "rich potential for integration with art and natural science" (p. 18). Because of the difference in artistic and scientific methods of inquiry, most people think of science and art as being complete opposites. However, Weigand (1985) says there is an interdependence between the two subjects and their differences "enhance and balance each other" (p. 18). With the "yin and yang" principles of science and art in mind, Weigand (1985) went on, in 1983, to conduct a study to "determine whether integrated study would improve attitudes toward science and art of a group of secondary school students" (Weigand, 1985, p. 21). Results showed that:

> students who had studied art integrated with science had better attitudes toward both art and science and had better retention of science and art knowledge than did students who had not undergone integrated study.

> This demonstrated mutual enhancement of art and science, when presented in a thoughtfully integrated context, furnishes the art educator with an additional argument in art advocacy and strengthens art's role in the general secondary school curriculum. (Weigand, 1985, p. 21)

Wiggin (1969) also acknowledged the differences, as well as the similarities between art and science. Wiggin said that science is a "hard core" subject, concerned mostly with the content, dealing with the "what" and "why" questions, while art is a "soft core" subject, concerned with the process, and dealing with the "how" questions. Despite the differences, Wiggin (1969) goes on to point out what he believes to be the similarities, stating that:

> In both science and art, the individual searches and sensitizes himself through study and investigation of the phenomena observed, and absorbs himself in the essence of the thing. In both, he records these observations, draws tentative conclusions about the nature of the observations, tests these conclusions, and applies them to the better solution of the current problems or future imagined needs. (p. 19)

Therefore, based on the similarities, Wiggin also supports the integration of science and art, and would like to see an interdisciplinary approach used to teach the two subjects in schools K-12.

Scientific illustration is an example of an interdisciplinary method that can be used to successfully connect art and science. Illustration can increase a student's perceptual development as the eye is better trained to see, and refine a student's drawing skills as the hand is given practice to clarify and capture accuracy in the

natural world around them (Gainer & Child, 1986). In Massachusetts, the Children's School of Science started a summer course that lasted for six weeks and focused on biological illustration. The course provided art instruction as well as an overview of the five kingdoms of life. "Local specimens of plant and animal life [were] used to train students in very careful observation and techniques of recording their observations on paper" (Gainer & Child, 1986, p. 20). In addition to developing "visual acuity and drawing proficiency" (Gainer & Child, 1986, p. 22), the summer program also helps to spark and retain the interest of the students in the areas of art and science.

## Summary

Historically, even though there is some disagreement among educators, curriculum integration and specifically art integration has been and continues to be an effective teaching method in many educational situations. The biggest concern that art educators sometimes have with art integration is that art not lose its integrity while enhancing other disciplines. Common rationale for using integrative methods is often based on the assumption that integration will help to solve the fragmentation and over crowding of required school curriculum, helping students to make more "real life" connections in their learning. Many educators believe that integration provides a more natural way of learning and addresses the learning styles as mentioned by Gardner (1995). In addition, various studies and personal experiences lead educators to claim benefits attained from integrative instruction such as, increased student test scores, improvement in student self esteem and confidence, and longer retention of factual information. Finally, those involved in the art and science disciplines recognize the

natural connections between art and science and are working towards enhancing both subjects through integrative, interdisciplinary teaching strategies.

"There is nothing quite like the excitement of understanding one subject by encountering it through another. The world suddenly becomes smaller as common ground is discovered and differences turn into similarities" (Barnes, 1993, p. 63). Kathleen Thompson (1995) quotes her principal as saying, "Art is an ideal discipline for interdisciplinary instruction....It seems to me that art can connect to almost every topic or subject" (p. 45). There is tremendous support for interdisciplinary teaching, especially when it involves using the arts.

In the following section, the background and development, as well as procedures, of this integrative curriculum project will be explored.

# CHAPTER THREE: PROJECT DEVELOPMENT AND PROCEDURES

## Introduction

The purpose of this project was to develop an interdisciplinary curriculum sample to integrate the visual arts with the physical, life and health sciences. Chapter three provides detailed information on the development and design of the project as well as the procedures used to complete the research curriculum project.

## Background & Development

When I began my masters degree several years ago, I knew I wanted to do a project. I wanted the project to be one that would be practical, something I could use in the classroom to enhance my teaching and instruction and improve student learning and interests. The indecisiveness came in trying to identify a specific direction to take the project and how to narrow the scope of the project so it would be a manageable size.

In this beginning stage of my masters study, I talked with many other teachers in my building, and friends and family members, all who are teachers with their masters degree. I wanted to find out what others had done for their degree and consider any helpful advice or guidance they may have to offer me. To be honest, I was quite confused and overwhelmed with the possibilities.

I went back and forth, mulling possible topic ideas around in my head. The ideas ranged from examining effective modes of communication, to exploring brain based research and the various ways of learning, to focusing on integrated curriculum in general, and on into looking at how art could enhance learning across the curriculum. Finally I had to step back from the situation and just ask myself what topics

really interested me, and what would be the most helpful and practical for me at this point in my teaching career. It was then that I decided I wanted to create a sample curriculum that integrated art into science.

Art had been a long time interest of mine and I had always hoped that someday I would have an opportunity to teach art. I wanted my masters study to help me prepare for that future opportunity. I chose to focus on integrating art into science because science was the subject I had taught for several years and was the current subject I was teaching at the time. I felt good about the direction my masters project was heading, and believed that I would gain practical insights and have a curriculum I could implement in my own sixth grade science classroom when I had finished. Little did I know that my "future opportunity" would come so soon and that the following year I would be teaching art!

As I completed this project during my first year of teaching art, I realized that I had gained some new insight into the development and implementation of integrated curriculum. Because of my experience teaching both science and art as separate subjects, I felt that I could better understand the benefits and drawbacks of integration and the attitudes or viewpoints that teachers may have. I also believe that my experience teaching both subjects has helped me be able to better design specific lessons integrating art into science.

## Procedures

To begin the research process, I turned to the electronic databases that I could access on-line through the Central Washington University library. With help from library employees, I began an Educational Resources Information Center (ERIC)

search. Literature was gathered from the electronic database using key words and phrases such as: interdisciplinary approaches, integrated curriculum, integrative models, art education, multiple intelligences, science and art curriculum, science, visual arts, across the curriculum and education. Through the ERIC search, I gained access to a large selection of useful journal articles and research studies. In an effort to continue expanding my research materials, I also used the bibliographies listed in the journal articles previously obtained through the ERIC search, as well as the bibliography lists located in other masters projects related to the study of art, science or integrated curriculum.

Throughout this whole process, I also found the Educational Technology Center located in Black Hall on the campus of Central Washington University provided useful information. For me, it was helpful to spend time looking through other master's projects in order to get an idea of how to organize and layout the sections of my own project, and also to see what types of ideas and information were included in the various chapters.

When designing and compiling the sample curriculum in chapter four, a variety of resources was examined. The EALRs for art, science, and health were obtained from the educational service district 105 and carefully studied. Using the Science Interactions textbook produced by McGraw Hill (1995), the major units of physical, life and health sciences were then identified while targeting the sixth grade level of development. Next, specific lessons that integrated art into science and aligned with the essential learnings were designed. Finally, assessment rubrics were created and included to be used with various sections of the sample curriculum.

It was challenging to design and identify lessons that treated both art and science with respect, allowing each subject to retain its integrity, yet provided students with relevant and meaningful integrated experiences. Once again, I used an ERIC search with descriptor words such as art and science lessons, curriculum, lesson plans, to begin identifying existing art and science integrative lesson plans. Although many lessons were found, only a few were kept for consideration because they did not meet the necessary criteria. I also gained lesson ideas by talking with other classroom teachers and by looking through books that specifically focused on classroom activities that integrated art and science. In addition, I created some of the lessons myself, based on my own experience and familiarity with the science and art concepts. Many of the sample lessons have been changed or adapted from their original state to best suit the needs of this integrated project.

There were some general and specific criteria that the sample lessons needed to meet in order to be considered and chosen for the project. First of all, the lesson had to be appropriate and meaningful for students at a sixth grade level. In order to determine the lesson's appropriateness for the sixth grade, I drew on my own teaching experience, refered to research written about middle school aged students such as that of Vars (1991) and Wasserstein (1995), as well as conversed with other sixth grade teachers. Second, the lesson needed to address concepts covered within the physical, life, and health science units. The Science Interactions text book by McGraw Hill (1995) was used to identify the concepts addressed. Third, in order to reinforce the EALRs, multiple art, science, or health essential learnings had to be adequately addressed through the use of the lesson. Fourth, the lesson needed to be

uncompromising in regards to maintaining the quality and integrity of art as it was being used in the interdisciplinary setting. Thompsons's (1995) guidelines for teaching art in an interdisciplinary environment were consulted when making this determination.

When evaluating a lesson to determine whether it maintains the quality and integrity of art, I used the criteria established by Thompson (1995) who is an art educator working in the integrative, interdisciplinary setting. Her criteria is listed below:

1. Art products must reflect the individuality of the creator.
2. Art skills must be taught as part of the lesson.
3. During the lesson, instruction should be directed at the aesthetic development of the art work.
4. Art educators should design and/or direct those art components used as part of interdisciplinary teaching.
5. Information drawn from art history, art criticism techniques, and aesthetic issues should be incorporated into interdisciplinary teaching units.
6. Interdisciplinary instruction should supplement, not supplant specific art instruction for all pupils.

The production of this project synthesizes a great deal of information from a wide range of sources and compiles it into the major categories of chapter two, the literature review and chapter four, the sample integrated curriculum. The following integrative curriculum sample was designed and compiled so that the lessons could be integrated with an existing sixth grade science curriculum.

CHAPTER FOUR: THE PROJECT

# THE ART OF SCIENCE:

# AN INTEGRATIVE CURRICULUM

EXAMPLE INTEGRATED

ART INTO SCIENCE

CURRICULUM

Table of Contents

# CHAPTER FOUR: THE PROJECT

## Introduction

Chapter four includes the following: (a) a copy of the EALRs for art, science, and health and fitness; (b) curricular or lesson plan descriptions; and (c) possible student assessment options.

## Curricular Description

The following curricular descriptions address three broad science units taught at a sixth grade level. The units include life science, health science, and physical science. Numerous integrated art and science curricular descriptions, or lesson plans, were written for each of the life, health and physical science categories. The lessons align with the essential learnings, state the purpose of the lesson, give descriptions of the scientific and artistic processes used, and include assessment options.

Within each life, physical and health science category, a variety of art media including drawing, collage, sculpture, clay, painting, printmaking, and marbling was used. In addition, crucial elements of art such as line, dot, shape, direction, tone, color, texture, scale, dimension, and movement or composition were taught and demonstrated throughout the integrated lessons.

In order to ensure the quality of both science and art as separate and unique disciplines, careful consideration was taken when designing and choosing the lessons. A copy of the EALRs for art, science and health were reviewed and lessons were chosen which aligned with the state guidelines. In addition, published criteria were reviewed for integrating art into other disciplines.

Washington State Essential Academic Learning Requirements (EALRs)

(Washington State Commission on Student Learning, 1998)

**Art:**

1. The student acquires the knowledge and skills necessary to create, to perform, and to respond effectively to the arts.

   To meet this standard, the student will:

   1.1 Understand and apply arts concepts and vocabulary to communicate ideas.

   1.2 Organize arts elements into artistic compositions. For example: color, shape, rhythm, balance...

   1.3 Use and develop arts skills and techniques to solve problems and express ideas.

   1.4 Use skills of craftsmanship to produce quality work.

   1.5 Create, present, and evaluate artworks using visual arts, music, drama, and dance.

2. The student applies the creative process with arts knowledge and skills to reason and solve problems.

   To meet this standard, the student will:

   2.1 Use the senses to gather and process information. For example: sight, sound, touch...

   2.2 Generate and analyze solutions to problems using creativity and imagination.

   2.3 Use arts criteria to consider the effectiveness of personal work and that of others.

3. The student uses at least one of the art forms (visual arts, music, drama, and/or dance) to communicate ideas and feelings.

   To meet this standard, the student will:

   3.1 Use image, sound, action, and movement throughout the arts to express individual ideas for a specific purpose.

   3.2. Reflect and respond critically to the use of the arts in all forms of communication.

   3.3 Use combinations of art forms to communicate in multimedia formats. For example: video, or the internet.

4. The student understands how the arts connect to other subject areas, life, and work.

   To meet this standard, the student will:

   4.1 Use arts skills and knowledge in other subject areas.

   4.2 Apply ideas and skills developed in the arts to daily life.

   4.3 Demonstrate an ability to use artistic knowledge in personal and community decision making.

   4.4 Recognize the influence of the arts in shaping and reflecting cultures and history.

   4.5 Incorporate arts knowledge and skills into the workplace.

**Science:**

1. The student understands and uses scientific concepts and principles.

   To meet this standard, the student will:

   1.1 Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

1.2 Recognize the components, structure, and organization of systems and the interconnections within and among them.

1.3 Understand how interactions within and among systems cause changes in matter and energy.

2. The student knows and applies the skills and processes of science and technology.

To meet this standard, the student will:

2.1 Develop abilities necessary to do scientific inquiry.

2.2 Apply science knowledge and skills to solve problems or meet challenges.

3. The student understands the nature and contexts of science and technology.

To meet this standard, the student will:

3.1 Understand the nature of scientific inquiry

3.2 Know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.

**Health & Fitness:**

1. The student acquires the knowledge and skills necessary to maintain and active life; movement, physical fitness, and nutrition.

To meet this standard, the student will:

1.1 Develop fundamental physical skills and progress to complex movement activities as physically able.

1.2 Incorporate rules and safety procedures into physical activities.

1.3 Understand the concepts of physical fitness and develop and monitor progress on personal fitness goals.

1.4 Understand nutrition and food nutrients and how they affect physical performance and the body.

2. The student acquires the knowledge and skills necessary to maintain a healthy life; recognize patterns of growth and development, reduce health risks, and live safely.

To meet this standard, the student will:

2.1 recognize patterns of growth and development

*develop an understanding of how various parts, organs, and systems of t the human body work together and how heredity and environmental f actors may influence growth and developments; understand changes that accompany maturity and the transition from adolescence to adulthood.*

2.2 Understand the transmission and control of communicable and non-communicable diseases.

2.3 Acquire skills to live safely

*Anticipate risky situations and demonstrate skills to promote safety and to assist in emergency situations at school, at home, and in the community; evaluate strategies and develop a plan to manage stress constructively and lawfully; identify situations and decisions related to drug use.*

3. The student analyzes and evaluates the impact of real-life influences on health.

To meet this standard, the student will:

3.1 Understand how environmental factors affect one's health

3.2 Gather and analyze health information

*Make informed choices about health services and products.*

3.3 Use social skills to protect health and safety in a variety of situations.

3.4 Understand how emotions influence decision-making.

*Develop strategies to avoid or minimize risky situations.*

4. The student effectively analyzes health and safety information to develop health and fitness plans based on life goals.

To meet this standard, the student will:

4.1 Assess needs and resources

4.2 Develop a health and fitness plan and a monitoring system that is consistent with life goals for work and leisure.

# Life Science: Invent An Animal

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3.

Science: 1.1, 1.2, 1.3, 2.1, 2.2,

## Purpose

In this lesson, students will study animals and their habitats, then invent a new animal and create the animal using wire. Students will apply scientific information they have learned in new and original ways. When designing the animal, students need to consider and document what types of adaptations the animal will have, what its habitat will be like, and what animals will be the predators and prey. In addition, the students need to give the animal a scientific and a common name. The final product will be a model of the animal, and written documentation of the characteristics of the new animal.

## Scientific Procedure

This lesson goes along with the study of animals and their habitats. Students need to have a basic understanding of the following scientific concepts: animal adaptations, reproduction methods, prey and predators, habitats, scientific names and any other related information. Therefore, it is necessary that these concepts have been studied previously before using this integrated lesson.

After studying animals and their habitats, students need to apply the scientific information they have learned in a new and original way. Students will invent a new animal. To begin with, a sketch of the animal will be created with all the animal's

adaptations being noted on the drawing. Students need to decide what type of habitat the animal will live in, and what adaptations the animal needs in order to survive. In addition, the students need to identify this new species with a common as well as a scientific name. Other considerations for this animal may include reproduction methods, its prey and predators, and its niche in the community and habitat.

After completing the artwork, a written report needs to accompany the animal model to document the details and characteristics of this new species. The report should include all the animal's adaptations, its habitat, its prey and predators, and the animal's scientific and common name. Other information about the animal can be included such as the animal's skeletal structure, how it reproduces, and anything else related to the existence of this new species.

**Artistic Procedure**

Using wire, the basic shape of the animal needs to be created. A head can be created by making a figure 8 out of the wire. Arms, legs or shoulders can be made by using just one piece of wire (see drawings). Once the basic form of the animal is developed, wads of newsprint will be added and attached with masking tape, to create a 3-D form that becomes mummy-like. Then students will put on two layers of plaster craft gauze. The gauze should be cut into 1" x 2" pieces, dipped into water, then draped over the wire form.

Tissue paper and acrylic paints can be used to create skin, hair, scales, or whatever other types of body covering, textures and adaptations the animal needs to have. The tissue paper can be carefully shaped to achieve the desired effect. The gauze surface can be painted, then layered with tissue paper, then painted again if

necessary. Tiny details can be created by using clay, wire, paper, buttons, string, or any objects.

Throughout the artistic process, emphasize the shape or form that is emerging through the creation of the new animal. Also encourage the students to be creative with texture as they think of ideas and look for materials to use to represent the body covering of their invented species.

# Life Science: Drawing

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 4.5.

Science: 1.1, 1.2, 1.3, 2.1, 3.2

## Purpose

Drawing is a way of recording what is seen. In science, it is an excellent way to document and describe the natural world. The following drawing ideas will emphasize some of the basic visual elements used in art such as dot, line, shape, value, texture, space, color, and overall composition. Students will be introduced to these visual elements through mini-lessons prior to the scientific drawings they will make. Drawing topics are taken from each of the five kingdoms of life; monerans, protists, fungi, plants and animals.

## Scientific Procedure

Scientific or technical drawings are important in many areas of the scientific world. Along with words, drawings help to express understanding and comprehension of specific ideas and concepts. The following drawing ideas can be used during the study of the five kingdoms of life. The teacher can tie the drawing activity into their current topic of study in whatever way she feels is best suitable.

## Artistic Procedure

Prior to the main scientific drawing students will make, the teacher needs to introduce some of the basic visual elements and techniques used in drawing. These elements can be taught and practiced during short 10 to 15 minute mini-lessons at the

beginning of multiple class periods. Giving students drawing tools and techniques in advance will help them to have more confidence to create larger, more complex types of drawings. Let the students know that the short practice exercises are leading up to detailed, scientific drawings.

Once students have some background knowledge in drawing, various drawing assignments can be given. The following are a list of possibilities.

***Flowers***

When drawing flowers, always start the drawing with the center of the flower, and work out from there. Students can bring in real flowers to draw, or pictures from magazines. Composition can include a single flower or multiple flowers. Use of color and shading techniques will help to give the flower a more 3 D appearance. Colored pencils are a good medium to use. Parts of the flower can be labeled. On a separate sheet of paper, students can then define or describe the purpose of each flower part.

A direct drawing technique can also be used to help encourage the reluctant drawers, and give them some confidence. For instance, give the students a copy of the day lily flower (located at the end of this lesson description), along with drawing paper. On the overhead, the teacher can model how to draw the flower by breaking it down into parts, drawing the pistil and stamens first, as the students do the same thing on their own paper. Next draw the petals, overlapping and twisting the petals, as students again follow the same steps. Although students are patterning after the teacher's model, each drawing is unique because of the personal detail each student adds or includes in their own drawing.

***Insects***

The same process described in the flower activity can be used in the insect drawing. Students can draw from actual insects or pictures of insects. It is usually best to begin the drawing with the head, then body and work out from there. Continue to emphasize drawing techniques while at the same time, focusing on parts of the insect and the vocabulary associated with it. Parts of the insect can be labeled as well.

Students can move away from the technical drawing of labeling and describing the parts and functions by creating artwork that incorporates the insects with their natural surrounding. Drawings that include details of the insect(s) in the natural habitat can show students understanding of scientific concepts as well as lead to an intriguing overall artistic composition.

***Molds & Mushrooms***

After growing molds in the classroom, and bringing in a variety of mushrooms, there should be a great deal of phenomena for students to observe and record through drawing.

Careful observation under microscopes or hand lenses will need to be done. As students observe, they need to accurately record what they see. This is an excellent time to practice creating textures and working on shading techniques. Many molds and mushrooms have a variety of colors which will allow students an opportunity to mix and blend colors to attain the desired effect.

***Microscopic Organisms***

Like the descriptions above, drawing microscopic organisms can be approached in much the same way. While observing through a microscope, students

need to carefully record the details of the bacteria, or protist, or any other microscopic organism seen. The name of the organism, if known, the cell parts as well as the magnification of the microscope all need to be recorded in the drawing.

# A. DIAGRAM DRAWING: PARTS OF A FLOWER

Please note: Content on this page was redacted due to copyright concerns.

# Life Science: Seed Cast Tiles

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3.

Science: 1.1, 1.2, 1.3, 2.1

## Purpose

During the study of plants, students will collect a variety of plants and categorize them into groups such as seed plants, either gymnosperms or angiosperms or seedless plants. Using leaves, roots, seed pods, and so on, students will layout and design a creative display of the plant parts on a slab of low-fire potter's clay. The plant parts will be pressed into the clay to form imprints.

## Scientific Procedure

Towards the beginning of the plant unit, students need to start collecting a variety of plant parts such as stems, leaves, roots, and seed pods. Throughout the collection process, students need to record the name of the plant and classify it as being either a seed bearing or seedless plant. If it is a seed bearing plant, the classification needs to be taken one level further, and the student needs to note whether the plant is a gymnosperm or an angiosperm.

## Artistic Procedure

Once plants are collected, and naming and classifying is complete, students will begin to layout the plant parts, creating a pleasing design. Design elements such as balance, movement, and size variation and placement should be considered in the layout process. After completing the layout, students will gently press the plant parts

into the low-fire potter's clay, then remove them, leaving an imprint. It is all right if plant parts stick to the clay since they will burn away during the firing process.

To prepare the clay, pound and knead it for about ten minutes to remove the air bubbles. Roll the clay out to about one fourth of an inch thick, then cut the clay into reasonable size slabs for students to use. The size of the slab may depend on the size of the plant parts the student intends to use for imprinting.

If the student wants to hang the tile when it is completed, a hole can be created in the top of the slab while the clay is still soft. In addition, if the student wishes to include the plant names or other words on the tile, the writing needs to be done before firing the tile.

After firing the tiles, color across the surface of the tile with chalk or white crayon. This will help to make the plant imprints stand out and be more visible. To finish the tile, brush the entire surface with acrylic matte medium to keep the chalk from smearing. Tiles could also be glazed with ceramic glaze or painted with acrylic paint.

**Alternative**

Instead of using clay that has to be fired, use modeling clay and make a plaster tile. Roll the modeling clay out into a slab then press the plant parts into the clay and remove after making an imprint. Then add one inch clay walls to the slab by creating clay coils or "snakes" and flattening them. After the walls are attached, mix and pour plaster of paris into the clay form and allow to dry. Remove the clay form then paint the plaster seed/plant tiles.

# Health Science: Game Boards

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4.

Health: 1.4, 2.1, 2.2, 3.1, 3.2, 3.3

## Purpose

This lesson should be used to culminate the unit of study on human body systems. The project will provide an opportunity for students to create a game board that focuses on a single body system and incorporates artistic patterns in the design. The game board will teach information about a human body system, while the design of the game board must utilize patterns found in various cultures or famous works of art.

## Scientific Procedure

After a brief overview of each of the main body systems, students will work in groups to research in depth one specific body system. Findings will be expressed through the creation of a game. Students will work in groups of two to three people to create their board game. Once a body system has been chosen or assigned, the group needs to do research to gather necessary information about the body system, in order to accurately represent the body system in the game. Research can be gathered from library resources, through interviewing health care workers, utilizing community resources, and so on.

The type of game needs to be decided upon by the group. A new game can be created or students can pattern after existing games, just adapting the game to fit their needs. Game rules need to be clearly written.

**Artistic Procedure**

This lesson provides an opportunity for students to study some art history and learn about art in other cultures. It also gives students a chance to use the elements and principles of art such as line, shape, texture, color, balance, and rhythm.

When deciding on the design and layout of the game board, students also need to consider how the use of pattern will be used. Research may need to be done in this area too. Students can study or copy patterns found in famous art work, or Egyptian, Greek, and Mayan carvings and sculptures for example. Have plenty of books and pictures available for students to see examples. The possibilities are endless.

Once the research is done, and patterns, designs, colors and so on have been decided, the game board needs to be well designed and crafted. Students need to consider how and where to incorporate the patterns into their body system games. Some possibilities may include on the pathway, around the boarder, on the game cards or spinner, or even on the game pieces themselves.

Students can choose the type of artistic media they want to use to create the game board, such as crayons, markers, oil pastels, paints, or any other practical materials. The game board may even have some two or three dimensional qualities.

When game boards are complete, allow students to present their games to the class, and explain the types of patterns used and the reasons behind the decisions they made when designing the game. Then of course...play the games!

***Extensions***

Make the game more challenging, design a game board on the computer, make an advertisement for your game, design a game focusing on a topic of your choice.

## Health Science: Stages of Life Collage or Mural

### EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4, 4.5.

Health: 2.1, 2.3, 3.2, 4.1

### Purpose

While studying the stages of life; from conception, to infancy, into childhood, through adolescence, and on up through the adulthood years, students have different perceptions of what it is like to experience each stage. This assignment will allow students a chance to express their views on the stages of life through the use of collage. Elements of composition and design will be emphasized when putting the collage together.

### Scientific Procedure

In conjunction with a study on the stages of life, this lesson can be used as an introduction or as a culmination project. There will be more accuracy in the final project if used as a culmination, but it is also a good way to start the topic of study in order to identify where the most misconceptions are.

Using magazine pictures, photographs, pamphlets, drawings, newspapers, various paper or material swatches and any other suitable objects, students need to gather enough materials to create an 11" x 14" collage. The collage needs to represent their viewpoint on each of the major stages of the human life. The stages being addressed are: conception, infancy, childhood, adolescence, and on up through the adulthood years. Students need to express what life at these stages is

like, including both positive and negative ideas they may have. The collage may also include items or stereotypes that are associated with the stages.

**Artistic Procedure**

The major artistic focus of this project is composition. Composition deals with the arrangement of the visual elements to create a harmonious whole. It requires the student to take time to plan an arrangement that is intriguing, or pleasing to the viewer's mind or eye. Students need to consider how each of their pictures or objects relate to one another and how they look together as a whole. They need to think about which way to face the pictures (for example, usually faces or eyes should not face the edge of the paper, but rather face toward the center of the artwork). It is also usually a good idea to use a variety of different sizes and shapes of pictures and objects. Examples of various artwork or pictures can be shown and composition can be discussed before students begin their own work.

Once the collage is finished, a paragraph or two can be written to go along with the collage to enhance the overall impact it may have on its audience.

**Extension**

Along with this study of the stages of life, an intergenerational mural can be created. This project encourages community involvement, by having the students work along with residents of a local nursing home. The mural theme can focus on "our town", and include the people, landmarks, and other public buildings and locations known to those who live in the town. Strips of plywood can be painted for the basic background of the mural. Using tag board, papier mache material, and any other suitable material, students and nursing home residents can work together or

individually to create replicas of buildings, people, animals, plants and anything else that the mural will include. Permanent markers and paint should be used on the pieces so that the mural can be sprayed with a polymer finish after all the separate parts have been arranged and glued onto the board. In the end, a great piece of artwork will have been created and bonds between the generations will have been created.

# Health Science: Create-A-Kid

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3.

Health: 2.1, 2.2, 3.1, 3.2,

## Purpose

The following activity combines heredity with portrait painting. Students will participate in a simulation that will illustrate how certain traits are passed along from one generation to another. After determining and recording their own genetic traits, students will determine the traits of their make believe kid through chance, by flipping a coin. Once the traits of the kid are determined, students will sketch the kid, then use paints to create a portrait of their kid as the kid may look as a teenager.

## Scientific Procedure

Students need to have some basic knowledge of heredity and how traits are passed along. This lesson should be used towards the end of a study of heredity. Students should be familiar with terms like dominate and recessive genes, chromosomes, genotype and phenotype, purebred and hybrid.

Students need to pair up and one person takes on the role of the mom, while the other person plays the role of the dad. Students will use the characteristics chart (see the sheets shown after this lesson description) to determine and record their own traits (genotypes and phenotypes). Then by flipping a coin, the traits of the kid will be determined and recorded. After going through the entire characteristics chart, students will be ready to create a drawing of their kid.

**Artistic Procedure**

Before beginning the sketch of the kid, it will be helpful to teach or review some techniques for drawing human faces. The human head is quite proportionate and there are some practical tips that make drawing the facial features much easier (see the handout on the next page). Practice drawing face shapes, and proportions of facial features. There are also many drawing books that give helpful information and tips for drawing portraits. Once students have a little practice drawing the human face, they will be ready to do a portrait of their "created kid".

Using the recorded phenotype (all the genetic traits previously determined) of the kid, students will make a sketch of the kid as he or she may look as a teenager. After completing a sketch, paint or colored pencils can be used to make a complete colored portrait of the created kid.

# DESIGN-A-KID

## DIRECTIONS

Adapted from activities originally developed by Sharon Winters, Lake Washington School District, and Kathy Paris, Bethel High School. The original author remains unknown.

### BACKGROUND

Gregor Mendel determined that hereditary traits are passed on in the form of genes from generation to generation with predictable outcomes. In this simulation, you will illustrate the genetic concepts of dominance, segregation, genotype, phenotype, polygenic inheritance, incomplete dominance, and multiples alleles as you and your partner "produce" a baby.

What will your baby look like if you and your partner (to represent your spouse) both have dominant genes for a particular trait? What if you both have recessive? Or one of each?

### OBJECTIVES

After completing this investigation, you will be able to: see the relationship between an individual's genotype and phenotype; describe the role of probability in genetics; and differentiate between the terms *dominance, incomplete dominance, polygenic, and multiple alleles.*

### MATERIALS

Colored pencils, plain paper, two coins, data sheet.

### PROCEDURES

Your first task will be to determine and record both your and your partner's genotypes for each of the traits listed. Match your facial features with the pictures to determine what your genotype for that particular feature will be. If you fall into the recessive category, your genotype is automatically *purebred recessive* for that trait (xx). If you fall into the dominant category, you could be either *hybrid (Xx)* or *purebred dominant* (XX) for that trait. To decide which, flip your coin. If it turns up heads, you are purebred dominant for that trait. If it turns up tails, you are hybrid for that trait:

HEADS=PUREBRED DOMINANT (XX)
TAILS=HYBRID (Xx)

Once you have determined your own genotypes, it's time to flip the coin again to see which gene from each parent gets passed on to the kid. *If you are purebred for a trait, you will automatically pass on that gene, and there will be no need to flip the coin.* If you flip heads, you pass along the dominant gene. If you flip tails, you pass on the recessive gene:

HEADS=DOMINANT
TAILS=RECESSIVE

Record the genes passed on from each parent in the data table provided, and describe the phenotype of your resulting kid. Once you have finished determining all of the genotypes and phenotypes, draw and color the features of your kid as s/he would look as a teenager.

# CHARACTERISTICS CHART

## SEX

Since dad is the one who determines the sex of the child, he is the only one who flips for this trait (mom automatically passes on an X chromosome). If dad flips heads, he will pass on an X chromosome, and the kid will be a girl. If he flips tails, he will pass on a Y chromosome, and the kid will be a boy. Give your kid a name!

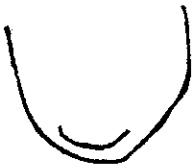
## FACE SHAPE

ROUND (RR or Rr)

SQUARE (rr)

## CHIN PROMINENCE

VERY PROMINENT (VV or Vv)

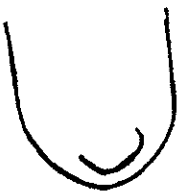


LESS PROMINENT (vv)

## CHIN SHAPE

ROUND (RR or Rr)

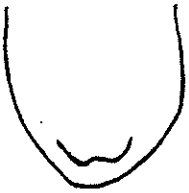
SQUARE (rr)



## CHIN CLEFT

CLEFT ABSENT (CC or Cc)

CLEFT PRESENT (cc)

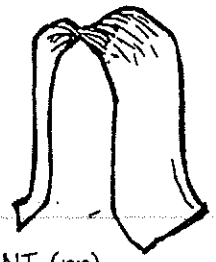


## HAIR SHAPE

CURLY (CC)

WAVY (Cc)

STRAIGHT (cc)



## WIDOW'S PEAK

PEAK PRESENT (PP or Pp)

PEAK ABSENT (pp)

## HAIR COLOR

Hair color actually involves more than one gene. One gene produces a brown pigment (none to much), and one produces a red pigment (none to much). The resulting hair colors are combinations of the two, although most likely there are even more genes that code for color. Match your and your partner's hair colors to the colors listed below. Flip once for each pair of genes involved:

| GENOTYPE | PHENOTYPE |
|---|---|
| AABB | Jet Black |
| AABb | Lighter Black |
| AAbb | Red |
| AaBB | Auburn |
| Aabb | Blonde |

| GENOTYPE | PHENOTYPE |
|---|---|
| AaBb | Light Brown |
| aaBb | Medium Brown |
| aaBB | Dark Brown |
| aabb | Pale Blonde |

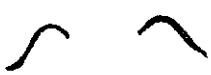
## EYEBROWS

BUSHY (BB or Bb)

FINE (bb)

## BROW LENGTH

NOT CONNECTED (NN or Nn)



CONNECTED (nn)

## BROW COLOR

DARKER THAN HAIR (DD) | SAME AS HAIR (Dd) | LIGHTER THAN HAIR (dd)

## EYE DISTANCE

CLOSE TOGETHER (CC) | AVERAGE DISTANCE (Cc) | FAR APART (cc)

## EYE SIZE

LARGE (LL) | MEDIUM (Ll) | SMALL (ll)

## EYE SHAPE

ALMOND (AA or Aa) | ROUND (aa)

## EYE SLANT

HORIZONTAL (HH or Hh) | UPWARD SLANT (hh)

## EYE COLOR

Like hair color, eye color is determined by a variety of genes. For our simulation, we'll pretend there are only two. One codes for depositing different pigments in front of the iris, and one for depositing pigments behind. Match your and your partner's eye colors to the colors listed below. Flip once for each pair of genes involved:

| GENOTYPE | PHENOTYPE |
|---|---|
| AABB | Darkest Brown |
| AABb | Medium Brown |
| AaBb | Light Brown |
| AaBB | Hazel Brown |
| AAbb | Hazel Green |
| aaBB | Green |
| Aabb | Gray Blue |
| aaBb | Dark Blue |
| aabb | Light Blue |

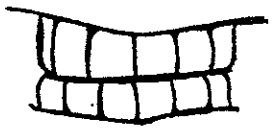
## EYELASHES

LONG (LL or Ll)

SHORT (ll)

## MOUTH

WIDE (WW)



AVERAGE (Ww)

SHORT (ww)

## LIPS

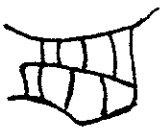
THICK (TT or Tt)

THIN (tt)

## DIMPLES

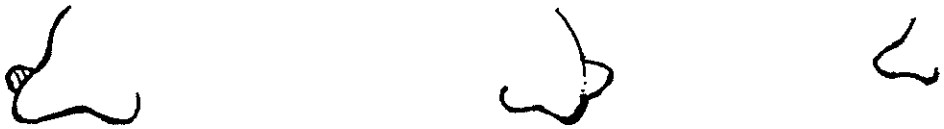
DIMPLES PRESENT (DD or Dd)

DIMPLES ABSENT (dd)



## NOSE

LARGE (LL) MEDIUM (Ll) SMALL (ll)



## EARLOBES

FREE (FF or Ff) ATTACHED (ff)

## EAR SIZE

EARS LARGE (EE) EARS MEDIUM (Ee) EARS SMALL (*ee*)

## BLOOD TYPE

For this trait, your results depend on what kinds of coins you and your partner use. Flip your coin twice. The first flip for the first blood gene, the second flip for the second blood gene:

PENNIES: Heads=*o* Tails=B
NICKELS: Heads=*O* Tails=A
DIMES OR QUARTERS: Heads=A Tails=B

TYPE A (AA or AO) TYPE B (BB or BO) TYPE AB (AB) TYPE O (OO)

# DESIGN-A-KID DATA SHEET

| CHARACTERISTIC FIRST KID | FATHER'S GENES | MOTHER'S GENES | KID'S GENES | KID'S PHENOTYPE |
|---|---|---|---|---|
| SEX | | | | |
| FACE SHAPE | | | | |
| CHIN PROMINENCE | | | | |
| CHIN SHAPE | | | | |
| CHIN CLEFT | | | | |
| HAIR SHAPE | | | | |
| WIDOW'S PEAK | | | | |
| HAIR COLOR | | | | |
| EYEBROWS | | | | |
| BROW LENGTH | | | | |
| BROW COLOR | | | | |
| EYE DISTANCE | | | | |
| EYE SIZE | | | | |
| EYE SHAPE | | | | |
| EYE SLANT | | | | |
| EYE COLOR | | | | |
| EYELASHES | | | | |
| MOUTH | | | | |
| LIPS | | | | |
| DIMPLES | | | | |
| NOSE | | | | |
| EARLOBES | | | | |
| EAR SIZE | | | | |
| BLOOD TYPE | | | | |
| CHARACTERISTIC SECOND KID | FATHER'S GENES | MOTHER'S GENES | KID'S GENES | KID'S PHENOTYPE |
| SEX | | | | |
| FACE SHAPE | | | | |
| CHIN PROMINENCE | | | | |
| CHIN SHAPE | | | | |
| CHIN CLEFT | | | | |
| HAIR SHAPE | | | | |
| WIDOW'S PEAK | | | | |
| HAIR COLOR | | | | |
| EYEBROWS | | | | |
| BROW LENGTH | | | | |
| BROW COLOR | | | | |
| EYE DISTANCE | | | | |
| EYE SIZE | | | | |
| EYE SHAPE | | | | |
| EYE SLANT | | | | |
| EYE COLOR | | | | |
| EYELASHES | | | | |
| MOUTH | | | | |
| LIPS | | | | |
| DIMPLES | | | | |
| NOSE | | | | |
| EARLOBES | | | | |
| EAR SIZE | | | | |
| BLOOD TYPE | | | | |

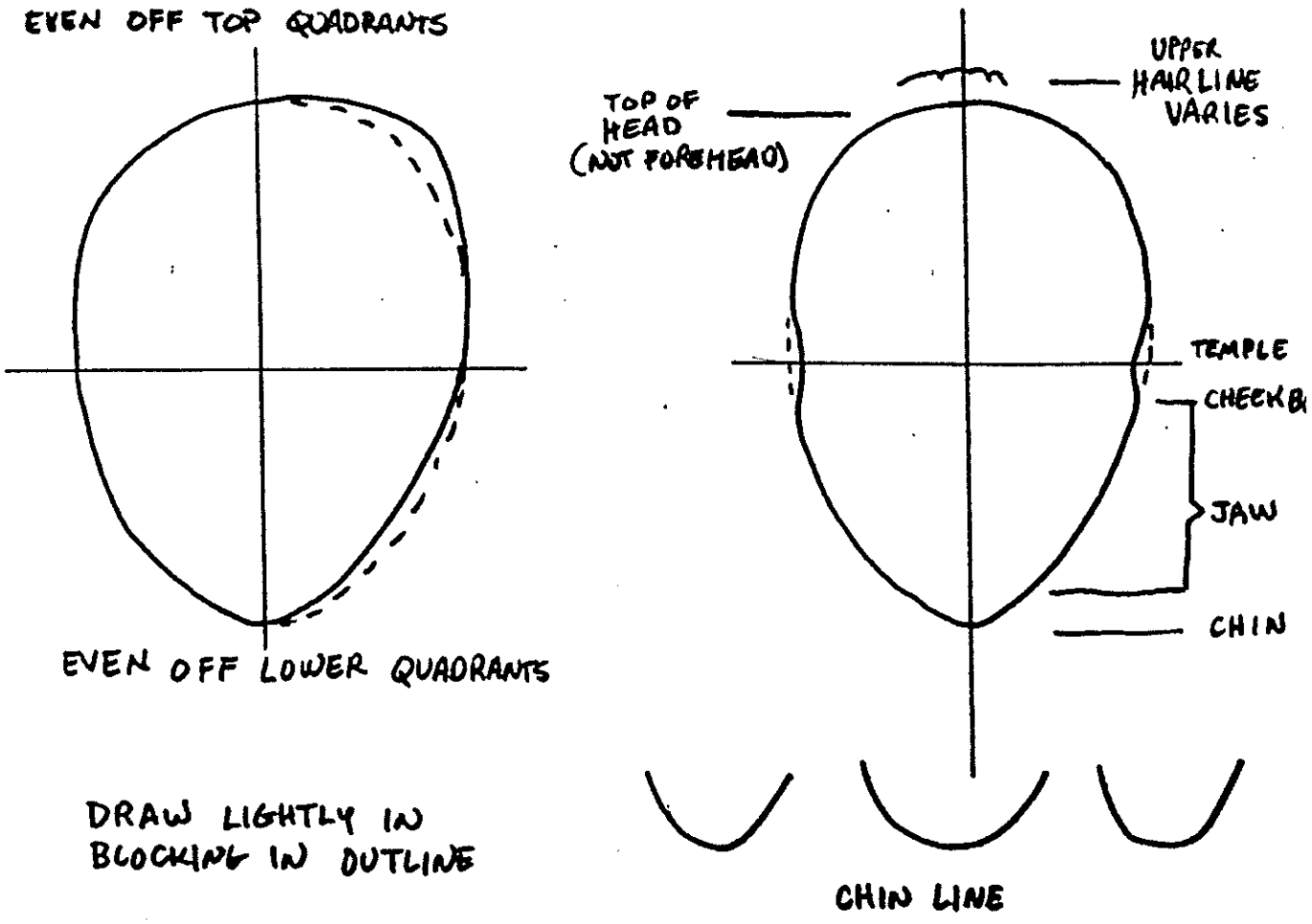
# THE THEORETIC PORTRAIT

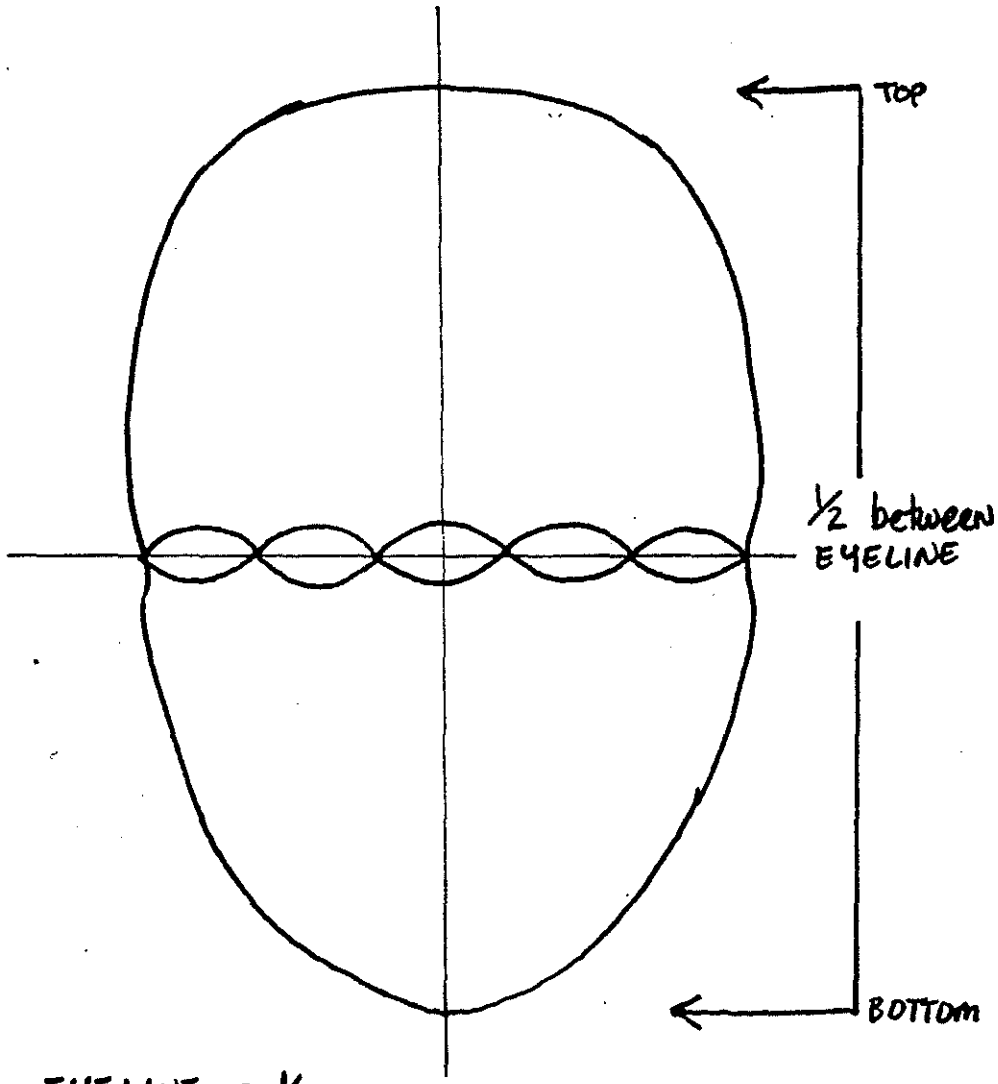
## THE HEAD

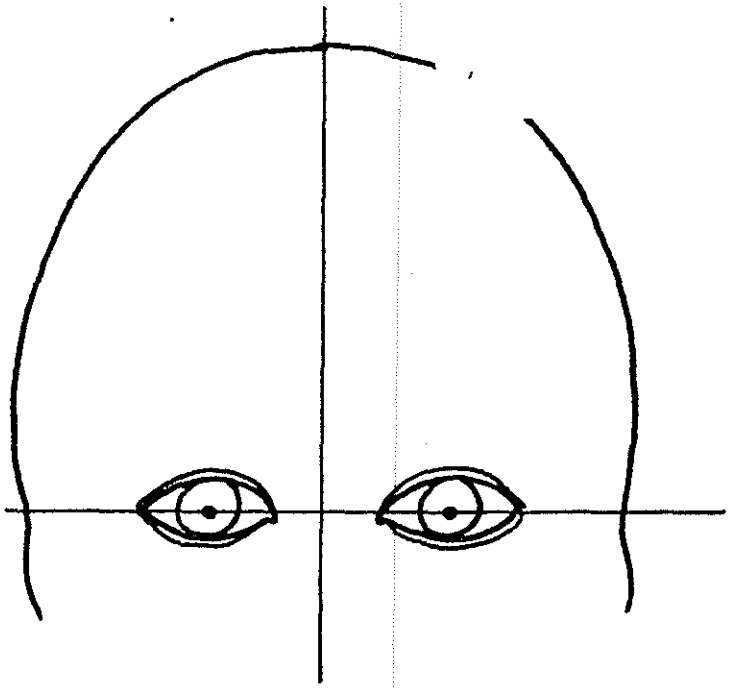
The head is basically an inverted egg shape - where the largest portion is the top of the head and the pointed end as the chin.

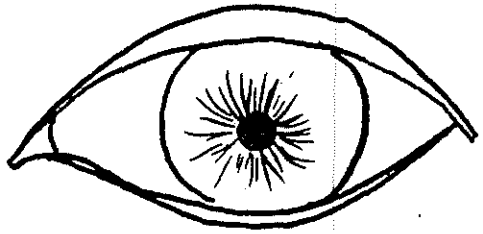
Lines that will vary noticeably on the outline of the face are:

A. The chin - can be rounded, squared, pointed
B. The jaw line - sunken, rounded, straight
C. The temple - indented slightly to compliment the eye sockets.





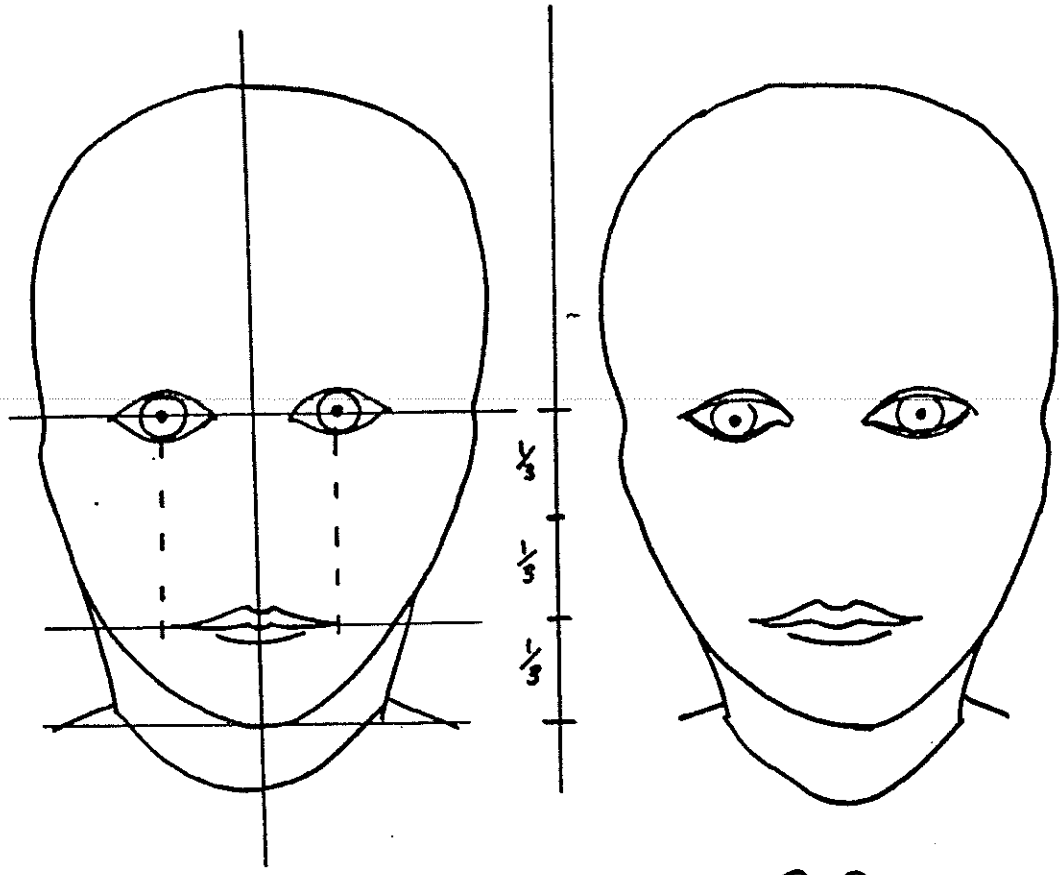





IRIS ■■■ FILLS ½ AREA OF EYE.

- EYELINE IS ½ DISTANCE BETWEEN TOP AND BOTTOM OF THE HEAD

- FIVE EYES, EQUAL SIZE FIT ACROSS EYELINE
- EYES ARE ALMOND SHAPE

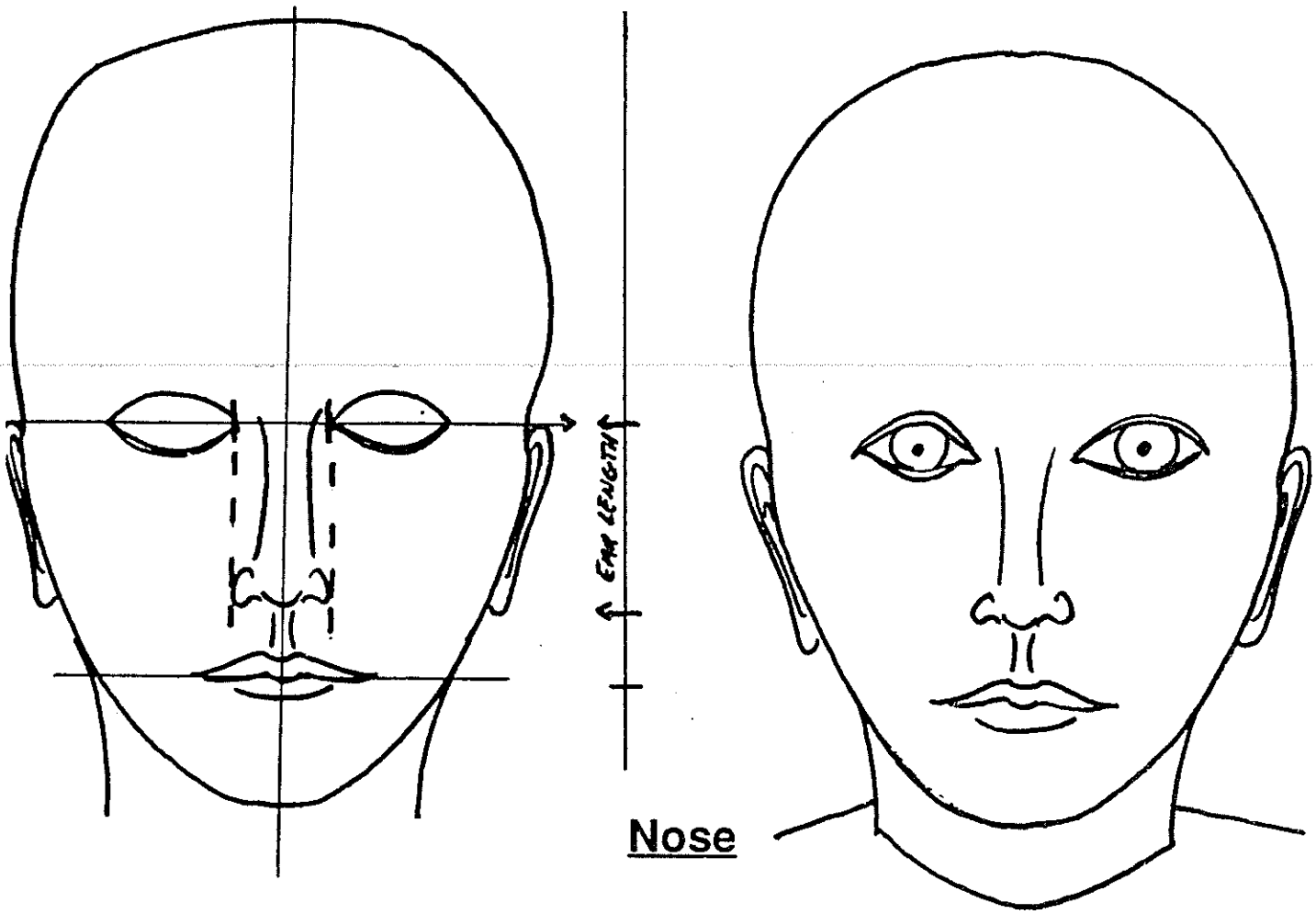



## Mouth

A. The horizontal mouth line is located 1/3 the distance from the chin to the eye line.
B. The length of the mouth is appropriately the size of the distance between the pupils of the eyes.
C. Upper lip is more defined than the lower lip.
   Cusp indents approximately 1/8" and 1/4" upwards from the mouth line.
   Upper lip lines flair from cusp to end of mouth- slight upward flair.
D. Lower lip defined approximately 1/4" below mouth line.

## Neck

A. Starts even with mouth line - under ear.
B. line of neck flairs inward.
C. Stop lines equal length to chin.
D. Connect side lines with an arched line ending approximately




## Nose

A. Length of the nose extends from the eye line to 2/3 or 3/4 of the way down the mouth line.

B. The width of the nose is approximately one eye width or the distance between the inside ends of the eyes.

C. Add nostrils as series of crescent shapes, bridge of nose, nostrum between lip cusp and bottom of nose.

## Ears

A. Length usually starts at the eye line and stops at the end of the nose or no more than 1/2 the distance between the end of the nose and the upper lip.

# Health Science: Hot Issues

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4, 4.5.

Health: 1.4, 2.1, 2.2, 2.3, 3.1,3.2, 3.3, 3.4

## Purpose

Students will demonstrate various levels of thinking and understanding about current health issues and topics by displaying researched facts and creating a powerful visual image using mixed media.

## Scientific Procedures

This activity crosses many different individual units of study often covered in a health curriculum and could therefore be used as the teacher sees fit. When introducing the activity, there should be a discussion on situations or problems that can impact a person's health. Topics such as drug and alcohol abuse, child abuse, teen pregnancy, sexually transmitted diseases, eating disorders, or starvation plus others may be mentioned. Direct students to consider not just physical threats, but also the social, emotional and mental threats related to the different issues. Continue the discussion by asking how a person's health can be protected.

After the discussion and brainstorming of ideas, each student needs to choose an issue or topic about which they feel strongly, or have a real desire to learn more. Time then needs to be given for students to complete an in depth research, gathering as many facts and information as they can about their chosen topic.

When the research is complete, students need to write up a paper, sharing the information and facts they have learned in a written form. The written paper should begin with four facts, each fact beginning with the following statement: What you don't know is.... For example, a project focusing on anorexia began, "What you don't know is: There are at least 8 million or more victims of anorexia in this country alone" (Vieth, 2000, p. 20). Another example is "What you don't know is: One out of every six people in the world is dying slowly from starvation right now" (Vieth, 2000, p. 21). The paper also needs to include at least a paragraph stating why the student chose their topic, including the personal connection there may be in connection with the topic.

**Artistic Procedures**

To begin the artistic side of this project, share and discuss the works of famous artists whose work draws attention to social and political issues of the day. For instance, Kathe Kollwitz depicts mothers who are protecting their children from war. Or Piccaso's *Guernica,* showing protection from destruction felt through Fascism. Use any other examples of artistic work that express a passion for a particular issue or concern. Focus the discussion on how knowledge of an issue and having the facts can lead to greater awareness and consequently have an impact on more people.

The students can be given a great deal of freedom in planning their visual image of the chosen topic or issue. The image needs to be a powerful display of the issue or topic, clearly showing the viewer what the problem or concern is, communicating to the viewer what it is that needs to be protected. Students can use any art media or mixed media they choose, and can create a flat piece or a two or

three dimentional piece. Encourage students to create strong images, using no words, or using as few words as possible only when absolutely necessary.

When putting the artwork on display, also post the written factual statements and the personal connection each student has with the topic. This is a great way to raise student awareness throughout the school regarding issues that are relevant to the lives of all people. Refer to the article written by Ken Vieth (2000) for specific examples of student work.

# Physical Science: Colors

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.3, 1.4, 2.1, 2.2, 2.3, 4.1, 4.2, 4.3, 4.4, 4.5.

Science: 1.1, 1.2, 2.1, 2.2, 3.1, 3.2

## Purpose

The lesson teaches the concept of color, which both scientists and artists use. Students will learn some background information dealing with color as it mixes with pigments and color as it mixes with light. Then students will have an opportunity to create models and demonstrate an understanding of the concepts of color; concepts essential for both scientists and artists.

## Background Information

Students should be familiar with what white light is, how it travels, the terms reflection, refraction, and absorption. In addition, some of the information students need to learn include the primary colors for mixing pigment; magenta, yellow and cyan, as well as the primary colors for mixing light; red, blue, and green. Every color in the world can be created by mixing the primary colors together.

Every time you combine two colored pigments together, you get a little closer to black, because more of the colors get absorbed. The opposite is true when combining light. Every time you mix colored lights together, you get a little closer to white, since more colors are being reflected. The colors we see around us are the results of the pigment in the object and the color of the light that hits the object.

One reason we see color around us is a result of all the colors being absorbed except the one being reflected. For instance, we see a red rose because the rose absorbs all the colors of the spectrum except red, which is reflected back to our eyes. But colors are reflected and absorbed in different amounts, which is why there are so many varieties and shades of colors. We see white because all colors are reflected, but we see black because all colors are absorbed.

Hue, value, and intensity (or chroma), are the three properties of color. The following definitions and lists of artists were stated by Greenberg and Patterson (1998, p. 28).

**Hue:**

Refers to the quality of a color that we indicate by its name, such as red, orange, green, and blue. To change the hue of a color, it must be mixed with another hue (e.g., to change yellow to yellow-green some blue must be added).

**Value:**

Refers to the lightness or darkness of a color. This lightness or darkness depends on the amount of white or black added to the hue. To make a hue lighter, white is added. To make a hue darker, black is added. Adding black or white to a hue does not change the hue to a different hue, this only lightens or darkens it.

**Intensity (or Chroma):**

Intensity, or chroma, refers to the color strength or saturation of a hue. A pure color as it appears on the color wheel is the strongest or most intense. The intensity of a color can be lessened by the addition of a gray to the color, which

dulls the color. A second way to lessen the intensity of a color is to add the hue that appears directly opposite on the color wheel. This opposite color is referred to as its complement.

While discussing these properties with students, it may be helpful to examine the works of some modern artists and look at how they each used color. The list below shows the artists' name and the properties of color used in their work:

| | |
|---|---|
| Piet Mondrian | Primary colors, full intensity, neutrals |
| Stuart Davis | Primary and secondary colors, full intensity |
| Georges Braque | Primary and secondary colors, full intensity |
| Pablo Picasso | Low intensity, neutrals |
| Juan Gris | Low intensity, neutrals |
| Hans Hoffman | Full intensity |
| Roy Lichtenstein | Full intensity, neutrals |
| Auguste Renoir | Light and dark values |
| Vincent van Gogh | Full intensity |

To attain further background information on color, refer to the sixth grade Science Interactions curriculum series produced by Glencoe, Science Crafts for Kids, by Gwen Diehn and Terry Krautwurst, as well as the book Art in Chemistry; Chemistry in Art, by Greenberg and Patterson .

## Scientific and Artistic Procedures

### *Mixing Light*

Cover three separate flashlights using red, blue, and green cellophane. The cellophane needs to be several layers thick. In a darkened room, students will shine all three flashlights onto white paper to make three circles that overlap.

Students should notice that green and blue combine to make cyan, green and red make yellow and blue and red make magenta, and white is a combination of all three lights. Students should continue to experiment with the flashlights and cellophane, taking turns moving one or two flashlights closer and further away from the paper, and documenting the results. Encourage students to create as many colors and they can.

### *Mixing Pigments*

To demonstrate understanding of mixing color pigments, students will create their own color spinners. Corrugated cardboard can be used to draw and cut out circles with approximately 4 inch diameters. Razor knives or scissors can be used to cut out the circles.

Using two primary colors, students will paint pie-shaped wedges, alternating every other color until the circle is complete. Use a large nail to poke a hole in the center. Insert sharpened pencil or dowel through the center and spin the pencil or dowel on a hard surface. Observe and explain what happens and why.

Students should make multiple spinners, experimenting with other color combinations, including spinners with all three primary colors as well as spinners that

include white or black. Encourage them to experiment, and have students document their findings and discoveries so they can be shared with the class at a later time.

***Warm and Cool Colors***

The following information and activity was taken from Chemistry in Art; Art in Chemistry (Greenberg & Patterson, 1998, p. 26-27).

A basic color wheel includes twelve colors. Half of the colors are considered to be cool colors and the other half are considered to be warm colors. The cool colors, which tend to be restful, cold, subdued, and quiet, include: Yellow-green, green, blue-green, blue, blue-violet, and violet. The warm colors which seem to created feelings of joy and happiness include: Red-violet, red, red-orange, orange, yellow-orange, and yellow.

1. Have students choose a descriptive theme (e.g., descriptive words such as excitement, peaceful, busy, and sad are possible themes). Each student should choose a different theme.
2. Have students find a variety of pictures in magazines to express their theme, cut them out, and arrange them into a composition, making effective use of warm and cool colors and the elements of design to best describe the theme.

***Extension***

After demonstrating how color mixes with pigments and lights, students will do some research and writing about how color is used within the artistic and scientific worlds as well as in our everyday life and the common household objects we interact with regular basis (such as the television, or camera, or computer).

# Physical Science: Marbling

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3.

Science: 1.1, 1.2, 2.1, 2.2, 3.1, 3.2

## Purpose

Using the scientific method, students will design and perform experiments to determine what type of conditions and materials lead to the best marbled paper results. During the experimental process, students will apply knowledge of color combinations, and design principles to create the final marbled product.

## Scientific and Artistic Procedures

Have a variety of materials available for students to test during their experiment, including: paper of different weights and textures, various kinds of paints such as acrylic, enamel, oil, and tempera. In addition, make available substances that will thicken the water such as starch or gelatin.

To gain more understanding of the marbling process, the following resources can be used: Science Crafts for Kids, Gee, Wiz!.

Working in groups of two or three, students need to write up their first experiment, including: stating the problem or question, their hypothesis, background or research they have on the topic, the steps or procedure of their experiment, then after the experiment is done, write up the conclusions and findings. After the first attempt to marble paper has been made, then as most scientists do, they need to change

variables and repeat the experiment several more times until they consistently achieve acceptable results.

Students need to keep accurate records of their data collection throughout the entire process. They should be able to show each marbled paper attempt with documentation of the exact procedure and materials used to achieve that result. Observations of successful and unsuccessful attempts need to be recorded and explained to the best of the students' ability.

In the end, students will choose their best work to display, and do a complete write-up showing the scientific process they went through to achieve the final results. The other marbled paper samples can be used to cover books, or pencils or create various origami objects.

During the experimental process of discovering the best combination of products, emphasize the basic elements of art. Remind students to consider color combinations when choosing paint colors, and to think about the elements of design as they arrange and swirl the colors. Although marbling is often abstract, careful preplanning can lead to a certain amount of control over the design.

# Physical Science: Chromatography

## EALRs

This lesson addresses the following EALRs:

Art: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 4.5.

Science: 1.1, 1.2, 2.1, 2.2, 3.1, 3.2

## Purpose

During the study of matter and solutions, students will know the differences between and be able to give examples of solutes, solvents, saturated, unsaturated, mixtures, solutions, and solubility. Students will use their understanding of the above terms along with the principles of chromatography to paint plant, animal or nature scenes using markers, water, and alcohol.

## Scientific and Artistic Procedures

The science of chromatography involves testing liquid mixtures to determine what type of substances the liquid contains. The basic meaning of chromatography is color writing. When you use a ballpoint pen to write for instance, the liquid part dries, leaving only the color on the paper. Often inks and dyes contain a combination of coloring molecules which can be taken apart using water or alcohol. For more background information on chromatography, refer to the book Gee, Wiz! (listed in the bibliography).

To begin, students need to experiment with different marker colors and types to see how water and alcohol affect each pen. One way is to draw a line with the marker then using a paintbrush dipped in water, touch the brush to one end of the line. Using a second brush dipped in alcohol, touch the brush to the other end of the line.

Compare the results to determine which solvent starts to dissolve the line. This is how students can see the difference between water soluble and alcohol soluble. Watercolor paper is ideal for this project.

Students need to continue to experiment in order to discover how to create special effects with the inks, water and alcohol. Draw simple lines and shapes, then go back over the inks with the solvents. Other techniques may include drawing on wet paper, going back over and touching up lines that have already dried, adding solvent to create shadows, and so on. Encourage students to come up with their own special effect techniques. The following page, taken from the book Gee, Wiz! shows a sample of these techniques.

After sufficient practice time has been given and the scientific concepts such as mixtures, solutes, solvents, and solubility have been covered, students can do a final piece of artwork, using a variety of special effects. Artwork can be focused around animal, plant, or nature scenes, or opened up to anything the student chooses to draw/paint. Elements of design, color, movement, scale, and even texture should be emphasized in the students drawing/painting.

***Extension***

Chromatography is used in criminology, the study of crime. A combination of sciences such as biology, physics and chemistry are used in criminology. If ink is involved with a crime, chromatography can be used by the FBI to determine what type of pen the ink came from. This is possible because each ink breaks apart in a slightly different way so that the results can be studied and compared in much of the same

way that fingerprints are studied. (Again, refer to the book Gee, Wiz! for more information).

Students can do a simplified version of this procedure by gathering three or four different black ink pens, using filter paper, alcohol, and water. Students can have a friend write something on the filter paper using one of the four pens. Then students take all four pens and the sample writing and perform tests using the scientific method and the water and alcohol solvents. Students need to keep track of how each pen ink breaks apart, and compare it with how the ink used in the sample writing breaks apart. When the students have found a match, go back and confirm the results with the person who did the sample writing.

Please note: Content on this page was redacted due to copyright concerns.

## Assessment Procedures

When assessing student learning, it is important to use an assessment tool that evaluates the specific points that the teacher and/or students determine is the focus, or important concepts addressed by the assignment. The next several pages of this project contain sample assessment options that can be used along with the integrated art and science lesson plans included in this project.

The following assessment samples were designed as generic templates which can be used to assess the artistic, scientific, and writing processes as separate components. When assessing the student projects described in the previous lessons, a teacher could choose to use one, two, or all three of these sample assessments. They can be used individually, or in any combination with each other. In addition, the teacher may choose to change and adapt the sample assessments or completely develop her own assessment tool which she feels would better assess specific learning targets determined for her specific students. There should be complete freedom on the teacher's part to use all, only certain parts, or none of the following assessment samples.

# Assessment for the Artistic Process:

Student Name_____ Period_____ Date_____

Project Name or Title_____

For each major category, and the self reflection, rate the finished work from 5 to 1 **(5 being the highest, and 1 being the lowest)**. On the other smaller blank lines, **place a "+" or a "-"** to show the specific strengths and weaknesses of the work in each category.

1. **General Standards and Expectations** _____
   - Name on art _____
   - Supplies and equipment used carefully and properly _____
   - Demonstrated good use of class time _____
   - Turned in on time _____

2. **Skill and Craftsmanship** _____
   - Finished product shows student control over the art medium _____
   - The product looks the way it has been designed or planned to look _____
   - Three dimensional parts are sturdy and well attached _____
   - Demonstrates the use of a variety of textures _____

3. **Creativity and Effort** _____
   - Shows an effort to learn and improve _____
   - Work shows individuality, and uniqueness _____
   - Feelings, ideas or specific moods are expressed in work _____
   - Enough details are included to give the work a sense of completeness _____

4. **Elements and Principles of Art** _____
   - When asked, students can identify the elements and principles that make the artwork interesting and appealing. _____
   - They would include: line, shape, form, color, texture, point, balance, variety, repetition (rhythm), emphasis, movement, and unity. _____

**5. Other Assignment Specific Requirements or Expectations**

- _____
- _____
- _____

**6. Student Self Reflection** _____

As you evaluate your own artwork, write a paragraph that addresses the following topics. Tell about: the process you went through to complete the project, the easy or challenging parts of the process, the finished parts you like or wish you could change about your artwork, the unique or creative parts of your work, and comment on anything else related to this project or process.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

**Total Points** _____/_____

# Assessment for the Scientific Process:

Student Name_____ Period_____ Date_____

Project Name or Title_____

For each major category, and the self reflection, rate the finished work from 5 to 1 **(5 being the highest, and 1 being the lowest)**. On the other smaller blank lines, **place a "+" or a "-"** to show the specific strengths and weaknesses of the work in each category.

**1. General Expectations** _____

- Work includes name and title _____
- Work is neat and readable _____
- Uses acceptable grammar and mechanics _____

**2. Procedures** _____

- Provides a lab or activity description _____
- States the problem or question _____
- Includes a hypothesis _____
- Follows and completes all steps of investigation _____
- Uses materials and equipment properly _____

**3. Results** _____

- Accurate calculations _____
- Shows results in an appropriate way, such as in tables or graphs or summary form _____
- Conclusions are drawn from results _____

**4. Other Assignment Specific Requirements or Expectations** _____

- _____
- _____
- _____

**Total Points** _____/_____

# Assessment for the Writing Process:

Student Name_____ Period_____ Date_____

Project Name or Title_____

For each major category, and the self reflection, rate the finished work from 5 to 1 **(5 being the highest, and 1 being the lowest)**. On the other smaller blank lines, **place a "+" or a "-"** to show the specific strengths and weaknesses of the work in each category.

1. **Focus and Organization** _____
   - Includes an introduction paragraph stating the focus or main idea _____
   - Writes a summarizing paragraph as a conclusion _____
   - Ideas are addressed in a logical order _____

2. **Content and Style** _____
   - Information and details are related to the writing topic _____
   - Body of paper expands and explains the main idea using a sufficient amount of proper paragraphs _____
   - Main ideas are developed and supported with examples _____
   - Descriptive, meaningful words are used _____

3. **Conventions** _____
   - Proper grammar, spelling, capitalization, and punctuation are used _____
   - Sentences are complete and show a variety of lengths and structures _____

4. **Other Assignment Specific Requirements or Expectations** _____
   - _____
   - _____
   - _____

**Total Points** _____/____

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# CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

There is a new interest in integration throughout schools in America today. Reasons for this renewed interest include, but are not limited to: (a) concerns regarding fragmentation of subjects and content in which students are unable to make connections in their learning and experience a lack of meaning or connections to the "real world", (b) frustration with the overloading of the curricula content causing teachers to feel like there is too much to teach and no time to teach it, and (c) the recognition and acknowledgment that curriculum integration has value and produces lasting benefits.

Through the examination of studies and published research, the literature review showed some of the benefits of integration or interdisciplinary teaching. Some of those benefits included: (a) student empowerment and satisfaction, (b)increase in students' self esteem, confidence, and motivation to learn, (c) rise in standardized test scores, (d) more freedom for teachers to assess student achievement, (e) improvement in students' problem solving abilities and retention of content knowledge, and (f) an increased opportunity to see natural relationships across disciplines and make more connections in the "real world".

In addition, the literature review made a natural, integrative connection between art and science. This integrative connection was demonstrated by Weigand (1985), when he stated "mutual enhancement of art and science [was possible], when presented in a thoughtfully integrated context" (p. 21). Various studies and existing integrative programs of art and science further support the connection of art and

science by claiming that their integration provided a more relevant, and meaningful way of studying science and art, while at the same time increasing student interest and alertness during the study, ultimately resulting in increased student learning in both subjects.

However, there are still some cautious art educators who, in spite of documented benefits, want to make sure that art does not take a back seat to science or any other content area during the process of integration. They emphasize the need to ensure that the integrity of art remains in interdisciplinary settings and stress the need to continue teaching art as its own separate discipline even when it is being included in integration.

Finally, a sample curriculum integrating art and science at a sixth grade level was compiled. The curriculum was consistent with the concerns and findings stated in the literature review.

## Conclusions

While completing this project on art and science integration, I became more aware of the specific issues revolving around the topic of integration or interdisciplinary teaching. I discovered that the term integration itself is interpreted and practiced in multiple ways. The terms such as integration, interdisciplinary, cross curricular, holistic, and thematic for instance are used quite interchangeably in much of the research and literature, even though specific individuals interpret each one slightly differently.

In addition to varying interpretations, I became more aware of benefits resulting from curriculum integration, specifically when art was involved, as well as certain concerns that art educators have regarding integration of art into other subjects. Because of my research, I am now even more convinced that when done correctly, so that each integrated subject maintains its integrity, curriculum integration can help provide a more meaningful, and worthwhile education for all students involved.

## Recommendations

Curriculum integration means a variety of things to many people. Even within a single school building there may be multiple interpretations of what integration means and what it would look like as it is being implemented. When deciding how to begin or expand the use of integration in a middle school setting, don't let the different interpretations of integration prevent integration from happening. Successful integration can happen in many different ways. The benefits of integration are too great to miss having; even if the process is challenging, the benefits are worth attaining.

In a middle school setting, where subjects and content areas can be specialized and segmented, it is critical that teachers are given common planning time if integration is to be truly successful. It takes teachers and administrators who are willing to put forth the extra time and effort needed to identify areas where integration would be most appropriate and then implement the necessary changes in order to allow the integration to take place. In order for this integration to occur, I am making the following recommendations.

1. Encourage all middle school teachers to go beyond the boundaries of their current discipline and look for natural and meaningful ways to integrate curriculum. This could be accomplished by allowing teachers time to observe in other classes within their own school or other schools. Also, grants or other funding could be provided in order to equip, train, and provide materials to help facilitate integration.
2. Provide middle school teachers with some common time to plan integration strategies and activities. This may include devoting some half or full day inservice time to curriculum integration. It may also mean rearranging the master schedule in order to provide consistent daily or weekly common plan times with teachers of other disciplines.
3. When integrating art into science or any other subject, be sure to keep the integrity of art, as well as the integrity of the subject art is enhancing. The guidelines mentioned by Thompson (1995) may prove helpful in this area.
4. Allow art to be taught as a valuable, and worthwhile subject on its own *in addition* to being integrated with other subjects. For instance, when times get hard financially, art should not be one of the first items cut or significantly reduced with the intention of simply integrating it into other subject areas rather than teaching it as a separate class.

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