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CROSS DISCIPLINARY INSTRUCTION THROUGH ART:

A QUALITATIVE STUDY OF ATTITUDES, PERCEPTIONS, AND EXPERIENCES

OF MIDDLE SCHOOL TEACHERS

A Thesis in

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by

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ABSTRACT

In this study, I use interviews with two middle school art teachers to discuss attitudes, experiences, and perceptions in relation to cross disciplinary learning. I examine the ways word choices shape understandings of specific concepts and their influence on teaching and learning styles. Using previous examples of my work to contextualize my conceptual framework, I highlight practical and theoretical aspects of this project. This presentation of my research captures the tone of the teacher interviews in the form of composites of the examples they provided and the concepts we discussed. Situated in relevant literature, I investigate both the teachers' and my own engagement with cross disciplinary learning through interpretations of our ideas about interdisciplinary learning and arts integration. Ending with a look forward, I connect my own thoughts about how learning transcends boundaries using the metaphor of fractals as a way to understand knowledge construction in relation to developing strategies for cross disciplinary and cross contextual learning experiences.

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Part 1

Introduction

Most of this will not be "in order," at least not chronologically. It is just

impossible. We, must, however, begin somewhere. But, where we will travel from there –

in time, space, and and thought – is a different matter.

Where We Begin

It started with a snowflake. The snowflake seems so far away now, yet I cannot

seem to shake it; it has become woven into my fabric of knowledge. A few years ago, I

was given a tissue paper snowflake by an elementary school student. This was in

innocent enough gesture. She made the object in art class and decided to give it to me as

a gift. For whatever reason, I could not stop thinking about it.

Figure **1-1**. The Catalyst.

To fully understand my fascination with this seemingly innocuous winter decoration, we must first step back a bit. I love math. I love math in the way that one is accustomed to understanding a casual love of music. I shout out answers to math problems the way I sing along to a favorite song on the radio. OK. Maybe not quite, but isn't that a lovely image? However, I do love seeing the way numbers fit together in my head. For me, math is highly visual. So when I saw that paper snowflake I thought, "Wow! What a beautiful example of horizontal and vertical reflective symmetry!" But I did not think, "That is snowflake." I mean obviously it was not a snowflake. *Ceci n'est pas une snowflake.*

Figure **1-2**. Magritte, René (1928-29) *The Treachery of Images*, [painting]. Los Angeles, CA: Los Angeles County Museum of Art. Retrieved from http://collections.lacma.org/

But even as a representation of a snowflake, it fell short in my eyes. Because I, like so many others, get caught up in the idea of there being a right way and a wrong way. Simply put, snowflakes have six sides. But even this is a generalization. I was so

caught up in my idea of a snowflake that I could not appreciate the value of the object for what it was, not an idea of what it could be, but the actual object that I was looking at.

I was fascinated with the snowflake because I was caught up in this idea of deceptions. I am not an accusatory person. I do not think that teachers make it their mission to "trick" students. I do not think that there is a covert, organized operation to consciously and consistently lie to students. I do not think that textbook manufacturers sit down and think, "how will we misinform the general populace today?" But I do believe that this is happening anyway and that through misinformation, omission, and artificial separation of subject matter, students are receiving conflicting, confusing, and downright incorrect information about the world around them. I think the ultimate deception is that there is some greater truth, that there is some way to have a definitive answer, or that there is a way to ever be done.

Once I embraced the process, I could move beyond the snowflake. But it is still there making me wonder how to best facilitate authentic experiences and causing me to question what an authentic experience even is. On "real experiences" John Dewey (1934), philosopher and educational reformer states:

> Because of continuous merging, there are no holes, mechanical junctions, and dead centers when we have an experience. There are pauses, places of rest, but they punctuate and define the quality of movement (p. 36).

There is something about the quality of this kind of experience that sets it apart from other types of interactions. Everything seems to flow and spaces and separation work into the structure of a whole.

I recently presented at the Pennsylvania Art Education Association conference where I planned on presenting a performance piece exploring ideas about images, what

they "say," how we "read" them, and how context affects meaning. Through the form of the presentation, I intended to approach ideas of inquiry-based learning and improvisation as pedagogy (Dewey, 1934; Vygotsky, 1978). I asked participants to submit images through the website Tumblr. I chose Tumblr fairly arbitrarily because I already had a blog on the site and because there is a submissions feature that I thought would work well for my purposes.

On the day of my presentation, I had four attendees show up. Two were classmates who stayed quiet throughout the entire hour-long presentation. The other two participants provided almost constant feedback throughout the duration of the presentation. I had intended to begin with a brief introduction and then move on to a more performative type interaction. However, these other two participants became so caught up in the method I chose for the submission of the images, that the presentation became an informational workshop on the usage of Tumblr. They were so fascinated by the technology I chose to facilitate the form of my presentation, that I could not actually perform the way I had intended. Like me and the tissue paper snowflake, where I could not appreciate the physical object in front of me, these participants not only could not get past the mechanics of the presentation, they actually prohibited it from taking shape.

These kinds of mental blocks – of not being about to see the forest for the trees – form the foundation for my explorations into different kinds of teaching and learning. How can we ever learn more if we think we know what the answers should look like before we even ask the questions?

Starting the Conversation (Methodology)

In developing a thesis topic, I had all of these ideas, but I needed to do something. I did not know what I was looking for, which in retrospect is probably a good thing, but I needed a process. So I decided to make it simple. I would find middle school teachers to interview about their experiences with cross disciplinary learning and see where it would go from there.

I began to reach out. My first contact was my former sixth grade art teacher. She replied at once and enthusiastically. Once I had her on board, I felt like everything would fall into place. I received a reply from another art teacher, but that eventually fell through. I emailed my former seventh grade art teacher, but had not heard anything back. I spoke briefly with her at an event in town but failed to set up a meeting.

I decided to trudge ahead with the one solid lead I had and planned a visit with my sixth grade art teacher. I planned to meet her an hour before her first class of the day so that we could begin with a conversation followed by observations of her classroom and interactions with students. She talked easily for the entire hour and could have talked for many more, her thoughts expanding to fill the time allotted. During the day I planned to visit, she also had an observation planned with the school principal. She suggested that during this period I go upstairs to see if the seventh grade art teacher was available. So by this chance interaction, I gained my second participant. This research technique, when a researcher locates participants who then help the researcher locate more participants, is known as snowball sampling (Babbie, 2001). I came back at the end of the school day on

a later date to conduct the interview with my seventh grade teacher: a much condensed affair compared with the first teacher interview I had conducted.

Both of my research participants, my former sixth and seventh grade art teachers, still teach in the same positions at the same school I attended as a student. To conduct my research, I returned to my former middle school situated in a university community best described as geographically rural and socio-economically suburban. On my visits to the school, I observed the teachers interacting with students, recorded written and drawn field notes, took photographs in the art classrooms and of artwork displayed in the hallways, and interviewed the teachers about their attitudes, experiences, and perceptions about learning across disciplines. The interviews were audio recorded and then transcribed. I used the following questions to guide a discussion about teaching and learning across disciplines:

1. What do you know about teaching and learning across disciplines?

2. What are your experiences with teaching and learning across disciplines?

3. How do you feel about teaching and learning across disciplines?

4. What do you hope your students gain from learning across disciplines?

5. What evidence would show you that students understand and are applying knowledge and skills across disciplines?

6. What skills, strategies, and experiences are necessary in order for students to engage in learning across disciplines?

7. What sorts of instructional materials do you, or would you, find most useful to encourage learning across disciplines?

This research was approved by the Pennsylvania State University Institutional Review Board: Study #2005. The interviews were held in each teacher's respective classroom. The interview with the sixth grade teacher lasted one hour, while the interview with the seventh grade teacher lasted thirty minutes. I observed three periods in the sixth grade teacher's room, two sixth grade art classes and one special education art class, and one class period in the seventh grade art teacher's room. Each period lasted 40 minutes. I conducted the research in two sessions over a period of a month and a half. On the first visit, I conducted classroom observations with the teachers and students and recorded the first interview. On the second visit, I took additional classroom and hallway photographs and recorded the second interview. I manually transcribed the the interviews from the audio recordings using word processing software.

I incorporate three types of images into this document: images from the school, images I have created, and images from other sources that connect to the theoretical underpinnings of the piece. Rather than serve as mere illustrations, the images should reinforce and interact with the ideas I am am establishing and elaborating on in text form. Together the text and images work together to communicate more complete ideas.

Developing a Strategy (Analysis)

After collecting data from the classroom observations and teacher interviews, I needed some way to distill the information into manageable ideas that I could then discuss in relation to relevant literature. I developed a framework of attitudes, experiences, and perceptions to analyze the responses that I gathered from the teachers. I

split the interview transcripts into experiences, a "physical" description or example of an event that occurred; perceptions, "ideas" or reactions to an event; and attitudes, vocalized or implied, generalized from and/or affecting perceptions of events.

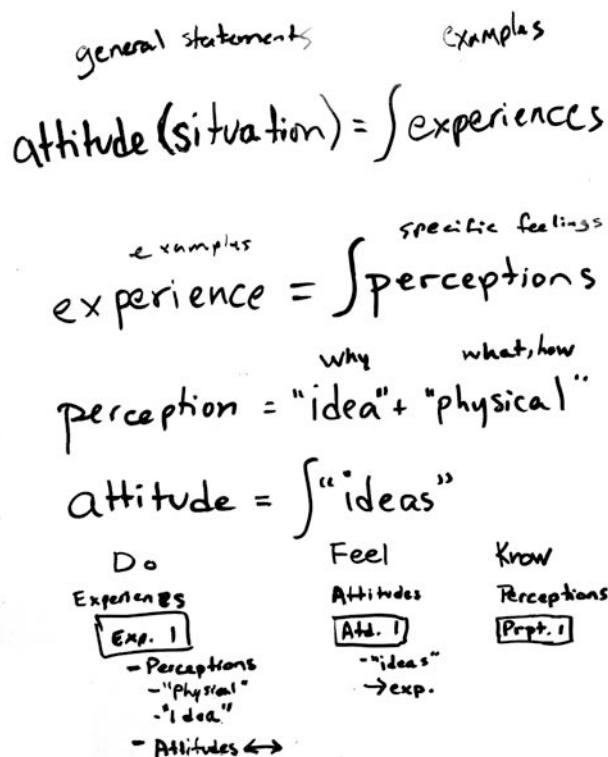Figure **1-3**. Personal analytical framework generalized from Dewey.

Dewey (1934) defines experience as continuous, differentiating between experiences that are incomplete and those that are whole or reach a conclusive end. The experiences the teachers describe in respect to learning across discipline fit into a wider, incomplete, experience of teaching, but many also represent discrete, complete, individual experiences.

While the data I was analyzing came primarily from spoken language, transcribed into written words, because I am a visual artist, I found returning to frameworks primarily used to discuss images helpful in developing my own method for working through the ideas presented. Often, I find that I have known or appreciated something on one level, and then, after acquiring additional language and knowledge, have found myself at a new level of understanding.

Semiotics is the study of signs (Saussure, 1959; Peirce, 1998). Signs, visual and linguistic, are vital in the process of meaning making. As an undergraduate student of photography, I went in with the assumption that my main concern was images. Eventually I realized that my fascination was, is, and has always been, with ideas: particularly the communication of ideas through visual imagery. This was the case in that my introduction to, and appreciation of Joseph Kosuth's (1965) *One and Three Chair*s (Figure 1-4) came well before my introduction to the language of semiotics. I was completely taken with the piece and even created my own rendition of the piece called *One and Three Pies* which consisted of a recipe for a pie, a picture of a pie, and an actual pie (Figure 1-5; actual pie not included, has been consumed, and impossible to attach electronically at the current time).

Figure **1-4**. Kosuth, Joseph (1965) *One and Three Chair*s, [installation]. New York: NY: Museum of Modern Art. Retrieved from http://www.moma.org/explore/collection/
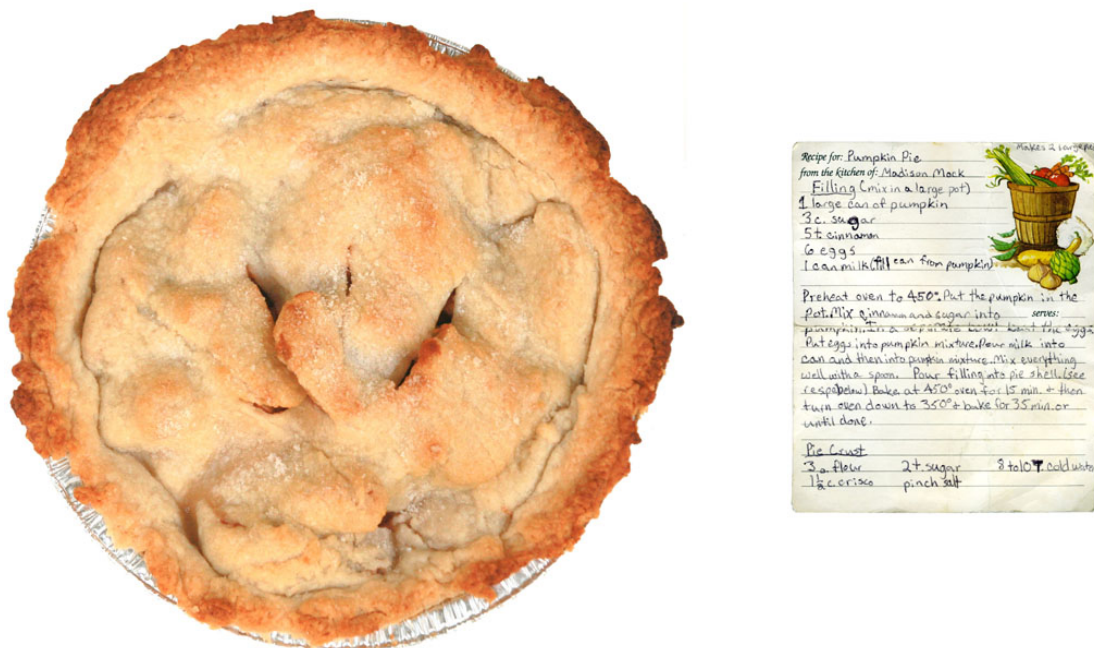

Figure **1-5**. (2011) *One and Three Pies*, [installation].

Everything snapped into place when I was introduced to semiotics through Plato's theory forms and the example of the idea of a chair: the ideal chair, a picture of a chair, and a physical chair. This related to both Kosuth's pieces and Charles Sanders Peirce's (1998) triadic model of *sign, object,* and *interpretant*. In Kosuth's (1965) work, multiple forms of representation are presented simultaneously. These three modes of representation could be seen to correspond with Pierce's (1998) different object types: *icon, index,* and *symbol.* The choice of three objects also draws parallels in my mind with the triadic model of signs. I was able to contextualize and verbalize the theoretical underpinnings associated with works of art I was appreciating and producing, creating a positive example of unintended consequences for the learner from disjointed curriculum being presented by multiple teachers.

With images, I am most concerned with the in between place created in the mind. Similarly, I am interested in the space between leaning experiences and knowledge construction. Cross disciplinary learning relates to this model in the way that different types of knowledge (signs) are represented in distinct disciplines (objects) and then interpreted by the students (interpretants). This framework informs my analysis of the attitudes, experiences, and perceptions the teachers communicated in discussing learning across disciplines. What relationship exists between how the teachers describe teaching and learning activities and how this is reflected in lived experience? What is changed through my own interpretations?

After recording and transcribing the interviews and conducting analysis using the framework of attitudes, experiences, and perceptions, certain patterns began to emerge.

One of the most prominent revelations was a distinction in how the teachers talked. I had purposefully chosen the phrasing "learning across disciplines" or "cross disciplinary learning" because I felt it lacked strong ties to a particular framework such as interdisciplinary learning, making connections between disciplines, or arts integration, merging disciplines together (Taylor, Carpenter, Ballengee-Morris, & Session, 2006). Even though I did not phrase my questions using this terminology, my sixth grade art teacher began to talk about arts integration and my seventh grade teacher about interdisciplinary learning. As I worked through the data and paired it with the literature, I began to think of my two teachers, and the ideas they encompassed, as Ms. Integration and Ms. Interdisciplinary.

Figure **1-6**: Ms. Interdisciplinary & Ms. Integration

The characters of Ms. Interdisciplinary and Ms. Integration are thus not simple reflections of the teachers I interviewed, but distilled representations formed by combining ideas gathered from what the teachers were saying, my own interpretations, and contributions from the relevant literature. So while the descriptions of Ms. Interdisciplinary and Ms. Integration begin as directly correlating with my former seventh and sixth grade art teachers, as the conversation continues, the ideas these characters espouse may deviate from the teachers they were initially inspired by.

Part 2

Interdisciplinary Learning

Interdisciplinary learning stresses making connections between subject areas while still keeping them separate while *integration* involves merging curricula together (Taylor, Carpenter, Ballengee-Morris, & Session, 2006, p. 6). These distinctions relate to different ways of conceptualizing how disciplines function. Viewing disciplines as distinct entities, versus bodies of knowledge that co-exist in larger contexts, affects how these ideas are taught and presented visually. After analyzing the two teacher interviews, by looking at which words which teacher used, I was able to put together ideas on how teacher perceptions about cross disciplinary instruction affected their experiences and influenced their attitudes.

Meeting Ms. Interdisciplinary

Visiting seventh grade was chaotic. I travelled through the hallways against the flow of the students, trying to remember where to go from my own time there years ago. In my confusion, I accidentally went in the out door on the stairway door and was flustered when I almost ran into a seventh grader. Once I reached the seventh grade hallway, located on the second floor, I entered an art room bustling with activity. Kids from the previous class period were scrambling to clean up while kids coming for the next session flowed in. The same scene was repeated when I left 40 minutes later.

Figure **2-1**. Seventh Grade Art Classroom – View 1.

Looking at the images of the classroom after the fact, it seems almost peaceful. But there is also a restlessness. I can almost see the ghost of Ms. Interdisciplinary with a streak of paint on her face, yelling "go, go, go," motivating students to clean up their work and move on to their next classes and assignments. On my first visit I was able to speak with Ms. Interdisciplinary very briefly between her interactions with students. I came back later in order to conduct our interview.

Ms. Interdisciplinary began our interview with a disclaimer: "Sometimes I struggle finding the right words to express myself, but I'm ok with that just because, well, I know I'm a pretty good art teacher and it's not just about words so much, it's more about the doing and all that." With these statements, Ms. Interdisciplinary not only defines her personal view of her role as art teacher but also provides insight into her connection with interdisciplinary learning and juxtaposes herself with the views and

demeanor of Ms. Integration. Ms. Interdisciplinary is a more reserved and reflexive speaker and her answers are more concise and distilled than those of Ms. Integration.

School Structures

Ms. Interdisciplinary's vision of learning across disciplines centers heavily on memories of a way things once were. The class schedule was recently rearranged in order to accommodate a new class focusing on academic literacy. Seventh and eighth grade at this middle school are structured so that students have art and music every day for half a year each. Students are on a "team" consisting of a core group of teachers including math, science, language arts, and social studies. The art teacher is also part of that team. When administration sought to add the academic literacy class to the team, they considered removing the art and music teachers in order to make room. Parents and students fought back, keeping art and music on the teams. However, this resulted in the further fragmenting of the daily schedule. Classes are now only 40 minutes each in order to accommodate the additional class. Ms. Interdisciplinary says, "shorter classes, but at least I'm still here!" However, she questions if things may be returning to art being the "icing on the cake." When talking about interdisciplinary learning, or any conception of learning across disciplines, the concern of art taking a subservient role to other subjects is a constant concern (Eisner, 2002; Stockroki, 2005; Taylor, Carpenter, Ballengee-Morris & Sessions, 2006; Russell & Zembylas, 2007).

In physical appearance, the seventh grade art classroom bears many similarities to the sixth grade room. This goes beyond the obvious structural similarities that come from

being housed in the same building. Both rooms feature the same instructional materials displayed on the walls showing art historical periods and elements and principles of art and design. There is also a feeling of organized chaos.

Figure **2-2**. Seventh Grade Art Classroom – View 2.

Figure **2-3**. Seventh Grade Art Classroom – View 3.

In exploring the room, I thought I caught one of my first glimpses of an interdisciplinary connection to science. However, it turned out to be a reference to a song, with the chemical formula $C_{12}H_{22}O_{11}$ used as a stand in for the word "sugar." But perhaps there are further implications here for not just cross disciplinary, but cross contextual learning. That little connection from a reference to a song could spark an interest in further investigating chemical compounds, result in another connection entirely, or lead nowhere, ending the line of inquiry. Encouraging students to make these sorts of cross contextual connections in the classroom helps to establish learning habits that can be applied outside of the school.

Figure **2-4**. Seventh Grade Art Classroom – View 4.

Past, Present, and Future

When Ms. Interdisciplinary speaks about learning across disciplines, it is often in vague terms as if she is trying to remember how things once were across a vast expanse of time. She is very eager to talk about past collaborative experiences and speaks of interdisciplinary methods with nostalgia. She expresses her full approval to implement more collaborative interdisciplinary or cross disciplinary projects in the future, but also has an understanding of the politics of the school at the current time and how this affects what and how subjects are taught.

Ms. Interdisciplinary spoke fondly of a school-wide interdisciplinary architecture unit from a vague amount of time in the past. The entire seventh grade class went on a field trip to a new building being built. Before the trip, city planners came in and talked about green spaces and parking. At the site, the students went on a tour and an architect talked about the layout of the building. This experience built positive perceptions about possibilities of interdisciplinary learning in Ms. Interdisciplinary's mind.

Art education scholar Elliot Eisner states the importance of recognizing the changing state of motivation for including subjects in the school and the very nature of those subjects, "the direction in which a field travels emanates not only from perceived needs, but also from imagined desired possibilities" (2002, p. 41). Ms. Interdisciplinary speaks of the architecture unit with an air of fondness for an image of a way things once were and perhaps an even further imagining of a way things could be. In the architecture unit, all subject areas could "buy in." Students could see how different disciplines work together to come to a final product – in this case a building. A student who draws

motivation from a certain discipline can feed off that influence and follow the connection

to another discipline. This type of movement from one discipline to another recalls the

metaphor invoked in the title of art education scholar Mary Stokrocki's (2006) book,

Interdisciplinary art education: Building bridges to connect disciplines and cultures.

Figure **2-5**. Building bridges.

Thinking about interdisciplinary learning through the metaphor of building

bridges leads me to visualize disciplines as islands. Each discipline is separate. Bridges

make connections to allow for the easy exchange of ideas. Some disciplines may be more

closely aligned than others. Some connections may travel more slowly as if carried by

boats while other ideas may float out in the sea of possibilities. Here there be dragons.

Seeing interdisciplinary learning in action in the architecture unit helped solidify Ms. Interdisciplinary's attitude that inter- and cross disciplinary learning experiences are more like real life. In her words, "you're not so isolated in the world of art." There is a connection between the disciplines, but they still remain separate. Connecting learning experiences to the "real world" also lessens the divide between how disciplines are taught inside the school and how they function out in the wild. Eisner (2002) points out these contradictions:

> We often assume that the aims to which a field is directed are given by the field itself: mathematics has aims defined by mathematics, scientific studies aims defined by science, historical studies aims defined by history, and so forth. This is only partially so. Mathematics can be taught in order to accomplish various ends; science can be used to teach scientific modes of inquiry to students or it can be taught, for example, to advance their understanding of the content of a chemistry course. Similar options exist in the arts. There is no single sacrosanct vision of the aims of arts education (p. 25).

Art education scholars Julia Marshall and David Donahue (2014) propose the use of contemporary art in the classroom as a way to address this divide:

> Contemporary art is often cast in popular media as elitist and as speaking only to an "in group." The same misperceptions exist about biologists or historians who supposedly engage in studies divorced from "real life" with no desire to create greater public discourse. Teaching with contemporary art can challenge such misperceptions and promote the kinds of inquiry and dialogue intended by contemporary artists and researchers in other disciplines (p. 7).

Both Eisner (2002) and Marshall & Donahue (2014) address perceptions of how disciplines function. Eisner (2002) suggests looking at not only how a particular field of study advances its own aims, but also how it interacts with other related disciplines while Marshall & Donahue (2014) advocate for bringing contemporary art, or research, into the classroom. Both approaches envision discipline not as isolated islands of ideas but as involved in a larger conversation. Bringing a discipline, such as architecture into the

school as it exists in "real world" gives students opportunities to see and apply concepts in context and see how subjects taught in school relate to other fields. With this type of hands-on experience, interdisciplinary connections are almost inevitable. The rigid disciplinary divides often seen in the school become messier when put into practice.

"The Best Way"

Interdisciplinary experiences such as the architecture unit have influenced Ms. Interdisciplinary's attitudes about the value of learning opportunities that mirror the "real world" through perceptions of increased student engagement and understanding. Ms. Interdisciplinary's vision of interdisciplinary learning increases student enthusiasm by appealing to different learning styles or multiple intelligences (Gardner, 1983), encourages lifelong learning (Goldberg, 1997), allows students to make choices (Hetland, Winner, Veenema & Sheridan, 2013), and develops problem-solving skills (Stokrocki, 2002).

Figure **2-6**. Seventh Grade Student Work – Mixed Media Still Life.

When I visited Ms. Interdisciplinary in her classroom, the students were in the middle of a still life project that involved online research, choosing a medium, and emulating a particular artistic style. While not currently actively collaborating with teachers in other disciplines, Ms. Interdisciplinary employs the strategies she sees useful in interdisciplinary learning in her own classroom, particularly giving students choices and encouraging learners to conduct their own research to find solutions to problems. These are strategies that are also pertinent to arts integration.

Eisner (2002) includes problem solving approaches within his vision of arts integration (p. 40). Art education scholar Lois Hetland, psychologist Ellen Winner, high

school visual arts instructor Shirley Veenema, and education scholar Kimberly Sheridan

establish eight studio habits of mind promoted in art classrooms: craft, engage and

persist, envision, express, observe, reflect, stretch and explore, and understanding arts

communities (2013). Several of the studio habits of mind, especially when used in

combination, involve and promote problem solving skills. These strategies have

particular relevance in arts integration in maintaining art as guiding force and also have

implications in interdisciplinary learning. Looking at a discipline like architecture, these

habits of mind could be applied by students to make connections between their school

subjects and how they are applied in different disciplinary structures in the "real world."

Ms. Interdisciplinary views interdisciplinary strategies as the "best way" to

encourage student connections by appealing to learner's individual strengths and

interests. Is it possible to foster these behaviors through other models of learning?

Certainly. But I can see Ms. Interdisciplinary's frustration in trying to accomplish these

things by herself in such a short amount of time with so many different students.

Stokrocki (2006) contends:

> In order to change the fragmentation of school curriculum and learning,
> integration of skills and content is necessary. Children tend to view and
> participate in the world and arts in a general interrelated way rather than a
> compartmentalized approach. Life outside of schools is full of concerns and
> problem solving that is not divided into separate areas (p. x).

People in general exist in the world in a way that does not mirror the fragmented structure

of the school. Knowledge must be combined and applied cross contextually, if only for

ease of existing. As each teacher on Ms. Interdisciplinary's seventh grade team only has

each student for 40 minutes a day, it would be surprising if it were not challenging to try

to motivate those students and have them see the connections of each compartmentalized

subject area to their daily lives. Ms. Interdisciplinary sees obstacles of time, money, and participation in executing inter- or cross disciplinary learning experiences. Her conception of cross disciplinary learning is predicated on teamwork and collaboration. She was happy to exist as part of the interdisciplinary machine, but no longer sees herself in a school that actively promotes this type of activity.

Part 3

Arts Integration

Both Ms. Interdisciplinary and Ms. Integration see their jobs as art educators first, however, this manifests in different ways and each incorporates varying educational goals. Eisner (2002) lays out seven "visions and version of art education": discipline-based art education (DBAE), visual culture, creative problem solving, creative self-expression, art education as preparation for the world of work, the arts and cognitive development, using the arts to promote academic achievement, and arts integration. Within his seven "visions and versions of art education," Eisner (2002) elaborates on methods within arts integration: exploring a historical period or culture, comparing and contrasting arts disciplines, focusing on a theme, and problem solving approaches (p. 39 - 40). I can see bits of Eisner's visions influencing the attitudes of both Ms. Interdisciplinary and Ms. Integration's approaches to teaching and learning. Experiences with various educational trends both inside and outside of the art room have led to varied perceptions about the efficacy of these methods.

Meeting Ms. Integration

Visiting the sixth grade art classroom on two occasions for other classwork and preliminary data collection, I found the room much as I remembered it. Some of the assignments listed on the board were even identical, or very similar, to ones I remember completing myself. The biggest changes to classroom items that I noticed, were carried with the students themselves: each student has their own personal Chromebook provided

by the school as part of a one to one computing initiative. Returning to the classroom for my data collection, I remarked on how much had stayed the same. Ms. Integration laughed and agreed. It was not just that it looked the same; it felt the same. I realized that much of what helped with that feeling was that it smelled the same. There is something about scents that so quickly and completely transport us to another space and time.

Ms. Integration is expressive and bubbly and when she talks her words weave themselves into story. One thread that weaves throughout our conversation is the story of the sugar cube Parthenon. In the story, a teacher comes up to Ms. Integration and asks, "Can you make a sugar cube replica of the Parthenon? Because that's what we're studying in social studies." Ms. Integration refuses to take the request at face value. She says, "Well sure, if you're willing to do *this* for me." Ms. Integration's refusal to play a subservient role reinforces the idea of integration: mixing disciplines together, feeding off of different bodies of knowledge, and not keeping ideas separate and distant.

Arts education scholar Merryl Goldberg (1997) establishes three ways of incorporating arts and learning: learning *with* the arts, learning *through* the arts, and learning *about* the arts. Learning *with* the arts uses the arts as a way to learn about a particular topic: looking at artworks from a particular time, place, and culture being studied. Learning *through* the arts uses art forms as ways to explore understandings: creating artworks related to learning experiences. Both of these methods, used individually or in tandem, could lead to an interest in learning *about* the arts (Goldberg, 1997). Even if unconsciously, Ms. Integrated takes these ideas of *with, through,* and *about* and applies them to interactions not only with students but also with the sixth grade general education teachers looking to incorporate art assignments with other curriculum.

The sixth grade general education teachers are responsible for teaching math, language arts, science, and social studies. Ms. Integration sees the general education teachers incorporating art into their own teaching most in social studies because of the activities presented in the prescribed curriculum those teachers follow for that subject.

In graduate school, Ms. Integration learned about different approaches to art education. Around that time, she stumbled upon a pamphlet at the library that explained states of matter through the use of anthropomorphized cartoon molecules. This presentation of scientific material through visual language helped her to grasp the concept. That was the first time she thought, "oh yeah, that makes sense, duh, learning a scientific term is going to help you possibly learn something else and in art it's going to help too." That experience and perception of understanding led to the acquisition of many attitudes that still shape her view of the role of art education.

Figure **3-1**. Ms. Integration

I think of these ideas as little thought bubbles constantly informing the actions of Ms. Integration: art is its own thing but it also crosses over, art is not the servant of any other discipline, and everything is going to mesh.

Ms. Integration's place within the school is slightly different than Ms. Interdisciplinary's. Sixth grade, while in the middle school, follows a structure closer to elementary school than secondary. Both art teachers are interacting with a team of teachers who teach the same students, but the seventh grade subject area teachers are even more heavily separated into disciplines than the sixth grade general education teachers. While the classrooms look similar, what happens there is different.

Figure **3-2**. Sixth Grade Art Classroom.

The posters identifying art terms and historical periods are the same in both classrooms. In sixth grade, the students come as full class groups, while in seventh grade there is more scheduling variety within the teams and students are not with the same peers during each class period. Comparing the photographs of the sixth and seventh grade art rooms, I notice that while both classrooms have a similar level of visual information, the way the sixth grade room is organized feels different. Just changing the arrangement can change the meaning.

From the Servant to the Guide

Justifications for including subjects change over time and at any one time there will be multiple utilities for arts in the school (Eisner, 2002). Ms. Integration makes a distinction between the types of projects to introduce in her classroom and those that the general education teachers can incorporate into their own classrooms. She sees her job as providing support and pushing the general education teachers to go further. Ms. Integration thinks that it is really important for the general education teachers to do these sort of art integrated projects that support the curriculum in their own classrooms. She sees the value of these projects for the general education teachers. Her attitude becomes solidified here: she is not the servant. She is the guide.

While at their core, strategies for learning across disciplines are all about collaboration, there is much potential for unequal focus on the disciplines being studied. Particularly within the context of interdisciplinary learning there is a worry about art becoming the handmaiden to other disciplines (Stockroki, 2005; Taylor, Carpenter, Ballengee-Morris & Sessions, 2006, Russell & Zembylas, 2007). With increased focus on the importance of subjects such as math and reading, the arts are often brought into conversations about learning in relation to their usefulness in improving performance in other disciplines (Eisner, 2002). While this conversation on its own is not inherently dangerous, it is important remember that learning across disciplines should be a conversation and not a relationship with only one beneficiary.

Ms. Integration sees invitations to field trips as a way into making connections with the general education teachers and opening up possibilities for integrated curricula.

Because she is invited, she feels like an essential part. One field trip involved a visit to an

art museum where the students paid particular attention to the architecture.

WE MUST HOLD EACH OTHER UP.

Figure **3-3**. Ms. Integration, a pillar of the curriculum.

Art Teacher Instructions for compulsory cooperative integration (as synthesized
from a conversation with Ms. Integration)**:**

- Take all the children and put them in a room
- Better yet make it a museum
- Take all the children and put them ~~in a room~~ on a bus
- Drive the bus to the museum
- Get the children off the bus
- Take the children into the museum
- Show them the structure
- Say, "look, a pillar!"
- Make the children hold each other up
- Make the general education teachers watch
- You say, "you could have done this yourselves"
- But they say, "we like to watch"

Ms. Integration sees potential in an annual team building field trip becoming an integrated experience. "It's not, I wouldn't say, a truly integrated thing at all. But I can see it perhaps happening [in the future]." Right now Ms. Integration is mostly filling a slot. It is a nice quiet time for the general education teachers to walk around and see their students making art: a slot, a quiet time, a way in.

Tools for Integration

Ms. Integration does not rely on other teachers to make opportunities to blend disciplines together or make connections throughout the school. A poorly designed poster in the hallway may inspire a lesson on basic graphic design skills. An art project relying on students knowing the difference between nouns and verbs may dictate an impromptu grammar lesson. When introducing a unit on clay, Ms. Integration begins by having the students act out a "clay play" wherein they personify clay molecules and explore the different states of matter. This incorporation of science into art is natural and not a forced connection. Explaining how things work makes sense: – not doing so because the explanation crosses into another field does not. Focusing on a theme and exploring historical periods or cultures, are ways Ms. Integration is able to find connections to the general education curriculum (Eisner, 2002, p. 39 - 40). Because the students still have what she calls "elementary brain," Ms. Integration perceives the students as more open to these types of cross disciplinary connections. Students in sixth grade receive instruction in general education classrooms with one or two teachers teaching most subjects. Being

in this environment, and coming from from elementary school, students are used to making connections between subject areas.

In our conversation, Ms. Integration flits from one topic to another, answering my questions and going off on tangents as she makes connections in her mind. Ms. Integration's experiences with cross disciplinary learning have produced perceptions not only about her role in educating the students but also the general education teachers. These perceptions inform, and are influenced by, attitudes about the benefits of integrated curricula and the importance a cultivating a symbiotic relationship between practitioners of various disciplines. What started as a sixth grade classroom teacher approaching Ms. Integration to have his students decorate book covers in her class became an integrated project with each teacher reinforcing lessons learned in the other's class.

Ms. Integration sees the Chromebooks the students at the school have been given as part of a one to one computing initiative as one of the most important tools in assisting with arts integration. The students are able to use the Chromebooks to research artists and other information relevant to projects they are working on. Previously, when students needed to find photographs for references, they would have to look through books. Now, they can simply use a search engine to find a result almost instantaneously. This cuts down significantly on the amount of time needed to make connections. Like Ms. Interdisciplinary, she sees time as one of the greatest hindrances in creating cross disciplinary learning experiences. Time allows for communication. While teachers may be open to the possibilities, the opportunities for that communication to occur are limited.

Figure **3-4**. Books in Sixth Grade Art Classroom.

The Imaginary School

Ms. Integration tells me about the school she wishes she could open with Ms. Interdisciplinary. She tells me to eat my Wheaties because they are getting older and need young people to play out their vision.

This is a school without boundaries: a place where classrooms are designated based on what materials are where, not on the information being learned or taught. This is a place where we move beyond a linear process: where we move beyond what comes first and what comes second and embrace taking chances to explore new ideas. This is a place where we are standing on top of the waterslide in that moment before the thrill, that

moment you question if you should push off: the moment before you reach the bottom and say, "Again! Again!" Here we have the continuous feeling of being at the top of the waterslide.

Figure **3-5**. About to make the leap.

Ms. Integration imagines a place where students are encouraged to explore concepts and classrooms become resource centers that are organized mostly on where particular supplies are kept. Marshall & Donahue (2014) discuss how this type of

> substantive, concept-based integration promotes integrated learning and thinking because it demonstrates how a subject is treated in multiple disciplines, allows students to construct their own meanings along the way, and corresponds with the natural way people learn (p. 23).

Making connections is something that will happen but requires both a time and a place in which to occur.
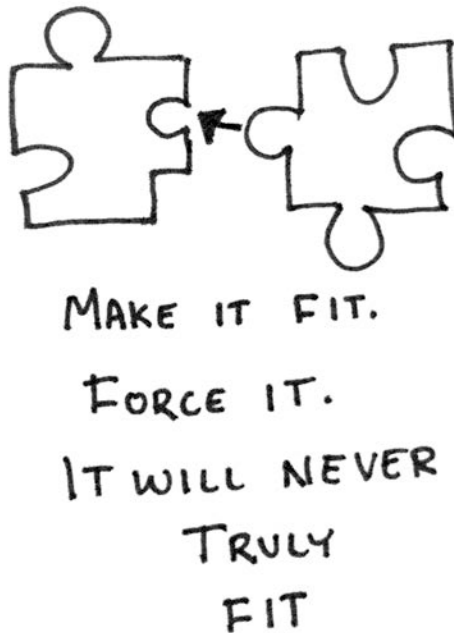
MAKE IT FIT.

FORCE IT.

IT WILL NEVER

TRULY

FIT

Figure **3-6**. Puzzle pieces – wrong piece or wrong puzzle?

Like students who question the relevance of school subjects within their own lives, teachers may find themselves questioning their role in incorporating other subject matter into their own disciplines. Taylor, Carpenter, Ballengee-Morris & Sessions (2006) express their concerns: "we taught art, not science or math, and it was the art-specific standards of learning and curriculum that were our primary concern" (p. 2). From the beginning there is a defensiveness, a resistance to falling into the trap of incorporating other disciplines into the arts in the superficial manner other subjects have often used to incorporate the arts. Interdisciplinary units require knowledge of each discipline being incorporated, or shallow understandings will result (Stokrocki, 2006). This is also seen when arts-based research is used by researchers in other fields without a studio arts background and leads to products that "fall short of the level of a work of art" (Rolling,

2013). These shortcomings also occur within disciplines when there is a lack of connection between a school subject and its application to related real-world fields. Focusing on the basics without experiences linking to real-world applications may also lead to superficial understandings. In order to use this sort of foundational knowledge, students need to be able to not just use basic skills in basic situations but also be able to apply these concepts to real-world situations that require them to stretch and explore (Hetland, Winner, Veenema & Sheridan, 2013). Another approach to art education that relates to real-world situations, visual culture, or looking at image production within its culture context, encourages students to critically analyze how mass media influences people (Eisner, 2002). This method encourages students to not just understand methods of communication through the arts, but also to question the messages being transmitted.

Part 4

Toward a New Theory

After exploring the initial questions posed to the middle school teachers related to learning across disciplines, I find myself with even more questions. New questions arise from a synthesis of the original questions and my analysis of the teachers' responses. As these questions begin to take shape, I hope they will form a path that leads not to more confusion, but rather begins to establish a framework for evaluating cross disciplinary learning experiences:

- What is the perceived purpose of the learning experience?

- What is the perceived connection between the disciplines involved?

- What attitudes about how learning happens are shaping the decision making process? Are decisions being made based on how learning is observed to be happening or on what is perceived to be an interesting or trendy methodology?

- Is the initial separation or segregation of subject matter the thing that does not make sense? Is this an inherently violent act?

My questions start as guidelines and quickly branch out on their own, because I cannot stop making connections. This is why we are in this particular predicament looking at cross disciplinary connections in the first place. Developmental psychologist Lev Vygotsky's (1978) idea of the zone of proximal development (ZPD) suggests that students should be evaluated not on what they can do on their own but rather what they can do with assistance. Interdisciplinary learning, while looking at disciplines

individually, relies on the support of each discipline involved in an interdisciplinary learning experience. Ms. Interdisciplinary talks about working with other teachers to create interdisciplinary learning experiences. Together teachers can draw on each other's individual areas of expertise to scaffold experiences for students that allow learners to connect and build on previous knowledge.

Certain ideas stick. I think about connections, about the big picture. Disciplines are easier, less messy. In some ways the big mess is easier, if only because that is the way things are. But in reality, it makes thing difficult. As a whole, where does one enter?

More Than Just New Words

Figure **4-1**. "They keep changing the words" - Ms. Interdisciplinary.

I chose the phrase cross disciplinary as my entry into this topic if only because I perceived it to have a relatively low politicized meaning. This seemed to work out pretty well in allowing my interviewees to grasp onto their own understandings and choice of buzzwords. It can be a daunting task to keep up with the seemingly endlessly growing list of terminology used to describe learning across disciplines: arts integration, interdisciplinary learning, transdisciplinary learning, Science Technology Engineering Mathematics and Art (STEAM). It does sometimes seem like all that is changing are the words. But differences in word usage does, or should, denote differences in the conception of the ideas themselves. Words (objects) represent ideas (signs) which are then interpreted differently in each individual's mind (interpretant) (Peirce, 1998). It is common for one sign to have many different objects that it may be represented by. There is a distinction between coming up with new words (objects) to represent new ideas (signs) and creating new words (objects) to represent existing ideas (signs). Ms. Integration and Ms. Interdisciplinary's differences in word usage, even if subconscious, reflect real differences in ideology. I am searching for a way to describe a new conception of cross contextual learning that goes beyond just "new words". Disciplines are not taught only to accomplish their own ends (Eisner, 2002, p. 25). However, if disciplines are taught in such a way as to fragment knowledge and present bodies of knowledge as being inherent and applicable only within a particular field, or fields, of study, then the possibilities for the individual to make cross contextual connections in the future is greatly reduced. Many strategies, including those listed above, make connections in the classroom in order to encourage learning and continue those connections beyond the school.

Arts integration looks to merge curricula together as Ms. Integration did in both her own classroom and in collaboration with other teachers. Interdisciplinary learning makes connections while maintaining boundaries as Ms. Interdisciplinary did in introducing concepts into her class that have applications across various fields. Marshall (2014) positions art integration as a transdisciplinary practice able to rise above disciplinary divides, abolish barriers, and create a new space (p. 106). STEAM seeks to insert the arts into the STEM fields, but often ends up feeling like the handmaiden situation Eisner and so many others warned about. These distinctions relate to different ways of conceptualizing how disciplines function. Viewing disciplines as distinct entities versus bodies of knowledge that co-exist in larger contexts, affects how these ideas are taught and presented visually. I begin to wonder if even thinking about disciplines is too limiting. Connections will happen with or without artificially defined distinctions.

New literacies are ways of receiving information that incorporate new technologies and can lead to new ways of knowing. Knobel and Lankshear (2007) identify two types of new stuff: new "technical stuff" and new "ethos stuff" (p. 7). "Technical stuff" encompasses the way that information is presented and the tools and media used. "Ethos stuff" includes what information is being presented and how, beyond the technical specifications. Without the ethos component, the literacy is not "new," but rather simply a way to use new technology to continue literacy practices in an already established mode. When implementing new technologies into the classroom, the focus is often on their technical attributes rather than relational qualities or incorporating their unique ethos. This is what happened when my planned performative inquiry turned into a presentation about the uses of Tumblr in the classroom.

The decontextualization of related technologies limits the possibilities for development of a new ethos. Within my definition of technology, I would include not only recently new technologies such as computers and internet access, but also what seem like basic technologies like pencil and paper and established problem solving strategies. These strategies detached from the "ethos stuff" also result in disjointed literacies. Within art teaching practices there is sometimes a disconnect between the use of principles of design (technical stuff) and the application of these principles within symbolic art making and other forms of cultural production (ethos stuff). Similarly, in math, there is often a disconnect between the teaching of a skill like addition (technical stuff) and actual applications of this problem-solving method (ethos stuff).

This disconnect between new ethos stuff and new technical stuff can also happen with the ancient technology of words. New words, or new word uses, can seem to describe new ideas, yet really just be being used as a replacement for an already established word or idea. It is, in part, for that reason, that I am having such difficulty settling on a distinct word or phrase to describe the type of learning I am talking about that is rich in natural connections.

We exist in an information saturated environment. All of the potential connections can become overwhelming. We have the technology to continuously check these perhaps tenuous connections and in the process develop even more that must then be verified. Semiotician and new literacies scholar Gunther Kress (2009) elaborates:

> When the environment is ubiquitously augmented with information, any possibility of exploration of 'the unknown' becomes difficult to recognize: when all of the world is treated as known, knowable and instantly accessible, the horizons of the new, the unknown have receded beyond visibility. Risk taking is avoidable; 'learning' is seen as grabbing all possible kinds of information –

reliable or otherwise – about the environment at issue. Experiencing life is conceived of as 'being in motion', fully supplied with on-the-spot information, 'delivered' in real time. Usability, selection (choice within given possibilities), bricolage and mobility are values that (have) come to signify a contemporary notion of 'freedom' and 'creation' (p. 195).

In the type of information rich environment described above, when faced with a question or problem, it can be tempting to grab the first bit of information and put it forth as the solution. However, this type of information regurgitation involves very few critical thinking skills. Rearranging information and creating juxtapositions of ideas define a new notion of creation (Kress, 2009). Giving students opportunities to learn and apply knowledge cross contextually provides tools to look at how bits of information culled from disparate sources create new ideas in the spaces in between.

The structure is known, but the contents are unknown. While it may seem like all the world is known or knowable, new ideologies are always emerging. Selecting and juxtaposing known information may be useful and interesting, but real possibilities lie in the spaces in between. When everything and nothing is simultaneously a risk, we must get back at the top of Ms. Integration's waterslide.

Acting as a backdrop to all of these constructions of knowledge are the very real constraints of life. We do not have unlimited time. We do not have unlimited funds. We do not have unlimited patience to discuss with others the feelings we are feeling about the ideas we are having and the connections we are making. With all of these ideas of learning that rely on stretching connections, while they make sense in terms of increasing understanding, the amount of time needed to create these types of experiences is

generally much greater. In any case, that is the perception. So then the attitude is formed that while the outcome is superior, the input may be far beyond the means attainable.

Fractals of Understanding

Trying to make sense of all this mess, I reached into my bag to pull out my books. I thought perhaps I could find some sense in the books have been using as references for this very undertaking. And with my stack of books about education and images out came a thin tome of less than a hundred pages: a manual for a game called *Microscope*. *Microscope* is a "fractal role-playing game of epic histories" (Robbins, 2011). It is not chronological. In the game, players create and explore a history of their own making, zooming in and out, and jumping around in the timeline as they see fit. When I pulled the book out, I initially thought of it as simply a great metaphor for how I was thinking about and constructing this actual written document. But then, I began to think about it more and realized the greater ramifications for explaining the broader theory about learning I was attempting to describe. While the process of the learning is not a game, per se, it can be playful. Disciplines play off of one another, make connections, and spread in different directions as a result of their interactions.

The essential element of a fractal is a repeating pattern. This pattern is observable at every scale. Zoom in, you will see the pattern. Zoom out the pattern is still there. Depending on the type of fractal, the similarity at each level varies, some patterns appear the same at each level, while others are more complex. Fractals display symmetry infinitely more complicated than a snowflake. But at the same time they are simple. One

pattern, ever expanding, inward or outward, depending on your perspective. (Mandelbrot, 1982)
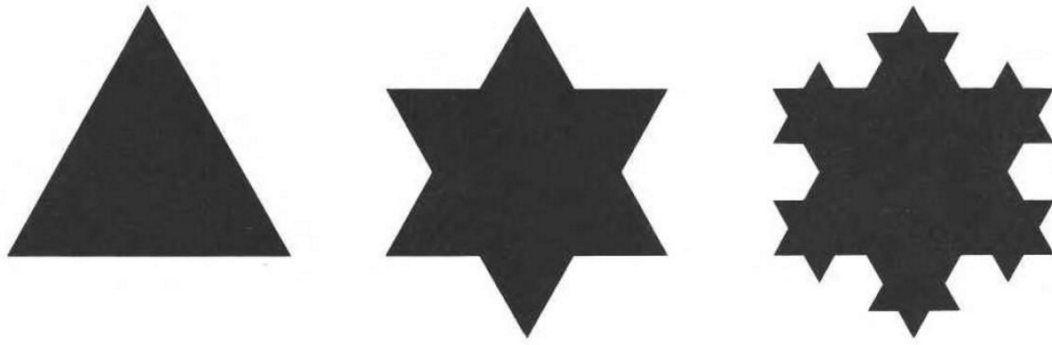
Plate 42 ¤ **TRIADIC KOCH ISLAND OR SNOWFLAKE** $\mathcal{K}$. **ORIGINAL CONSTRUCTION BY HELGE VON KOCH (COASTLINE DIMENSION D=log 4/log 3~1.2618)**

Figure **4-2**. The Product. Reprinted from *The Fractal Geometry of Nature* (p. 42), by B. Mandelbrot, 1982, San Francisco: W.H. Freeman. Copyright 1982 B. Mandelbrot.

The fractal takes us back to that original snowflake I could not get out of my head. It takes us deeper within a subject and also thrusts us outward to explore other disciplines and contexts. Using the fractal as a framework for thinking about learning across – and through and between and around – disciplines and contexts allows for both an intense complexity and simplicity of repetition.

In his memoirs, science fiction author Isaac Asimov wrote:

I believe that scientific knowledge has fractal properties, that no matter how much we learn, whatever is left, however small it may seem, is just as infinitely complex as the whole was to start with. That, I think, is the secret of the Universe (1994).

I contend that using the idea of a fractal as a model of knowledge construction has implications for any body of information. A body of knowledge is never finite. There are always new perspectives.

Mathematician Benoit Mandelbrot (1982) coined the term fractal as a way to bring together and describe a variety of mathematical phenomena that were previously defined separately, often using abstract terms like in between, strange, and wiggly (p.5). These names previously used to describe shapes now collectively referred to as fractals, remind me of the vast array of terminology used to describe learning that crosses, combines, and transcends disciplines. Could a theory of fractal-like knowledge construction bring together these ideas under one heading?

I relate this understanding of fractals to describe knowledge construction to philosophers Gilles Deleuze and Félix Guattari's (1987) idea of the rhizome. If the rhizome represents the learning process, the fractal represents the visible structure of knowledge. If the rhizome is the learning process, the possible, the state of becoming, then the fractal is the construction of knowledge, the actual, the state of being.

Using the fractal as a model of knowledge construction, we can make connections, dig deeper and branch out. Deleuze & Guattari (1987) differentiate between two types of lines that make up an assemblage: those that are molar, contour forming, arborescent, and make up striated space and those that are molecular, rhizomatic, and make up smooth space (p. 505). In my mind the fractal initially relates to the aborescent, constantly branching off and within. However, smooth and striated space are always linked and Deleuze & Guattari (1987) propose the fractal as approaching a mathematical definition of smooth space (p. 486).

A fractal displays constant expanding or evolving symmetry. With a total lack of symmetry:

the stems of the rhizome are always taking leave of the trees, the masses and flows are constantly escaping, inventing connections that jump from tree to tree and uproot them: a whole smoothing of space, which in turn reacts back upon striated space (Deleuze & Guattari, 1987, p. 506).

The tendency is toward smoothness. The same could be said of cross disciplinarity; the tendency of information is to branch off and make connections to multiple contexts. However, in the process of knowledge building, ideas are compartmentalized creating a striated state of mind. This information can then be retrieved and applied in a variety of contexts. Encouraging cross disciplinary or cross contextual learning experiences reinforces a flexible construction of knowledge I define as being fractal-like.

"We are always, however, brought back to a dissymmetrical necessity to cross from the smooth to the striated, and from the striated to the smooth" (Deleuze & Guattari, 1987, p. 486). This crossing over from smooth to striated relates to the crossing over from learning process to knowledge formation. Using the fractal, which tends towards smooth space, as a model for knowledge formation points to a theory that supports the development and implementation of cross contextual learning experiences.

Using a fractal model of knowledge and applying it to designing learning experiences, allows the teachers and learners to analyze connections at all levels: starting with the art classroom and zooming out to the team, out to the grade level, out to the school, out to the community, and out and out. Or, conversely, one could start with the art classroom and zoom in to the learner, into the topic, into a specific term, and in and in. The fractal encourages a way of thinking that allows ideas to expand outward while looking inward, and vice versa. Using the fractal as a model for encouraging learning across disciplines allows for adoption on an individual level or on a wider scale. Learning

that goes beyond the art classroom can and will occur with or without leaving the physical, or even conceptual space.

A person's knowledge always forms a whole. That whole is constantly evolving, whether through expansion of general knowledge or through intense focus on particular areas of interest. Learning across disciplines and contexts supports fractal-like acquisition of knowledge by removing limits on which part of an individual's body of knowledge is expected to be growing at a particular time. While a particular segment of knowledge may seem incomplete, this can be altered with a change of perspective, a change of scale.

Developing new words to describe frameworks of learning that encourage not just learning across disciplines, but also learning more generally across contexts, will shape the ways in which we understand learning and also influence the process itself. When words serve to clarify and expand ideas, this can affect the process of knowledge acquisition. Thinking about learning as cross contextual requires students and teachers to think about not only what is being learned in other classes, but also connections from beyond the school. Using the metaphor of the fractal for knowledge construction works well in this context because it allows for growth in multiple directions.

A fractal model of knowledge construction provides a lens through which to view perceptions of learning outcomes in relation to a discipline-based framework. In my conceptions of knowledge building as fractal-like, disciplines are acknowledged, but not viewed as fixed. Fractals are always emerging or evolving. Experiences viewed through this lens need not be classified into a static framework, but rather simultaneously inform, and are informed by, attitudes of continuously evolving conceptions of knowledge.

Theories of integration search for a combination of subjects – an amorphous mass of information – where there is not a hierarchy of one discipline over another. When asked to do something to support another content area, Ms. Integration always asks what the benefit is for her. For her must be a mutually beneficial relationship. Achieving this sort of balance is difficult. Making sense of the great mass of knowledge generated by this type of learning experience needs some sort of organizing structure.

A fractal model of knowledge construction acknowledges both discrete points and paths of connection. In this way, relationships are created between the disciplinary merging of arts integration and the discreet bodies of knowledge of interdisciplinary learning. A fractal-like construction of knowledge also goes beyond both of these constructs by emphasizing further cross contextual relationships while also encouraging self-reflection.

REFERENCES

Asimov, I. (1994). *I. Asimov: A memoir*. New York: Doubleday.

Babbie, E. (2001). The Practice of Social Research: 9th Edition. Belmont, CA:

Wadsworth Thomson.

Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*.

Minneapolis: University of Minnesota Press.

Dewey, J. (1934). *Art as experience*. New York: Minton, Balch & Company.

Eisner, E. W. (2002). Visions and versions of art education. *The arts and the creation*

of mind, 25-45. New Haven: Yale University Press.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences.* New York:

Basic Books. New York: Teachers College Press, [2014]

Goldberg, M. R. (1997). *Arts and learning: An integrated approach to teaching and*

learning in multicultural and multilingual settings. White Plains, N.Y: Longman.

Hetland, L., Winner, E., Veenema, S. & Sheridan, K. M. (2013). *Studio thinking 2:*

The real benefits of visual arts education.

Knobel & Lankshear (2007). *A new literacies sampler.*

Kosuth, J. (1965) *One and Three Chairs.*

Kress, Gunther (2009). *Multimodality: A Social Semiotic Approach to Contemporary Communication*. Taylor and Francis. Kindle Edition.

Marshall, J. & Donahue, D. (2014). *Art-centered learning across the curriculum: Integrating contemporary art in the secondary school classroom*.

Marshall, J. (2014). Transdisciplinarity and Art Integration: Toward a New Understanding of Art-Based Learning Across the Curriculum. *Studies in Art Education*, 55(2), 104-127

Mandelbrot, B. (1982). *The fractal geometry of nature*. San Francisco: W.H. Freeman.

Peirce, C. S., & Peirce Edition Project. (1998). *The essential Peirce: Selected philosophical writings. Vol. 2, ,* 1893-1913. Bloomington, IN: Indiana University Press.

Robbins, B. (2011). *Microscope.* Seattle: Lame Mage Productions.

Rolling, J. H. (2013). "Moving pictures: Reshaping the qualitative quantitative divide through the currents of arts based research." C. J. Stout (Ed.), *Teaching and Learning Emergent Research Methodologies in Art Education*, 7795. Reston, VA: National Art Education Association

Russell, J. & Zembylas, M. (2007). "Arts integration in the curriculum: a review of research and implications for teaching and learning." L. Bresler (Ed.)*, International Handbook of Research in Arts Education*, 287–302. Springer.

Saussure, F. (1959)*. Course in general linguistics.* New York: Philosophical Library.

Stokrocki, M., & National Art Education Association. (2005). *Interdisciplinary art education: Building bridges to connect disciplines and cultures*. Reston, VA: National Art Education Association.

Taylor, P. G., Carpenter, B.S., Ballengee-Morris, C. & Sessions, B. (2006). *Interdisciplinary approaches to teaching art in high school*. Reston, VA: National Art Education Association.

Vygotsky, L. (1978). Interaction between learning and development. From: Mind in Society (p. 79-91). Cambridge, MA: Harvard University Press.