UNIVERSITY OF CALIFORNIA, SAN DIEGO

Aesthetic Mathematics: Using a SMART Board in a Kindergarten Deaf Classroom to Explore and Express Geometry through the Arts

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in

Teaching and Learning: Bilingual Education (ASL-English)

by

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2012

The thesis of Sarah Rachel Kasavan is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

2012

DEDICATION

My thesis is dedicated to the students and staff at California School for the Deaf, Riverside, Plainfield Elementary School and Washington School for the Deaf. From my first internship to the last, I would not be the teacher I am today without the support and growth made possible by the wonderful cooperating teachers, supportive staff, and delightful students with whom I have had the opportunity to learn, and who have taught me more than I ever could have imagined.

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EPIGRAPH

Mighty is geometry; joined with art, resistless.

Euriphides

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ABSTRACT OF THE THESIS

Aesthetic Mathematics: Using a SMART Board in a Kindergarten Deaf Classroom to Explore and Express Geometry through the Arts

by

Sarah Rachel Kasavan

Master of Arts in Teaching and Learning: Bilingual Education (ASL-English)

University of California, San Diego, 2012

Professor Tom Humphries, Chair

Mathematics performance in Deaf education is less than desirable. As the stakes are raised, pressure increases and motivation drops. To combat leading evidence, this curriculum was designed to not only

improve mathematics competence, but also motivation through a cross-content integration with the arts. Students had opportunities to explore geometry through art projects, with the use of a SMART Board and hands-on activities, ultimately showcasing selected works. Additionally, students developed their academic language, as it pertained to the content, in both American Sign Language (ASL) and written English.

I. Introduction and Overview

Much discussion by educational researchers in recent years has pointed out the scarcity of arts in academia. Both Deaf and hearing students spend most of their school day on two major content areas: Language Arts and Mathematics. These subjects are often emphasized without personal connections or meaning attached; even in this paradigm, Language Arts is one of the highest priorities in classrooms today, especially in Deaf education. Inspired by this inequality, my thesis emphasizes not only the importance of mathematics, but also integrates the arts as the method by which mathematics can be learned. Rather than focusing solely on the necessary algorithms to succeed on standardized tests to pass each grade level, this curriculum challenges students to explore mathematics through the arts. Based on teacher observation, student work samples, field notes and rubrics, students developed Cummins' (1999) basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP) using both American Sign Language (ASL) and English print, in addition to three main curriculum goals, which will be discussed below.

This curriculum addresses student motivation in mathematics by providing *worthwhile tasks*, through the arts and real world experiences. Throughout the projects, students will explore mathematics in multiple

ways, specifically through various arts, where they can express themselves through mediums such as paint, sculpture and illustration. Thus, the students are motivated through artistic, *worthwhile tasks* (Brown, 2005).

Inspired by a project by the Model Secondary School for the Deaf, which aims to motivate students to accumulate money for a math auction, I seek to motivate students through artistic, meaningful experiences and interactions with the content at hand. Additionally, students will have opportunities to discuss their works using ASL and written English, thereby contributing to their linguistic development as bilingual individuals. Overall, this curriculum provides multiple methods for students to experience artistic flexibility and creativity, enjoy mathematics, and to tap into their abilities and passions with regard to these crucial content areas. As an accumulating project, students will showcase their skills and aesthetic expression in a class showcase, or museum.

This thesis is designed for a four-week implementation process, in which students begin with an introduction and end with a showcase of their mathematical works of art. Students make shapes with nonstandard mediums, such as wax and felt, as well as discuss geometry in both signed ASL and written English, regarding their museum displays. This curriculum ultimately challenges students to open their minds about what mathematics can be, requiring them to create, describe and identify

elements of their own learning. There are also opportunities to discuss mathematics in the environment, such as in literature and sculptures around and off campus. Students also have the opportunity to learn from a Deaf artist, making further connections to mathematics and Deaf culture. The culminating assessment requires each student to choose his/her favorite piece of artwork from his/her own collection. This piece is to be displayed with a plaque where students use written English to describe their work. In addition, the museum showcase features student vlogs, in which students describe their work using academic ASL. These elements make connections between mathematics and art, as well as to the linguistic and cognitive development of these students in BICS and CALP across both languages.

There are three primary goals for this curriculum:

Firstly, *students will explore multiple methods and art mediums to develop their conceptual and mathematical skills*. From the beginning of implementation, students use both familiar and nonstandard art mediums to explore mathematics, specifically geometry. These projects provide memorable, and thus meaningful experiences in mathematics for students to recall and relate to their developing knowledge. Additionally, this curriculum serves as a foundation for the future of students, both in mathematics and art, enabling students to view academics from a

broader perspective while making connections across content areas that are ultimately mutually beneficial.

Secondly, *students will recognize how art and mathematics are present, applicable and integral to daily life*. In order to encourage personal connections to the content, as well as to explicitly demonstrate major implications of this curriculum, students are required to identify art and mathematics in the environment. Students participate in a read aloud, learn from a guest artist, in addition to finding two-dimensional shapes and three-dimensional figures on and off campus. Of the three goals, this one is crucial in that it demonstrates the value and application of what is learned in the classroom. These facilitated experiences help students to internalize the relevance and value of art and mathematics.

Finally, *students will produce and present their artwork in a showcase, expressing what they know*. Throughout the implementation, students create works of art to develop and express their art and mathematical knowledge. To conclude the implementation process, students select their favorite piece of art to display in a class showcase, which is introduced to the students as the class museum. Students will accompany their artwork by creating a descriptive plaque and vlog, showcasing what they know in ASL and English, as well as documenting the works of others. This process ultimately empowers students to

demonstrate their knowledge in a way that reinforces their motivation and learning through the use of academic language and artistic creativity.

This curriculum is innovative in that it seeks to develop mathematics through the arts. It seeks to move beyond the mandated algorithms and curriculum resources by bringing students into the process of their own learning. Students are empowered to construct their own knowledge through art, using kinesthetic learning across content areas. These tasks are meaningful and motivating to students and help to expand their ability to understand mathematics on a deeper, more complex level.

II. The Need for a Bilingual Approach to Deaf Education

1. Pedagogy

In order to engage students in the process of their own education and help foster their development as lifelong learners, it is necessary to focus pedagogy on reciprocal, interaction-oriented practices (Cummins, 1986). This not only means eliciting student participation, but also setting up high expectations for students to invest in their own learning process. Through student-centered learning, students are provided with opportunities to create and express their knowledge in a variety of ways, thereby developing their critical thinking skills. This pedagogy also enables students to learn while expressing their language, cultural and academic identity (Goldberg, 2006), which supports the goal of bilingual, multicultural practice of Deaf education. While the teacher facilitates learning, students are held responsible for discovering and constructing their own knowledge and learning in a focused, social context. Through this reciprocal learning, students actively engage with peers and the content, empowering them to learn for their own motivation and satisfaction. This exploration and expression is essential in both Deaf and hearing classrooms, for students to develop their own point of view, which will later serve them in society. This type of personal growth enables

students to be better equipped to advocate for themselves beyond school as their abilities and passions develop outside of the classroom.

Additionally, the discussed pedagogy helps adapt the state standards to be accessible to all students by providing flexibility to meet student needs. It is important that students receive grade-level content in a way that is comprehensible and accessible, scaffolding them to develop to the best of their abilities. Since all students learn differently through each of their strengths, it is crucial to address and take advantage of their diverse needs (Gardner, 1983). Using a variety of methods to best accommodate students as individuals and a group is at the heart of differentiating instruction, thereby providing access to all students in terms of content and linguistic development.

Furthermore, upon examining the theoretical framework of Jim Cummins (1986), there are four primary domains in the school context that serve to either empower or disable students: cultural/linguistic incorporation, community participation, pedagogy and assessment. As educators seek to empower students in their academic social context, which ultimately transfers to their lives outside of the classroom, it is essential to be linguistically additive, culturally collaborative, base pedagogy on collaboration and assess students in a manner that advocates their abilities and potential. This portion of my thesis aims to

illustrate the aforementioned categories of empowerment in the bilingual/multicultural classroom for Deaf and Hard of Hearing students, thereby supporting the bilingual approach in a Deaf/Hard of Hearing classroom. All these students will be referred to, from this point forward, as Deaf, rather than D/deaf or Hard of Hearing, in order to represent them as part of a greater identity and culture, rather than focus on the degree of hearing loss, as determined by an audiogram (Humphries, 1988).

In order to foster a culturally and linguistically additive environment in the bilingual/multicultural Deaf classroom, it is necessary for teachers to recognize student diversity. Linguistically, children come to school with a variety of home languages, from ASL to English, Spanish and other languages, either signed or spoken. Our job as educators in providing a safe learning environment is to facilitate learning in a way that empowers students to become productive, confident members of society. Although it would be impractical to learn every home language of each of our students, we can celebrate languages through the type of literature and classroom decorations in our environment, as well as the language and attitudes expressed towards diverse students. This project will focus on English and ASL as the two primary languages used by the students in the classroom, although it can be adapted to include other languages, as well.

Cummins (1986) supports that children can only learn in a language they understand, provided the language is completely accessible. ASL is visual, and thus accessible to all Deaf students, even those with residual hearing, hearing aids and cochlear implants. This supports that ASL be the full-time language of instruction and communication. By using this language at school, students have access to content and spontaneous communication, fostering their linguistic and cognitive development (Cummins, 1986). Although many students now have cochlear implants and assistive technology for hearing, they should continue to have full access to the visual language. As reported by Graney (1998), ASL does not prevent speech and English development, and should the child's family decide to proceed with speech and voice for added communication, that option is available. Even incorporating the speech teacher into the general classroom routine, such as in a learning center, can be beneficial, should children's Individual Education Plans (IEPs) request speech. As suggested above, although various modes of communication are all acceptable, it is important to be inclusive and additive, rather than eliminate any opportunity to communicate, supporting that ASL be the primary language of instruction. Even for students who are still learning ASL, its accessibility suggests that students, regardless of level upon entering school, have the ability to acquire it, as it

is a completely accessible language. This notion was tokened as the input hypothesis by Krashen (1985), which supports that children will acquire an accessible language with adequate exposure. Not only will ASL be respected in the classroom, but also viewed equally valuable as English, which is made accessible through print.

Lastly, Cummins (1986) discusses the potential of assessments to empower or disable students. Rather than utilizing assessments to identify deficits, it is important provide students the opportunity to showcase what they know. This requires using assessment as ongoing and a part of instruction, in context and familiar to students. Students should be held to high standards, provided the tools and experiences that will empower and promote them to succeed with given assessments. Cummins (1986) labels this type of assessment as "advocacy-oriented," where students have the opportunity to advocate for themselves in modeling what they know. This means allowing for multiple forms of expression, enabling students to showcase their knowledge in a variety of ways. This idea also supports developing academic language (CALP) as a means of expression, in addition to artistic or ASL representations of knowledge.

2. Research

Until the 1960's, ASL was not recognized as having linguistic features such as syntax, semantics, morphology and phonology, and was

therefore not identified as a language. This thinking negated the question of bilingual education for Deaf students, as their language was not yet recognized as so. However, recent research shows the progression of linguistic understanding and the broadened definition of language, proving that ASL is a complete language (Baker & Battison, 1980; Klima & Bellugi, 1979; Stokoe, 1960). With this identification, the need for native language use in education for Deaf students became a topic of interest. Additionally, by 1994, the United States began to recognize the official need for this integration among students labeled as English Language Learners (ELLs), creating multiple models for how this would be carried out (Crawford, 2004). Although Deaf students are not officially categorized as ELLs, the notion of ASL as a primary language is gaining popularity amongst researchers and educators today, as most student are from hearing families and were not exposed to ASL as a native language. This idea has given rise to the label of "bilingual" when discussing Deaf education, although it would differ in practice from bilingual programs for hearing students.

Although many Deaf students still experience oral education, that method of teaching has begun to lose popularity amongst several leading researchers, as well as have other forms of Manually Coded English (MCE), which are artificial sign systems, rather than natural

languages. Since the time when manual communication was considered important in Deaf education, most of the teachers, themselves hearing, used and continue using these artificial sign systems, such as Signing Exact English (SEE) and Total Communication (TC), which are forms of English expressed on the hands (Strong, 1988). Strong (1988) discusses that these systems continue to fail the students, as these modes of communication fail to represent full, complete languages. This points educators in the direction of research supporting not only that ASL is a language, but also that it is a complete language, equivalent to any spoken language with the ability to serve as a primary language. With the recognition of ASL as a language, Deaf people were finally viewed as bilinguals, according to Grossjean (1992, 1996), who defined bilinguals as people who regularly use and interact with two languages.

Drasgow (1998) supports that Deaf children need a language that is both natural and complete, and thereby has linguistic features. Refuting the argument for MCE, Drasgow's case highlights that ASL is not only a natural language that occurred as a product of a people, just as any other language, but that it is a complete language. Although ASL exists and interacts with English, it is not an expression of this English on the hands, but rather a fully natural language that emerged in its own right. This language use by and with Deaf children can be further supported by

Cummins' (1996) common underlying proficiency, which supports that the development of one language transfers to the development of another. It can be inferred that encouraging and nurturing the development of ASL will foster English development through its solid linguistic foundation.

When examining the importance of using ASL with Deaf children in academic settings, there are several key studies worth discussing. Strong and Prinz (2000) studied the correlation of ASL fluency with English proficiency. One of the findings showed that overall, Deaf students with Deaf parents outperformed Deaf students with hearing parents in terms of ASL fluency and English literacy, as they are more likely to have full ASL language access from a young age (Strong & Prinz, 2000). However, the key finding in this study showed that when ASL fluency ranged from medium to high in both groups of students (from Deaf and hearing families), the English literacy gap disappeared; students of equal ASL fluency had equal English literacy scores, regardless of having Deaf or hearing families (Strong & Prinz, 2000). It can be inferred that supporting the use of complete ASL in school provides a solid primary language foundation to support English acquisition, whether or not students have the extra benefit of full language access outside of school.

Furthermore, Hoffmeister, et al. (1997) studied the correlation between the SAT-HI (Stanford Achievement Test for the Hearing Impaired)

and ASL fluency for deaf children. Findings showed that the two scores were positively correlated, providing evidence to support the benefit of early language access through ASL for Deaf children. As said by Mason and Edwoldt (1996), "This is not only what deaf children need, but what they deserve" (pp. 297).

Lastly, Krashen's input hypothesis states that humans have an innate capacity and mechanism to learn language, and when we receive intelligible input, we have "no choice but to acquire language" (Krashen in Crawford, 1994). Deaf students, who have a variety of access to spoken language, all have full access to ASL, as it is a visual, tactile language. It can be inferred that with exposure to this completely accessible language, Deaf children will acquire it, and thus have a primary language. As can be further supported by Livingston (1997) and Petitto et al. (2001), humans have the biological predisposition to learn accessible, complete language. The aforementioned research supports the notion of teaching in an environment rich in accessible language, in this case, ASL.

3. Social/Cultural

In order to be linguistically/culturally additive, it is essential for teachers to recognize the cultural diversity of students, hence being bilingual and multicultural. Rather than assuming all the Deaf students

identify with Deaf culture primarily, we must note that the majority of Deaf children come from hearing families, and likely identify with the culture of their family, as well. While students come from homes with a wide range of primary languages, this curriculum will focus on English and ASL, as the former is widely used in the United States and the latter is their language of communication in the school environment. Thereby, utilizing at least two of the students' languages, while respecting all languages through actions and literature, we show students an additive attitude towards incorporating and utilizing multiple languages in accessible ways. Educators can take from this the power of adding to students' home languages and cultures. This practice ultimately empowers students to become lifelong, confident and motivated learners, which applies to students of all backgrounds.

In summary, students can be empowered by their educational setting to be who they are while developing into who they can become as lifelong learners in multiple cultures and two or more languages. By using an additive approach, students grow as individuals over several domains. Teachers must guide students to develop as learners and expressive individuals who are equipped with the tools to advocate for themselves, while contributing to society as a whole. As a teacher, I am

empowered to foster the development of my students into becoming independent, strong and intelligent lifelong learners.

III. Assessment of Need

According to the Stanford Achievement Test scores for Deaf students, the average mathematics ability at the age of projected high school graduation is just below the fifth grade level (Traxler, 2000). Being the most recent finding from the Gallaudet Research Institute (2002), more up-to-date results are unavailable, but are suspected to remain the same, according to personal communication with teachers of Deaf students from my student teaching placements. A serious red flag in the realm of mathematics, this result signals a need to improve the teaching of mathematics in the education of Deaf students.

While student teaching in one of California's two residential Deaf schools and one Deaf program in a public high school, I have observed students' mathematics experiences as following given algorithms in curriculum resource books. Through personal communication with teachers in these schools, I found that the demands of legislations such as No Child Left Behind (2001) have forced teachers to teach directly from text books to meet deadlines and prepare students for the following year of algorithms, which often results in rote memorization tasks and training for standardized tests. From this, it is no surprise that scores are low, as this passive work with pencil and paper fails to require students to critically think, thereby failing to provide the same level of intellectual stimulation

and growth. As a result, Deaf students lack motivation, causing a mismatch with modern society. With the rapidly changing world today, there is a demand for creative and critical thinking in the way of progress; traditional teaching must adapt to prepare students to meet these evolving expectations. Students are trained to produce answers on worksheets, rather than consider the "why" behind their work, especially in mathematics. By being challenged to approach mathematics through the arts in a way that requires students to think creatively, they not only experience *worthwhile tasks*, but also are able to apply the ability to think dynamically and use meta-cognition in their daily learning.

Furthermore, Mousley and Kelly (1998) report that Deaf students have greater abilities to discuss mathematics in ASL than in English. As English is often seen as a daunting task, this curriculum seeks to provide fresh motivation for students to approach mathematics from multiple perspectives and methods, opening their minds to further learning opportunities to close the gap between their ASL and English expression of mathematics. This curriculum often uses an ASL to English approach, enabling students to think and express themselves in ASL before translating their thoughts into English. By being provided the proper experiences in the arts in relation to academic language, these students

will improve their English abilities to express what they know regarding mathematics and art.

Lang and Pagliaro (2003) discuss that Deaf students experience mathematics word problems that lack challenging cognitive engagement. This finding is unfortunate, but not surprising, as supported by the aforementioned test results. Adora Svitak (2010) is an elementary student who was featured on TED.com, and expresses to an audience of educators that when the stakes are low, children will sink to them. With this curriculum, not only will expectations be high and made clear, but also students will be expected to rise to the expectations by utilizing their own strengths and preferences.

With regard to creativity and the arts, Sir Ken Robinson (2006) supports that "creativity now is as important in education as literacy" in our world that has such a high demand for progressive and innovative thinkers. Rather than squandering the creativity of children, who are born artists, multiple intelligences need to be celebrated and supported throughout education (Robinson, 2006). He explains that sadly, pure academic ability, which is limited in what it covers, has been substituted for overall intelligence, and we need to reverse this trend in support of educating the whole child (Robinson, 2006). To further support his argument, he tells the story of Gillian Lynne, who was an elementary

student in England during the 1930s. She had trouble focusing and sitting still in class; rather than being given medicine, she was sent to a dance school, and subsequently excelled from there and ultimately choreographed *Cats* and *Phantom of the Opera* with Andrew Lloyd Webber. From this example, we can see that intelligence is dynamic and diverse (Robinson, 2006), and educators must educate whole children, encompassing the arts and multiple intelligences into the content areas.

Furthermore, Riscili (2002) reports that art therapy has been shown to facilitate the language development of children, both Deaf and hearing. Surely, providing artistic experiences as a method for teaching mathematics fosters academic language development relating to the content area being taught. Not only art, but also accessible technology is lacking for Deaf students (Kurlychek, 2000). This reality is combated by using the SMART Board during lessons as a means to learn the content, which further familiarizes students with the skills needed for a world that is largely dependent upon technology. By integrating art and technology into mathematics instruction, it is clear that students will be provided with the necessary experiences to meet not only the curriculum goals, but also develop their motivation to learn.

As is sadly evident, many students, both Deaf and hearing, are missing the arts in their education. Deaf students continue to perform at

low levels across the content areas, and especially for mathematics, despite the push for rapid, rote memorization and algorithms. That is why I have proposed a curriculum that utilizes student creativity and multiple intelligences in relation to mathematics. A similar curriculum has yet to be published, especially for young Deaf students. This curriculum empowers students to take advantage of their skills and abilities, in addition to developing new dexterity in both the arts and mathematics.

IV. Review of Existing Materials and Curricula

When I decided to conduct my curriculum regarding mathematics and the arts, I studied past theses from the University of California, San Diego (UCSD), as they consist of various other curriculums that pertain to Deaf students. All three theses regarding mathematics available from UCSD have a focus on mathematics and language, specifically word problems. To build to this collection of curriculum in this content area, I will not only incorporate academic language, but also focus on mathematics with its relationship to the arts, as well as embracing multiple perspectives and intelligences to gain a deeper understanding of mathematics content. Vrbancic (2000) focuses on making connections between language and mathematics in order to help students with tasks that require both abilities, such as word problems. Zernovoj (2005) uses various forms of stories to develop word problem skills, providing strategies for students to be able to succeed at this task. Lastly, Bluestein (2007) uses comprehensible input and literacy in ASL and English to scaffold students to complete word problems with accuracy. These theses, developed and implemented throughout a seven-year period, suggest the need for further development in the realm of mathematics, and serve to function as a solid foundation for my own curriculum, as it will also include

language as an art form to express and explore mathematics, as well as academic language.

After reviewing the aforementioned curricula, I synthesized sources from my personal library, including various articles and texts discussing arts in education, mathematics in education and various intelligences. In *About Teaching Mathematics* (2007), Marilyn Burns provides various mathematics activities to support students learning mathematics concepts in a creative way, which can guide the notion of seeing math from multiple perspectives. The examples set in this book inspire educators to think outside the box and develop lessons that teach children in creative and diverse ways. These methods utilize students' multiple intelligences, as well as facilitate discussion, and foster the innate curiosity and ability to reflect upon one's own learning. Moreover, Gardner (1983) discusses these multiple intelligences, illustrating that people have multiple domains of intelligence; although each individual possesses each of these intelligences, each profile is unique in its combination of strengths. This idea suggests that students should be given opportunities to express and explore each of these domains in order to be educated as a whole person. My curriculum seeks to educate the whole child, emphasizing the domains that are oftentimes left out.

With regards to the arts, Goldberg (2006) supports that art and mathematics feed the mind and the soul, going as far as to describe the relationship between the two through the analogy to "fraternal twins" as they "are interrelated yet have their own lives" (pp. 154). As Goldberg (2006) explains, schools tend to use mathematics as a way to find answers, rather than a lens from which to view, explore and understand the world. Not only will using art as a medium help students understand mathematics, but the inverse is also true; students will use mathematics to better understand art. As art is added to the practice of mathematics, mathematics is added to the practice of art; this ultimately enables students to broaden their own perspectives of the world in which they will become productive citizens. This idea is crucial when educators aim to educate the whole child.

Lastly, I searched online at ERIC, JSTOR and the Clerc Center at Gallaudet University for educational research, the latter of which is specific for Deaf students. I decided to use these three databases in order to seek diverse sources on the content areas in general, then specifically for Deaf students, as that is the population for which this curriculum is designed.

Wieder (1998) supports that when children are provided the opportunity to create, their multiple intelligences and abilities are not only

showcased, but have the opportunity to develop. Student learning styles emerge as a result, thereby providing the necessary opportunities for students to develop meta-cognitive abilities, which will ultimately motivate them to become lifelong learners.

Bickley-Green (1995) examines the theoretical and practical view of mathematics with art, expressing methods in which the pair can be implemented in school by supporting one another through their concurrence. This idea is explored in order to develop both content areas through a creative approach that believes the two are interrelated. This cross-content relationship is a key concept that is an integral foundation for this curriculum. Furthermore, Macintosh (2008) suggests it is an innovative idea to juxtapose mathematics with art, as the traditional content pairings are art with English and science with mathematics. This shows that although the two content areas are practically related, they are not always integrated in the academic setting. However, there are examples of the arts already being used in school: Behannon and McDowell (2010) provide an example of how dance introduced students to mathematical concepts, enabling them to learn through their bodies and physical experiences. While dance is not a part of this curriculum, students will use their bodies to paint, sculpt and explore their environments and materials to experience mathematics.

After thoroughly searching the Clerc Center, specifically reviewing *Odyssey Magazine*, pertaining to Deaf education, it became apparent that art and mathematics are not discussed together for Deaf children in the way they are discussed for hearing children in other publications. While motivating students in creative ways for mathematics is discussed for high school students, empowering these students through the integration of both content areas is lacking resources and research. This discovery provided further motivation to develop a curriculum that not only integrated these areas, but also fostered student development in art and mathematics that ultimately benefits students beyond the classroom.

V. Key Learning Theories and Relevant Research

The first learning theory addressed in this thesis is Gardner's (1993) **multiple intelligences**, which supports that traditional I.Q. testing is limited to only specific domains of intelligence. It also emphasized there are many overlooked realms that are not considered as abilities or intelligences. He states that there are seven domains to consider: Visual-Spatial, Body-Kinesthetic, Musical, Interpersonal, Intrapersonal, Linguistic and Logical-Mathematical (Gardener, 1993). While Visual-Spatial intelligence can be logically, yet minimally, related through mathematics through traditional algorithms, this curriculum seeks to expand that domain to include various forms of visual art, in addition to the other intelligences, specifically Linguistic, Visual and Kinesthetic. Students are encouraged to utilize multiple forms of intelligences to not only explore mathematics and the arts, but also develop their own domains of intelligence.

Secondly, this curriculum will incorporate Krashen's (1985) **input hypothesis**, which states that when people are exposed to an accessible language with linguistic, intelligible meaning, they will acquire it. In this curriculum, students are repeatedly exposed to the academic functions using both ASL and English, in a linguistically rich environment with the goal of them acquiring content knowledge and the ability to discuss it.

This hypothesis, along with the flexibility of multiple intelligences, ties into the bilingual, multicultural classroom in which this curriculum will be implemented. Students will experience several modes of expression and exploration, thereby being valued as bilingual, multicultural, intelligent beings with diverse perspectives and abilities. Related to the input hypothesis is Cummins (1986) **linguistic interdependence**, which utilizes student background knowledge (linguistic and cultural) on which to build their knowledge, rather than replace it. This is related to the input hypothesis in that ASL is a completely accessible language, which is used for communication and instruction to become a solid linguistic foundation; knowledge can be applied to English, and also the content areas. This theory is based on a framework that ultimately empowers students by being culturally/linguistically additive, collaborative within the community, pedagogically reciprocal, and advocacy-oriented in assessments (Cummins, 1986); it serves to inspire students to develop a sense of pride and ownership in being unique, independent, lifelong learners. This framework ultimately empowers rather than disables by including and utilizing student prior knowledge and experience to become applicable in and beyond the classroom.

Thirdly, this curriculum will take into account **student-centered learning** (Ngeow, 1998; Thomas 1993), which supports that students be

active participants in constructing their own learning through a series of activities facilitated by the teacher. This means that students are encouraged to take the lead in being active participants in their own learning process, both physically by interacting with materials and mentally by constructing their own knowledge, ultimately feeling a connectedness with the materials and content. This aspect goes on to encompass student discovery through explaining work to peers and learning from what classmates envision and create. This pedagogy makes lessons more meaningful for students, as they are compelled to become active learners. As mentioned above, students ultimately become integral players in their own learning, which makes these experiences *worthwhile tasks* with clear benefits.

Lastly, this curriculum will utilize **meta-cognition** (Collins, 1994; Flavell, 1979; Piaget, 1986; Vygotsky, 1978). Defined as thinking about thinking, this concept helps students to feel a sense of ownership, pride and motivation with the work they are producing. As students are provided the necessary scaffolding and academic language in both languages, they simultaneously develop the ability to critically consider what they are learning and experiencing using academic ASL and English. Students will discuss their work in relation to rubrics and a class museum, in addition to writing about what they have discussed in ASL. This will include what they

create, in addition to how it was created, both mathematically and artistically. This skill to reflect upon one's own work is the essence of meta-cognition, making the learning process more explicit for students.

Although other learning theories and strategies will be addressed throughout this thesis, the aforementioned theories are the main theories upon which this thesis is based. These ideas have been discussed, but have yet to be specifically synthesized into a mathematics and arts curriculum for Deaf students in the bilingual setting. This curriculum not only seeks to create such resources, but to empower students to maximize their learning and development across and beyond content areas.

VI. The Curriculum

The curriculum, "Aesthetic Mathematics: Using a SMART Board in a Kindergarten Deaf Classroom to Explore and Express Geometry through the Arts" is divided into sixteen lessons, which I called "projects" to emphasize the focus on artistic creation and project-based learning. While based on a SMART Board in conjunction with hands-on experiences, concepts and materials build on one another throughout the sequence of the curriculum.

Each of the projects is based on California and Washington state standards, regarding both art and mathematics, specifically pertaining to geometry. All goals from California are specifically tailored for kindergarten students; Washington state goals include some standards from first grade, as well as general elementary goals for art. These standards are addressed in each lesson plan under the heading entitled "Standards Addressed," and are split into categories by state. From this point forward, I will quote each heading to highlight important titles as they appear in the lesson plans.

Each project corresponds with at least one main "Curriculum Goal," of which there are three throughout the curriculum. Although the third goal, which focuses on the creation and presentation of art in a culminating showcase, it is implemented throughout the projects as new

artwork is created. Although present throughout the curriculum, this goal is only mentioned in the final to lesson plans, as that is the main focus of those projects.

These projects also include a "Language Objective" and "Learning Objective," specifically tailored to each lesson plan. Also included are "Materials Used," "Set Up," and "Teacher Notes," which are essential to read prior to implementing each lesson, as some require a great deal of preparation and material management. Furthermore, each project has a page describing "Activities," which includes the "Introduction," "Procedure," and "Conclusion" of each project, followed by what materials will be used in the "Assessment" of what students learned. Each lesson is accompanied by a "Rubric" to assess student progress, in addition to a space for "Teacher Observations" that can be filled with anecdotal evidence and quotes from students to represent their work and learning process.

To help students keep track of their artwork created throughout the curriculum, it is suggested that each student have a "student station," which is used by students to leave their work and by staff to set up materials for students. This not only helps students stay organized, but also take ownership over their own work. Further ideas for implementation are included in Appendix A, along with all lesson plans.

At the end of the curriculum implementation, students will present their mathematical artwork in a class museum. This showcase will enable students to demonstrate their knowledge in an artistic presentation.

VII. The Evaluation Plan

During the implementation of my thesis, I used three main sources of evaluation: field notes, teacher-created rubrics and student work samples. As the curriculum encouraged open-ended work by students, these diverse methods of data collection helped me gain a more comprehensive assessment of student work.

Field Notes.

I used field notes on a daily basis to monitor both individual and group progress. This helped me adjust the curriculum to meet the needs of the students, and to ensure that each of the curriculum goals was met. I made notes before, during and after each project to predict, observe and reflect on what was effective and what was not effective for the students, both individually and collectively. These notes included observations during implementation, in addition to feedback meetings with my cooperating teacher. I also recorded evidence of student learning outside of implementation, as students often demonstrated their knowledge while at recess, during lunch or in relation to other content areas.

Teacher-Created Rubrics.

To better measure student progress with the curriculum goals and project objectives in mind, I used rubrics to measure student progress, and

what was being achieved across specific domains. The rubrics were mainly for my use, but were sometimes used in conjunction with student input and reflection regarding their learning progress. By sharing rubric criteria with students, they were made aware of what I expected from them, thereby making the rubrics an integral part of the implementation. These rubric-related evaluation methods, especially through student-teacher discourse, enabled students to be more actively involved in their own learning, by assessing themselves in accordance with the criteria.

Student Work Samples.

Using student work samples as an assessment provided evidence that the students were able to meet the expected goals and objectives, and/or identified areas that were still developing.

I used various other assessments within the three main sources of evaluation, which allowed me to have a more comprehensive appraisal of student progress. These methods of varied and diverse evaluation were further strengthened from the feedback from my cooperating teacher and students, as all were active participants in the implementation process. Their involvement became crucial as modifications were tailored to the specific student needs. This ensured that the students had access to succeed while engaged in learning activities. It also ensured that the curriculum goals and objectives were effectively achieved.

VIII. The Curriculum Implementation

Description of Implementation Site

I implemented my curriculum at a state residential school for the Deaf. The school is in the process of certifying all teachers with ASL English Bilingual Program Development (AEBPD), and is nearly finished with the first level. The staff is approximately 50% hearing and 50% Deaf, with a campus language policy of signing at all times, using ASL.

The classroom of students that experienced my curriculum was an all-day kindergarten classroom with six students, and one third grade visiting special needs student, who sat in and participated in some lessons with his one-on-one aide with the goal of improving his social skills. In the mornings, a first grade student also joined us, but she was rarely there during the implementation of my thesis.

During a typical day, students experienced a morning meeting, which included calendar time, a daily vocabulary word, and review activities from previous lessons across content areas. Students were also introduced to concepts for background knowledge during this time. Students also had a mini-lesson prior to writer's workshop and reading twice daily, which were often integrated. Three times each week, students also had "centers" where an outside reading specialist and a speech therapist joined the class and ran individual centers, while the

main classroom teacher worked on various activities and assessments. Math, science and story time were taught daily in the afternoon. Story time alternated between ASL and English stories, which was also integrated with writing and reading story structure.

As my thesis is about mathematics, I will focus on this content area. Every day, mathematics was divided into two forty-five minute segments, the first to meet kindergarten goals with reading and understanding a calendar, and the second part for other grade-level mathematics. The main part of my thesis was implemented during the second time allotment. My cooperating teacher was occasionally absent during the implementation due to staff meetings, but the classroom aide was present throughout the implementation.

Additionally, classroom centers were held three times weekly for forty-five minutes, where I worked with students individually and in small groups to catch up on work and assessments. My goal was to work with each student once a week, which occasionally had to be made up during other pull-out times while in the library or doing independent work. Most of the language activities were done individually in centers or occasionally integrated into our writing curriculum in journal time or writer's workshop.

Individual Student Notes

1. AA is the only student who was born Deaf from a Deaf family. Her parents are both Deaf, as are her two sisters, one older and the other younger. Her father attended a residential school and her mother was mainstreamed, but AA has been a student at WSD since she entered pre-school. Her primary language at home with her family is ASL, which she has been exposed to since birth. She is skilled at BICS and is developing CALP on grade level. Although her age dictates that she should be in pre-school, her academic and linguistic performance levels allow her to be placed in kindergarten, where she remains at the top of the class for most subjects. She participates in after school activities on campus, and also attends gymnastics with an interpreter.
2. CF was adopted from China two years ago, and began attending formal school for the first time this year. His past is unknown, except that he lived on the streets and in an orphanage until adopted by his American adoptive parents when they were on a trip in China. During the fall and winter, CF spent his weekday mornings in kindergarten and his afternoons in pre-school to improve his social and behavioral skills. During my first week of interning, he began full day kindergarten. CF lives in the cottages during the week with

older students and Deaf supervisors as he rapidly improves his ASL BICS, which he has been using for less than two years. On the weekends, he spends time with his family, consisting of an older brother, a younger sister, and a new baby brother, who are all learning some ASL.

3. HH has been exposed to ASL for two years, and he is working on signing without using his voice to speak oral English simultaneously. His first language is oral English, which he uses with his family at home. HH is learning to self-regulate his signing by answering yes or no if he is using his voice, and changes his behavior if he is mixing English and ASL. HH has difficulty with language processing, both in input and output, and often signs one sign and voices another word, making his message unclear for both hearing and Deaf audiences. When not using his voice, he signs more clearly. His family does not use technology at home, other than his grandmother's house, and he volunteers often to use the SMART Board in class. He does not participate in after school activities on campus.
4. JTM has been signing for less than one year, and is developing her BICS in ASL. She recently started using appropriate ASL facial expressions and is continuing to develop that skill. She uses English

speech at home with one – two word utterances, which are unintelligible to teachers and the speech therapist at school. In mathematics, she can recognize shapes, but has trouble drawing them without a ruler, showing she is working on her fine motor skills. She does not participate in after school activities on campus.

5. MF is from a hearing family that began learning and using ASL when she was born. Her mother is very involved in the school, taking leadership positions among the staff and advocating for her daughter. MF has attended the school for two years, but has been exposed to ASL from birth. During pre-school, she was being monitored for signs of autism, but is now identified as a late bloomer and is no longer being watched for autism. MF is at the top of the class for mathematics. She predominantly uses classifiers and is learning to incorporate more signs to express how she is feeling. She participates in after school activities on campus and attends a Deaf church with her family.
6. NF was adopted from India three years ago by a Deaf teacher at the school. She has been exposed to ASL since adoption and is greatly improving her BICS and CALP. She has difficulty following multiple directions and remembering information from previous lessons. As a result, she is sometimes at the top of the class and

other times struggles to keep up with her classmates. Her mother is very involved in the school and communicates with the regular classroom teacher and me on a regular basis. NB attends after school activities on campus and socializes with her mother's Deaf friends.

During the majority of my thesis implementation, all the students were taught together, with the exception of center and pull-out time, or when students missed some class time for speech and were caught up on a separate occasion. There was one day that was dedicated to math alone in order to speed along the process and make way for further content between the completion of my thesis and the end of the school year.

The Implementation

Project 1: Shapes in Salt (April 11, 2011)

For the implementation of Project 1, students participated in groups, rather than a whole group setting. This was due to the time constraint of coordinating my curriculum implementation with the completion of their previous mathematics unit. I was concerned that the curriculum would not feel like a cohesive unit with a beginning through an end, but this project served as an introductory activity for the students.

Prior to beginning the project, I set up three salted plates and left them in a stack on the table. AA and JTM were with me from the beginning, and MF joined after another center. I showed the students a saltshaker and asked if they knew what was inside. AA signed "salt." I asked both students if they would like to taste and touch the material, and both said yes. JTM signed, "know," to show that she was familiar with the material.

I projected Slide 1.1 and asked if this was the same material that students had just held. JTM and AA nodded yes, and I signed, "Yes, you are right, the material is the same." I pointed to the sentence on the SMART Board and underlined it with my finger. I then signed "The material is salt." After signing "salt," I fingerspelled it, pointed to the pictures and signed "salt" again. I pointed to the word, "salt" and asked students to spell with me. As I predicted, AA spelled accurately and JTM struggled, so I pointed to individual letters and asked her what they said. Afterward, I had both students spell "salt" and sign it with me to provide more practice for AA and a model for JTM. I explained that salt can be used for food, but today we would use it for mathematics and art.

When we moved to Slide 1.2, I asked AA and JTM to look at the slide and think about what they saw before signing. After a few seconds, I asked students what they saw. AA was able to sign "shapes." I said,

"Yes, there are many shapes." I pointed to the word "shapes," then ran my finger under the sentence and read it aloud. JTM signed "shapes." I explained that we would use salt to make shapes in plates of salt.

I projected Slide 1.3 and asked AA and JTM to describe what shape they saw. I called on JTM, who gestured as if she was tracing the shape in the air, rather than signing, "circle." I signed, "circle" back to her, and AA pointed to the SMART Board and signed, "circle, that circle." I asked JTM to come to the board and trace the circle with her hands. The shape was too large, so she used a pointer to do so. Next, we used two fingers in the "H" handshape to draw a circle in the air. Both students were capable of doing this activity. Afterwards, with student help, I underlined the sentence with my fingers but did not read the last word. I asked JTM if she could show me where she sees the word, "circle" in the sentence. JTM walked to the board, then shrugged her shoulders. AA was waiving her hand, so I suggested to JTM that she look to AA for help. AA pointed to "circle," in the sentence, and JTM pointed to it on the SMART Board. Although she did not find the word on her own, the support of her classmate not only provided her with exposure to finding the correct word, but ideally a confidence booster that will make her feel comfortable to answer next time. I asked JTM to find another place where she saw the word "circle." Before looking at her answer, I

turned to AA and asked her to make sure JTM was right. JTM correctly pointed to "circle" then looked at me. I had her ask AA if she agreed, and AA said, "Agree, you're right."

I explained that we would follow the same procedure for the shapes we will make in salt today, but that I would model first how we do it. I put one of the plates in front of me and looked at the SMART Board. I drew a circle in the salt. I asked JTM and AA if it matched the circle and both agreed. I checked my answer by drawing the shape in the air with two fingers again to confirm that it did match. I asked the students if they could do the same, and they agreed. After students had drawn their circles, I noticed JTM's looked more like an oval. I modeled drawing an exaggerated oval in the air and had the students to do the same. Both students concluded that shape did not match the SMART Board and started over. AA drew another circle and JTM drew a less pronounced oval that looked more like a circle. I explained that we would do this for the remaining slides. Between each shape, I collected plates for material management, then passed them back when students were ready.

JTM struggled with drawing the shapes with sides and corners, making several variations of ovals or shapes with curved sides (Figure 8.1). We counted the sides and corners, which I informally introduced during this project. (The formal introduction of "sides" and "corners" is discussed

in Project 3 after students have background experiences from Project 1 and Project 2). As an experiment, I gave AA and JTM a paper to draw the shapes and noticed the same mistakes on paper, concluding that students need experiences in drawing shapes accurately. I developed the worksheet, "Practice at Home: Drawing Shapes," which was explained in class and sent home, one page at a time after being worked on in class.

Figure 8.1: JTM's Pentagon in Salt

When we arrived at Slide 1.6 with a pentagon, MF joined our group from another center. I asked AA to explain the activity, and asked JTM to watch to make sure AA explained the activity correctly. AA said, "copy shapes." She pointed to her plate with a pentagon and signed "salt,"

then pointed to the SMART Board and signed "home." She signed, "Want shape, will give plate. First need sign then plate give will." MF nodded and JTM agreed that AA had explained the activity clearly. I had MF join where we had left off, and she counted the sides of the pentagon without being prompted, and drew the shape in the salt.

AA, JTM and MF were able to answer the conclusion questions together by signing the shapes, rather than spelling them, as this was their first exposure to many of the shape names, and JTM was still learning letter recognition. I realized that was too difficult a task for her, but pleased that she was exposed to AA and MF spelling and recognizing words.

When AA and JTM finished and joined other centers, MF was able to go through the slides easily with me, recognizing materials and shapes. She was able to accurately identify and draw shapes, as well as self-correct her mistakes. She recognizes letters and accurately spells words, and goes through drawing quickly. When finished, there was extra time, so I showed her a triangle and a quadrilateral coming together to make a house. I asked her what shapes she could combine. MF selected a pentagon and quadrilateral to make a bow and arrow. I asked her to draw the shapes on paper then decorate what she visualized. Rather than drawing the shapes, MF drew a bow and arrow. I decided to let her

continue, as she was able to explain "pentagon, quadrilateral," before gesturing using a bow and arrow. Her drawing and the shapes she used can be seen below (Figure 8.2).

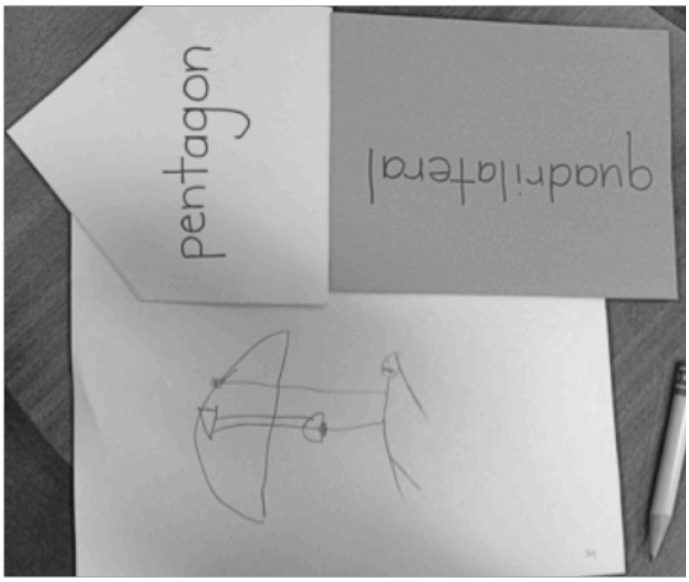


Figure 8.2: MF's Bow and Arrow

The next group of students, CF, HH and NB, began the project together. I went through the activities the same way as I did with AA and JTM, as CF is similar to JTM in his language development. I noticed that CF repeatedly reversed counting sides and corners/vertices when checking his work, which indicated that it was the signs confused him, rather than the concepts. I went ahead to show him Slide 3.2 to help, but he continued to confuse the words. This demonstrated to me that I would need to emphasize the labeling of words to help him accurately express his knowledge.

Both HH and NB completed the activity with much accuracy. HH repeatedly called a quadrilateral "rectangle," as he signed it with his pointer fingers, using the uninitialized sign for "quadrilateral" as he voiced "rectangle." I wrote "rectangle" on the SMART Board under quadrilateral to show the difference in words, and explained that a rectangle is a special kind of quadrilateral that we will learn about, and that he was right about the specific quadrilateral on the SMART Board being a rectangle. To help, I drew a non-rectangular quadrilateral to show a different kind of quadrilateral. At that moment, AA walked by and protested, "At home, we say 'rectangle,' too." I called student attention to how great it was that some had already seen this shape and called it a rectangle at home. I explained that at school we would call it a quadrilateral until we saw a special quadrilateral called a rectangle. AA, HH and other students agreed it was a good idea.

HH and NB completed the project by signing shapes they recognized and signing "salt" when sharing the material used. Both students recognized circle, triangle and quadrilateral, and HH added "house" for pentagon. Due to material management and behavioral issues, we ran out of time for drawing on paper, but students would have several opportunities later for similar types of activities.

CF had some difficulty using materials appropriately, and was later called by my cooperating teacher for another activity. When I worked with him one-on-one later, he refused to work and never finished this project. Since he had already demonstrated his competence at recognizing shapes, I decided to not force him to finish Project 1, in hopes of keeping him interested in mathematics with art. If the behavioral problem continued, a more serious intervention would be necessary.

Project 2: Wax Shapes on Fabric (April 12, 2011)

As this was the first whole group project, we began by reviewing what students had done in Project 1. We discussed what students thought about using art for mathematics before I reviewed that we would be doing many projects for the next several weeks. When finished, we would have a class showcase in a museum for our families and friends to see what students created. AA asked what a museum was, so I wrote the word on the SMART Board before describing what the word meant. When the word was described, several students, including AA reported knowing what a museum was, showing it was the word that was unknown, rather than the concept.

As we went through the slides, students helped me read the sentences and vocabulary words. CF and JTM mainly helped identify specific letters, frequently with the help of their classmates. HH read

many words using his voice simultaneously, but then switching to signing only when a staff member said, "I noticed you are using two languages at the same time. I wonder if you can pick one."

For material management, I poured some white glue in paper cups and gave each student a popsicle stick. Students dipped the popsicle sticks in the glue to transfer a small amount of glue to their cardstock each time they glued on fabric. All students were able to cover their cardstock, but I noticed HH and JTM struggled when overlapping fabric pieces, as they would fall from students not using enough glue. In retrospect, I should have explained that students may need to dip their popsicle sticks multiple times to make sure the fabric sticks. MF, in contrast, did not overlap any fabric pieces, making a collage that easily stuck to the cardstock.

After letting the glue dry, we reviewed Slide 2.3 as I pointed out the triangle I found in my collage. I signed it in ASL, then clicked on the slide for the English sentence to appear. This enabled me to use ASL first and English second, then refer back to ASL. This ensured meaning was behind my signing, rather than signing 1:1 English to ASL. When I asked students to sign the sentence with me, all of their hands remained on the table. I had to explain that I would like them to sign at the same time before trying on their own. JTM and CF signed with me, HH voiced some of the

sentence and AA went ahead. NB and MF did not sign with me. I asked for a volunteer to show what I expected from the class, so CF stood next to me in front of his classmates. He followed each of my signs between looking at the whole sentence then individual words, then sat down. All students signed with me the next time. When I asked for a volunteer to find a shape in his/her collage and sign the sentence, AA volunteered. AA pointed to a quadrilateral and practiced signing the sentence with me, using a quadrilateral. Students practiced her sentence then tried with their own in partners. This task was too difficult for CF and JTM to do in partners, even when working with other students. MF and NB did not participate and HH tried voicing with his partner. I decided to drop this activity, as I could assess students through their vlogs. More practice with sentence frames would have been useful prior to the implementation of this lesson, or having more time to dedicate to sentence frames.

After introducing materials, students were to trace the shapes they had all found. To monitor that each had found a shape, I had each show me before gathering wax strings from student stations. Each student was able to find a shape, some independently and others with support. I noticed the classroom aide took the initiative to assist JTM and NB, who did not seek help for identifying the shape each would trace.

When placing wax strings on their collages, students struggled more than I had anticipated. It seemed that the fine motor skills required for the task were too advanced. Many had circles around the shapes they found. MF tried to create straight sides, but they became bent and round when she picked up her finger from the collage. The same occurred for AA, as can be seen below (Figure 8.3). I decided to have students describe their goal with the wax string, and the classroom aide and I could help keep the wax string down as students moved their fingers from the wax string.

Figure 8.3: AA's Wax String Shape on Fabric Collage

Due to their fine motor skill development, the students experienced difficulty in carrying out this task. One alternative idea would be to place a sheet cover or saran wrap over the collages for students to trace a

shape, but have a more workable surface. Another idea would be to photocopy student collages and have them trace with a marker or wax string.

In the vlogs, AA, CF, MF and NB showed the shapes they found in their collages, despite the variance in representation by wax string. JTM created a vlog with support from the classroom aide prompting her with questions about what she found in her collage. HH became very frustrated in his vlog, repeatedly signing "quadrilateral" while voicing "rectangle."

Project 3: The Greedy Triangle (April 13 – 14, 2011)

Day 1: I began Project 3 by projecting SMART Board Slide 3.1 and asking students what they noticed. NB immediately signed "triangle." Other students agreed and I asked her to describe where she saw a triangle, and had JTM point it out on the board. When JTM asked her classmates if she was right, the students said they agreed.

During this read aloud, I read the book and acted as the shapes. My cooperating teacher was dressed up to be the shape shifter, who was assisted by the students when adding sides to the shape. Prior to reading the story, I asked students if they wanted to see the story. All said yes except for MF, which is when I realized I should not have asked a yes/no question regarding the activity. My cooperating teacher

suggested I honor MF's decision, predicting that she would return to the table once the story began. I let MF work on independent assessments for mathematics at another table while I read the story. Although she occasionally looked at the story, she remained at the other table until we were finished. She caught up later while other students had free time, and read the story with me.

During the read aloud, I noticed AA participating appropriately and volunteering more than the other students. NB participated occasionally, but had trouble getting back on task when story continued following student participation. CF was highly engaged, signing "I know" several times throughout the story. I had shown him the book the day before during free reading time, since he had a tendency to become distracted during story time, and noticed that seeing the book prior to the implementation helped him focus. Leaving materials in the free time area would be good for CF, and likely other students, who can experiment with materials both before and after implementation.

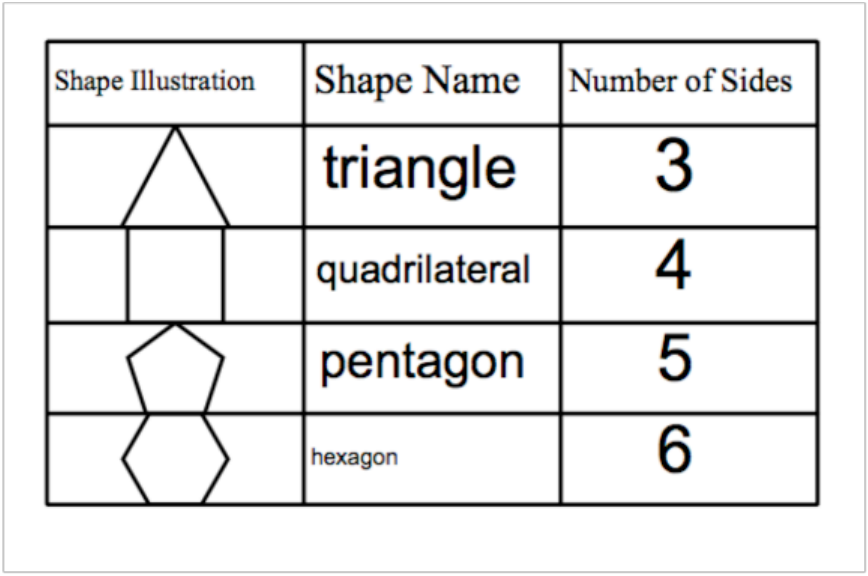
By the time the story had finished, time had run out, so I decided to hold the rest of the project for the next day. Students shared what they liked about the story in partners as a conclusion. I noticed NB emphasizing that she liked tracing the triangle that her arm and side

made when she put her hand on her hip, and then JTM mimicking NB's description.

Day 2: I began this day by reviewing the book and having students share what happened. With my guidance and looking at the pictures, students retold the story to help refresh their memories and to provide background information for HH, who was absent the day before. We then discussed sides and corners on Slide 3.2, and I explained that we would go through the book to count sides and corners. After practicing with a triangle, I showed students Slide 3.3 for us to begin filling out. We went back through the book as students helped me count sides by tracing them with their fingers and corners/vertices by touching them. As we went through the book, I noticed CF continuously mixing up sides and corners/vertices. JTM had trouble counting, as she is still working on counting 1 – 10. The other students helped CF and JTM, and were able to count sides and corners/vertices. Occasionally CF and NB would count the same side or corner/vertex several times, so I showed them how to place a finger on the first part counted, then stop counting at the part right before where his/her finger was placed. This helped students count with more accuracy.

Students helped me complete Slide 3.3, as seen on the next page (Figure 8.4). As a class, the chart was accurate, as we had filled it out

using the text as our resource. I told students that I would put the chart back up as soon as I explained our next activity.



Shape Illustration	Shape Name	Number of Sides
	triangle	3
	quadrilateral	4
	pentagon	5
	hexagon	6

Figure 8.4: Shape Information Chart

I projected Slide 3.4 and read the sentence frame with students. We read the shape names together as CF and JTM identified the first and last letters of the shape names. Students helped me find a quadrilateral in the door of the classroom. With student help, we completed the slide to model Worksheet 3.1. Students were then dismissed to find a shape as quickly as possible before returning to collect their worksheets. I returned the SMART Board to Slide 3.3 for student reference.

When students returned, I noticed that each student found a triangle or a quadrilateral. I realized I should have given a choice of two

different shapes for each student, encouraging AA, HH, NB and MF to find a pentagon or hexagon, while permitting CF and JTM to find a triangle or quadrilateral. I decided that I would let students keep the shapes they found and use that idea for next time in order to encourage students to work harder for tasks that are potentially simple.

When students completed their worksheets, the classroom aide and I interviewed students, asking what shape he/she found and where. I would have liked students to share with partners afterwards, but we ran out of time. Since we had more partner sharing in other projects, I was satisfied with the sharing of the same information in a different context.

Project 4: What Can These Be For? The Purpose of Shapes Through Our Eyes (April 18 – 19, 2011)

Day 1: Prior to beginning this lesson, I cut up several versions of each shape (circle, triangle, quadrilateral, pentagon and hexagon) out of foam, as well as bending pipe cleaners to form the shapes. I placed them in the proper shape bags, in order to match Slide 4.1. I found the slide an effective way of familiarizing students with materials in a controlled way, in addition to combining technology with the hands-on project.

When I selected two shapes to place together, I selected a quadrilateral and a pentagon, and I asked students what they saw when

I placed the shapes together. HH pointed to the pentagon and said, "house." I pointed back to it and said, "Yes, a pentagon is shaped like a house," and was sure to use chaining by signing, fingerpelling, and signing the shape name, while validating his "house" label for the shape. I explained that while a pentagon can look like a house by itself, I could also make a house with a garage when I place the quadrilateral next to the pentagon. With student help, I added details to the house (Figure 8.5).

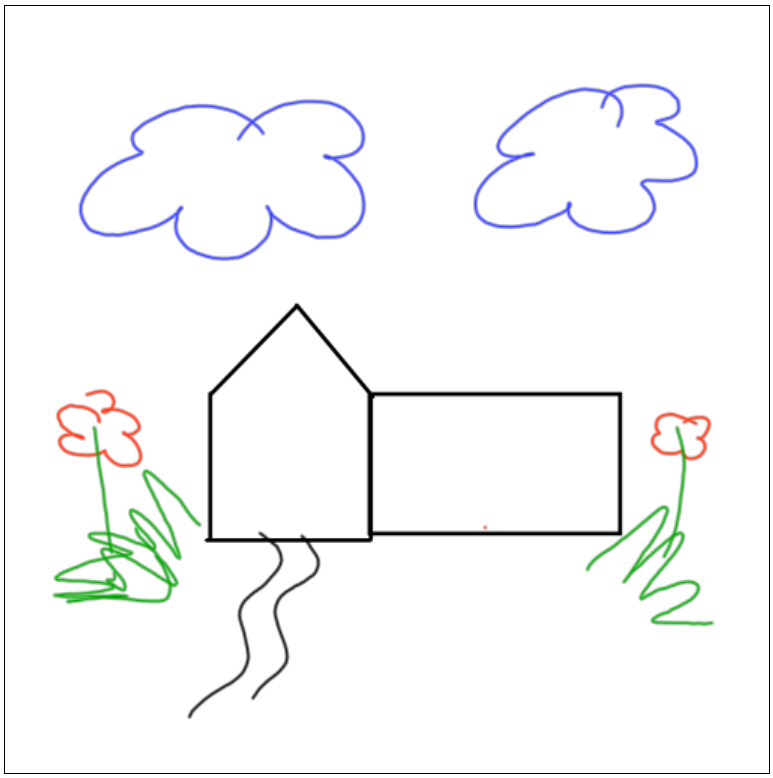


Figure 8.5: Combining a Pentagon and Quadrilateral

When finished, I reviewed materials with students and placed shape bags on the tables, requiring that students were to make

something different than mine. To challenge AA, I had her spell the names of the shapes she wanted before choosing, and had JTM identify the first letters of the shapes she chose on her own. Having students spell shape names and/or identify first and last letters would have been good for all of the students, rather than just AA and JTM. HH would have especially benefitted from this activity, as he is very attentive to print, especially when questioned.

I noticed that many students made houses, using a variety of shapes. Additionally, HH and MF used more than three shapes. It may have been easier for them to refrain from adding shapes if the bags had been at another table for gathering materials before working. Since many directions were not followed, but students were still experimenting with the shapes they chose, I decided to let them continue to see what they made. I should have used a less standard model, such as combining two circles to make glasses.

NB struggled with materials, since she chose to use a pipe cleaner for one of her shapes, so I provided tape. This made the task easier for her, and AA requested using tape, as well, for her pipe cleaner creation. When students were finished, they added details, but did not have time for Worksheet 4.1. This was done during pull-out time.

Day 2: During pull-out time, I worked with students individually to complete their sentence frames. I took advantage of the next day by creating another combined image with two circles to make glasses and a sentence that said, "I made sunglasses. I used two circles." Rather than using Worksheet 4.1 due to technical errors, students picked a piece of colorful paper on which to write their sentences. AA, HH, MF and NB completed their sentences independently after I modeled my sentence. While MF and NB used my sentence as a frame with which to replace the words that applied to their creations, AA and HH used my example as a reference point. Referring to her creation below (Figure 8.6), AA wrote, "I just used quadrilaterals and triangle. I just make house." I asked her how many quadrilaterals she used and she said one. To rephrase, I asked, "You used quadrilaterals. Did you use one or many?" AA again said, "one." I pointed to the word, "quadrilaterals" on her paper and asked if she needed the –s for one. She shook her head in negation and erased it.

Figure 8.6: AA's Pipe Cleaner House

Rather than spelling shape names for students, I had them refer to the shape bags. I noticed MF was unsure of one of the shape names, so she guessed and confirmed her guess by checking a shape in the bag to see if it matched. I thought that was a great idea and implemented it with the other students.

CF and JTM needed more support, so I created sentence frames for them. I provided the option of writing on their own or signing and having me write. CF decided to write while JTM decided to sign while I wrote for her. Both students underlined the shapes used. I provided a sentence frame and the shapes names, similar to Worksheet 4.1B. CF's example is with my written sentence frame (Figure 8.7).

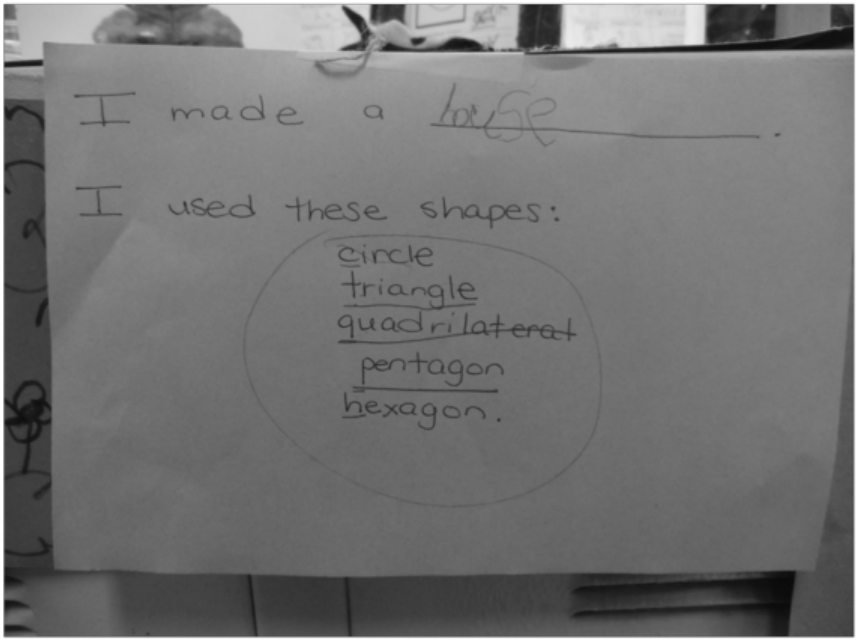


Figure 8.7: CF's Sentences with Sentence Frame

I should have had a backup plan for Worksheet 4.1, but I am pleased that some students had more freedom to write in a different way than they would have on the standard worksheet format that is frequently used in the classroom, especially during this curriculum. I decided that students did not need to draw a picture of what they created, as they used an alternate format for sentences and had their creations alongside their sentences.

Project 5: Sewing Combined Shapes (April 19 – 20, 2011)

Day 1: The first day of this lesson was dedicated to learning about the materials and sewing. Based on previous lessons, I saved the

sentences for the second day of the activity, which also permitted time for students to consider their work and discuss it in ASL before written English.

Prior to teaching, I had placed several felt shapes in each of the shape bags, enough for each student to select two felt shapes of their choice from the various bags.

When we began, I explained that I would pass around some felt, and their role was to feel it, pass it around in the circle, and think of one way to describe it. After approximately thirty seconds, students had passed back the felt and had their hands crossed, as I had specified would be their way to show me they were ready. I projected Slide 5.1 and pointed to the felt. I had students share their word to describe the material, then recorded their answers on the SMART Board near the word, "felt" (Figure 8.8). I then reviewed the slide, reading the sentence and discussing the other materials we would be using before discussing what we would be doing.

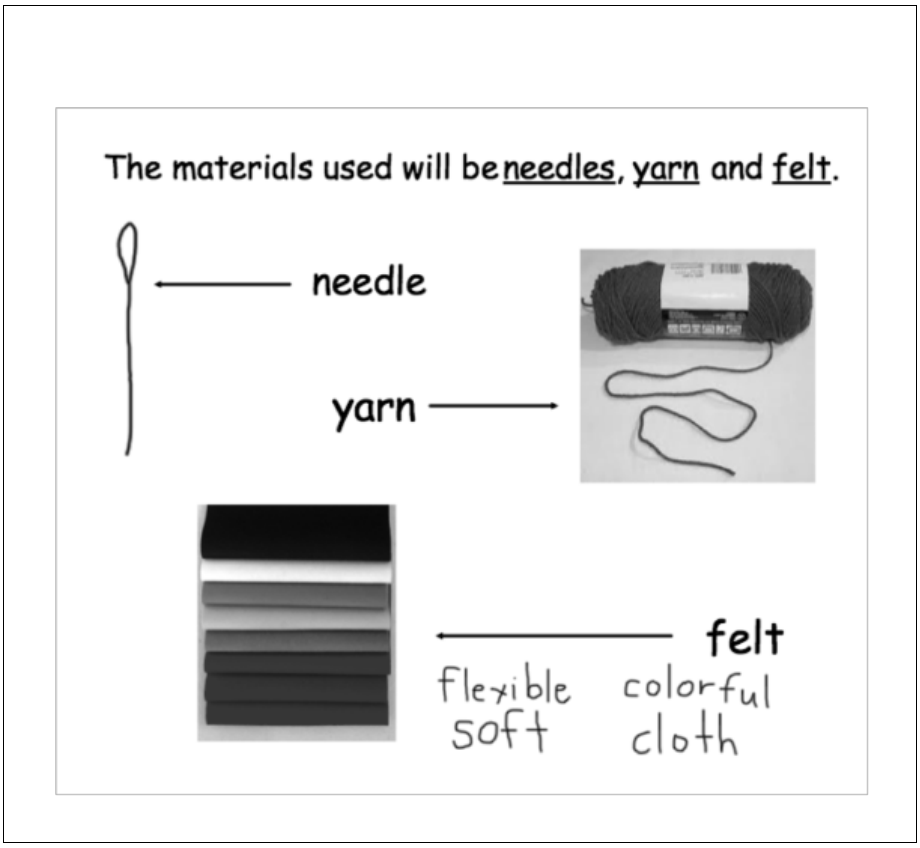


Figure 8.8: SMART Board Slide 5.1 with Felt Descriptions

I said, "I wonder what we can do with these materials." I showed students two pieces of felt and demonstrated that the felt was not strong enough to stick together on its own. I asked the class how we could help the pieces stick together. NB suggested we tape the felt and MF thought we should use a stapler. To validate student responses, I said they both had good ideas, but I wondered what we could do with the materials I showed them. JTM raised her hand and said, "Sew." I said, "That's right, we can sew the felt together to help it stay in place." I projected Slide

5.2 and demonstrated sewing on the SMART Board, then with my materials. I passed around the teacher samples for students to see how the yarn was woven, then collected materials again. Students gathered their threaded needles and practiced the motion in the air before choosing their shapes. I had students select two shapes each from the shape bags and begin sewing. I decided I would wait until students had collected materials and ask them later what shapes they had chosen to move the process along.

While students worked, the classroom aide and I ensured that students placed the felt where they wanted it before sewing. MF and AA needed more help than anticipated getting their needles in and out of the felt, but were able to identify and spell the shapes they selected with the shape bags for spelling support. CF needed minimal support getting started, but was able to continue on his own. He signed the shape names and identified the first and last letter with the support of the shape bags. He signed "g" for "q" in quadrilateral, but was able to self-correct. JTM was able to sew her shapes independently, and sign the shape names. She struggled identifying the first and last letters, but was able to spell with me, and then identify the letters afterwards. When HH selected shapes, he signed quadrilateral and said, "Starts with 's.'" I told him that a special kind of that shape can start with 's,' but asked what we call it in

school. He looked at the accurate bag and signed "q." Then while sewing, he repeatedly said, "I can't do it," and became frustrated with the task of sewing. JTM helped him, but he left his project incomplete. He was able to spell the shape names with accuracy using the first and last letters, but mixing the middle letters, showing that he is still recognizing mainly word shape. He continued to voice the shape names correctly, self-correcting when he said "rectangle" instead of quadrilateral. Upon reflection, this task was too difficult for students, likely because the needle was too big. I should have used smaller needles or looser felt.

For AA, CF and HH, I let them sew one shape, rather than two. Although AA began on track, her thread became very knotted, but when she was finished, she said it looked like a purse. I let her keep the one shape, since she had sewn and created something new. CF had requested to make a pocket. I decided it would be all right since he had been working hard, and we had been reading a story that discussed a pocket. This opened up the window to discuss the pocket in Language Arts time, making connections across content areas.

Day 2: To review, I projected Slide 5.2 to review what shapes I had combined on the SMART Board. I said, "When I look at two triangles, I see a boat." I drew the triangles, as they were on Slide 5.2, onto Slide 5.3. I

then added details to make it look like a boat. With student help, I then filled out Slide 5.3 to prepare for Worksheet 5.1. AA, HH and MF were able to spell "felt" independently while the other students spelled with me, letter by letter. When we arrived at "shapes used," I asked each student to think before sharing. When I asked for a volunteer, JTM raised her hand and pointed to the shape bag that read "triangles." I asked her what letter the shape started with and she said "t." I asked the rest of the class to sign the first letter, and they also signed, "t." Together, we spelled "triangle" and wrote it on the slide. We discussed that I used many triangles, and needed to add an –s.

Students then completed their worksheets according to their own sewing project. When they finished, they shared with partners what they had done. I noticed several students making up stories about what they had sewn, especially AA with her purse, CF with his pocket, and NB with her house, which can be seen on the next page (Figure 8.9). NB wrote an –s at the end of each shape she had used once, and self-corrected when asked if she used many or one of each shape.

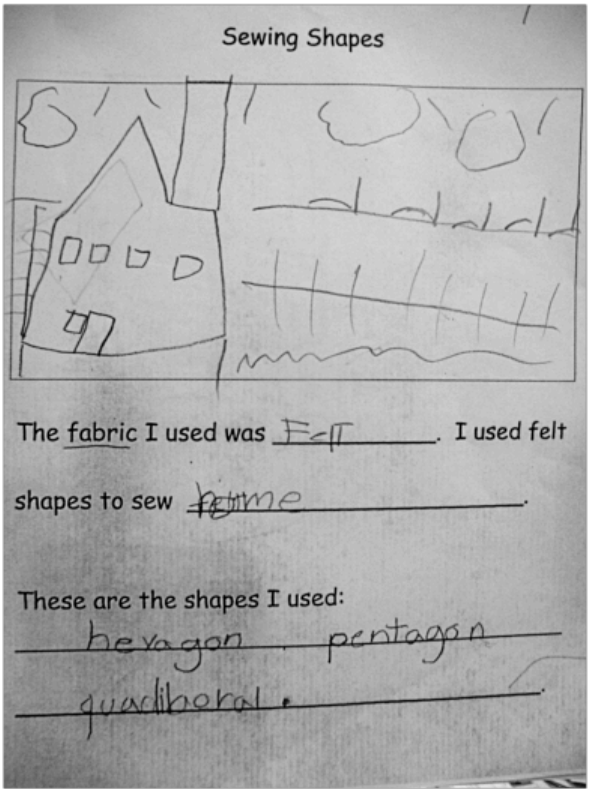


Figure 8.9: NB's Sewing Shapes Illustration and Sentences

Project 6: Quadrilaterals and the Graphic Organizer (April 21, 2011)

I began this lesson by projecting Slide 6.1 and having students help me fill out the graphic organizer. We selected pictures to place in three categories: the outer circle for "people," the center circle for "children" and innermost circle for "[cooperating teacher's name]'s students," as seen in *Figure 8.10*. Students helped me complete the graphic organizer, appearing to understand. When I asked what we had done, nobody could answer. After some think time, MF raised her hand and said, "Children there [pointing to center circle] why? Not people." When I

pointed out that the center circle was within the outer circle, MF protested, saying it was wrong. I asked the class if children were people or plants. MF responded, saying "plants." The other students did not offer answers, proving this project would be more difficult than I had anticipated.

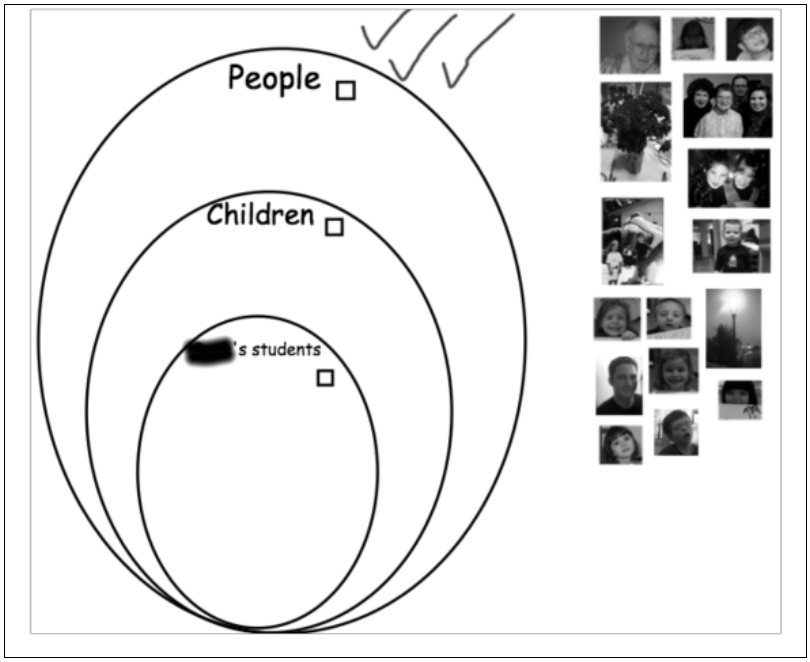


Figure 8.10: Introducing the Graphic Organizer

Just then, my cooperating teacher had an idea and asked if she could try it out. She had all students stand up. She said, "If you are a child, stay standing," to which all students remained standing. She then said, "if you are a girl, stay standing." The boys sat down, and the teacher called attention to those who were standing were both children and girls. Those who just sat down are children but not girls. She then said, "if you have glasses, stay standing." The girls without glasses sat

down, and my cooperating teacher called attention that the one student still standing was all three of those categories. She then wrote the three categories on the SMART Board over the categories I had chosen, as seen below (Figure 8.11). She used the pictures on the SMART Board to complete the graphic organizer with student help.

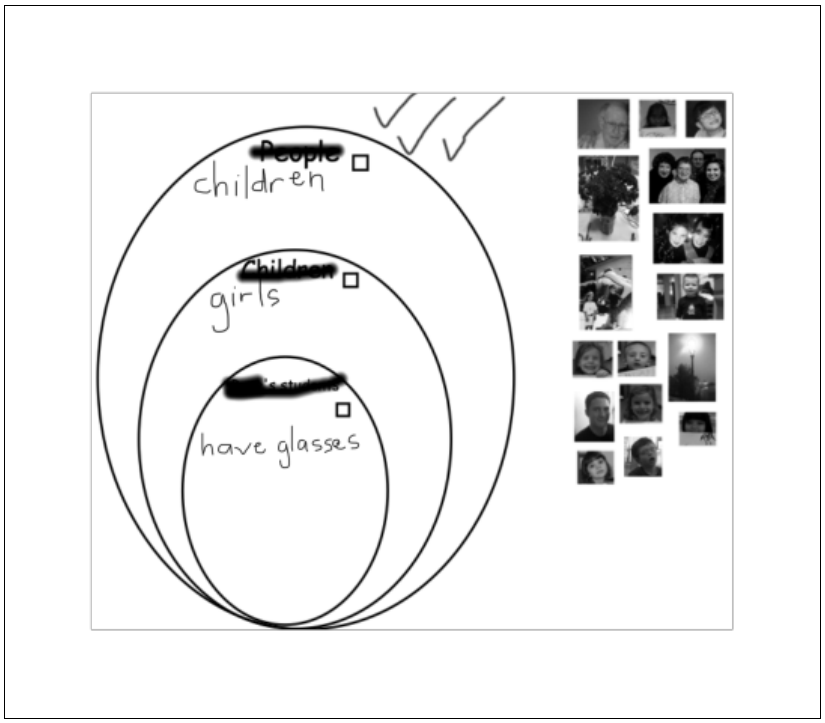


Figure 8.11: Graphic Organizer Remake

When resumed instruction, I asked students to explain what they had done. AA accurately explained the graphic organizer, saying, "the small circle means glasses, girl and children." When she asked her classmates if they agreed, all said yes. We were able do continue the project with quadrilaterals, and students did so accurately with their own Worksheet 6.1.

When reflecting upon the project with my cooperating teacher, she said the students had never seen a graphic organizer in her class before. I should have exposed students to a Mini Lesson about graphic organizers, and specifically this graphic organizer to leave more time for focusing on categorizing quadrilaterals.

Project 7: Recognizing, Fixing and Creating Shapes in Picasso's Art (April 25, 2011)

Prior to implementing this project, I familiarized myself with the text, *Getting to Know the World's Greatest Artists: Picasso*, that would be read to the class. Based on what I knew about the students, I decided that summarizing each page, rather than reading through the book, would be more beneficial, as the book is rather advanced. After introducing the book and showing students Picasso's name sign, I read through the text, summarizing as I went along and calling student attention to Picasso's different styles of art.

I explained to students that their job was to help Picasso. He has a lot of shapes in his artwork, but not all of them are complete. We reviewed that sides must be straight and shapes must be closed. I projected Slide 7.3 to show students three different ways of identifying shapes in Picasso's work: finding, fixing or creating.

After having students choose which of the three pieces they would like, I had students find shapes for a few minutes before explaining the Score Card. I noticed, however, that many of the students had found many circles, triangles and quadrilaterals, but were not attending to pentagons and hexagons. Before moving on, I decided to extend the task. I had students choose a different colored marker, and on the same sheet, identify each of the shapes we had been learning about. I collected all papers, and challenged students to find, fix or create a circle. I passed out the papers, and then collected them when they were finished. I repeated this for each shape, all the way through hexagons. When students were uncertain, I referred them to the shape bags for assistance.

When students had the opportunity to have experiences with the more advanced shapes, many struggled, but took the beginning steps to improvement. The Score Cards were difficult until I explained that it was a report on what each student had done. All would be different and that was acceptable. Additionally, I reminded students that they were "scoring" Picasso, rather than themselves.

When the task was finished, I had students share with a partner what they had done. I noticed JTM signing the shape names and HH beginning to spell the shape names with more accuracy. NB signed and

spelled Picasso's name to her partner, and described the Score Card with accuracy.

Project 8: Introduction to Geoboards (April 25, 2011)

As an introduction to geoboards, I had planned a SMART Board review on basic shapes and how they tie into the geoboard with a game that I had found on a SMART Board resource website. However, students became restless as I lost their attention, so I decided to drop the entire introduction and begin by passing around geoboard materials for students to experience hands-on.

As I learned from the lesson on Picasso, it would be better for students to be required to create each shape, rather than making only the shapes that came easiest to them. However, in a whole-to-part approach, I encouraged students to experiment prior to using the geoboards for creating specific shapes.

After reviewing materials and that geoboard points can be used as corners/vertices, students collected materials and became creative. When finished, I had students clean up and leave their geoboards on the table as I showed students my geoboard that matched the design on Slide 8.3. I signed, "I used a geoboard to create a sun." Students signed with me, and then helped me complete the sentence frame to prepare

for Worksheet 8.1. Students were able to complete their work after sharing in partners with minimal support, other than with spelling.

Project 9: Making Different Shapes with Geoboards (April 25, 2011)

As an introduction, I used the SMART Board to model using Worksheet 9.1 before students completed their own geoboards. I asked students to make a triangle. Then, without students seeing, I made a quadrilateral on my own geoboard before collecting all geoboards. I noticed many triangles were the same, using one full side of the geoboard as the base of the triangle, so I altered some of the triangles as students handed them in. After emphasizing that whose geoboard I would hold up was not important, I explained that we would vote if shapes were appropriate triangles or not.

All students were able to agree that each geoboard had a triangle until I showed them the geoboard I had created with a quadrilateral. Each student was able to tell me the shape was not a triangle, but nobody was able to tell me how to fix it. The cooperating teacher volunteered to describe a way to fix it. From her description, I twisted the rubber band to create two triangles. MF supported the change because the shapes were triangles. I decided to validate her response by saying she was right about the two triangles, then asked for help in making the rubber band into one triangle. HH volunteered to fix

it, and I let him use the actual geoboard after struggling to describe what he wanted, as the shape was challenging to describe at that point.

When HH had fixed the shape, all students agreed that he was correct. I called student attention to notice that there were many different possibilities for making a triangle and all were correct after we fixed them. We crossed off the triangle from our task list and moved onto a quadrilateral. Students had the option of working with me or working independently. AA, MF and NB decided to work independently while CF, HH and JTM worked with me on each individual shape. AA completed the task independently while MF formed each shape without writing on her worksheet. With support from the classroom aide, she checked off her worksheet to coincide with her geoboard. I noticed NB struggling with a hexagon, repeatedly creating quadrilaterals. This was surprising, since she had not been struggling with most of the fine motor tasks given to the students. For the students working with me, we took one shape at a time, similar to how students found shapes in Picasso's artwork. JTM struggled with the pentagon and hexagon, the more challenging shapes.

When discussing NB's geoboard with her, she counted the corners/vertices and signed, "sides." When I asked her what a side looked like, she signed, "side." I asked if a side was straight or a point,

and she said, "Side, straight." I modeled counting sides and corners/vertices without saying the words. Then, she replied, "Oh, corners," and counted the corners. CF continued to confuse sides and corners/vertices, but he knew they were equivalent. This further confirms that he knows the concept and simply reverses the labels.

I noticed that although all students are very familiar with triangles, they are inconsistent with spelling the word, "triangle." I decided that we would be doing more spelling practice, but I would also lower my spelling expectations to meet the needs of the students. All could recognize the first and last letter, as well as identify the shape and the sign, proving they understood the content and are still developing spelling the shape names, which are large words.

When we were finished, I explained that we would be using special geoboards, each of which had been designated for a specific shape, except one, which was for each student's favorite shape. Students' responsibility was to make as many different types of each shape by adding one shape with their color rubber band to each designated geoboard. This task took place with students rotating in a circle. The set up can be seen on the following page (Figure 8.12).

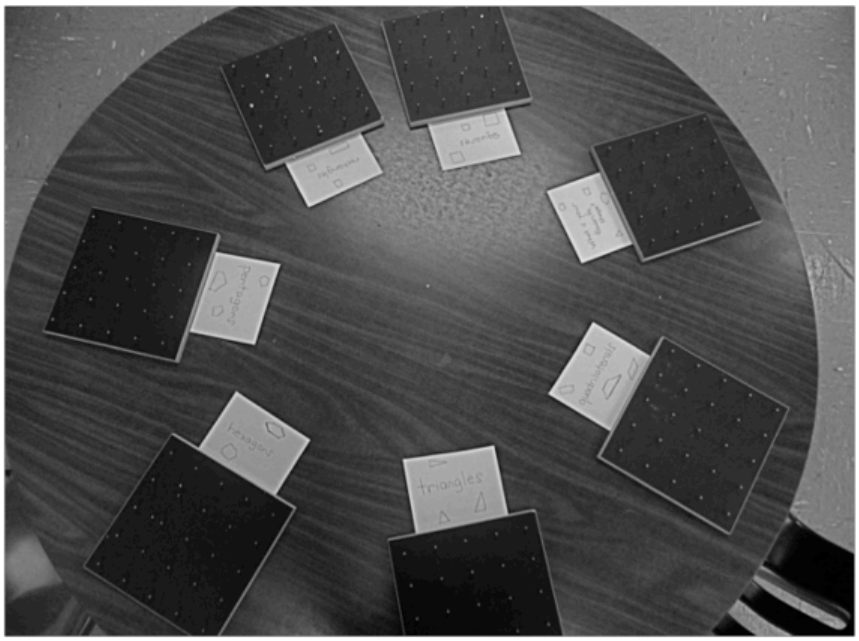


Figure 8.12: Designated Geoboard Rotation

I decided to start MF and AA on the triangle and quadrilateral geoboards in order to arrive at the pentagon and hexagon geoboards last. This placement challenged them to create new pentagons and hexagons at the end, where other students had already created several of those shapes. I placed JTM and CF on the miscellaneous and square geoboards first to ensure that they would be last to work with the triangle and quadrilateral geoboards. While they have been comfortable creating standard versions of those shapes, being last would require them to make less standard versions of the two simpler shapes where other students had been working.

This activity went better than I anticipated with material management and creating new shapes. I was pleasantly surprised to find each pentagon accurate and unique, specifically the outermost pentagon that was placed by CF. This designated geoboard can be seen below (Figure 8.13).

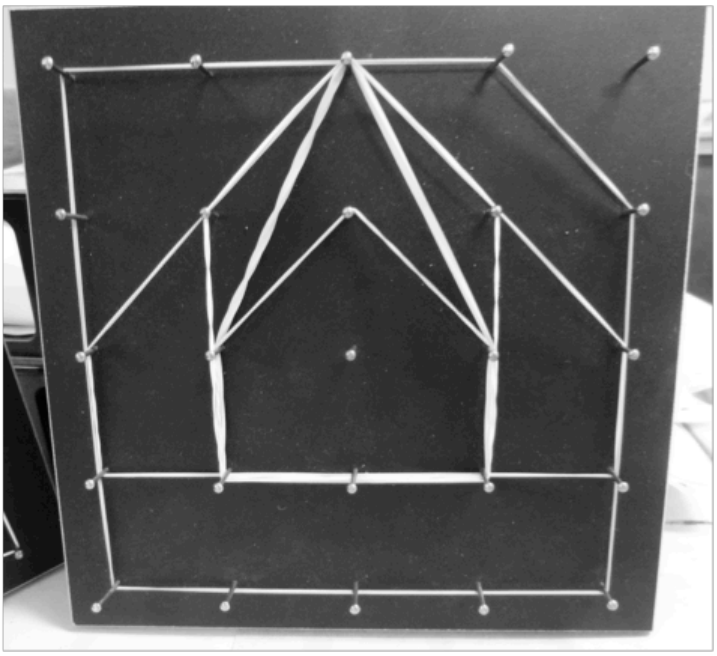


Figure 8.13: Designated Geoboard: Pentagons

To wrap up the geoboard projects, I had students complete Worksheet 9.2 to check their comprehension of materials used. All students attempted to spell "geoboard" and sign "rubber band" in partners. All were able to sign "rubber band." When spelling "geoboard," I noticed that HH still spelled with the accurate first and last

letters while mixing the middle letters, and that JTM accurately recognizing some of the letters within the word while looking at the word on paper, but not yet spelling independently. AA, MF and NB spelled correctly, and CF improved what letters he recognized, spelling "geoboard" accurately and self-correcting spelling mistakes.

Project 10: Symmetrical Paintings (April 25 – 26, 2011)

Day 1: I began this lesson by projecting Slide10.1 and asking students how they thought that painting was made. I had students do a Think-Pair-Share. NB signed, "Paint, art, paint." I said, "Yes, this is a painting. I wonder how it was made." AA raised her hand and said, "Fold paper." I took note of what was said and asked the students if they agreed. JTM nodded in negation and HH said he did not know. I clicked above the picture and read the sentence before reviewing materials on the next slide.

I reviewed the rules with students before we moved to a different table to begin painting. I challenged students to include shapes in their paintings, and was sure to keep cardstock folded over while students painted, exposing only half of the cardstock. When JTM finished painting, she raised her hand, and I gave her permission to fold her paper. I noticed that MF and NB went ahead and did the same without asking permission, then opened their papers and painted more on one side. I

then saw AA fold her paper then touch up what was not symmetrical on the other side of the cardstock. I decided to let students finish before trying again. This activity was carried over to Morning Meeting the following day.

Day 2: Since I decided to hold the project yesterday, I wanted to wait for student paintings to dry before making new artwork.

Again, I projected Slide 10.1 and called student attention to the symmetry of the painting. I explained that I noticed students were very creative the day before and could bring those paintings home. However, we were going to try again to make symmetrical paintings and that it would be very important to follow directions. With the second attempt, all students completed the task accurately, followed directions and made symmetrical paintings.

When completed, I showed the sample vlog and discussed with students the three key details in the vlog: type of painting, how it was made and what materials were used. Students practiced signing with partners then made vlogs. Since students had help practicing for the vlogs, less help was needed when actually recording. JTM was the only student that needed the classroom aide to ask her each question in an interview format, while the others expanded on each question to explain

how their painting was created. A sample of this can be seen in Slide 10.3.

Project 11: Lines of Symmetry (April 26, 2011)

After the introductory discussion yesterday, I noticed that MF was the only student who was able to identify the line of symmetry. It had not yet been officially introduced, but we discussed the black line down the center of our work, and MF was able to explain that the painting was the same on either side of the black line. This inspired me to expand on this topic in an activity to develop awareness with lines of symmetry and the ability to identify them.

I created voting sticks, which resembled auction sticks; one blue and one pink, as seen on the next page (Figure 8.14). The blue voting sticks said, "That is symmetrical," while the pink voting sticks said, "That is asymmetrical." After I demonstrated how to use the voting sticks with the classroom aide, students used these to vote on whether or not images in the video shown were symmetrical. MF pointed out that the sentences were identical, except for the a- on the pink voting sticks. Her observation provided a teaching moment that a- means "not" and therefore that voting stick was for "not symmetrical." The colors provided extra support for students who are beginning readers.

Figure 8.14: Symmetry Voting Sticks

Also notable is that when we came across the word "symmetrical," NB signed "same" with one hand. I said, "Yes, that says symmetrical," singing the word with two hands, the way we had signed it in class. NB and the other students signed "symmetrical" with me.

Material management was difficult at times, but students were able to answer accurately as to whether an image was symmetrical or not. I also wondered if JTM understood the task, as she repeatedly looked to her classmates before voting. CF was able to self-correct without looking at his classmates when he made a mistake.

On some of the more challenging images, students began to disagree over their symmetrical properties. I asked students to explain their votes. On a picture of a flower, MF came to the front of the class

and signed, "Flower fold in half symmetrical flower will." After her explanation, students voted a second time on the flower and all voted symmetrical except AA. Interestingly, she explained, "Asymmetrical, why?" and pointed to the background of the picture, which was asymmetrical. While she was correct, I redirected her attention towards the displayed image alone, whereas she changed her vote.

When we finished the video, students helped me place lines of symmetry in the symmetrical images on Slide 11.3. I was sure to call attention to the fact that a circle has more than one line of symmetry.

Next, students gathered materials and placed wax strings on the lines of symmetry they found in shapes. I noticed that JTM had folded her paper in half at the line of symmetry and placed her wax string over the fold. She also drew a picture on both sides, which appears as if she attempted to draw a symmetrical drawing (Figure 8.15). When students were finished, they had the option of finding more lines of symmetry or testing the first letter of their name to be symmetrical or asymmetrical, which I wrote for students on a small sheet of paper. AA worked with my cooperating teacher to find multiple lines of symmetry in a pentagon.

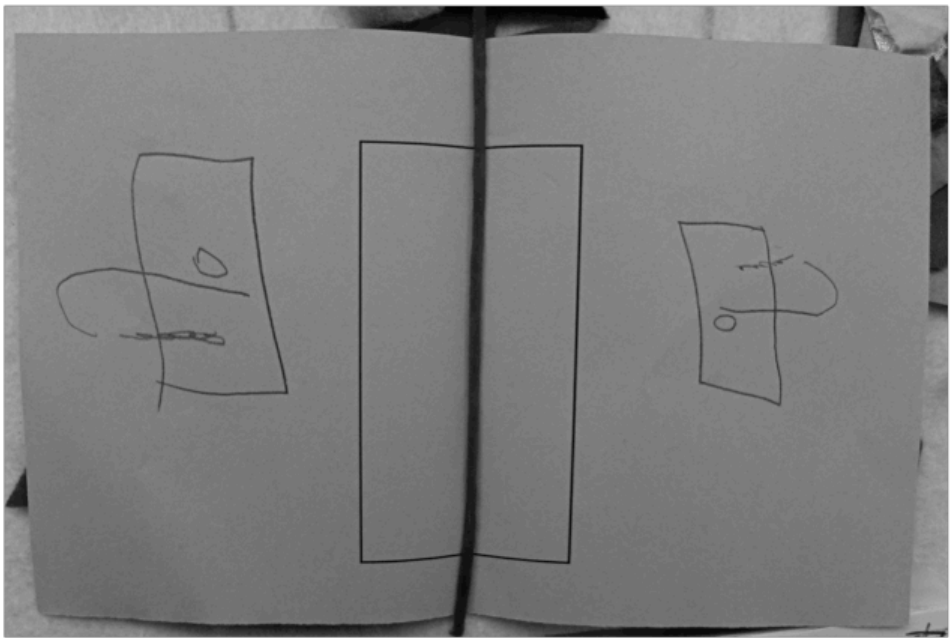


Figure 8.15: JTM's Line of Symmetry

Project 12: Clay Sculpture (April 27, 2011)

I began the lesson by reviewing materials and what we would make on Slide 12.1. CF raised his hand and independently fingerspelled "clay." Thrilled that he is now recognizing enough letters to spell words, I signed back, "Yes, we will use clay." I asked him to show the class where he saw the word on the SMART Board, and he pointed to the correct word. When he asked his classmates if he was right, all agreed with him. I then asked that he lead the class in fingerspelling "clay," and he did. It was great to see his improvement. JTM was able to follow his fingerspelling.

When students had their materials, they began to work. All students began with one color and were given one more color at a time as they asked. I wondered how it would have been different to leave a few colors at each student station or leave mounds of colored clay in the center of the table. I noticed that AA, JTM and MF made somewhat flat sculptures, pressing their clay onto their cardstock. AA and MF had more bulging sculptures than JTM, whose cardstock folded up at the corners when her sculpture dried, making it more 3D, as seen in below (Figure 8.16).

Figure 8.16: JTM's Clay Sculpture

When I asked HH what he was making, he signed "clay balls." He asked for more colors, which he made into spheres. He then flattened and added to his sculpture, as seen below (Figure 8.17). I wanted to remember this for the implementation of Project 13, as students would be learning about sculptures with "multiples" in a vlog from a Deaf artist.

Figure 8.17: HH's Clay Sculpture

When completed, I gave students a preview of labeling 2D and 3D on Slide 12.2. When I asked students what 3D meant, NB offered that it was a type of movie that involved the picture coming out to the audience. I thought that was very interesting and discussed that a 3D movie looks like it is bulging, rather than flat. Students predicted that the two photos would be 3D, so we placed the photos in the 3D column

(Figure 8.18). MF noticed that the artist was holding the artwork in a way that made it look like it was bulging, rather than flat, meaning it was 3D. Students would confirm their predictions during Project 13.

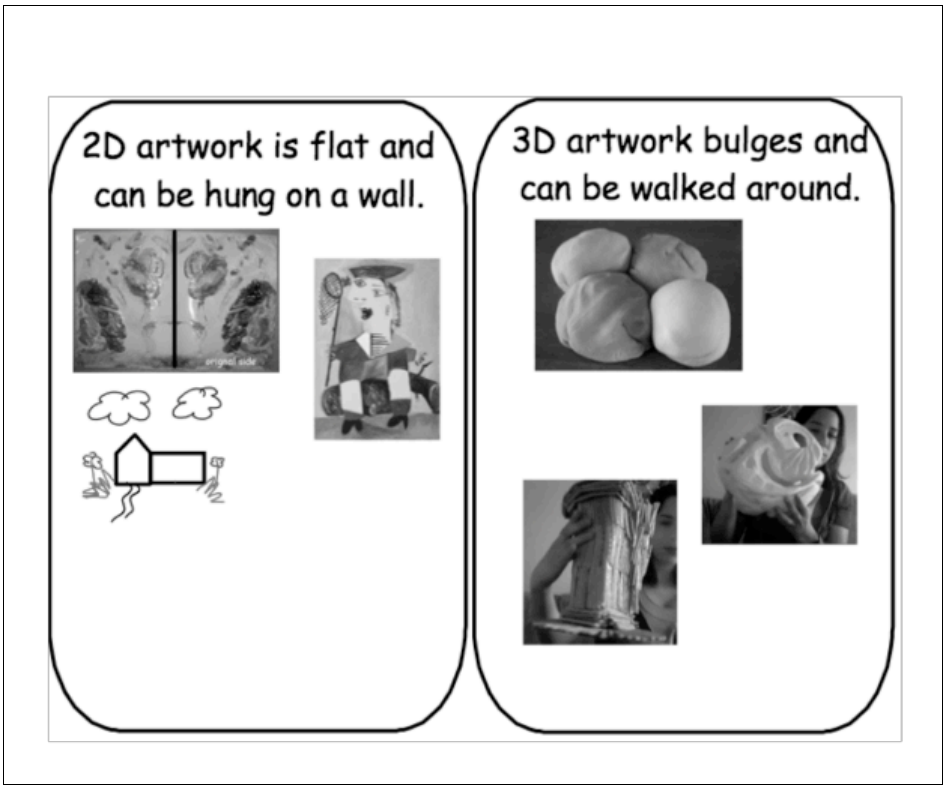


Figure 8.18: Student 2D and 3D Chart Prediction

Project 13: Sculpture: analyzing the Work of Other Artists (April 28, 2011)

Prior to this lesson, I photocopied and cut out several sheets of Worksheet 13.1 for each student and clipped them onto a clipboard with two charts per page. I placed these at student centers and kept my sample with me. The principal had set up sculptures in her office window.

I also made sure we had permission slips to leave campus and search for sculptures.

To begin this project, I told students that they had a special message from a Deaf artist. I showed the vlog on Slide 13.1 before discussing the criteria to be a sculpture that we would be using: the object is 3D and we can walk around it. I called student attention to HH's sculpture and said it reminded me of "multiples." HH signed and voiced, "Yes!" excitedly.

Students helped me complete the chart on Slide 15.2, which read, "Is it a sculpture?" We used one of the pieces of art from the vlog before each student used his/her own. To support students in answering if the sculpture was 3D, I asked if we could walk around it. My cooperating teacher handed me a globe for the class to walk around after MF confirmed that the globe was 3D and a sculpture, by our definition. I asked students if the artwork from the vlog was 3D by asking them to show me a thumbs up or down for agree or disagree, respectively. All students agreed.

For the next sample, I asked a volunteer to bring his/her sculpture, and chose CF. We used his example to complete the chart, then had students complete their first charts for each of their own artwork as a part of Worksheet 13.1. After setting up behavior expectations, I distributed

"explorer costumes," which consisted of visors for students and safari hats for my cooperating teacher, the classroom aide, and myself. Students were to notify staff when they saw a sculpture, and we would notify them if we found one. Students brought their clipboards and pencils, and I brought a small white board and dry erase marker to model any writing that we would have to do.

We walked through the building and I pointed out sculptures in the office window, as students each picked one to write in their charts. This went better than I thought, with students only asking me for spelling, but working with one another. I noticed MF and AA helping one another with marking the checklist to identify a sculpture. When completed, we gathered in the lobby to discuss the first sculpture we found other than our own, meaning we had the first page with two charts completed. I had students turn to the next page before reviewing behavior expectations once again.

As we were walking across campus to leave the school and identify sculptures off campus, MF and CF found multiple sculptures at the school, both outside and in building windows. Students documented these sculptures, as seen on the following page (Figure 8.19). We ended up completing a total of four charts before it began raining too hard for

students to be outside. I was satisfied with four of six planned charts being completed, so when we returned, we moved onto the conclusion.

Figure 8.19: Students Finding and Documenting a Sculpture

I asked students if we had documented sculptures and all said "yes." I asked if what we found was 2D of 3D. I went around the circle, asking each student to rapidly reply 2D or 3D, and all answered 3D.

To confirm the chart from Project 12, we completed the same chart on Slide 13.4 then checked our work. Students had been right the day before and were very excited. I noticed JTM volunteering to place pictures into the 2D and 3D columns, as well. I liked how this activity engaged students in identifying artwork that they see daily on campus.

Project 14: Cubes and Spheres (May 2, 2011)

Due to timing, students were unable to implement the making of papier-mâché during my thesis implementation. To meet the objectives in the project, I laid out an assortment of 2D and 3D items that fell into four subcategories: cubes, spheres, squares and circles. I had students categorize them by taping 2D objects onto the wall around labels for "square" and "circle," and place 3D items on a table next to labels that said "cube" and "sphere." Although all items were placed correctly at the end, I wish I had left an assortment of items at each student's station to keep track of which students placed items where. However, students worked together on this. I noticed JTM and MF working together as MF signed "bulge 3D" to JTM as they placed a cube in the 3D cube pile. I noticed AA signed 3D as she pointed to a circle, and I asked her if it was flat or bulging. She said flat, looked at the labels, then self-corrected to say it was 2D.

As the closure to this project was cut short, we completed the chart on Slide 14.5 to prepare for Worksheet 14.2. With my support in underlining the key words in sentences, students were able to help me match the images to their descriptions (Figure 8.20). Students then completed the same task on their worksheets in a different format. AA,

MF and CF worked independently, while HH, JTM and NB asked for support in reading the sentences.

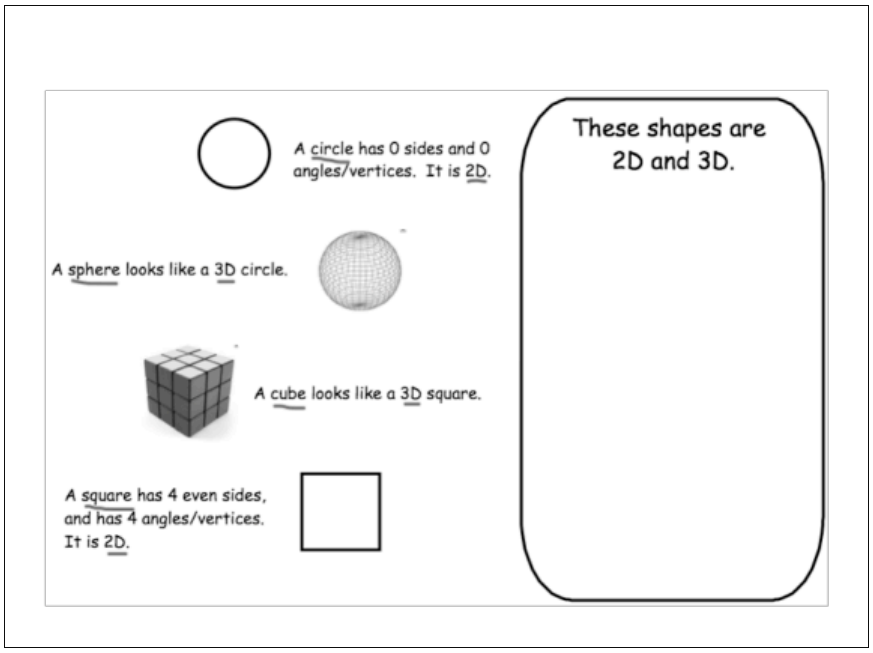


Figure 8.20: Matching Images with Descriptions, 2D and 3D

Project 15: Showcase Preparation (May 2 – 5, 2011)

Preparing for our showcase took much longer than expected. This was likely because we were nearing the end of the school year, where assessment catch-up became crucial, and students were oftentimes pulled out of class by various specialists, if not by my cooperating teacher. This made the preparation mainly one-on-one, where the classroom aide and I worked with students to complete their work. A colleague offered to come and help during her prep period as well,

which made the preparation run much more smoothly. Each day was the same, with students rotating through the tasks in no particular order.

Luckily, all students were with me at the beginning of the first day for all to choose the artwork to be displayed. This enabled students to pick a variety of pieces while also picking one of their favorites. Student choices can be seen below (Figure 8.21). Although the selections were not as distributed as I would have liked, I decided to let students keep their selections, especially because CF had wanted his symmetrical painting displayed, as well, but volunteered to switch to his second favorite piece. Additionally, I removed the option for papier-mâché, since we did not complete that project.

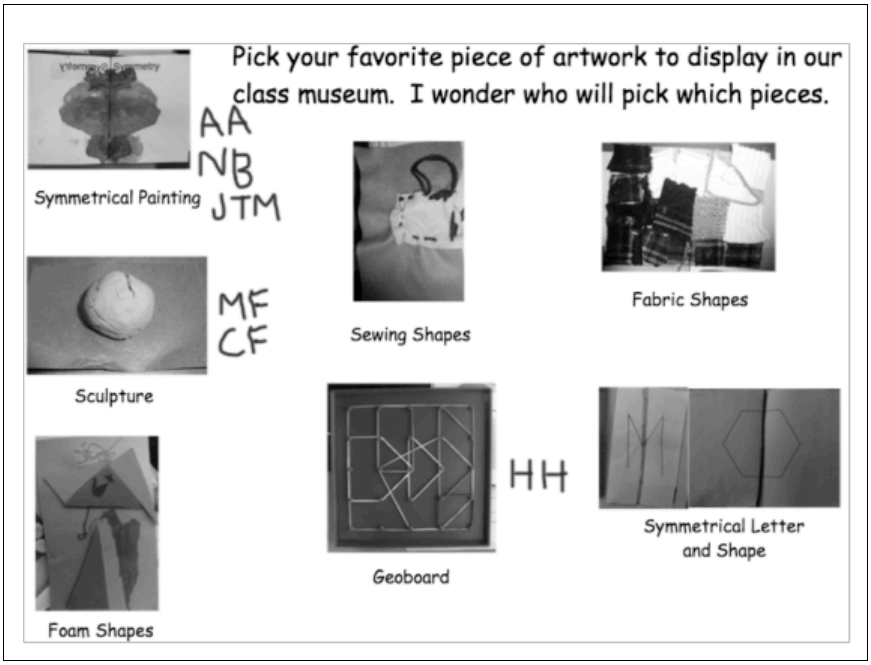


Figure 8.21: Distribution of Student Showcase Selections

Due to the amount of pull-outs happening, I decided to take advantage of the opportunity it gave to have one-on-one time as well. Each student had individual attention for creating his/her plaques, ensuring that each was polished for the final showcase museum. AA was able to read her plaque independently, and only needed assistance with spelling, which she was able to complete with my support and using the classroom vocabulary wall.

CF and JTM needed me to write on the SMART Board what they had signed to me in ASL to model what the English looked like. Although we had plenty of time, they still needed that extra support. Both students used the vocabulary wall to find words, but I modeled where and how to write on the plaque for the majority of their answers.

I had originally planned on students signing about their work at the museum, but decided a vlog would work better, as guests would be arriving at various times. Also, students would be documenting artwork during the museum, and I wanted them to be able to focus on that single task. When students made their vlogs, each selected an interview except MF, who signed somewhat clearly. She included all the important information but was not clear when expanding on why she picked her sculpture. AA wanted to sign independently at first, but asked for an partial interview to remind her of the last question regarding why her

painting was her favorite at the end of her vlog. I noticed that CF protested participation, which resulted in his vlog inadequately representing his knowledge.

Project 16: Showcase (May 5, 2011)

When preparing for the class museum, we had invited the school staff to come, including the superintendent. Since she had a meeting at the time of our museum, she had asked if she could come earlier that morning while we were preparing. I thought it was a great idea to practice behavior expectations and get students excited about the museum. When the superintendent came in, the students were eager to show off their artwork, so we decided to show her our class video first, let her look around, then ask questions afterwards. When she left, CF said "I'm excited why museum today," and smiled.

After the museum was set up in the lobby, as een on the following page (Figure 8.22), I used Slide 16.1 in the classroom to model how students would complete their charts during the museum. Using my own artwork, I demonstrated how to do so with student help. When we were finished, I gathered student materials as we went to the department lobby for the museum.

Figure 8.22: Showcase Museum Set Up

Students' families and another class met us in the lobby as we showed the video. Unfortunately due to technical difficulties, the large television did not work, so we played the DVD on a laptop. This was also available to be replayed for people who came later.

After the video, students began to work on their charts (Figure 8.23). Although most students completed their work, I noticed some common difficulties. First, one student's writing on his plaque was difficult to read, making it a challenge for other students to take note on what was written on the plaque. Additionally, JTM repeatedly asked me to help with reading the sentences to check whether a piece of art was 2D

or 3D. I should have included pictures with that portion, since I was unable to help her one-on-one throughout the museum.

Artist Initials:		Artwork Title:
Illustration	Shapes I See	Dimensions
		o This is 2D. o This is 3D.

Figure 8.23: Sample Museum Chart

Logistically, it would have been a good idea to have the museum later in the day, as HH's parent took him home after the museum, since she was already there. It made it difficult to do a wrap-up assessment on him. Also, the other students were restless and unable to regain their complete focus by the end of the day. I should have planned on assessing all students the following Monday in centers.

Lastly, most students needed support in keeping track of what artwork they had already documented. Since the class was small, I required students to document each piece, meaning that each of the six charts should be filled. HH filled out the chart six times for his own work, and other students had trouble identifying who they had missed, as students did not work in any particular order. It would have been a good

idea to have prewritten student initials in each chart to help them keep track of whose artwork they had not yet documented. However, the majority of the students were able to complete the task during the showcase.

IX. Report on the Results of my Evaluation

The goals of the curriculum were:

1. Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.
2. Students will recognize how art and mathematics are present, applicable and integral to daily life.
3. Students will produce and present their artwork in a showcase, expressing what they know.

The three methods of evidence that I collected consisted of student work samples, teacher-created rubrics and field notes. Since the curriculum included a great deal of student-created works of art, it became essential to keep track of their projects, how students met expectations and general observations that permitted them to be individually creative. By utilizing three different types of evaluation, it was shown that the goals were generally met, both implicitly and explicitly.

The first goal stated that *students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.* Indeed, the majority of the projects focused on kinesthetic art tasks that required students to interact with art, both created by themselves and others, in relation to mathematics, specifically geometry. When looking at work samples (Figures 8.1, 14.1, 14.2 and 14.3), students clearly demonstrated

their capabilities of exploring art mediums in ways they related to mathematics. Not only did this occur inside the classroom, but also outside the classroom, as can be seen in NB's illustration of shapes with their names (Figure 14.4). This drawing was given to me during the implementation of the curriculum, representing that this student considered shapes and the English print associated with those shapes, even while not required to do so. Although the spelling was inaccurate, NB demonstrated that she drew patterns of shapes and outlined shapes at home, thus further internalizing what she learned in school.

Furthermore, students had the opportunity to use more familiar mediums such as gluing objects to understand various types of quadrilaterals, as can be seen in CF's work (Figure 14.5). Extending from the idea of the familiar, students also worked with materials such as wax strings, which are ordinarily used solely for art purposes, which may have been a key factor in solidifying the mathematical concepts discussed in class (Figure 14.6). Additionally, when students struggled with the artwork, such as during the symmetrical paintings, evaluating student work showed me that it is not only art that informs mathematics, but mathematics can inform art. For example, after students created their first symmetrical paintings, several did not turn out exactly symmetrical after students unfolded the cardstock (Figure 14.7). I noticed students filling in the areas

of the cardstock that did not match both sides after the paper was unfolded, enabling me to reanalyze the situation to see that students had indeed understood the concept beyond that which the rubric could express alone. This instance provided more support that the combination of the three methods was crucial in evaluating the effectiveness of the curriculum.

The second goal intended that *students will recognize how art and mathematics are present, applicable and integral to daily life*. In addition to rubrics inside the classroom, student work samples and field notes provided strong evidence for these goals being met, both inside and outside of the classroom. Notably, after the implementation began, and through the end of my internship, HH repeatedly identified shapes around campus by pointing to the objects such as the television screen in the cafeteria, tiles on the ground and shapes in books, and signed the shape names. Similarly, NB identified shapes on clothing and in patterns in the classroom. Also notable is that although I had planned to bring the students off campus during Project 13, both CF and MF identified sculptures around campus and were able to document that what they found were, indeed, sculptures, based on the criteria learned in class (Figures 8.19 and 14.8). This unplanned attention to the environment was documented largely through field notes.

Recognizing shapes in the environment was especially apparent in specific activities, both planned and unplanned. For example, when practicing drawing quadrilaterals out of context, MF recognized a bracelet I was wearing that had large, quadrilateral panels around my wrist, which she drew and circled, showing that she attended to her environment unprompted (Figure 14.9). Even during Project 5, JTM identified her project as two pockets when asked to describe what she created (Figure 14.10). She purposely left a corner open that she said was the pocket opening.

Furthermore, while at recess after learning about 2D and 3D, HH and MF pointed out that a mound they had created of wood chips was 3D (Figure 14.11). NB saw what they had done and created a 2D circle with wood chips (Figure 14.12). She then correctly identified the shape and stated that the word started with the letter, "c." These examples both inside and outside of the classroom, using the three types of evaluation, specifically field notes, provided evidence toward meeting this goal.

The final goal required that *students will produce and present their artwork in a showcase, expressing what they know*. While students produced works of art throughout the curriculum, each selected one piece to show in the classroom museum (Figure 8.21). Students created plaques for their pieces (Figure 14.13), as well as created a vlog

from signing or from an edited interview regarding similar information as their plaques. These plaques were later set up in the museum with student artwork (Figures 8.22, 14.14 and 14.15). Students were able to name and showcase a piece while including essential information about it, in addition to taking notes from the work of their classmates. When identifying shapes in the artwork of others, students had the option of drawing or spelling the shapes (Figures 14.16 and 14.17). In both preparing and carrying out the showcase, student work, rubrics and field notes showed that students were able to meet this goal.

Overall, I feel that this curriculum was successful. There were numerous changes made from the original plan, as the SMART Board was added to the projects, in addition to meeting student needs, both individually and as a group. There were several time constraints, as my internship was nearing the end of the school year, dictating less time for 3D geometry, specifically regarding cubes and spheres.

X. Conclusion

After studying bilingual education for Deaf children for two years in the Deaf classroom, as well as in a graduate course of study, this curriculum was developed to incorporate art as it pertains to mathematics for Deaf students. Too often are the arts overlooked, rather than utilized for their benefit in a way in which students understand, interact with and perceive mathematics. This curriculum provided a means for students to be able to do so, as well as expressing their knowledge in signed ASL and written English.

Upon reflection, I enjoyed that some of the lessons overlapped with the Science and Language Arts curriculum. As art served as the medium to do so, I would have liked to extend this methodology to encompass more content areas in the classroom. However, through evaluating the implementation, I do see that the curriculum was generally successful for the students, in ways that were both planned and unplanned. For example, the superintendant requested to borrow the museum to display at a meeting of the school's Board of Trustees. This unexpected honor gave students a further feeling of pride in their work.

Additionally, I would have liked to have further developed two tracks for this curriculum: one for the SMART Board and one without a SMART Board. I had not planned to use the SMART Board until I arrived

at my internship and learned that the students responded better to lessons that involved this medium. Although possible to implement the projects without the SMART Board, it would require extra material collection and demonstrations on behalf of the educators using the curriculum.

From the time of envisioning the curriculum implementation to the reflection process, I made major changes that ultimately provided me with experience in a new technology applicable to young children. Not only did I add the SMART Board, but found out that what I had envisioned to be one project became three projects. As this internship was my first experience with kindergarten, I learned how to adapt my vision to their needs, ensuring that I facilitated experiences that enabled students to construct their own education.

Ultimately, I was pleased to see student interest in the subject throughout the curriculum implementation, in their daily environments outside of the classroom, and during the showcase. These experiences showed me that students did benefit from using art as a medium to develop their knowledge in mathematics, which led to students developing work in a showcase and ultimately integrating art and mathematics in their daily lives, both inside and outside of the classroom.

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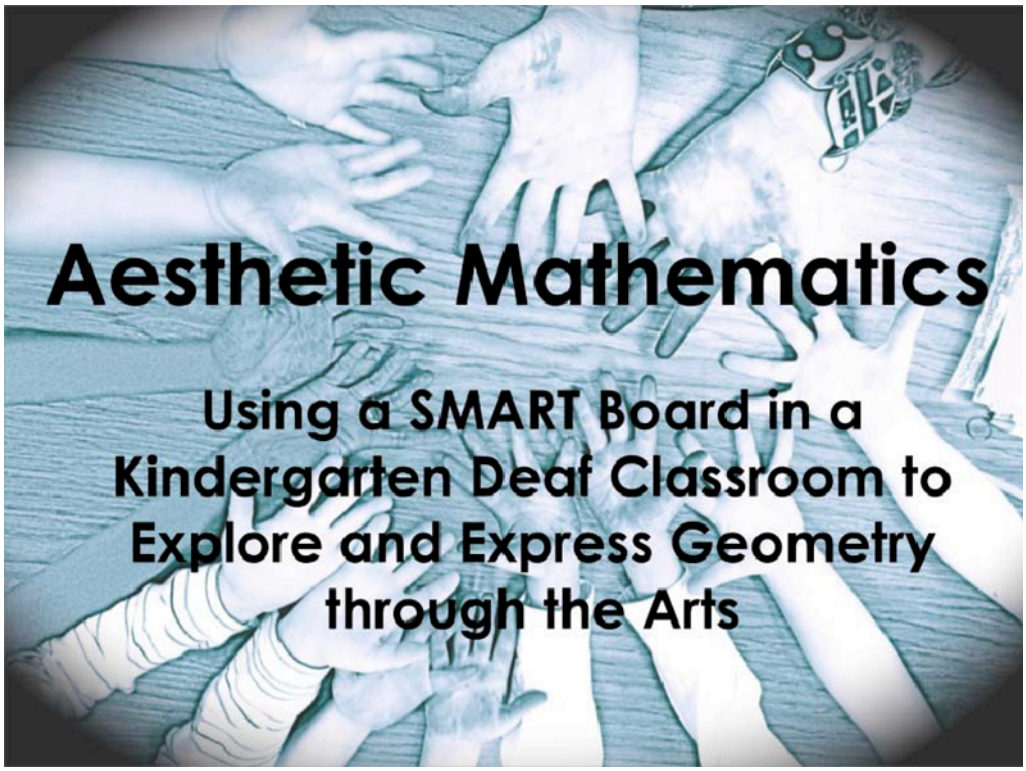
Appendix A.



A Curriculum By
Sarah Rachel Kasavan

Project 1	Shapes Introduction: Drawing Shapes in Salt

We cannot hope that many children will learn mathematics unless we find a way to share our enjoyment and show them its beauty as well as its utility.
~ Mary Beth Ruskai

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.6: Use geometric shapes/forms in a work of art.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.2: Develops arts skills and techniques.

Language Objective → Given sample sentences with vocabulary, students will recognized signed and written words in order to draw the corresponding shapes.

Learning Objective → Given specific shapes, students will draw the appropriate figures in the air and in salt, as measured by documented student work and Rubric 1.

Materials Used	○ One plate per student ○ Salt to fill each plate ○ Salt shaker ○ Cut-outs of each shape (optional) ○ Practice at Home! Drawing Shapes Worksheet ○ SMART Board Project 1

Set Up	Set up the SMART Board on Project 1. Cover bottom of plates with dark paper so it will be visible when students draw shapes. Fill the plates with salt enough to cover the colored paper at the bottom. Set up plates at separate station or at the teacher station to be passed out to students.

Teacher Notes
When naming the shape cut-outs, be sure to label them on removable labels, such as post-it notes, to show that orientation is irrelevant; no matter how the shape is turned, the label can be placed appropriately to represent the shape has not changed. These can be used throughout the lesson as needed for additional support. The shapes on the SMART Board can be rotated, as well, to show that the shape is constant, regardless of orientation. When signing the shapes, students will be using the "1" handshape. When they draw in the air, they will be using two fingers together in the "H" shape to distinguish signing the shape and drawing it in the air. For material management, salt plates can be collected after each shape is drawn, or set up at a different station where students can move each time they draw in the salt. Be sure to explain to students that this is the beginning of a curriculum where they will create several art projects, and they will have a class museum at the end. Be sure to remind students of this throughout implementation, as well. "Practice at Home! Drawing Shapes" worksheet can be sent home for more practice drawing shapes. You can send this packet over the period of one – two weeks. Students should draw these shapes three ways per sheet: 1. Tracing the shape 2. Connecting the corners/vertices with appropriate sides (except for circle) 3. Free hand

Shapes Introduction: Drawing Shapes in Salt (Activities)

Introduction (Notes 1, Slides 1.1 – 1.2)

1. Show students the salt-covered plate and ask them what material it is. Students can touch and taste the salt to figure it out.
2. Show students the saltshaker and ask if it is the same material. Ask what it is used for, then tell students that they will use it for art.
3. Slide 1.1: Review materials and task with students.
4. Slide 1.2: Read the sentence and have students discuss what shapes they recognize.
5. Have students select a shape and model drawing it in the salt plate.

Procedure (Notes 2, Slides 1.3 – 1.7)

1. Slide 1.3 – 1.7: For each slide, complete the following tasks with students:
    a. Have a volunteer trace the shape on the SMART Board with his/her finger, then have all students draw the shape in the air with two fingers.
    b. Spell the shape name and identify known letters.
    c. Sign the shape.
    d. Draw the shape in individual salt plates.
2. You may document their work with photos and/or Teacher Observations.
3. You may want to call attention to the first and last letters of the shapes, especially for beginning signers.

Conclusion (Notes 3)

1. In partners, have students share the following:
    a. What material did they use?
    b. What shapes did they recognize?
2. Use Teacher Observations and Rubric 1 to record what students discuss and what academic language they use.

Assessment → Use documented student work to complete Rubric 1 and Teacher Observations.

Rubric 1	Shapes Introduction: Drawing Shapes in Salt

Student Name: _____ Date:_____

Category	3	2	1
Signing	Student signed all given shapes.	Student signed most given shapes.	Student is still working on signing shapes.
Spelling	Student spelled most or all of the given shape names.	Student spelled some shape names and/or identified the first and last letters of the shape names.	Student is still working on spelling shape names or identifying first/last letters.
Salt Shapes	Student accurately drew all shapes in salt and self-corrected mistakes.	Student accurately drew some shapes in salt and may have corrected mistakes with minimal feedback from peers or staff.	Student is still working on accurately drawing shapes in salt or improving shapes when given feedback from peers or staff.

Teacher Observations:

Name: _____ Date: _____

Practice at Home:
Drawing Shapes!

circle	
triangle	
quadrilateral	
pentagon	
hexagon	

circle

sides:

corners:

triangle

sides:

corners:

quadrilateral

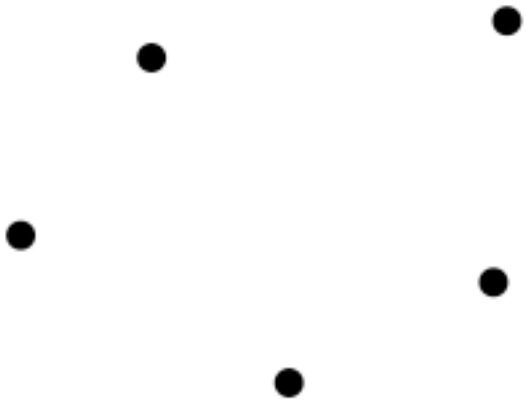
sides:

corners:

pentagon

sides:

corners:



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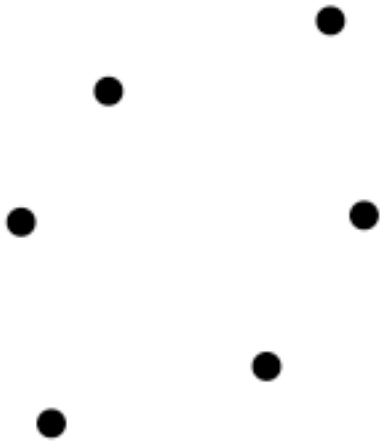
hexagon

sides:

corners:



Project 2	Wax Shapes on Fabric

For me it remains an open question whether [this work] pertains to the realm of mathematics or to that of art.

~ M. C. Escher

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.3: Make a collage with cut or torn paper shapes/forms. Creative Expression 2.6: Use geometric shapes/forms in a work of art. Aesthetic Valuing 4.3: Discuss how and why they made a specific work of art.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given vocabulary and sentence frames, students will describe their artwork using appropriate vocabulary and grammar.

Learning Objective → Given a hands-on experience, students will create collages with an identified shape, as measured by their fabric collages, vlogs and Rubric 2.

Materials Used	○ Scraps of fabric in various shapes in paper cups ○ Cardstock halves ○ White glue ○ Shape cut-outs ○ Wax strings ○ Teacher-made collage ○ Plastic sheet covers or saran wrap (optional) ○ SMART Board Project 2

Set Up	Set up the SMART Board on Project 2. At each student station, leave a cardstock half, wax string, and a paper cup filled with fabric scraps. Have teacher-made collage and plastic sheet covers/saran wrap ready for use.

Teacher Notes
For material management, white glue can be poured into paper cups for students to use with popsicle sticks, rather than squeezing the glue onto their collages. To provide an additional visual, use shape cut-outs to help students identify and find shapes. The plastic sheet covers or saran wrap can be used to cover the collage before tracing the shapes with wax strings. This will help students who struggle with the fine motor task of sticking the wax to the fabric. This lesson may need to be divided into two days or throughout one day, as the Procedure requires the student collages to be dry.

Wax Shapes on Fabric (Activities)

Introduction (Notes 4, Slides 2.1 – 2.2)

1. Show students your teacher-made collage and discuss what they notice.
2. Slide 2.1: Review that students will be making a collage.
3. Slide 2.2: Review materials with students.
4. Have students gather materials from their stations and create collages with their shapes. Their goal is to cover the entire piece of cardstock with fabric.
5. When students are finished, leave collages to dry.

Procedure (Notes 5, Slides 2.3 – 2.5)

1. Slide 2.3: Show students your collage and call their attention to the triangle you notice (same triangle from Slide 2.4) and trace it with your fingers. Sign, "I notice a triangle in my fabric collage" then click above the collage picture, where the sentence will appear. Read it in English, sign it again, then trace triangle.
2. Have students help you find other shapes in your collage and sign the sentence, "I notice a _____ in my fabric collage."
3. It is not students' turn to find shapes in their own collages.
4. Slide 2.4: Review materials that will be used.
5. Slide 2.5: Review slide with students, and have students find shapes in their collages. When students have found shapes, they can trace a shape with the wax strings from their individual stations.

Conclusion (Notes 6, Slide 2.6)

1. Slide 2.6: Show students sample vlog.
2. Have students practice signing about their own collages then film their own vlogs. Sentence structure may vary.
3. Complete Rubric 2 with each student.

Assessment → Use student collages, vlogs and student conferences to complete Rubric 2 and Teacher Observations.

Rubric 2	Wax Shapes on Fabric

Student Name: _____ Date:_____

Category	3	2	1
Collage	I completed my collage; fabric is covering the whole cardstock.	I completed my collage; fabric is covering most of the cardstock.	I am still working on my collage.
Shape	I independently found a shape in my collage; I traced it with a wax string.	With help, I found a shape in my collage and traced it with a wax string.	I am still looking for a shape in my collage.
Vlog	I finished a vlog about my collage. I signed clearly and included the shape I traced.	I finished a vlog about my collage. I signed somewhat clearly and included the shape I traced.	I am still working on making a clear vlog.

Teacher Observations:

Project 3	*The Greedy Triangle*

Bees … by virtue of a certain geometrical forethought … know that the hexagon is greater than the square and the triangle, and will hold more honey for the same expenditure of material.

~ Pappas

Curriculum Goal → Students will recognize how art and mathematics are present, applicable and integral to daily life.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Measurement and Geometry 2.2: Compare familiar plane and solid objects by common attributes. Artistic Perception 1.1: Recognize and describe simple patterns found in the environment and works of art.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.2: Develops arts skills and techniques.

Language Objective → Given context and sentence frames, students will identify and discuss shapes in the environment.

Learning Objective → Given a read aloud, students will identify and describe shapes in the environment, as measured by anecdotal evidence, Worksheet 3.1 and Rubric 3.

Materials Used	○ Book: *The Greedy Triangle* by Marilyn Burns ○ Shape cut-outs (on string necklaces – optional) ○ Shapeshifter costume (optional) ○ Worksheets 3.1 (A – E) ○ SMART Board Project 3

Set Up	Set up the SMART Board on Project 3. Have *The Greedy Triangle* and optional costumes ready. Photocopy enough of Worksheets 3.1 (A – E) for each student to have enough options.

Teacher Notes
This lesson may take place over a two-day period, depending on the amount of time allotted for mathematics. Depending on staff availability or student volunteering, the read aloud can occur in several ways: a. If many staff members are available, one staff member can be the Shapeshifter, one can be the narrator, and another the various shapes. Students can also play the shapes. b. If few staff members are available, one can be the Shapeshifter and the other the narrator/shapes. c. If you are the only staff member available, a student (or the students as a group) can be the Shapeshifter or the character can be played with references to the book. Costumes for the Shapeshifter are optional, such as a large cloak or silly hat. The shape cut-outs can be mounted on string necklaces to be worn each time the shape changes to add a side. Slide 3.2: The sides and corners of the triangle can be removed for students to take them off and replace them. Student Worksheet 3.1 has five versions: A, B, C, D and E. Each is for a different shape that students find. Depending on the students, you can have each student fill out one version for each shape, have students pick which shape they aim to find, or have them match the worksheet to the shape they have found. A second copy of Worksheet 3.1 can be sent home for homework, as well.

***The Greedy Triangle* (Activities)**
Introduction (Notes 7, Slide 3.1) 1. Slide 3.1: Project the SMART Board and ask students what they notice. Draw student attention to the triangle in the picture, as well as the word, "triangle." 2. Introduce the book and explain that you will do a read aloud. Sometimes they will participate, and other times they will watch the story. **Procedure (Notes 8, Slides 3.2 – 3.3)** 1. Read aloud the story. Be sure to act it out. 2. With partners, have students share what they liked about the story. 3. Have students share what they learned from the story with the class. 4. Slide 3.2: Review the slide with students and have them identify sides and corners. 5. Slide 3.3: Explain the chart to students and fill it out for triangle from the previous slide. Go through the book again, counting sides and corners of each shape. Fill out the chart while looking through the story again. **Conclusion (Notes 9, Slide 3.4)** 1. Slide 3.4: Using the slide, model how to complete Worksheet 3.1. Have students help you complete this slide with an item you notice in the classroom, such as a piece of paper (quadrilateral). Be sure to review the sentence in written English and ASL. 2. Have students complete their own worksheets regarding an item they each find in the classroom, with guidance if necessary. When students are finished, have them share their worksheets with partners. You may need to model how to share their sentences in appropriate ASL.

Assessment → Use anecdotal evidence and Worksheet 3.1 to complete Rubric 3 and Teacher Observations.

Rubric 3	*The Greedy Triangle*

Student Name: _____ Date:_____

Category	3	2	1
Participation	Student participated and watched read aloud at appropriate times; engaged in partner talk and group discussion appropriately.	Student participated and watched read aloud most of the time; may or may not have engaged in partner and group talk appropriately; may have gotten of topic. Student able to return to topic with minimal support.	Student is still working on participation, attention and partner talk skills; may have missed parts of the read aloud due to disruptions.
Finding Shapes	Student independently identified at least one shape in the classroom and recorded it on Worksheet 3.1.	Student identified at least one shape in the classroom with moderate to great support from staff or peers and recorded it on Worksheet 3.1	Student is working on finding his/her own shape in the classroom.
Sentences	Student independently completed the sentence on Worksheet 3.1 and signed its meaning in ASL.	With help, student worked on Worksheet 3.1 sentence and may have completed English or ASL.	Student is still working on Worksheet 3.1 and signing his/her sentence in ASL.

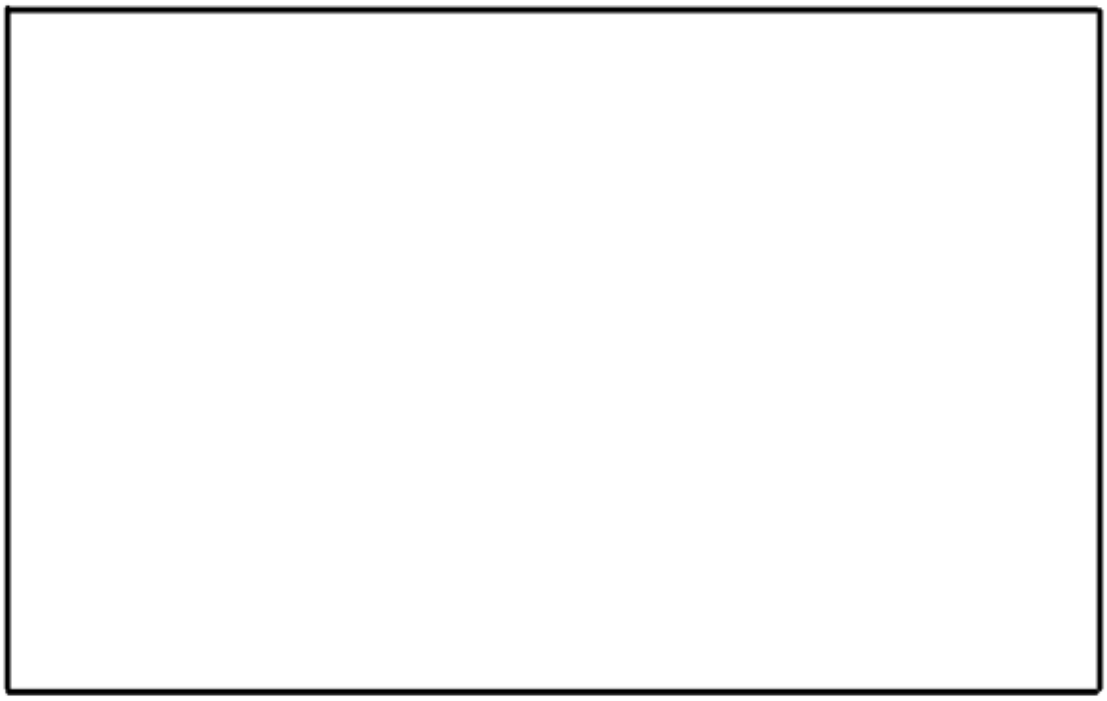
Teacher Observations:

Name: _____ Date: _____

Worksheet 3.1 (A)

The Greedy Triangle: Shapes in the World

Directions: Complete the sentence below and illustrate.



I notice a circle in a _____.

Name: _____ Date: _____

Worksheet 3.1 (B)

The Greedy Triangle: Shapes in the World

Directions: Complete the sentence below and illustrate.

I notice a triangle in a _____.

Name: _____ Date: _____

Worksheet 3.1 (*C*)

The Greedy Triangle: Shapes in the World

Directions: Complete the sentence below and illustrate.

I notice a quadrilateral in a

_____.

Name: _____ Date: _____

Worksheet 3.1 (D)

The Greedy Triangle: Shapes in the World

Directions: Complete the sentence below and illustrate.

I notice a pentagon in a _____.

Name: _____ Date: _____

Worksheet 3.1 (E)

The Greedy Triangle: Shapes in the World

Directions: Complete the sentence below and illustrate.

I notice a hexagon in a _____.

Project 4	What Can These Be For? The Purpose of Shapes Through Our Eyes

In reality … it [mathematics] is a science which demands the greatest imagination.

~ Sofia Kovalevskaia

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.6: Use geometric shapes/forms in a work of art. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate vocabulary. Aesthetic Valuing 4.3: Discuss how and why they made a specific work of art.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement 1.3.C: Combine known shapes to create shapes and divide known shapes into other shapes. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given vocabulary and sentence frames, students will describe materials and what they created.

Learning Objective → Given a hands-on activity with shapes, students will create new images, as measured by anecdotal evidence and Rubric 4.

Materials Used	○ White glue ○ Cardstock ○ Shape bags ○ Worksheet 4.1 (A and B) ○ SMART Board Project 4

Set Up	Set up the SMART Board on Project 4. At each student station, leave one piece of cardstock. Cut out various pieces of foam and paper shapes to place in each labeled shape bag, as the physical version of what is in Slide 4.1.

Teacher Notes
When students pick shapes from the bags, they can be challenged to share the name of the shape they desire, and try to draw the shape from the correct bag by checking if that is the shape anticipated. Once introduced, these bags can be used throughout the curriculum implementation. Worksheet 4.1 has two versions (A and B). The variation depends on the English level of each student: A requires students to independently write the material and shape names and B provides the materials and shapes in trace font. If students use Worksheet 4.1 B, they can either trace or circle the materials and shapes they used and cross out what they did not use.

What Can These Be For? The Purpose of Shapes Through Our Eyes (Activities)

Introduction (Notes 10, Slides 4.1 – 4.2)

1. Slide 4.1: Project slide and explain that students will use real brown bags fro this project. Pick shapes from the bags to show students how the shapes inside correspond to their names on the outside of the bags. Select two circles and place them side-by-side to resemble glasses.
2. Explain that when you put the shapes together, you see glasses. If students can see another image, that is great. Call student attention to the fact that everyone has a different interpretation.
3. Slide 4.3: Drag the shapes from Slide 4.1 to 4.3, and explain that students will glue their shapes together to create something new. Explain your glasses and add details (i.e. a face wearing them) around the shapes to make a cohesive work of art.
4. Slide 4.2: Review materials with students. Each will use some or all of the materials to create something new with their shapes.

Procedure (Notes 11)

1. Have students pick 2 – 3 shapes from the bags. They can pick from the same bag or 2 – 3 different bags.
2. Students should gather materials from their student station and begin gluing their shapes together.
3. When students are finished gluing their shapes, have them share with a partner what they have created or think they are creating.
4. Students can add details to their creations.

Conclusion (Notes 12, Slide 4.3)

1. Model signing what materials and shapes you used. Tell the students you will pretend your shapes are made from foam, and sign "I used foam to create glasses."
2. In partners, have students share the following:
    a. Materials used
    b. Shapes used
    c. What was created
3. Record what students say in Teacher Observations.
4. Slide 4.3: Model writing your own answers in English in the sentence frame. Have students do the same for their creations. When they are finished, they can draw a picture of what they created.

Assessment → Use anecdotal evidence and Worksheet 4.1 to complete Rubric 4 and Teacher Observations.

Rubric 4	What Can These Be For? The Purpose of Shapes Through Our Eyes

Student Name: _____ Date:_____

Category	3	2	1
Creation	Student selected 2 – 3 shapes and created a new image; details were added to the artwork.	Student selected 2 – 3 shapes and created a new image; may still be working on adding details.	Student is still working on selecting 2 – 3 shapes and/or gluing something new.
Signing	Student identified materials and shapes used; able to explain what he/she created and it makes sense.	Student mostly identified materials and shapes used; explains what he she created but may be unclear.	Student is still working on signing about materials, shapes used and what was created.
Sentences	Student completed worksheet 4.1 independently or with minimal support from staff or peers.	Student completed or nearly completed Worksheet 4.1 with great support from staff.	Student is still working on Worksheet 4.1

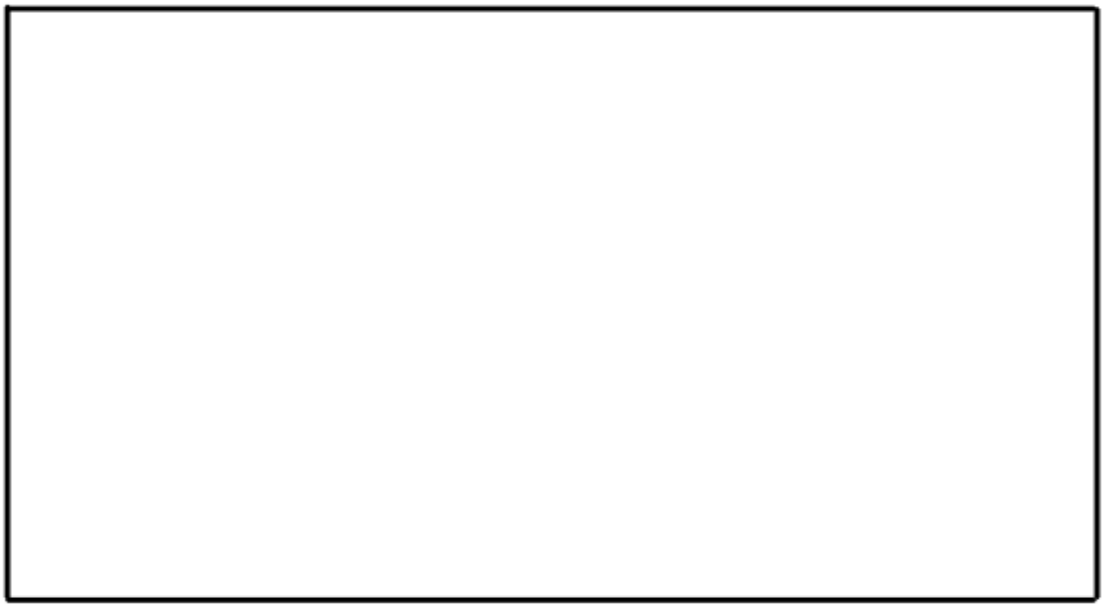
Teacher Observations:

Name: _____ Date: _____

Worksheet 4.1 (A)

What Can These Be For? The Purpose of Shapes Through Our Eyes

Directions: Complete the sentence below and illustrate.



The materials I used were: _____

_____.

These are the shapes I used: _____

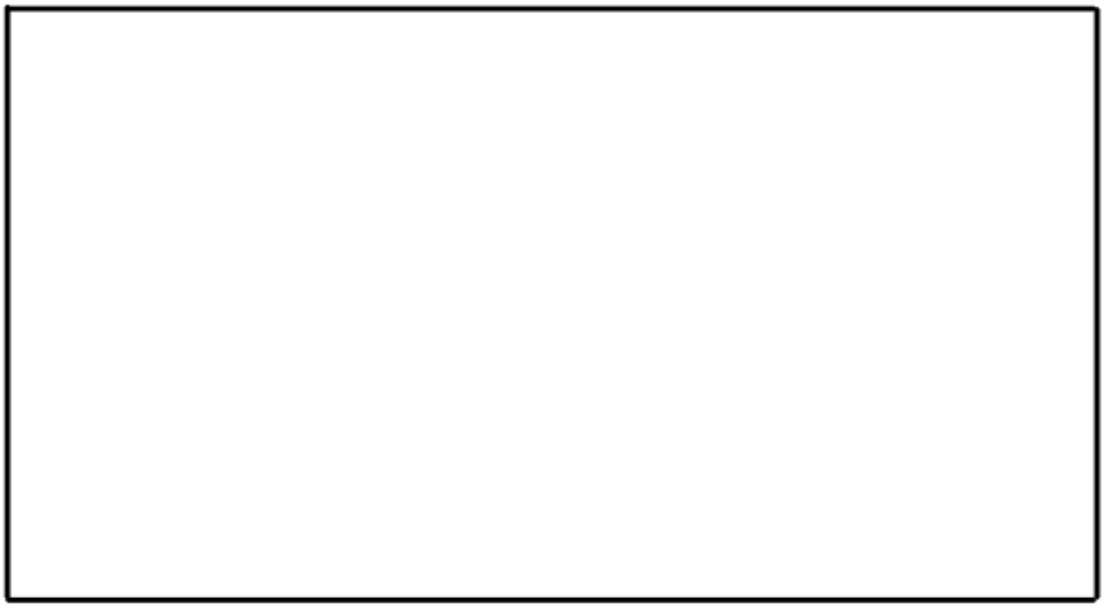
_____.

Name: _____ Date: _____

Worksheet 4.1 (B)

What Can These Be For? The Purpose of Shapes Through Our Eyes

Directions: Complete the sentence below and illustrate.



The materials I used were: cardstock, foam, glue, markers and pipe cleaners.

These are the shapes I used: circle, triangle, quadrilateral, pentagon and hexagon.

Project 5 | Sewing Combined Shapes

The essence of mathematics is its freedom.

~ George Cantor

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.6: Use geometric shapes/forms in a work of art. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate vocabulary. Aesthetic Valuing 4.3: Discuss how and why they made a specific work of art.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement 1.3.C: Combine known shapes to create shapes and divide known shapes into other shapes. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts.

Language Objective → Given vocabulary and sentence frames, students will identify sewing materials used and what they created.

Learning Objective → Given a hands-on activity, students will combine felt shapes in a sewing project, as measured by their sewing projects, Worksheet 5.1 and Rubric 5.

Materials Used	○ Felt shapes in each shape bag ○ Large, threaded needles (one per student) ○ Shape bags ○ Teacher-made samples ○ Worksheet 5.1 (A and B) ○ SMART Board Project 5

Set Up	Set up the SMART Board on Project 5. Leave a threaded needle and half sheet of felt at each student station. Add several felt shapes to the shape bags.

Teacher Notes
Be sure that the type of threaded needles are appropriate for students. Depending on the students, standard or larger needles may be used, metal or plastic. When students select their shapes from the shape bags, be sure they select the felt shapes, as they will be mixed in with foam and pipe cleaners. If this will be a problem, you can go ahead and remove the foam and pipe cleaner shapes from the bags for this project. Worksheet 5.1 has two versions (A and B). The variation depends on the English level of each student: A requires students to independently write the material and shape names and B provides the materials and shape names in trace font. If students use Worksheet 5.1 B, they can either trace or circle the materials and shapes they used and cross out what they did not use.

Sewing Combined Shapes (Activities)

Introduction (Notes 13, Slides 5.1 – 5.2)

1. Pass out felt and have students feel it and discuss what they notice. Collect felt and tell students they will use felt shapes today. Have students think of words to describe the felt that you will record on the SMART Board.
2. Slide 5.1: Introduce materials that will be used and record words that students used to describe the felt. Write the descriptions next to the vocabulary word, "felt."
3. Slide 5.2: Show students how you sewed two pieces of felt together. Have students share with a partner what shapes they see (triangles). Ask students what they see when the two triangles are put together and brainstorm student answers. Call student attention to how everyone has a different interpretation, and that is great.

Procedure (Notes 14, Slide 5.1)

1. Slide 5.1: Show students how the stitching on the SMART Board looks like it is over and under the fabric. Show them the teacher sample and discuss what students observe.
2. Have students gather their threaded needs from their stations and practice the stitch in the air without felt.
3. Each student will collect two shapes from the shape bags, and bring the larger piece of felt from their student stations. Once they place the felt shapes where desired, they can sew the fabric together.

Conclusion (Notes 15, Slide 5.3)

1. Slide 5.3: Draw your sewn creation on the slide then read the sentence frames with students. Practice signing the sentences in ASL, then fill them in using written English. Sign the sentences with students.
2. Have students fill in Worksheet 5.1.
3. Review Rubric 5 with each student.

Assessment → Use student sewing projects, Worksheet 5.1 and student conferences to complete Rubric 5 and Teacher Observations.

Rubric 5	Sewing Combined Shapes

Student Name: _____ Date:_____

Category	3	2	1
Materials	I followed directions and used materials appropriately.	I followed most of the directions and used materials appropriately.	I am still working on following directions and using materials appropriately.
Sewing	I independently sewed felt shapes onto a larger piece of felt; I made something new.	With help, I sewed felt shapes onto a larger piece of felt; I made something new.	I am still working on sewing shapes onto a larger piece of felt to make something new.
Sentences	I discussed the required information for Worksheet 5.1. I signed clearly.	I discussed the required information for Worksheet 5.1. I signed somewhat clearly.	I am still working on clearly discussing the required information for Worksheet 5.1

Teacher Observations:

Name: _____ Date: _____

Worksheet 5.1 (A)
Sewing Shapes

Directions: Complete the sentence below and illustrate.

The fabric I used was _____. I used

felt shapes to sew _____.

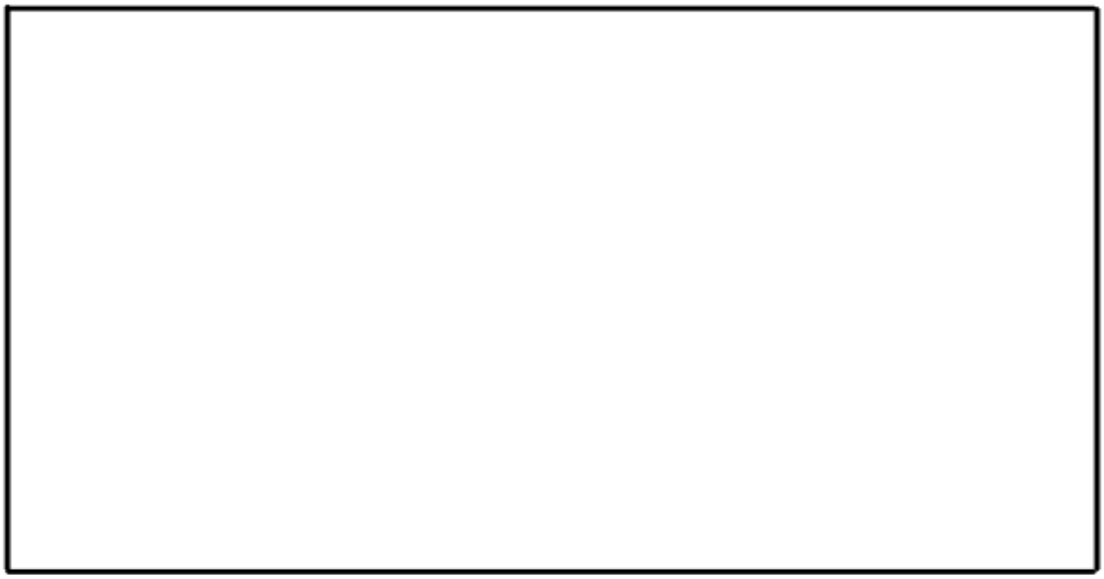
These are the shapes I used: _____

_____.

Name: _____ Date: _____

Worksheet 5.1 (B)
Sewing Shapes

Directions: Complete the sentence below and illustrate.



The fabric I used was felt. I used felt shapes to sew

_____.

These are the shapes I used:

triangle
quadrilateral
pentagon
hexagon.

Project 6	Quadrilaterals and the Graphic Organizer

There is no branch of mathematics, however abstract, which may not someday be applied to phenomena of the real world.
~ Nicolai Lobachevsky

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Measurement and Geometry 2.2: Compare familiar plane and solid objects by common attributes. Artistic Perception 1.2: Name art materials introduced in lessons.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement K.3.B: Sort shapes using a sorting rule and explain the sorting rule. The Arts 2.1: Applies a creative process to the arts.

Language Objective → Given vocabulary, students will categorize and explain a graphic organizer.

Learning Objective → Given an in class lesson, students will categorize various quadrilaterals, as measured by their graphic organizers, Worksheet 6.1 and Rubric 6.

Materials Used	○ Graphic organizers with cardstock backing ○ Paper cups (one per student, each containing at least two shapes from each of the following categories: squares, non-square rectangles, non-rectangle quadrilaterals, non-quadrilateral shapes) ○ White glue ○ Teacher sample of completed graphic organizer (optional) ○ Worksheet 6.1 ○ SMART Board Project 6

Set Up	Set up the SMART Board on Project 6. At each student station, leave one graphic organizer (pre-mounted on cardstock), paper cup containing quadrilaterals, and Worksheet 6.1. Leave the shape bags readily available at the teacher center for students to place unused shapes.

Teacher Notes
Photocopy enough graphic organizers for each student to have one and mount on cardstock. Depending on student prior knowledge, it may be necessary to take extra time to review the graphic organizer. The inner circles can be moved to show that the inner categories are included in the outer categories. Pictures in Slide 6.1 can be replaced with photos of people and places the students recognize. Graphic Organizers can be enlarged or left the given size, depending on the size of the shapes and needs of students.

Quadrilaterals and the Graphic Organizer (Activities)

Introduction (Notes 16, Slides 6.1 – 6.2)

1. Slide 6.1: This slide is to understand the graphic organizer. Have students help you correctly place the pictures in their respective categories. Do so by doing the following:
   a. For pictures that don't belong, discuss why they cannot be part of the circle.
   b. For non-children people, guide the pictures to enter the outermost circle and place a checkmark in the checkbox to show it belongs there. Since each does not fit the next category, each of those must stay in that category. After each picture, replace the checkmark outside.
   c. For non-boy children, enter the outermost circle and place a checkmark in the checkbox to show it belongs there. Ask students if the photo can be moved down to the next category. Since the photo is a person and a child, check the box for the next category and move the picture down. You can show that the photo is a boy and also a person by removing the "children" category, showing that the child is part of both categories. Replace the checkmarks when finished.
   d. For boy children, follow the same procedure, but check all three boxes, one at a time, moving the picture through the categories. You can remove the inner circles to show that boy children are boys, children and people.
2. Complete the graphic organizer with the photos, having students help.
3. Slide 6.2: Complete the graphic organizer with the same procedure above, placing the quadrilaterals in the appropriate categories.
4. Discuss what students notice and what they can tell you about the different types of quadrilaterals. Have students think independently, share with partners and with the group in a Think-Pair-Share format.

Procedure (Notes 17, Slide 6.3)

1. Slide 6.3: Review materials by having students help you draw lines to connect the appropriate materials with their names.
2. Have students collect their cardstock graphic organizers, cups of shapes and place the shapes where necessary. When they are finished, they can glue down the shapes. Shapes that do not fit into the graphic organizer can be placed in the appropriate shape bags at the teacher station.

Conclusion (Notes 18, Slide 6.4)

1. In partners, have students share what they know about each type of quadrilateral. Take notes in Teacher Observations.
2. Slide 6.4: Using a completed student graphic organizer (or teacher example), complete the checklist with student assistance.
3. Have students collect Worksheet 6.1 from their stations and complete, using their own graphic organizers. Be sure students use a different quadrilateral than the example used in Slide 6.4.

Assessment → Use student graphic organizers and Worksheet 6.1 to complete Rubric 6 and Teacher Observations.

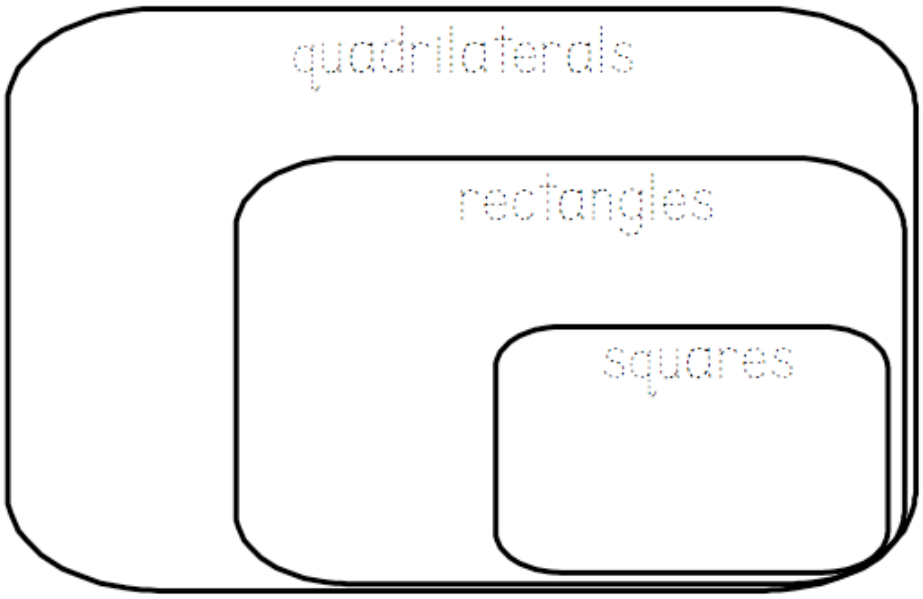
Rubric 6	Quadrilaterals and the Graphic Organizer

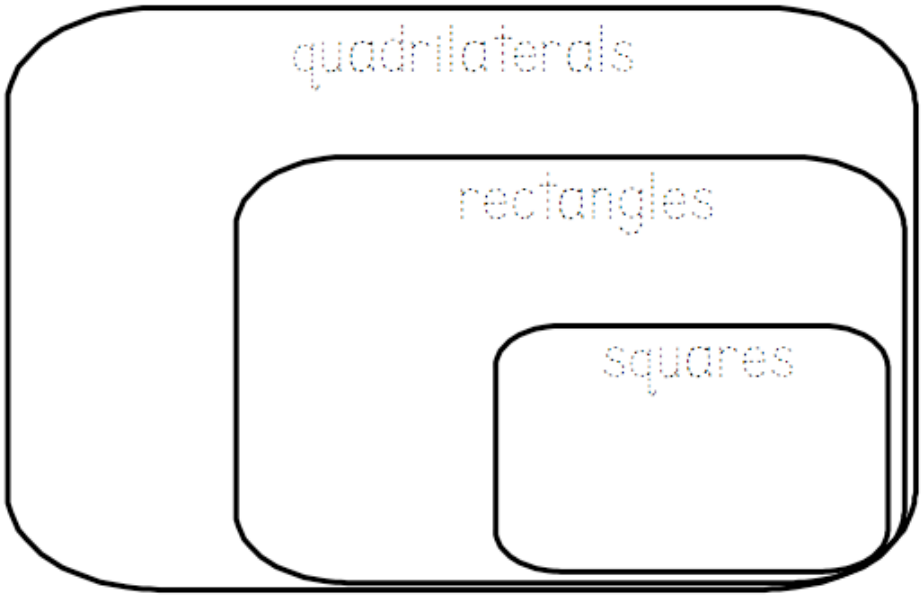
Student Name: _____ Date:_____

Category	3	2	1
Participation	Student participated often throughout the project.	Student sometimes participated throughout the project; may or may not have disrupted class.	Student is still working on participation skills; may have repeatedly disrupted class.
Graphic Organizer	Student independently completed the graphic organizer.	Student completed the graphic organizer with moderate to great support.	Student is still working on the graphic organizer.
Checklist	Student independently completed checklist; may have received minimal support.	Student completed the checklist with much support.	Student is still working on the checklist.

Teacher Observations:

Project 6 Graphic Organizers





Name: _____ Date: _____

Worksheet 6.1

Quadrilateral Comprehension Check

Directions: Using your graphic organizer, pick one type of quadrilateral to fill out the checklist below for all that is true.

Shape Name: _____

- ☐ It is a quadrilateral.

- ☐ It is a rectangle.

- ☐ It is a square.

Project 7	Recognizing, Fixing and Creating Shapes in Picasso's Art

Every child is an artist. The problem is how to remain an artist after he (she) grows up.

~ Pablo Picasso

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.1: Recognize and describe simple patterns found in the environment and works of art. Artistic Perception 1.2: Name art materials introduced in lessons. Historical and Cultural Context 3.3: Look at and discus works of art from a variety of times and places. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate art vocabulary. Connections, Relationships, Applications 5.4: Discuss the various works of art that artists create and the type of media used.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.1: Understands and applies arts concepts and vocabulary.

Language Objective → Given vocabulary, students will identify Picasso and shapes in his artwork.

Learning Objective → Given an in class lesson, students will analyze Picasso's work, as measured by anecdotal evidence, their marked artwork, Picasso Score Cards and Rubric 7.

Materials Used	○ Book: *Getting to Know the World's Greatest Artists: Picasso* by Mike Venezia ○ Photocopies of Picasso's artwork, size 8 ½ x 11 (Boy in Sailor Suit with Butterfly Net, Three Musicians & Weeping Woman) ○ Markers ○ Picasso Score Cards ○ SMART Board Project 7 ○ SMART Board Project 1 (optional)

Set Up	Set up the SMART Board on Project 7. Photocopy and enlarge each of Picasso's three artworks to 8 ½ x 11. (Each of the given works can be found in the book.) You can either pre-place one of the three at each student station or have students select which of the three with which they would like to work. Photocopy one Picasso Score Card per student and leave them at student stations. Have book and markers readily available.

Teacher Notes
This lesson may need to be divided between several time allotments, as it includes a read aloud. You can read aloud each page, or select significant information on each page to share with students while discussing works. Be sure to model how to use the Picasso Score Card, as it is different than a checklist and is a report on what students did when they found, fixed and created shapes. Students do not have to find, fix and create for each of the shapes. Some of Picasso's artwork have several shapes that can be found and fixed, and do not need to be created. Other artwork may have only circles, and need creations for all other shapes. Student interpretation is encouraged and welcomed. Important definitions: Find – to identify a complete and accurate shape Fix – to slightly alter a shape, such as making a curve become a straight side Create – to add sides or curves to form shapes

Recognizing, Fixing and Creating Shapes in Picasso's Art (Activities)

Introduction (Notes 19, Slide 7.1)

1. Slide 7.1: Show students the book cover and discuss what they notice. Who was Picasso? Introduce his name sign and have students predict who he is. You can prompt students by asking what they have been studying and creating in math. Student can share in partners and with the group. Explain that you will now read the book and learn about him.
2. *Read Getting to Know the World's Greatest Artists: Picasso*. Be sure to summarize what you are reading, as it is an advanced text.

Procedure (Notes 20, Slides 7.2 – 7.4)

1. Ask students again who is Picasso. Have them share with a partner, then as a group. Keep notes of what students say in Teacher Observations.
2. Slide 7.2: Project slide of Picasso's artwork and click above the picture. The sentence, "Pablo Picasso is a famous artist." will be projected. Identify important words, sign the sentence, and refer to the English print with the chaining method. Have students sign the sentence in partners using ASL.
3. Explain to students that their job is to help Picasso! They must find, fix and create shapes in his artwork. You will use this work as an example, then they will do so on their own.
4. Model finding, fixing and creating shapes on the work of art, and have students help you create more. Be sure the shapes you model are the same as the shapes on Slide 7.3.
5. Slide 7.3: Review what you have just done and have students help you find, fix and create more.
6. Slide 7.4: Review materials. Have students help you match Picasso's artworks to the titles by drawing lines connecting the two. Have students help identify letters and words as you read aloud the title. Students should be able to match titles with works with your guidance. This can be done in a Think-Pair-Share format.
7. Have students collect or select their works of art and a marker.
8. Slides 1.3 – 1.7 (optional): Go through each slide, having students find, fix or crate each known shape in Picasso's artwork.

Conclusion (Notes 21, Slide 7.5)

1. Slide 7.5: Using your sample artwork, fill out the Picasso Score Card for what you did to find shapes. Using one box at a time, model how you see in your example that you found, fixed and created shapes. This means that you check all three boxes if you found, fixed and created on your sample. Clarify to students that this is like a report on what you already did, and to only check the boxes for how you found, fixed and/or created shapes.
2. Have students collect their Score Cards from their stations and do the same, using their individual papers to fill out the Picasso Score Card. Have students share, in partners, what they did.

Assessment → Use anecdotal evidence, marked artwork, and Picasso Score Cards to complete Rubric 7 and Teacher Observations.

Rubric 7	Recognizing, Fixing and Creating Shapes in Picasso's Art

Student Name: _____ Date:_____

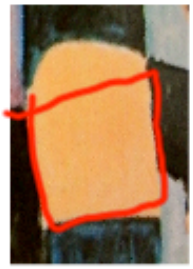
Category	3	2	1
Participation	Student was focused during read aloud and participated in partner/group discussion appropriately.	Student was mostly focused during read aloud and participated during most of the group/partner discussion; may have minimally gone off task.	Student is still working on attention and partner talk skills; may have caused disruptions and repeatedly gone off task.
Finding, Fixing and Creating Shapes	Student found, fixed and/or created each required shape in Picasso's art with minimal or no support from staff or peers.	Student found, fixed, and/or created most of the required shapes in Picasso's art with minimal to much support from staff or peers.	Student is still working on finding, fixing and/or creating shapes in Picasso's art, with or without support from staff or peers.
Score Card	Student completed Score Card and shared with peers.	Student completed Score Card with minimal support and may or may not have shared with peers.	Student is still working on the Score Card.

Teacher Observations:

Score Card

☐ I traced the shapes Picasso already made.

☐ I changed some sides of Picasso's artwork.



☐ I had to add sides and corners or close the shape.

Project 8	Introduction to Geoboards

The real voyage of discovery consists not in seeking new landscapes but in having new eyes.

~ Marcel Proust

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.6: Use geometric shapes/forms in a work of art. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate art vocabulary.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement 1.3.C: Combine known shapes to create shapes and divide known shapes into other shapes. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given vocabulary and sentence frames, students will identify geoboard materials and what they created.

Learning Objective → Given a hands-on activity, students will create images on geoboards, as measured by their geoboards, Worksheet 8.1 and Rubric 8.

Materials Used	○ Geoboards ○ Rubber bands ○ Worksheet 8.1 (A and B) ○ SMART Board Project 8

Set Up	Set up the SMART Board on Project 8. At each student center, leave a geoboard and copy of Worksheet 8.1. Have some geoboards and some rubber bands set up for students to explore prior to the procedure.

Teacher Notes
Blank geoboards are needed several times throughout Project 8 and Project 9. If students will potentially use their geoboard creations in the Showcase and there will not be multiple sets of geoboards available for the class, this Project can be done after Project 9 to preserve student creations. If there are plenty of geoboards, students can keep their creations from Project 8 at their student stations for Showcase options. Worksheet 8.1 has two versions (A and B). The variation depends on the English level of each student: A requires students to independently write the material and shape names and B provides the materials and shapes in trace font. If students use Worksheet 8.1 B, they can either trace or circle the materials and shapes they used and cross out what they did not use.

Introduction to Geoboards (Activities)

Introduction (Notes 22, Slides 8.1 – 8.2)
1. Pass around some geoboards and rubber bands for students to touch.
2. Ask students what they notice and what they think they can make.
3. Slide 8.1: Review materials with students.

Procedure (Notes 23)
1. Have students collect geoboards from student stations and use rubber bands on the table to create designs with their geoboards.

Conclusion (Notes 24, Slide 8.3)
1. In partners, have students share what they created. Take notes on what they say in Teacher Observations.
2. Slide 8.3: Model how to use what was just shared in partners to write in English sentences. Have students help you fill out the sentence frame, then sign it again in ASL.
3. Have students gather Worksheet 8.1 from their stations and fill out the sentence frames. When they are finished, they can draw their designs on the worksheet.
4. Review Rubric 8 with each student.

Assessment → Use student geoboards, Worksheet 8.1 and student conferences to complete Rubric 8 and Teacher Observations.

Rubric 8	Introduction to Geoboards

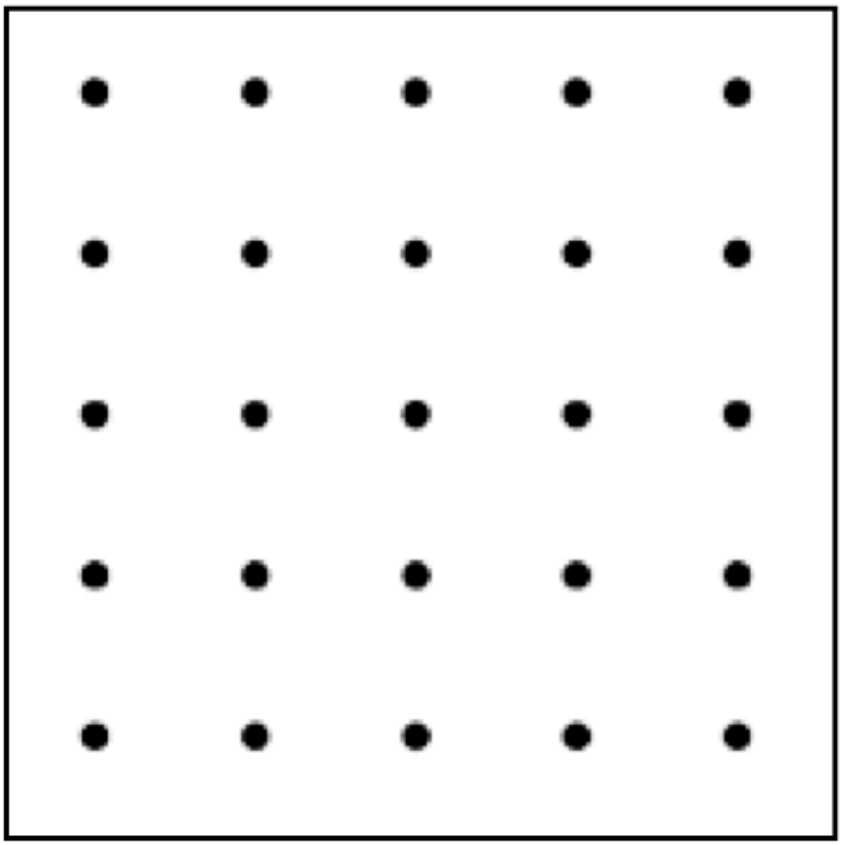
Student Name: _____ Date:_____

Category	3	2	1
Materials	I used materials appropriately.	I used materials mostly appropriately.	I am still working on how to use materials appropriately.
Personal Geoboard	I can identify what I created on my geoboard. I signed clearly.	I can identify what I created on my geoboard. I signed somewhat clearly.	I am still working on signing clearly to identify what I created on my geoboard.

Teacher Observations:

Name: _____ Date: _____

Worksheet 8.1 (A)
Drawing my Geoboard



I used a _____ to create a

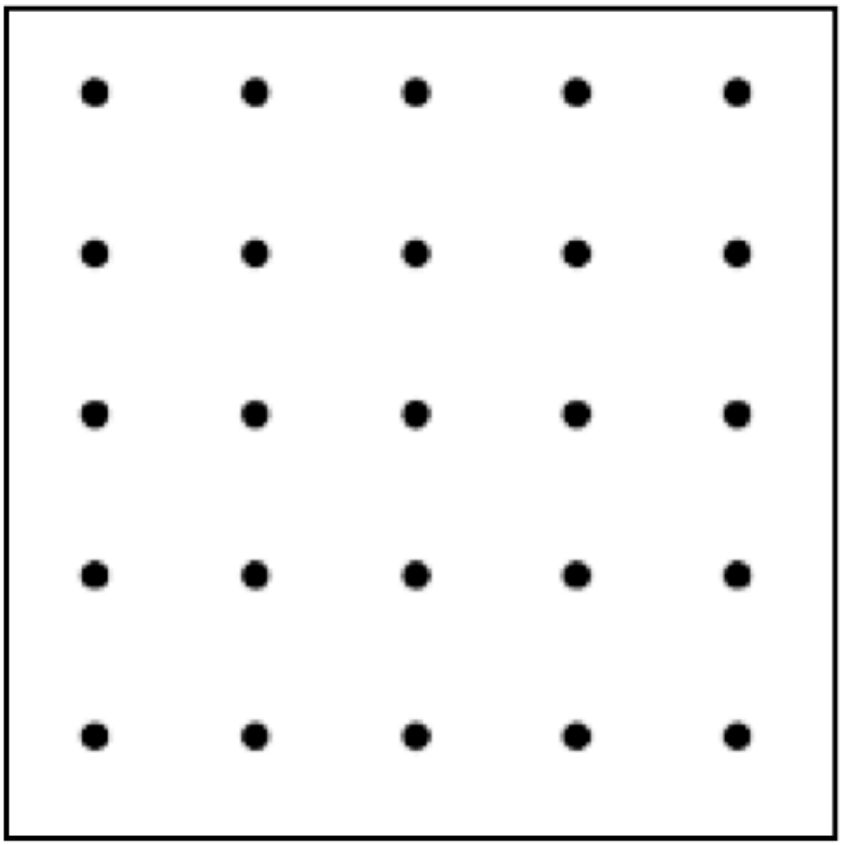
_____.

I used these shapes: _____

_____.

Name: _____ Date: _____

Worksheet 8.1 (B)
Drawing my Geoboard



I used a geoboard to create a _____.

I used these shapes:

triangle
quadrilateral
pentagon
hexagon.

Project 9	Making Different Shapes with Geoboards

The only way to learn mathematics is to do mathematics.
~ Paul Halmos

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.1: Recognize and describe simple patterns found in the environment and works of art. Creative Expression 2.2: Demonstrate beginning skill in the use of tools and process, such as the use of scissors, glue and paper in crating a 3D construction.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement K.4.A: Make direct comparisons using measurable attributes such as length, weight and capacity. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given written vocabulary, students will recognize shape names in order to create corresponding shapes on a geoboard.

Learning Objective → Given a hands-on activity, students will create given shapes on individual and group geoboards, as measured by the completed geoboards, Worksheets 9.1 – 9.2, and Rubric 9.

Materials Used	○ Geoboards ○ Rubber bands ○ Geoboard label cards ○ Worksheet 9.1 ○ Worksheet 9.2 ○ SMART Board Project 9

Set Up	Set up the SMART Board on Project 9. At each student center, leave a geoboard and two paper cups. a. One paper cup should have rubber bands in each of the following colors (to go along with Worksheet 9.1): yellow, white, pink, green, red and blue. b. The other paper cup should have at least 5 of the same color of rubber bands. Each student should have a different color. Leave Worksheet 9.1 at each student station. Have a small card of paper for each shape, and one extra for miscellaneous shapes. Each should be labeled with a shape name and various drawings of each shape. If you decide to use an extra card, write, "What is your favorite shape?" with drawing of various shapes. These will be used when students work with the rubber bands from the second cup.

Teacher Notes
After the introduction, either document student work by photographing what they completed or use another set of unused geoboards for the second part of the task. When students are working on making various pentagons and hexagons, the task will likely be demanding in terms of fine motor skills, and can be an extra challenge. You may want to start the more advanced students on the triangle and quadrilateral geoboards, so they will be more challenged at the end. Creating different triangles and quadrilaterals will appropriately challenge the newly developing students. Keep track of which student used each color of rubber bands. When students are finished with Project 9, you can review their work by looking at the colored rubber bands on each geoboard. This also will enable you to engage with the students during the activity.

Making Different Shapes with Geoboards (Activities)

Introduction (Notes 25, Slide 9.1)

1. Slide 9.1: Model how to use Worksheet 9.1 to create each shape on the geoboard.
2. Have students gather their geoboards and cups of different colored rubber bands from student stations, and use Worksheet 9.1 to complete their geoboard task.

Procedure (Notes 26, Slide 9.2)

1. Using blank geoboards, have each student make a triangle. Have students pass in geoboards to the teacher. Either add a geoboard with a quadrilateral or change a student geoboard to be a quadrilateral.
2. Go through each geoboard with the class, having students vote by showing a thumbs up or thumbs down if each is a triangle or not. Be sure to emphasize that who made each one is not important.
3. If all triangles look the same, have students make a different kind of triangle and repeat the task.
4. Call student attention to the fact that there are so many different ways to make a triangle. This is also a good opportunity to review what makes a triangle (three sides and three corners).
5. Slide 9.2 (optional): When reviewing the triangles, you or students can draw the geoboard triangles on the slide to review.
6. Take rubber bands off geoboards, and place them on the table next to their label cards.
7. Tell students that each geoboard is for a specific shape that they can see written on the shape card next to each geoboard. Their job is to make shapes on each geoboard, but they cannot be the same as the others. Each student must make a different version of each shape than the ones already placed by other students. This means that on the triangle geoboard, for example, there will be one different kind of triangle for each student, and each student will use the same color on each geoboard so the teacher can see who made which shapes.
8. Have the students gather cups with single colored rubber bands from student stations and begin the task.

Conclusion (Notes 27)

1. Have students gather Worksheet 9.2 from their student stations and complete it.
2. When finished, students should share the materials with a partner by spelling and signing what materials are used for geoboards. Take notes of what students say in Teacher Observations.

Assessment → Use individual and group student geoboards, and Worksheets 9.1 – 9.2 to complete Rubric 9 and Teacher Observations.

Rubric 9	Making Different Shapes with Geoboards

Student Name: _____ Date:_____

Category	3	2	1
Individual Geoboards	Student completed geoboard task; it matches the checklist.	Student completed the geoboard task; most of it matches the checklist.	Student is still working on geoboard task; it may or may not match the checklist.
Group Geoboards	Student created a new version of each shape on all of the geoboards.	Student created a new version of most of the shapes on all or most of the geoboards.	Student is still working on creating new versions of shapes on the geoboards.
Worksheet	Student accurately completed Worksheet 9.2.	Student completed Worksheet 9.2; it is mostly accurate.	Student is still working on completing Worksheet 9.2 with accuracy.

Teacher Observations:

Name: _____ Date: _____

Worksheet 9.1
Geoboards: Shape Checklist

Directions: Complete each task. Check off each as it is completed.

- ☐ I made a yellow triangle.

- ☐ I made a white pentagon.

- ☐ I made a pink hexagon.

- ☐ I made a green quadrilateral.

Challenge!

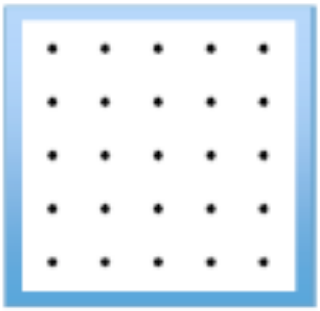
- ☐ I made a red rectangle.

- ☐ I made a blue square.

Name: _____ Date: _____

Worksheet 9.2
What Materials We Use for Geoboards

Directions: Circle and write the names of the materials we use for geoboards. Cross out what we don't need for geoboards.



geoboards
geoboards

pencils
pencils

rubber bands
rubber bands

Project 10	Symmetrical Paintings

Geometry is the foundation of all painting.

~ Albrecht Durer

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Measurement and Geometry 2.2: Compare familiar plane and solid objects by common attributes. Artistic Perception 1.2: Name art materials introduced in lessons. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate art vocabulary. Aesthetic Valuing 4.3: Discuss how and why they made a specific work of art.	Geometry/Measurement 1.3.C: Combine known shapes to create shapes and divide known shapes into other shapes. The Arts 1.1: Understands and applies arts concepts and vocabulary. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given frontloaded vocabulary, students will identify painting materials and describe symmetry.

Learning Objective → Given a hands-on activity, students will create and discuss symmetrical paintings, as measured by their paintings, vlogs and Rubric 10.

Materials Used	○ Cardstock (made for symmetry/easy to folded in half) ○ Various paint colors ○ Paint brushes ○ Paper cups ○ Symmetry labels ○ SMART Board Project 10

Set Up	Set up the SMART Board on Project 10. Make sure the cardstock has been folded in half. Draw a black line down the center. At the top, paste the symmetry label in the middle so it is also symmetrical. Leave at student stations. Set up paint station with various colored paints in paper cups with paintbrushes, ready for students.

Teacher Notes
When putting paint in cups, be sure to use a minimal amount to prevent overuse of paint. It is important for paint to be used in moderation, as there is limited amount of time for the paintings to become dry before students create their vlogs. If the paint needs more time to dry, this project can be spread out over a longer period of time. To help students follow the rule of painting only one side of the cardstock, it may be helpful to fold the cardstock in half so only the side they are painting is exposed.

Symmetrical Paintings (Activities)

Introduction (Notes 28, Slides 10.1 – 10.2)

1. Slide 10.1: Show students the slide and discuss what they notice. How do they think that was made? Click above and below the painting and read the sentences together and discuss vocabulary.
2. Slide 10.2: Review materials for the project.

Procedure (Notes 29)

1. Review rules with students before painting:
    a. Paint one side of the cardstock. For an extra challenge, include shapes in your painting.
    b. When you are finished, raise your hand. Staff will give you permission to fold the painting in half and rub paper together.
    c. Open painting and leave to dry.
2. Model this activity with students watching, calling attention to how you can add shapes into your painting.
3. Have students gather labeled cardstock from student stations and begin painting. When they are finished, they can leave their paintings to dry.
4. Clean up materials and gather for conclusion.

Conclusion (Notes 30, Slide 10.3)

1. Slide 10.3: Show sample vlog. Call student attention to what was included in the vlog:
    a. type of painting (symmetrical)
    b. how it was made
    c. materials used
2. Have students create their own vlogs. Depending on available staff, someone can hold painting in background for students (similar to sample vlog), or students can show painting before signing about it.

Assessment → Use student paintings and vlogs to complete Rubric 10 and Teacher Observations.

Rubric 10	Symmetrical Paintings

Student Name: _____ Date:_____

Category	3	2	1
Painting	Student completed symmetrical painting by following all directions.	Student completed symmetrical painting; following directions most of the time.	Student is still working on completing a symmetrical painting.
Vlog	Student completed vlog; contains all required information and it makes sense.	Student completed the vlog; contains most of the required information; makes sense most of the time.	Student is still working on creating a clear vlog.

Teacher Observations:

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

yrtemmys symmetry

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Project 11 | Lines of Symmetry

Symmetry, as wide or as narrow as you define its meaning, is one idea by which man through the ages has tried to comprehend and create order, beauty and perfection.

~ Hermann Weyl

Curriculum Goals → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Students will recognize how art and mathematics are present, applicable and integral to daily life.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.2: Compare familiar plane and solid objects by common attributes. Artistic Perception 1.1: Recognize and describe simple patterns found in the environment and works of art. Artistic Perception 1.2: Name art materials introduced in lessons. Artistic Perception 1.3: Identify the elements of art in the environment and in works of art, emphasizing line, color and shape/form.	Geometry/Measurement K.3.B: Sort shapes using a sorting rule and explain the sorting rule. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts.

Language Objective → Given vocabulary and sample sentences, students will identify what is symmetrical and lines of symmetry.

Learning Objective → Given an in class lesson, students will identify symmetrical objects and find lines of symmetry, as measured by anecdotal evidence, student shapes with identified lines of symmetry and Rubric 11.

Materials Used	○ Internet connection or images of symmetrical and asymmetrical objects ○ Symmetry sticks (one of each per student) • popsicle sticks • symmetry sentences • blue and pink index cards ○ Symmetrical painting from Project 10 ○ Asymmetrical item from classroom, such as pencil ○ SMART Board Project 11

Set Up	Set up the SMART Board on Project 11. To make symmetry sticks, there should be two popsicle sticks for each student. One stick should have a blue index card or small paper taped to it with the sentence, "That is symmetrical." The other sticks should have a pink index card or small paper taped to it with the sentence, "That is not symmetrical." An example is available on Slide 11.1 and in the following page entitled, Symmetrical Votes." Cut out and photocopy sentences as necessary and glue to sticks to complete the symmetry sticks. At student stations, leave a pink and a blue symmetry stick for each student. Also leave shape papers and 2 – 3 wax strings at each station. Photocopy shape papers as needed for your class. Have available a symmetrical painting from Project 10 and asymmetrical item.

Teacher Notes
If the internet is unavailable or the video connection fails, images of symmetrical objects (with visible lines of symmetry) and asymmetrical objects can be used instead. Watch the video from the link on Slide 11.2 prior to teaching the lesson in order to decide which parts will be useful for your students. When setting up student stations and distributing shape papers, leave two shape papers at each student station. (Be sure to cut each paper in half so that each half-sheet with a single shape is on its own sheet of paper.) Use the more challenging shapes for the more advanced students. Have extra sets of papers at the teacher station for students who finish early and/or who need an extra challenge. Following Rubric 11 are large shapes on paper that can be photocopied for students to find lines of symmetry.

Lines of Symmetry (Activities)

Introduction (Notes 31, Slide 11.1)

1. Slide 11.1: Review materials with students and read sentences. Make sure students understand what the words mean.
2. Have students gather symmetry sticks from student stations and practice using them with some classroom items (i.e. painting from Project 10 and asymmetrical item).

Procedure (Notes 32, Slide 11.2 and internet)

1. Explain that you will show a video about symmetry. Some things will be symmetrical and others will be asymmetrical. When you pause the video, have students vote on symmetry by holding up the appropriate symmetry sticks.
2. Slide 11.2: Click on the "Symmetry Video" button and watch video. Pause several times throughout the video to have students vote on whether images are symmetrical or asymmetrical, using their symmetry sticks.
3. During the video, be sure to stop and explain the line of symmetry, or the line that divides the picture into symmetrical parts.

Conclusion (Notes 33, Slide 11.3)

1. Slide 11.3: Have students help you place the line(s) of symmetry on the three images. The red line under "line of symmetry" is set to infinite cloner, which means the red line of symmetry can be dragged from its place infinite times and left on the lines of symmetry. Call student attention to the fact that all images are symmetrical on the slide, and discuss about asymmetrical images not having lines of symmetry.
2. Have students gather shape papers and wax strings from their student stations. They should place the wax strings where they see lines of symmetry.
3. Review Rubric 11 with each student.

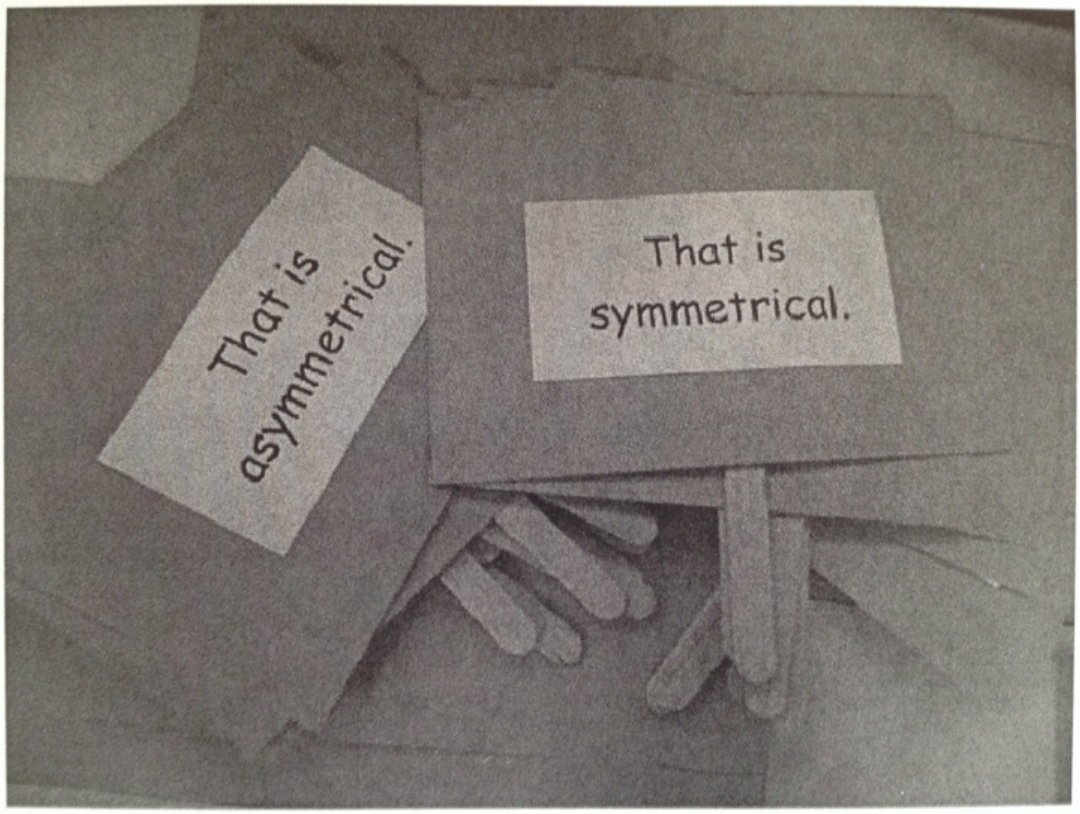
Assessment → Use anecdotal evidence, student shapes with identified lines of symmetry and student conferences to complete Rubric 11 and Teacher Observations.

Rubric 11	Lines of Symmetry

Student Name: _____ Date:_____

Category	3	2	1
Voting	I participated in voting all or most of the time.	I participated in voting some of the time.	I am still working on how to participate.
Finding Lines of Symmetry	I independently found lines of symmetry on the shape papers.	With help, I found lines of symmetry on the shape papers.	I am still working on finding lines of symmetry on the shape papers.

Teacher Observations:



That is
symmetrical.

That is
asymmetrical.

That is
symmetrical.

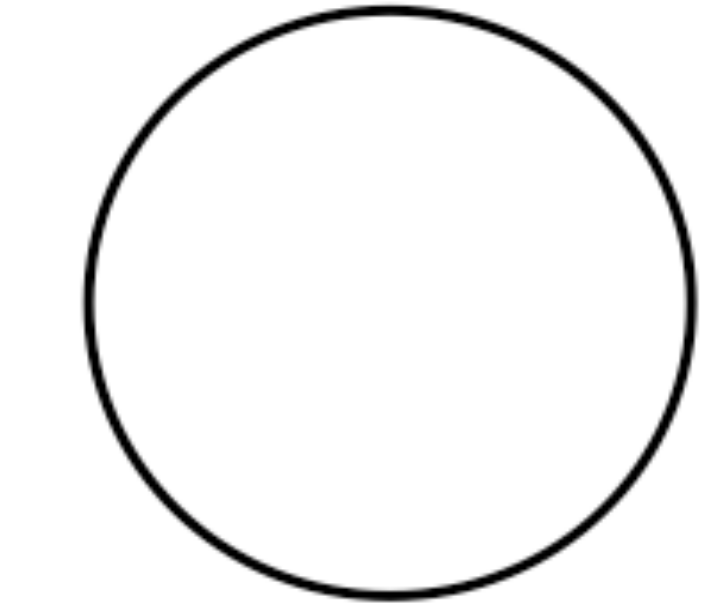
That is
asymmetrical.

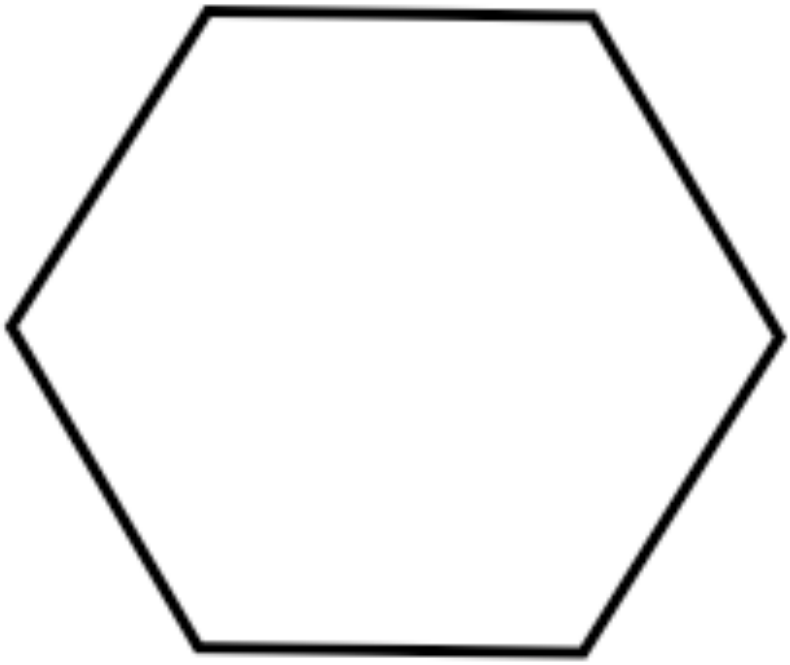
That is
symmetrical.

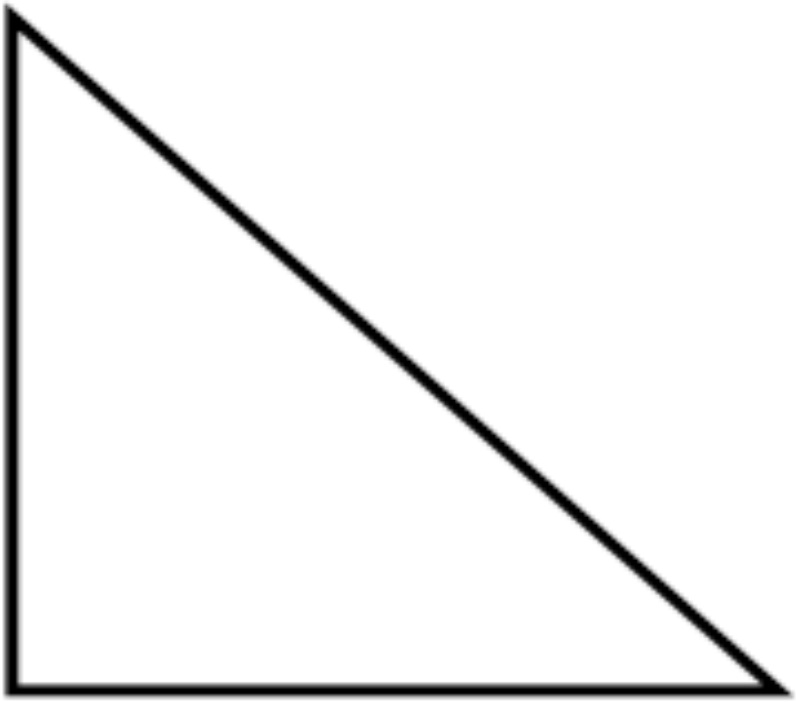
That is
asymmetrical.

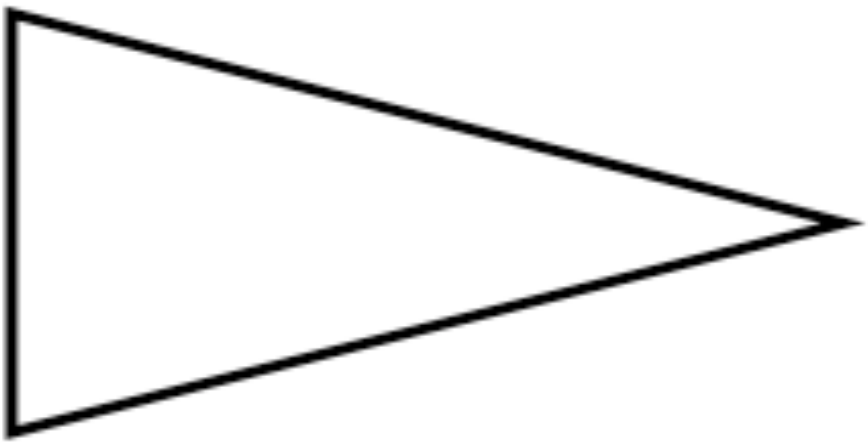
That is
symmetrical.

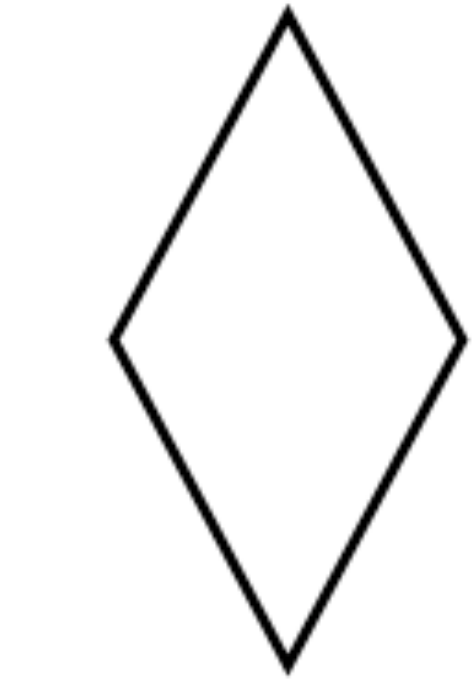
That is
asymmetrical.

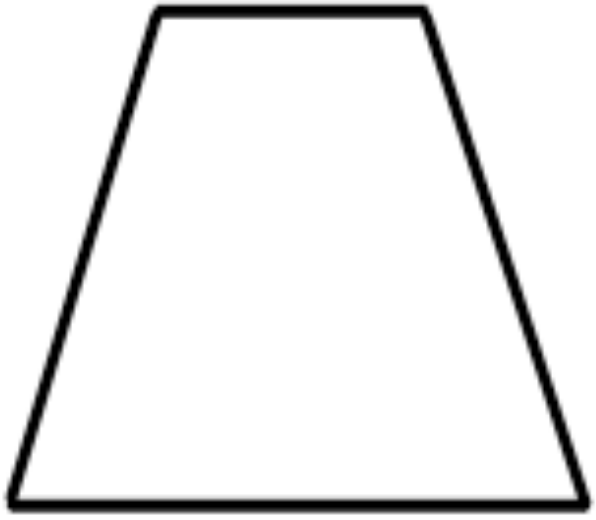


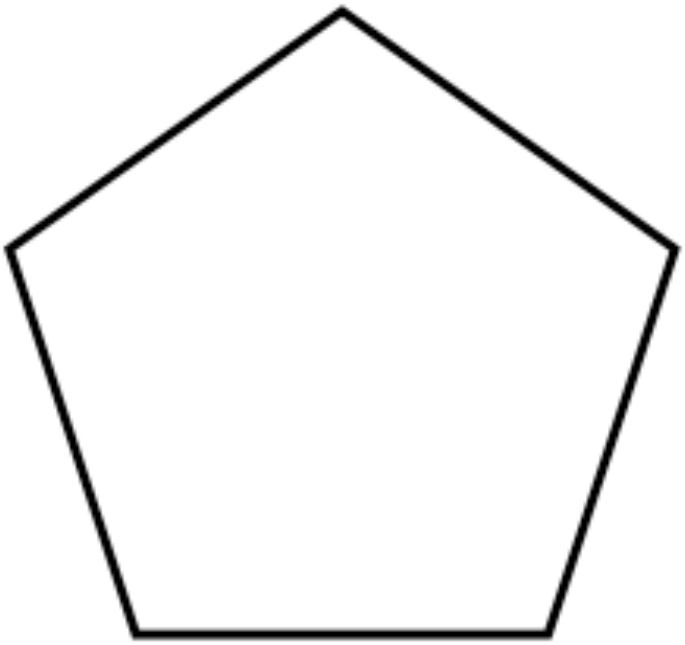












Project 12	Clay Sculpture

There is a difference between not knowing and not knowing yet.
~ Shelia Tobias

Curriculum Goals → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Creative Expression 2.2: Demonstrate beginning skill in the use of tools and processes, such as the use of scissors, glue and paper in creating a 3D construction. Creative expression 2.7: Create a 3D form.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.1: Understands and applies arts concepts and vocabulary. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts.

Language Objective → Given vocabulary and sample sentences, students will identify sculpture materials, discuss what was made and understand the difference between 2D and 3D.

Learning Objective → Given hands-on activities, students will create clay sculptures and categorize photos 2D versus 3D objects, as measured by student sculptures, anecdotal evidence regarding categorized items and Rubric 12.

Materials Used	○ Cardstock ○ Various colors of clay ○ SMART Board Project 12

Set Up	Set up the SMART Board on Project 12. At each student station, leave a small piece of cardstock and one color of clay. If you can, keep extra colors of clay if students request to use more.

Teacher Notes
The Conclusion of this project is an introduction for students to the labeling of artwork and shapes as 2D and 3D. Students have already had several experiences with 2D and are now experiencing 3D, meaning the concepts are already familiar; it is only the labels that are new. Keep notes in Teacher Observations regarding what occurs. These terms will be further experienced in future Projects.

Clay Sculpture (Activities)

Introduction (Notes 34, Slide 12.1)
1. Slide 12.1: Review materials with students.

Procedure (Notes 35)
1. Have students gather cardstock and clay from student stations and begin making their sculptures onto the base of the cardstock.
2. If students ask for another color, they can add various colors, one at a time, as are available.
3. Support students in making obviously 3D sculptures, as opposed to flattening the clay on the cardstock.

Conclusion (Notes 36, Slide 12.2)
1. Ask students if their sculptures were flat or bulging. (They are bulging.) This means that they are 3D.
2. Slide 12.2: Discuss 2D as flat and 3D as bulging. Discuss pictures of artwork in the categories. Have students predict where to place the last two pictures. After Project 13, students will come back to this slide and confirm their predictions.
3. Have students share with a partner what it means to be 2D and 3D. Take notes in Teacher Observations.

Assessment → Use student sculptures and anecdotal evidence to complete Rubric 12 and Teacher Observations.

Rubric 12	Clay Sculpture

Student Name: _____ Date:_____

Category	3	2	1
Sculpture	Student independently created sculpture on cardstock base.	Student created sculpture on cardstock base; may or may not have needed staff support.	Student is still working on creating a sculpture on a cardstock base.
Participation	Student participated in conclusion.	Student partly participated in conclusion.	Student is still working on participation skills; may have caused some disruptions.

Teacher Observations:

Project 13	Sculpture: Analyzing the Work of Other Artists

Children need to do what "real" mathematicians do – explore and invent for the rest of their lives.

~ Susan Ohanian

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Students will recognize how art and mathematics are present, applicable and integral to daily life.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.3: Identify the elements of art in the environment and in works of art, emphasizing line, color and shape/form. Connections, Relationships, Applications 5.4: Discuss the various works of art that artists create and the type of media used.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 2.3: Applies a responding process to an arts performance and/or presentation.

Language Objective → Given a vlog, discussion and checklist, students will identify features of sculptures to identify whether or not artwork is sculpture and the difference between 2D and 3D.

Learning Objective → Given a vlog and exploration, students will identify what is a sculpture, as measured by anecdotal evidence, Worksheet 13.1 and Rubric 13.

Materials Used	○ Worksheet 13.1 ○ Clipboards or another solid surface ○ White board (8 ½ x 11) ○ Dry erase marker ○ Student sculptures from Project 12 ○ SMART Board Project 13 ○ SMART Board Project 12

Set Up	Set up the SMART Board on Project 13. Keep Project 12 available. Photocopy enough of Worksheet 13.1 for each student to have between 4 – 6 blank charts for sculptures. Depending on the class, the worksheet can be shrunk or enlarged. Be sure to cut out the charts for students to staple together. Be sure student sculptures from Project 12 are available at their student stations. Keep a white board and dry erase marker for yourself when you leave the classroom to find sculptures.

Teacher Notes
Since Worksheet 13.1 will be photocopied several times for each student, there is no place for student names. Names can be written on backs of pages or above the charts on the first page. Prior to this lesson, make sure there are several available sculptures available around the school, both inside and out if possible. This can include water fountains, artwork and other items. If not, walking on campus is another option. Be sure to have permission slips if leaving campus. When you leave the classroom, keep the white board and dry erase marker with you, as you may need to model writing specific words for the students on their charts.

Sculpture: Analyzing the Work of Other Artists (Activities)

Introduction (Notes 37, Slide 13.1)

1. Explain to students that they have a special message from a Deaf artist. She is just like them, but older and studying art in school.
2. Slide 13.1: Show "Meet the Artist: Hinda Kasher" vlog.
3. Discuss criteria for being a sculpture:
    a. 3D
    b. can walk around it/it stands out

Procedure (Notes 38, Slides 13.2 – 13.3)

1. Slide 13.2: Have students help you complete the chart for the piece of artwork that was just seen in the vlog.
2. Have students bring Worksheet 13.1 and copy what you just did on the SMART Board onto their worksheets.
3. Have students bring their sculptures from Project 12 and complete another chart for their own artwork.
4. Explain that you will now walk around the school (or off campus), looking for sculptures. When students see a sculpture, have them get your attention to fill out the chart as a class.
5. Find sculptures around the school and/or off campus. When a sculpture is found, have the class fill out each chart together. Encourage students to actively search for sculptures. Continue this for 4 – 6 charts.

Conclusion (Notes 39, Slides 13.4, 12.2)

1. Discuss what students found. Were all the sculptures 2D or 3D?
2. Slide 13.4: Have students help you complete the slide.
3. Slide 12.2: Look back at the chart to confirm predictions. If the chart needs to be fixed, how can we do it?

Assessment → Use anecdotal evidence and Worksheet 13.1 to complete Rubric 13 and Teacher Observations.

Rubric 13	Sculpture: Analyzing the Work of Other Artists

Student Name: _____ Date:_____

Category	3	2	1
Participation	Student participated appropriately.	Student participated appropriately most of the time.	Student is still working on participation skills; may have caused disruptions.
Finding Sculptures	Student participated in finding sculptures and completed Worksheet 13.1 accurately.	Student participated in finding sculptures and completed Worksheet 13.1 mostly accurately.	Student is still working on finding sculptures and/or completing Worksheet 13.1 with some accuracy.
2D/3D	Student is able to independently identify 2D versus 3D.	Student is able to identify, with some assistance, 2D versus 3D.	Student is still working on identifying 2D versus 3D.

Teacher Observations:

Worksheet 13.1 (to be duplicated & cut out individually)

Is it a sculpture? Yes/No	
Illustration	Checklist
	○ 3D ○ I can walk around it.
Material Used:	

Is it a sculpture? Yes/No	
Illustration	Checklist
	○ 3D ○ I can walk around it.
Material Used:	

Project 14 | Cubes and Spheres

Mathematics, rightly viewed, possesses not only truth, but supreme beauty – a beauty cold and austere, like that of sculpture

~ Bertrand Russell

Curriculum Goal → Students will explore multiple methods and art mediums to develop their conceptual and mathematical skills.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.2: Name art materials introduced in lessons. Creative Expression 2.2: Demonstrate beginning skill in the use of tools and processes, such as the use of scissors, glue and paper in creating a 3D construction. Creative Expression 2.6: Use geometric shapes/forms in a work of art. Creative Expression 2.7: Create a 3D form.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. Geometry/Measurement K.3.B: Sort shapes using a sorting rule and explain the sorting rule. The Arts 1.1: Understands and applies arts concepts and vocabulary. The Arts 1.2: Develops arts skills and techniques. The Arts 2.1: Applies a creative process to the arts. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given vocabulary and sample sentences, students will identify papier-mâché materials and what 3D figure they made.

Learning Objective → Given a hands-on activity, students will create either a 3D cube or sphere, as measured by student papier-mâché projects, Worksheets 14.1 – 14.2 and Rubric 14.

Materials Used	○ Teacher samples of papier-mâché projects ○ Assorted cubes and spheres some to papier-mâché, some to categorize. ○ Assorted squares and circles to categorize (from shape bags) ○ Tape ○ Labels: 2D, 3D, squares, cubes, circles, spheres ○ Glue or flour ○ Bowl(s) of water ○ Smocks (optional) ○ Paint ○ Paintbrushes ○ Paper cups ○ Worksheet 14.1 (A and B) ○ Worksheet 14.2 ○ SMART Board Project 14

Set Up	Set up the SMART Board on Project 14. Be sure to have an example of at least one premade papier-mâché project. To make papier-mâché, mix one part water with one part flour or glue. You may need to add more glue, based on the consistency. Leave mix in bowls for students. Tear or cut newspaper for students to dip into the papier-mâché mix. Leave an assortment of cubes and spheres for students to pick for their artwork. At student stations, leave a copy of Worksheet 14.1 (A or B) and Worksheet 14.2. At a separate station, have the following labels ready: 2D, 3D, square, cube, circle and sphere. Have assorted squares, cubes, circles and spheres ready to be categorized. 2D items can be taped on the all and 3D items can be left on the table, categorized accordingly. (These placements emphasize that 2D is flat and 3D bulges/can be walked around.)

Teacher Notes
This project will likely be done over the course of several days, as the papier-mâché needs to be completely dry before it can be painted. It is optional to wait for paint to dry before writing sentences, as well. When selecting cubes and spheres to be covered in papier-mâché, various items can be used, such as tennis balls, plastic balls, and tissue boxes. To cover objects in papier-mâché, students must dip one piece of newspaper at a time into the mix. Students must then lightly run the newspaper between their fingers to remove the excess mix before placing it on the object or other layers of papier-mâché. Repeat until object is covered. Worksheet 14.1 has two versions (A and B). Both worksheets require the same information, but A requires students to write each sentence without the support of sentence frames. Version B provides sentence frames for students.

Cubes and Spheres (Activities)

Introduction (Notes 40, Slide 14.1)

1. Show students teacher sample of papier-mâché and discuss what they notice. How do you think we can make this? Take note of what students say in Teacher Observations.
2. Slide 14.1: Review materials needed for Project 14.

Procedure (Notes 41, Slides 14.2 – 14.4)

1. Have students select a cube or sphere from the assortment to cover in papier-mâché.
2. Be sure to review appropriate use of papier-mâché materials with a demonstration.
3. Have students cover their cubes and spheres in papier-mâché, then leave to dry. This is a good place for a break.
4. Slide 14.2: Review materials needed to paint cubes and spheres.
5. Have students paint their cubes and spheres. You may want to leave these to dry before completing Worksheet 14.1.
6. Slides 14.3 – 14.4: With students, complete Slide 14.3 with your teacher example. (A sample can be seen on Slide 14.4).
7. Using their own cube or sphere, have students gather and complete Worksheet 14.1.

Conclusion (Notes 42, Slide 14.5)

1. Using cubes and spheres, in addition to the assorted cubes, spheres, circles and squares, have students sort items into 2D and 3D categories, with the following subcategories: squares, cubes, circles and spheres. When completed, discuss what students did and refer to the categories for following SMART Board demonstration.
2. Slide 14.5: With student help, categorize the boxed items. Call their attention to important words in each sentence to help them understand what the sentences mean.
3. Have students gather and complete Worksheet 14.2 by matching the pictures with their descriptions.
4. Collect worksheets and review Rubric 14 with each student.

Assessment → Use student papier-mâché projects, Worksheets 14.1 – 14.2 and student conferences to complete Rubric 14 and Teacher Observations.

Rubric 14	Cubes and Spheres

Student Name: _____ Date:_____

Category	3	2	1
Papier-mâché	I completed my papier-mâché and used materials appropriately.	I completed my papier-mâché and used materials appropriately most of the time.	I am still working on my papier-mâché; I may have used materials appropriately some of the time.
Writing	I completed Worksheet 14.1 and it makes sense.	I completed Worksheet 14.1 and it is mostly clear.	I am still working on Worksheet 14.1; it may still be unclear.
Closure	I completed Worksheet 14.2 and it is accurate.	I completed Worksheet 14.2 and it is mostly accurate.	I am still working on Worksheet 14.2 or it may be inaccurate.

Teacher Observations:

Name: _____ Date: _____

Worksheet 14.1 (A)
Cubes and Spheres

What did you make with your papier-mâché?
Is it a cube or a sphere?

Name: _____ Date: _____

Worksheet 14.1 (B)
Cubes and Spheres

What did you make with your papier-mâché?
Is it a cube or a sphere?

I used papier - mache to make a

_____. I used these

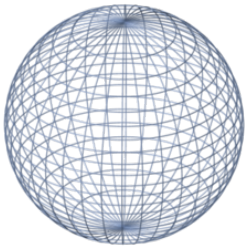
shapes: _____

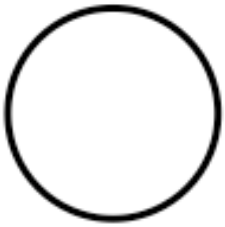
_____.

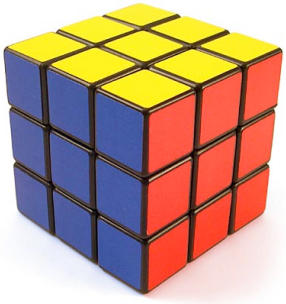
Name: _____ Date: _____

Worksheet 14.2
2D and 3D Shapes

Directions: Match each shape with its description. Remember some are flat (2D) and others bulge and stand out (3D).







A circle has 0 sides and zero corners/vertices. It is 2D.

A cube looks like a 3D square.

A square has 4 sides and four corners/vertices. It is 2D.

A sphere looks like a 3D circle.

Project 15	Showcase Preparation

Happy is the person who comes to understand something and then gets to explain it.

~ Marshall Cohen

Curriculum Goal → Students will produce and present their artwork in a showcase, expressing what they know.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Aesthetic Valuing 4.1: Discuss their own works of art, using appropriate art vocabulary. Aesthetic Valuing 4.3: Discuss how and why they made a specific work of art. Aesthetic Valuing 4.4: Give reasons why they like a particular work of art they made, using appropriate art vocabulary.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.2: Develops arts skills and techniques. The Arts 2.2: Applies a performance and/or presentation process to the arts.

Language Objective → Given sentence frames and a sample vlog, students will name and describe their works of art.

Learning Objective → Given an in class lesson, students will complete their museum vlogs and plaques, as measured by anecdotal evidence regarding vlogs, Worksheet 15.1 and Rubric 15.

Materials Used	○ Worksheet 15.1 (A and B) ○ Museum movie ○ SMART Board Project 15

Set Up	Set up the SMART Board on Project 15. Photocopy enough of Worksheet 15.1 (A and B) for students to have either. The worksheets will become the plaques for the museum, and differ in terms of the arrangement of space for writing, rather than level of difficulty.

Teacher Notes
Be sure to emphasize that people will come see student artwork in a museum. When selecting Worksheet 15.1 (A or B), keep in mind that A and B are not separated by difficulty level, but rather by arrangement space for writing. Each student can pick either plaque format. Worksheet 15.1 (A and B) is not labeled, as it will be used as a plaque during the museum showcase. When each student considers which piece of artwork to display in the museum, encourage a wide variety of selections. Call student attention to the distribution of student initials by each piece students select. You may want to limit two students per type of artwork. To prepare museum for Project 16 (to be completed by teacher following Project 15): 1. Plaques: Frame student plaques. If frames are smaller than 8 ½ x 11, you may need to trace student writing in a black pen and shrink with a photocopier before framing. 2. Museum: Set up artwork and plaques to be ready for the showcase. An example is provided on Notes 47. 3. Kids Museum Vlog: Edit and put student vlogs together in a movie. A sample of this movie is available on Notes 46. **(Notes 46)**: This video is called Museum Movie, and is a sample of what the video can be. Photos of the class, as well as each student with his/her artwork were also included.

Showcase Preparation (Activities)

Introduction (Notes 43, Slide 15.1)

1. Slide 15.1: Show students slide, which represents each of the projects they have completed that can be used in the showcase, or class museum. Have each student select which of the works he/she wants to represent in the museum.
2. As students are selecting which piece they want to show, you can keep track by writing their initials by the piece they select.

Procedure (Notes 44, Slide 15.2)

1. Slide 15.2: Using a teacher sample, complete the plaque.
2. Using their own artwork, have students select Worksheet 15.1 (A or B) and complete.

Conclusion (Notes 45, Slide 15.3)

1. Slide 15.3: Show sample vlog.
2. Have students make vlogs, using one of two formats:
    a. Interview that will be edited to only show student answers in a cohesive vlog
    b. Student including all the required information about the artwork without interview (can use Worksheet 15.1 for support)
3. In either format, be sure students include the following information, in addition to showing their piece:
    a. name of piece
    b. how it was made
    c. dimensions (2D or 3D)
    d. materials used
    e. why it is student's favorite
4. Have students decorate plaque frames.
5. Complete Rubric 15 with each student.

Assessment → Use anecdotal evidence regarding student vlogs, student plaques, Worksheet 15.1 and student conferences to complete Rubric 15 and Teacher Observations.

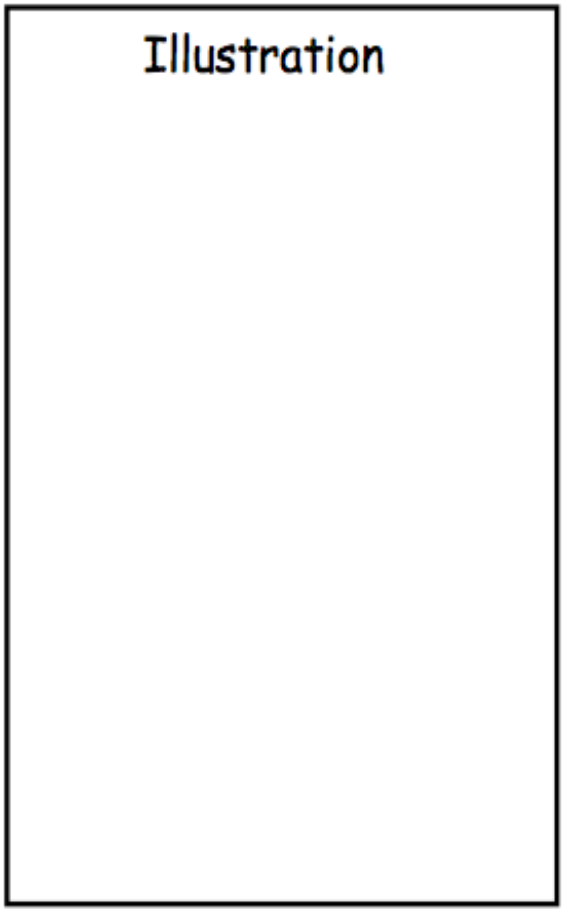
Rubric 15	Showcase Preparation

Student Name: _____ Date:_____

Category	3	2	1
Plaque	I completed my plaque independently and it is neatly done.	I completed my plaque with some help and it is neatly done.	I am still working on completing my plaque neatly.
Vlog	I completed my vlog/interview. I included all the required information and signed clearly.	I completed my vlog/interview. I included most of the required information and signed somewhat clearly.	I am still working on my vlog/interview.

Teacher Observations:

Artwork Title: _____



This is a _____

_____.

It is my favorite

because _____

_____

_____.

I used these shapes:

_____

_____.

I used these materials: _____

_____.

Artist Initials: _____

Artwork Title: _____

Illustration

This is a _____.

It is my favorite because _____

_____.

I used these shapes: _____

_____.

I used these materials: _____.

Artist Initials: _____

Project 16	Showcase

Just as any sensitive human being can be brought to appreciate beauty in art, music or literature, so that person can be educated to recognize the beauty in a piece of mathematics.

~ Peter Hilton

Curriculum Goal → Students will produce and present their artwork in a showcase, expressing what they know.

Standards Addressed	
California	**Washington**
Measurement and Geometry 2.1: Identify and describe common geometric objects. Artistic Perception 1.1: Recognize and describe simple patterns found in the environment and works of art. Connections, Relationships, Applications 5.4: Discuss the various works of art that artists create and the type of media used.	Geometry/Measurement K.3.A: Identify, name and describe circles, triangles, rectangles, squares (as special rectangles), cubes and spheres. The Arts 1.1: Understands and applies arts concepts and vocabulary. The Arts 2.2: Applies a performance and/or presentation process to the arts. The Arts 2.3: Applies a responding process to an arts performance and/or presentation.

Language Objective → Given sentence frames, students will identify and document features of works of art.

Learning Objective → Given a student museum, students will participate in the showcase and document artwork, as measured by anecdotal evidence, Worksheet 16.1 and Rubric 16.

Materials Used	○ Worksheet 16.1 (one chart for each displayed piece of artwork) ○ Clipboards or other solid surface ○ Kids Museum Movie ○ SMART Board Project 16

Set Up	Set up the SMART Board on Project 16. Prior to the showcase, be sure you have edited and created the Kids Museum Video with student vlogs and photos of their artwork. Set this up in a way that can be viewed by those that come to the class museum. With student help, set up the museum showcase for people to come visit. If possible, invite other classes, administration and families to attend the museum. Photocopy enough of Worksheet 16.1 charts for students to fill out one chart per piece of artwork (or one for each of their selected artworks, for larger classes). Be sure to have the museum set up. The description is in the Teacher Notes of Project 15.

Teacher Notes
If possible, invite other classes, administration and families to come visit the museum. This should be done ahead of a time and can be incorporated into Language Arts by students making invitations. See Teacher Notes on Project 15. Worksheet 16.1 is to be used during the museum, as several copies will be given to each student. You can shrink these, if needed, and staple one packet for each student. There should be one chart for each piece of artwork on display, or for the decided number of charts for each student (for larger classes). If the museum goes longer than anticipated and students have completed their work, one option is to have support staff watch them play outside when they are completed with their work. Conclusion #2 and #3 can be completed at a later time.

Showcase (Activities)

Introduction (Notes 48, Slide 16.1)

1. Slide 15.1: Using a teacher sample, complete the sample worksheet with students. Explain that students will have to fill out these charts for each piece of artwork at the museum.
2. Have students gather Worksheet 16.1 and clipboards/hard surface and sit at the class museum.

Procedure (Notes 49)

1. Before or when guests arrive and are seated, Show the Kids Museum Movie.
2. Open the museum for looking at art. During this time, have students complete their charts on Worksheet 16.1 for their own and their peers' artwork. Depending on class size, you may do this one of two ways:
    a. For smaller classes: Prewrite artist initials on each student chart and have students complete the information for the rest of Worksheet 16.1.
    b. For larger classes: Let students pick specific pieces of artwork to observe and complete Worksheet 16.1
3. When students complete Worksheet 16.1, they can look around the museum more with the other guests.

Conclusion (Notes 50)

1. Collect packets of Worksheet 16.1.
2. When the museum is finished, have each student record a vlog with the following information:
    a. What was his/her favorite part of the museum?
    b. What did he/she learn?
3. Complete Rubric 16 with each student.

Assessment → Use anecdotal evidence, Worksheet 16.1, vlogs and student conferences to complete Rubric 16 and Teacher Observations.

Rubric 16	Showcase

Student Name: _____ Date:_____

Category	3	2	1
Participation	During the museum, I was on my best behavior all of the time. I appropriately interacted with my classmates and guests.	During the museum, I was on my best behavior most of the time. I appropriately interacted with my classmates and guests.	During the museum, I was not on my best behavior. I may have inappropriately interacted with my classmates and guests.
Documentation	I documented all of the required work. I wrote neatly.	I documented most of the required work. I wrote neatly or somewhat neatly.	I am still working on neatly documenting the required work.
Vlog	I completed my vlog about the museum and it makes sense.	I completed my vlog about the museum and it makes sense most of the time.	I am still working on completing my vlog about the museum.

Teacher Observations:

Worksheet 16.1 (to be duplicated and cut out)

Artist Initials:	Artwork Title:	
Illustration	Shapes I See	Dimensions
		○ This is 2D. ○ This is 3D.

Artist Initials:	Artwork Title:	
Illustration	Shapes I See	Dimensions
		○ This is 2D. ○ This is 3D.

Appendix B.

The following pages contain SMART Board slides that were used during implementation of *Aesthetic Mathematics: Using a SMART Board in a Kindergarten Deaf Classroom to Explore and Express Geometry through the Arts.*

Teacher Notes: Introduction

Slides 1.1 - 1.2

Review slides with students to provide background information.

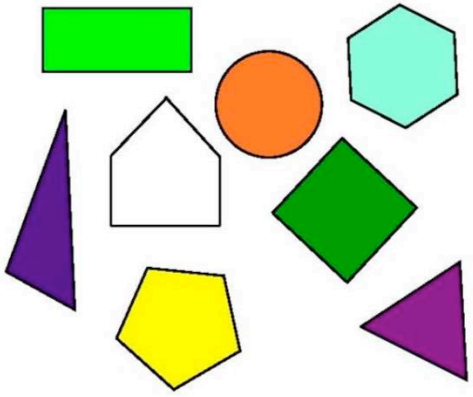
NOTES 1

This material is <u>salt</u>.

salt

Slide 1.1

These are <u>shapes</u>. We will draw them in salt.



Slide 1.2

Teacher Notes: Procedure

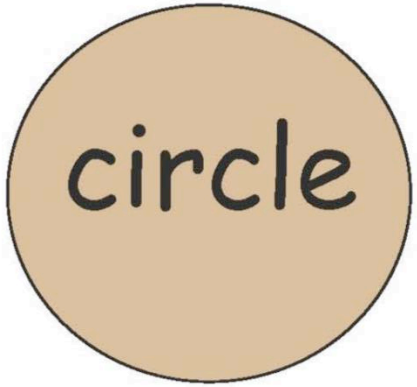
Slides 1.3 - 1.7

Have students do the following for each slide:

1. Using fingers, draw the shape in the air.
2. On plates, draw the shape in salt.
3. Spell the shape names (or identify first/last letter of each shape name).

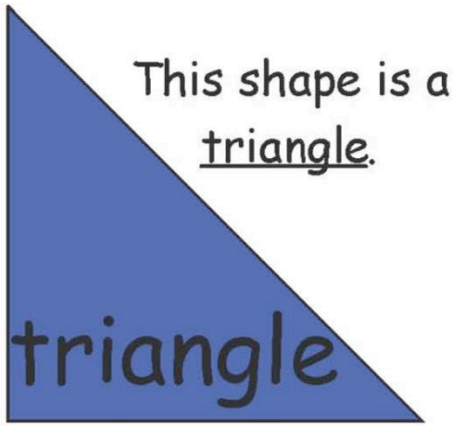
NOTES 2

This shape is a circle.



Slide 1.3

This shape is a triangle.

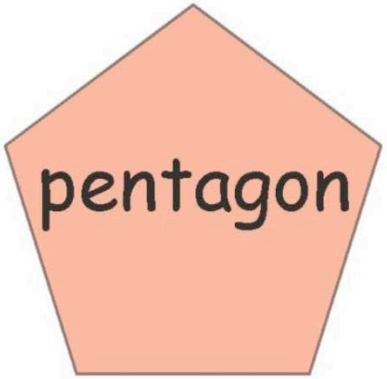


Slide 1.4

This shape is a quadrilateral.

Slide 1.5

This shape is a pentagon.



Slide 1.6

I traced a triangle in my collage with a wax string.

Slide 2.5

Teacher Notes: Conclusion

Slide 2.6

1. Show sample vlog.
2. Have students create vlogs about their collages.

NOTES 6

Sample Vlog: Shapes in Fabric

Slide 2.6

Teacher Notes: Introduction

Slide 3.1

1. Introduce the story.
2. Read aloud The Greedy Triangle.

NOTES 7

Teacher Notes: Conclusion

Slide 3.4

Review and fill out Slide 3.4 with students, then have them fill out their own worksheets.

NOTES 9

Directions: Complete the sentences below and illustrate.

I notice a _____ in a _____.

circle pentagon
triangle hexagon
quadrilateral

Slide 3.4

Teacher Notes: Introduction

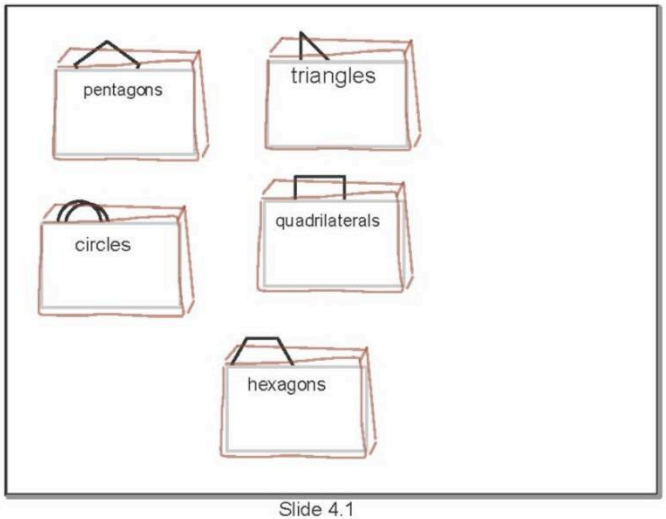
Slide 4.1 - 4.3

Slide 4.1: Show students how the bags have shapes in each that correspond with the shape names.

Select two circles bags and place them where they can form glasses. Copy and paste the shapes to Slide 4.3 and draw the setting, i.e. wire connecting glasses and face where they are worn.

Slide 4.2: Review materials with students. They will use some or all the materials.

NOTES 10



Slide 4.1

Teacher Notes: Introduction

Slides 5.1 - 5.2

Pass around felt and have students think of a word to describe it.

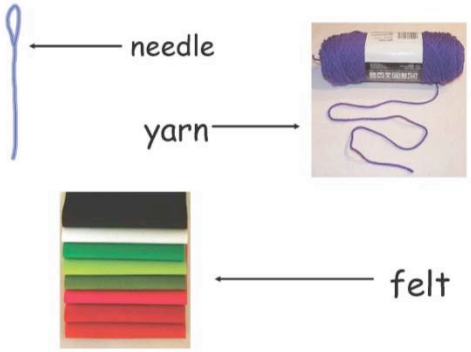
Slide 5.1: Record student descriptions near the word, "felt." Review other materials that will be used before students begin sewing their own creation.

Slide 5.2: Show students how you sewed two shapes together on. Tell them that you created a boat. What do they see? What else can you make with two shapes?

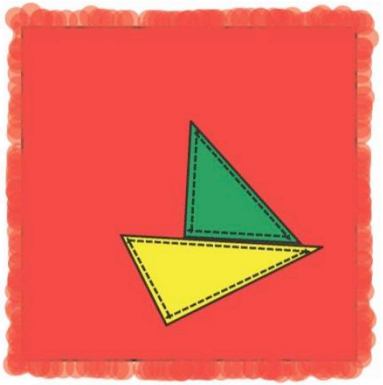
Have students pick their shapes from the shape bags and begin sewing.

NOTES 13

The materials used will be needles, yarn and felt.



Slide 5.1



Slide 5.2

Teacher Notes: Procedure

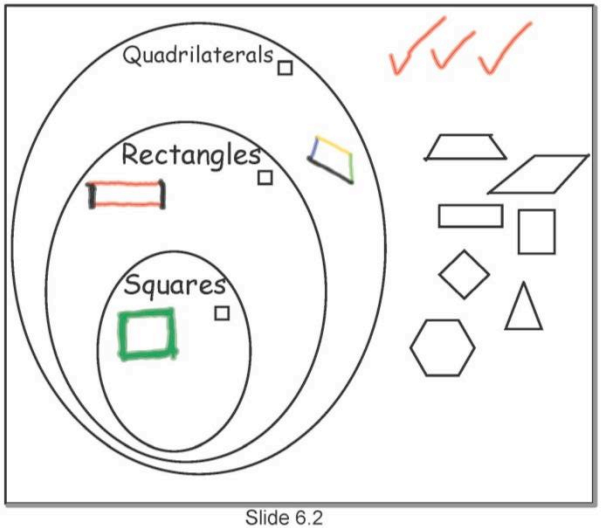
Have students do the following:

1. Select two felt shapes from the shape bags.

2. Place shapes on larger felt to create something new.

3. Sew shapes on felt.

NOTES 14



Slide 6.2

Teacher Notes: Procedure

Slide 6.3

Review materials by having students draw the lines between the pictures and words identifying materials.

Have students do the following:

1. Gather materials.

2. Categorize their individual quadrilaterals and glue them onto their graphic organizers.

NOTES 17

The materials we will be using are cardstock, glue and foam.

cardstock

foam

glue

Slide 6.3

Teacher Notes: Closure

Slide 6.4

Model filling out Slide 6.4. When finished, have students complete Worksheet 6.1, using a different type of quadrilateral than the one used in the sample on Slide 6.4.

NOTES 18

Shape Name: _____

☐ It is a quadrilateral.

☐ It is a rectangle.

☐ It is a square.

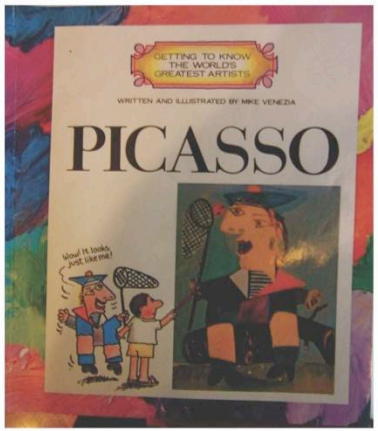
Slide 6.4

Teacher Notes: Introduction

Slide 7.1
Book: Getting to Know the World's Greatest Artists: Picasso

1. Introduce the story.
2. Read Getting to Know the World's Greatest Artists: Picasso.

NOTES 19



Slide 7.1

Teacher Notes: Procedure

Slides 7.2 - 7.4
Slides 1.3 - 1.7 (optional)

Slide 7.2: Read sentence then find shapes in Picasso's artwork, as shown in Slide 7.3. There are three ways to find shapes:

a. Find: Identified shapes can be traced as is.
b. Fix: Potential known shapes that have a curved side can be "fixed", and drawn with a straight side.
c. Create: Potential known shapes that need a side added, such as a "V", can be traced with an additional side.

Have students find, fix, or create one of each known shape, from circle to hexagon. You may want to collect papers between each shape drawn, and refer back to Slides 1.3 - 1.7 (optional).

Slide 7.4: Review materials used. Have students help you draw lines connecting the works of art with their titles, using group and partner discussion.

NOTES 20

Slide 7.2

Pablo Picasso is a famous artist.

Slide 7.3

The materials used will be markers and Picasso's artwork.

markers

Picasso's Artwork: Three Musicians

Picasso's Artwork: Boy in Sailor Suit with Butterfly Net

Picasso's Artwork: Weeping Woman

Slide 7.4

Teacher Notes: Conclusion

Slide 7.5

Review Slide 7.5 with students, then have them share, in partners, what they did for Picasso's artwork.

Have students complete their own Picasso Score Cards.

NOTES 21

Teacher Notes: Procedure

Slide 8.3

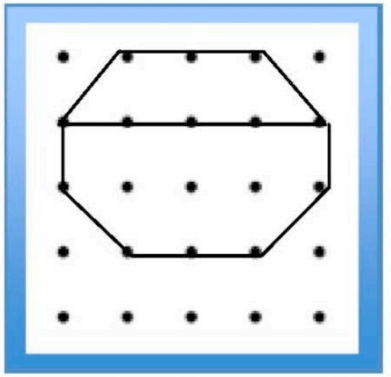
Have students do the following:

1. Gather geoboards from student stations.

2. Use rubber bands on table to make a design on their individual geoboards, then share what they created with a partner.

Slide 8.3: Model how to fill out Worksheet 8.1, then have students fill out their own papers.

NOTES 23



I used a geoboard to create a _____.

Slide 8.3

Teacher Notes: Conclusion

Have students complete Worksheet 8.2 and share with a partner by signing and spelling what materials they used.

NOTES 24

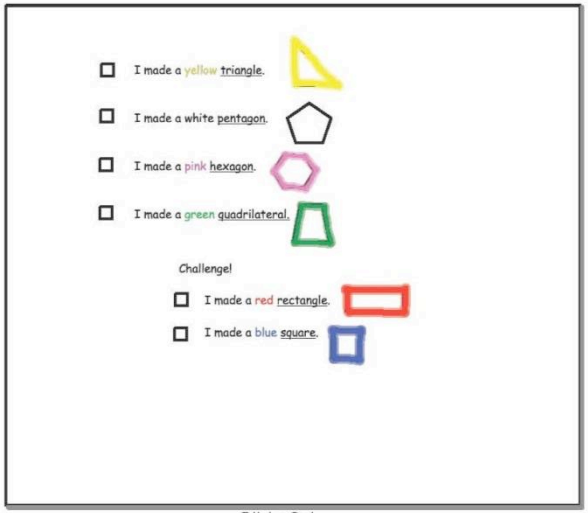
Teacher Notes: Introduction

Slide 9.1

Slide 9.1: Model how to use Worksheet 9.1 to complete the geoboard task.

Have students gather materials from student stations and complete their individual worksheets. Document student work by photographing their geoboards or using a new set of geoboards for the next task.

NOTES 25



Slide 9.1

Teacher Notes: Procedure

Slide 9.2

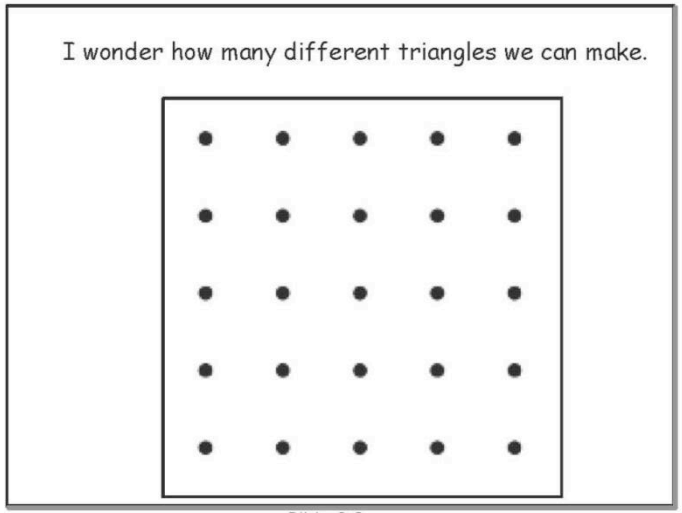
1. Have all students make a triangle on clean geoboards then pass them in. Add your geoboard with a quadrilateral.

2. Review each geoboard with the class, having students tell you which are right and which need to be fixed. Have students help you fix the incorrect ones. Be sure to emphasize that it doesn't matter who made which one.

3. Slide 9.2: Call student attention to the fact that there are many different ways to make the same shape on a geoboard, as we just saw. Practice drawing some different triangles on the slide with students.

4. Have students gather materials and rotate around the geoboards to create new versions of each shape on each geoboard.

NOTES 26



Slide 9.2

Teacher Notes: Conclusion

Have students complete Worksheet 9.2 to demonstrate their understanding of materials used with geoboards. When finished, each student will be interviewed.

For interviews, have students answer the following:
1. What materials were used?
2. Spell and sign the names of the materials.

Complete Rubric 9 with each student.

NOTES 27

Teacher Notes: Introduction

Slides 10.1 - 10.2

Slide 10.1: Look at painting on slide with students and discuss what they notice. How can we make this type of painting? Click above and below the painting for the sentences to appear. Discuss "symmetrical" and "symmetry."

Slide 10.2: Review materials for this project.

NOTES 28

We will make symmetrical paintings.

Each painting will have symmetry.

Slide 10.1

The materials used will be cardstock, paint and paint brushes.

cardstock

paintbrush

paint

Slide 10.2

Teacher Notes: Procedure

Have students create their symmetrical paintings by following the procedure below:

1. Paint one side of the cardstock. For an extra challenge, include known shapes in your painting.

2. Raise your hand for teacher permission to fold and rub your carstock together.

3. Open cardstock and leave painting at student station to dry.

NOTES 29

Teacher Notes: Procedure

Slide 11.2

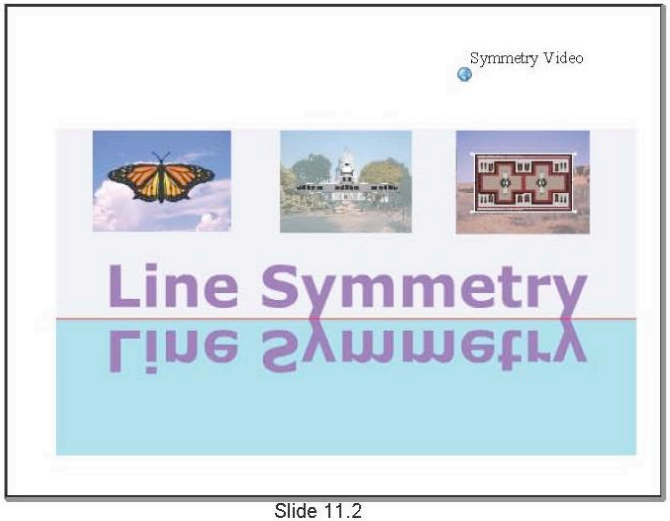
Slide 11.2: Click link called "Symmetry Video" on top right of slide.

As video plays, call student attention to lines of symmetry. Pause after each picture has been shown with its line of symmetry (or lack of line of symmetry). Have students vote.

Continue this process as long as you feel necessary for your class.

*The video has a voiceover (without captions), but it is to be disregarded during Project 11. Video is used for its images, rather than what it says.

NOTES 32



Slide 11.2

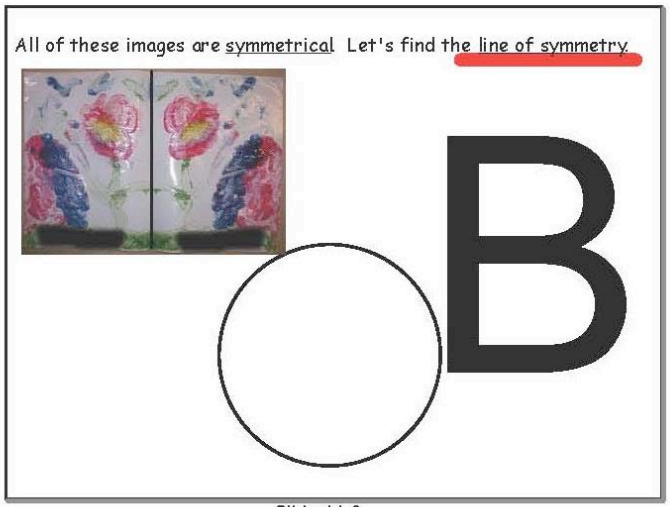
Teacher Notes: Conclusion

Slide 11.3

Slide 11.3: Have student help you place the line of symmetry (or multiple lines of symmetry) on each image. The red line underlining "line of symmetry" is set to infinite cloner, meaning it can be infinitely dragged, manipulated and placed on each image.

Distribute shape papers and have students place wax strings on the lines of symmetry they find.

NOTES 33



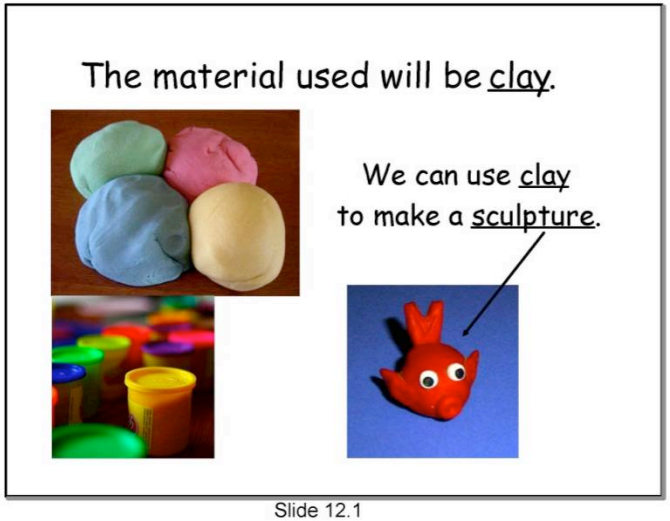
Slide 11.3

Teacher Notes: Introduction

Slide 12.1

Slide 12.1: Review materials with students.

NOTES 34



Slide 12.1

Teacher Notes: Procedure

Have students gather materials and create sculptures.

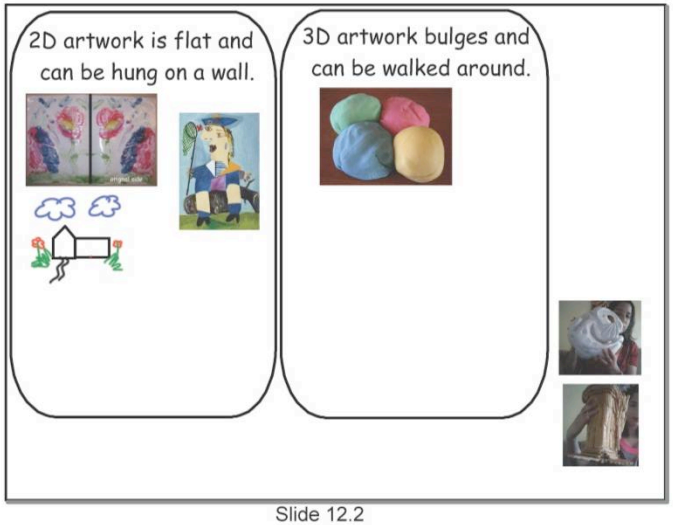
NOTES 35

Teacher Notes: Conclusion

Slide 12.2

Slide 12.2: Introduce vocabulary and discuss how students have learned a lot about 2D artwork. Today they began 3D. Where do students predict the last two pictures will be placed? Categorize them as 2D or 3D, and explain that you will come back to check after completing Project 13.

NOTES 36



Slide 12.2

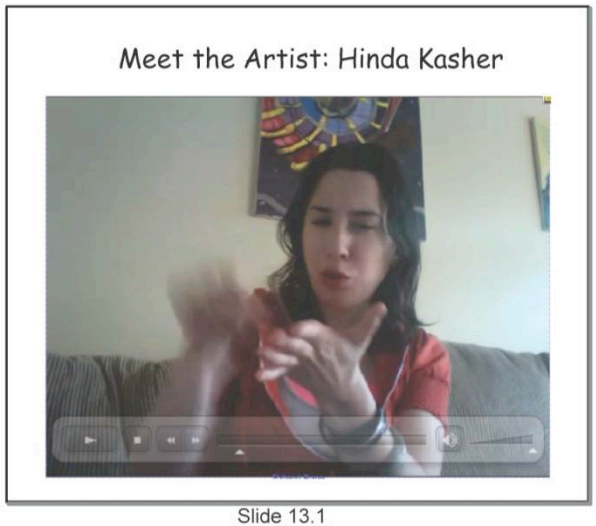
Teacher Notes: Introduction

Slide 13.1

Slide 13.1: Show the "Meet the Artist" vlog. Discuss criteria to be a sculpture:

a. 3D
b. We can walk around it.

NOTES 37



Slide 13.1

Teacher Notes: Procedure

Slide 13.2 - 13.3

Slide 13.2: Show students the "Is it a sculpture?" chart. With student help, complete it for the piece of art in the vlog.

Slide 13.3: Complete the chart using a student sculpture from Project 12.

Have students collect charts and clipboards/solid surface and complete a chart for their own sculpture on the first page of Worksheet 13.1. When completed, bring materials and pencils outside. Walk around the school for students to fill in the chart for other items that may or may not be sculptures around the school.

NOTES 38

Teacher Notes: Introduction

Slide 14.1

Review materials needed for Project 14.

NOTES 40

The materials used for papier-mâché will be newspaper and mâché paste.

newspaper

mâche paste

Mâche paste is made from water and flour or glue.

water

flour

glue

Slide 14.1

Teacher Notes: Procedure

Slide 14.2 - 14.4

Have students select a cube or sphere to cover in papier-mâché. Cover then leave to dry.

Slide 14.2: Review materials that students will use to decorate their cubes and spheres.

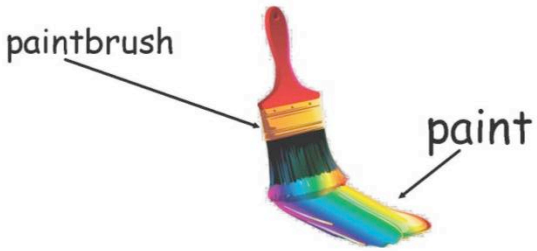
Have students paint their cubes and spheres. You may want to leave to dry before completing Worksheet 14.1.

Slides 14.3: With student assistance, complete the slide with your teacher example. (An example can be seen on Slide 14.4.)

Have students complete Worksheet 14.1.

NOTES 41

When the papier-mâché dries, we will paint our cubes and spheres. We will use paint and paintbrushes.



Slide 14.2

What shape is your papier-mâché? Is it a cube or a sphere?

Slide 14.3

What shape is your papier-mâché? Is it a cube or a sphere?

I used papier-mâché to make a globe. It is a sphere.

Slide 14.4

Teacher Notes: Conclusion

Slide 14.5

Slide 14.5: With student help, categorize the boxed items. Call attention to important words in each sentence to help students understand their meaning.

Have students gather Worksheet 14.2 and match the pictures to their descriptions.

NOTES 42

A circle has 0 sides and 0 angles/vertices. It is 2D.

A sphere looks like a 3D circle.

A cube looks like a 3D square.

A square has 4 even sides, and has 4 angles/vertices. It is 2D.

These shapes are 2D and 3D.

Slide 14.5

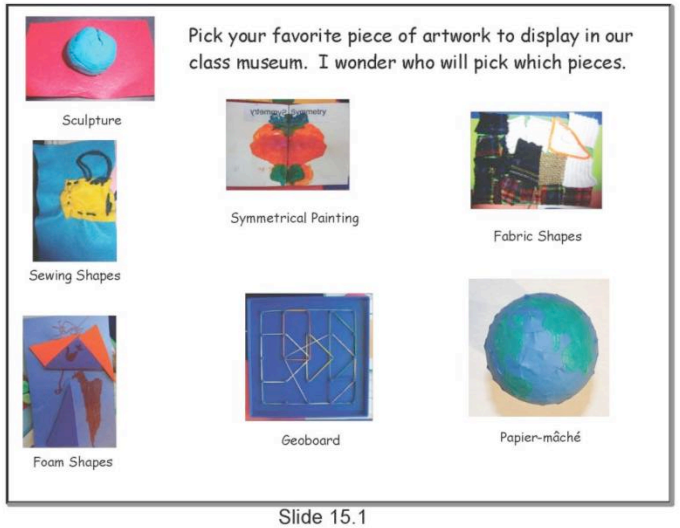
Teacher Notes: Introduction

Slide 15.1

Show students samples of the projects they have created throughout this curriculum. Each student has each of these works.

Have each student select which they would like to represent in the showcase. Encourage a wide variety of selections by writing the initials of the students as they pick which piece they would like to show, having students recognize the distribution of their initials over the slide.

NOTES 43



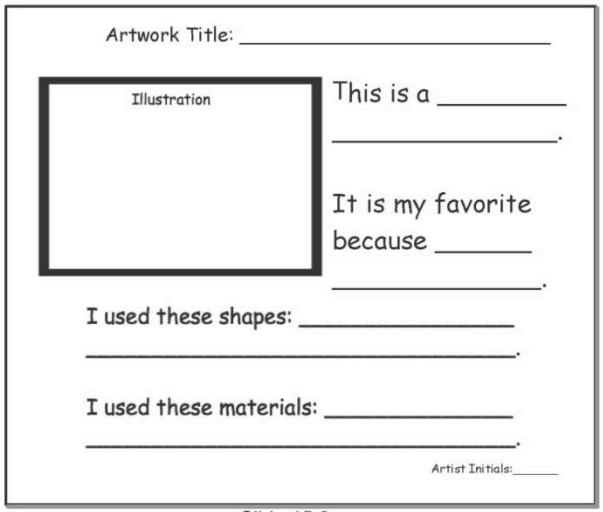
Slide 15.1

Teacher Notes: Procedure

Slide 15.2

Using a teacher sample, complete the plaque. Have students complete their own plaques, using Worksheet 15.1 A or B.

NOTES 44



Slide 15.2

Teacher Notes: Conclusion

Slide 15.3

Slide 15.3: Show the sample vlog.

Students have a choice of format in making their vlogs:
1. Interview that will be edited to only show student answers
2. Student including all required information about the artwork without interview (can use Worksheet 15.1)

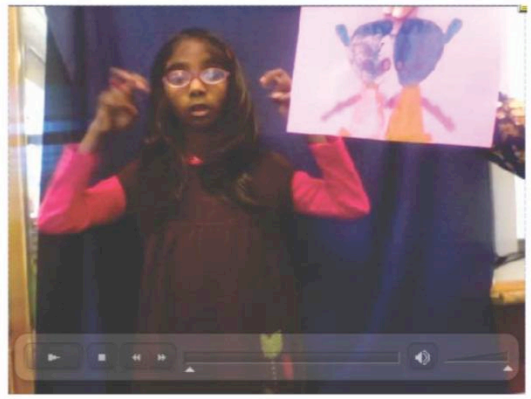
In both formats, the following information must be covered, in addition to showing the piece:
a. name of piece
b. how it was made
c. dimensions (2D or 3D)
d. materials used
e. why it is student's favorite piece

Have students decorate plaque frames.

*A sample of a complete video of student vlogs is on Notes 46.

NOTES 45

Sample Vlog: Showcase Artwork



Slide 15.3

Sample Movie: Museum Vlogs

NOTES 46

Showcase Sample: Museum Set Up

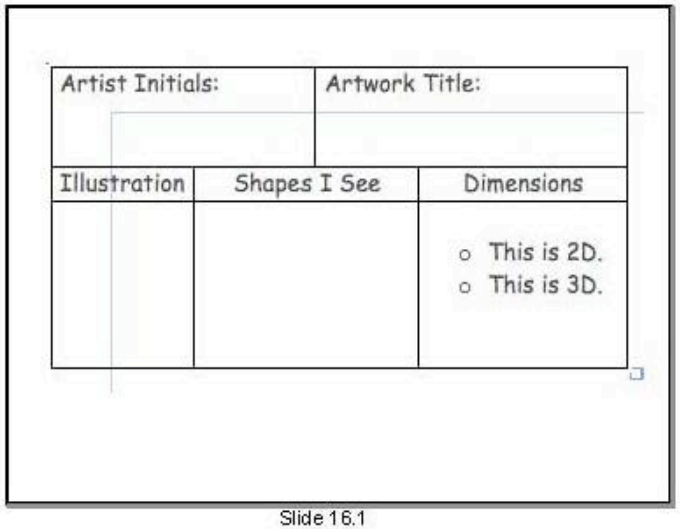
NOTES 47

Teacher Notes: Introduction

Slide 16.1

Slide 16.1: Have students help you complete the chart for a teacher sample of artwork with a plaque.

NOTES 48



Slide 16.1

Teacher Notes: Procedure

Museum Vlogs

At the showcase, show student vlogs, then open the showcase to observing art.

Have students complete their charts on Worksheet 16.1 for their own and their peers' artwork. Depending on class size, you may do this one of two ways:

1. For smaller classes: Prewrite artist initials on each chart and have students complete the information for the rest of each chart.
2. For larger classes: Let students pick specific pieces of artwork to observe and complete their worksheets.

NOTES 49

Teacher Notes: Conclusion

Collect student work.

Have each student make a vlog with the following information:

1. What was his/her favorite part of the museum?
2. What did he/she learn?

NOTES 50

Appendix C.

The following pages contain individual student work collected during implementation of the curriculum, *Aesthetic Mathematics: Using a SMART Board in a Kindergarten Deaf Classroom to Explore and Express Geometry through the Arts.*

Figure C.1: MF's Salt Triangle

Figure C.2: JTM's Wax Triangle on Fabric Collage

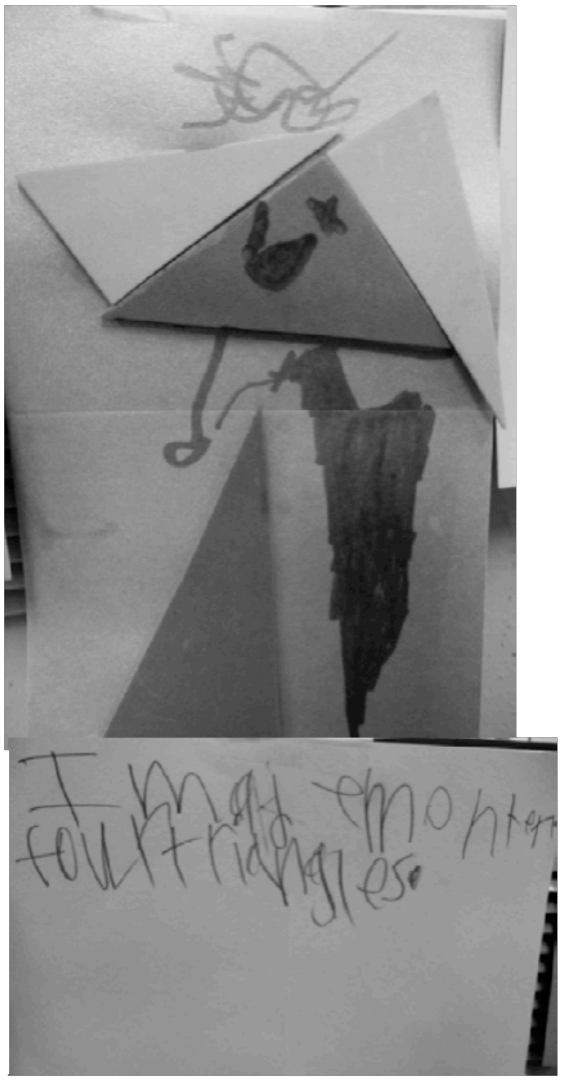


Figure C.3 HH's Triangle Monster with Sentence

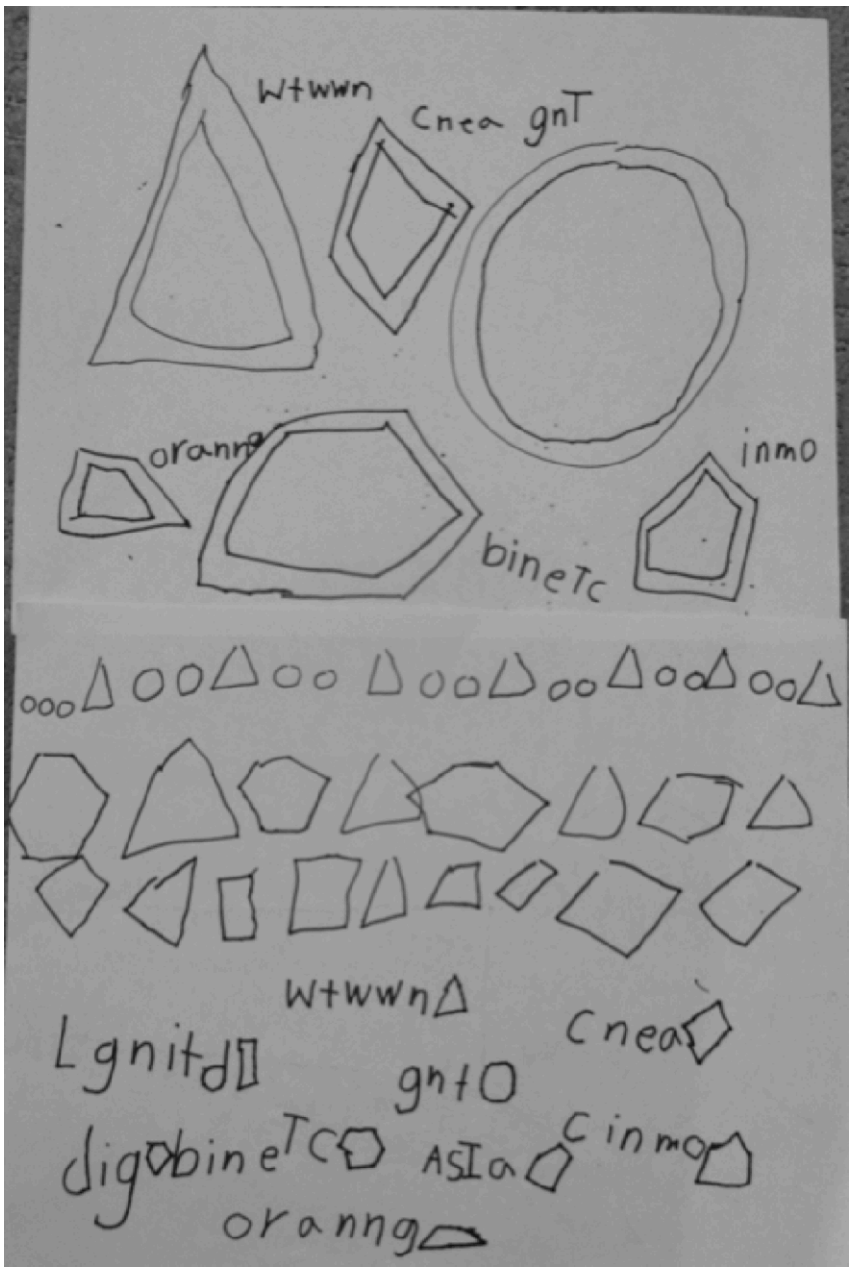


Figure C.4: NB's Shape Illustrations with Shape Names

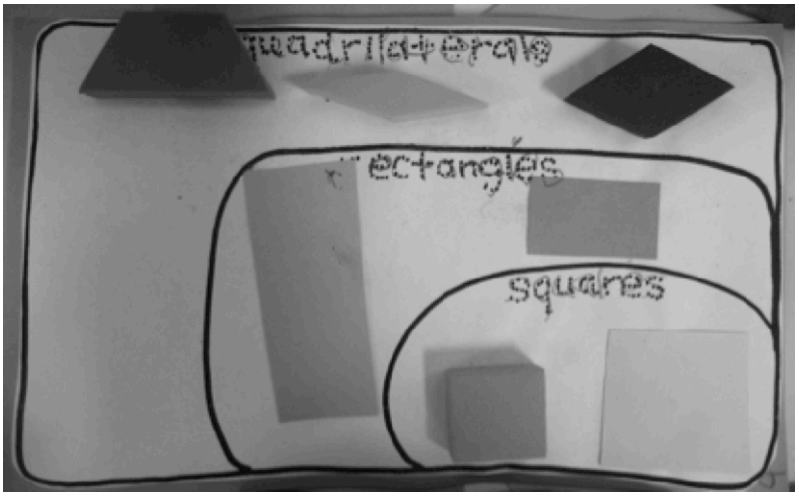


Figure C.5: CF's Categorized Quadrilaterals with Glue

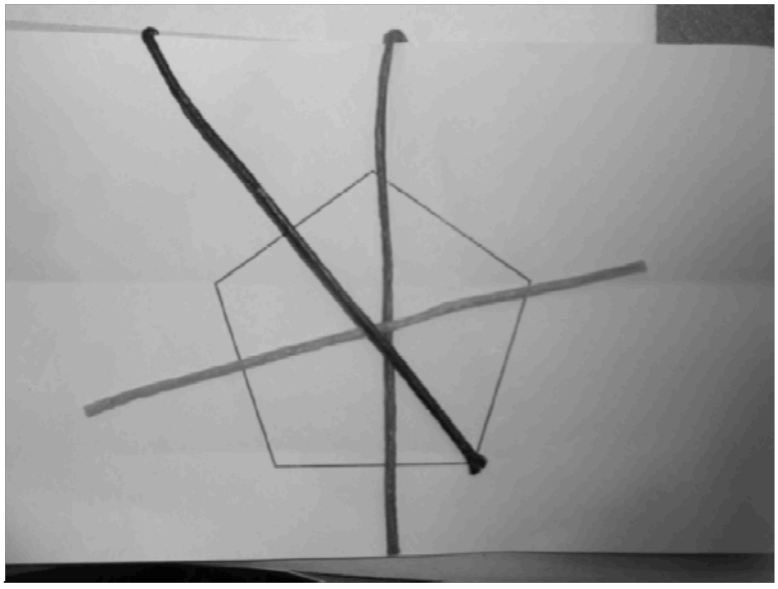


Figure C.6: AA's Pentagon with Lines of Symmetry

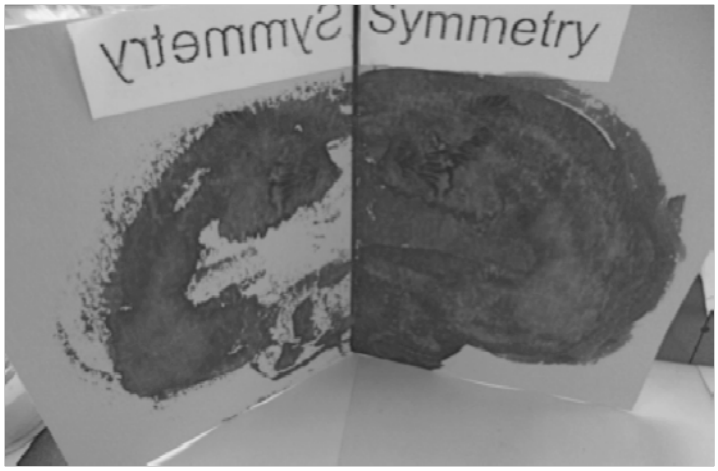


Figure C.7: CF's First Symmetrical Painting

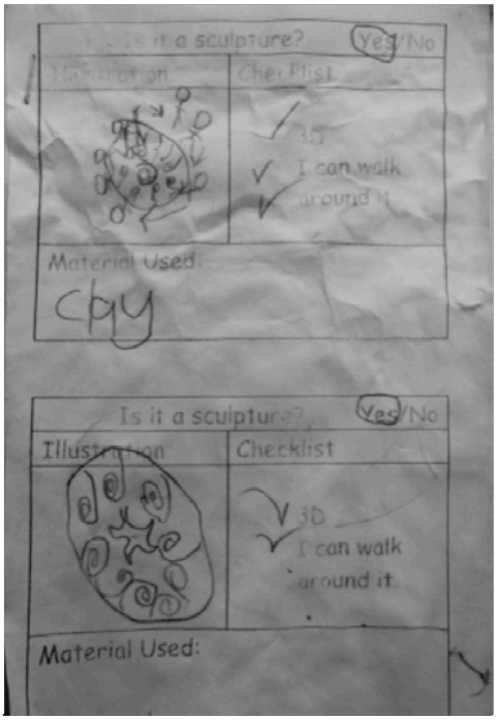


Figure C.8: CF's Sculpture Documentation

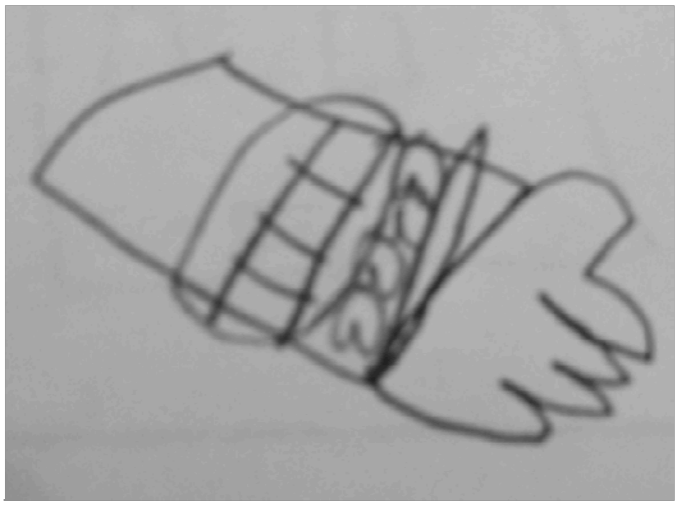


Figure C.9: MF's Circled Quadrilateral-Shaped Bracelet Drawing

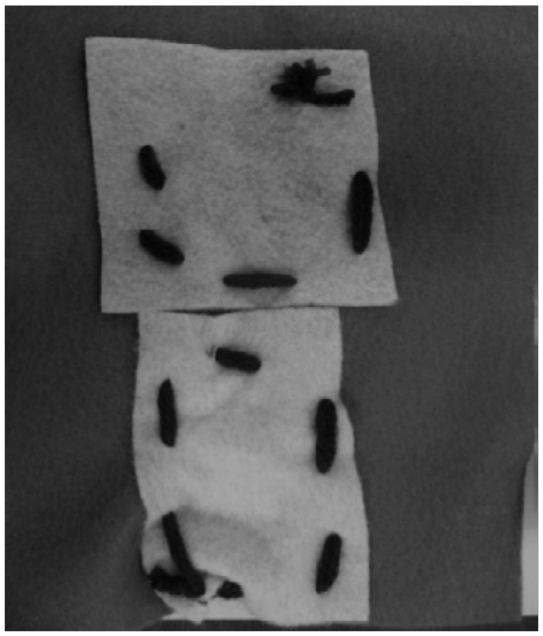


Figure C.10: JTM's Combined Shapes Sewing

Figure C.11: HH and MF's 3D Mound at Recess

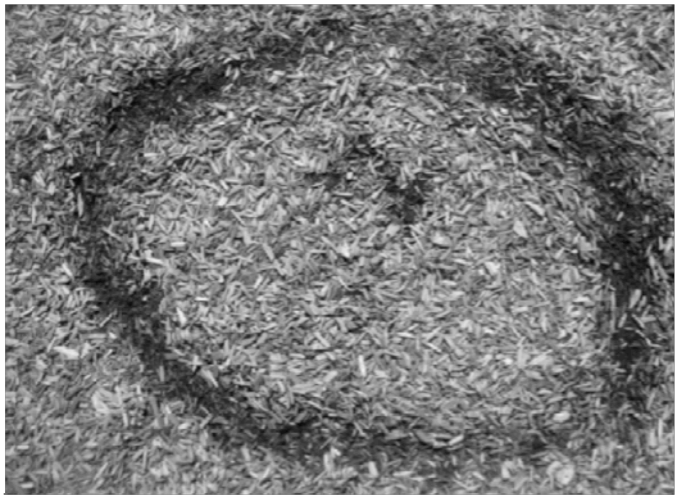


Figure C.12: NB's 2D Circle at Recess

Figure C.13: NB's Showcase Plaque

Figure C.14: CF's Museum Display

Figure C.15: HH's Museum Display

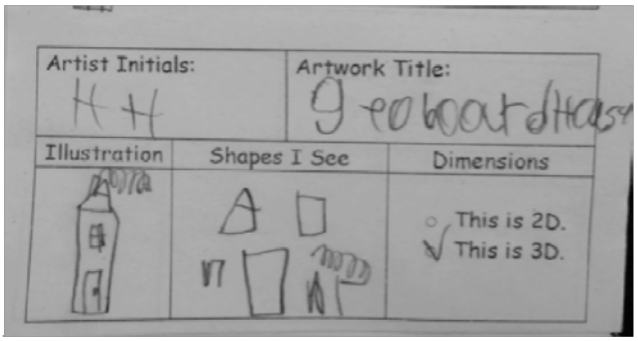


Figure C.16: HH's Showcase Chart

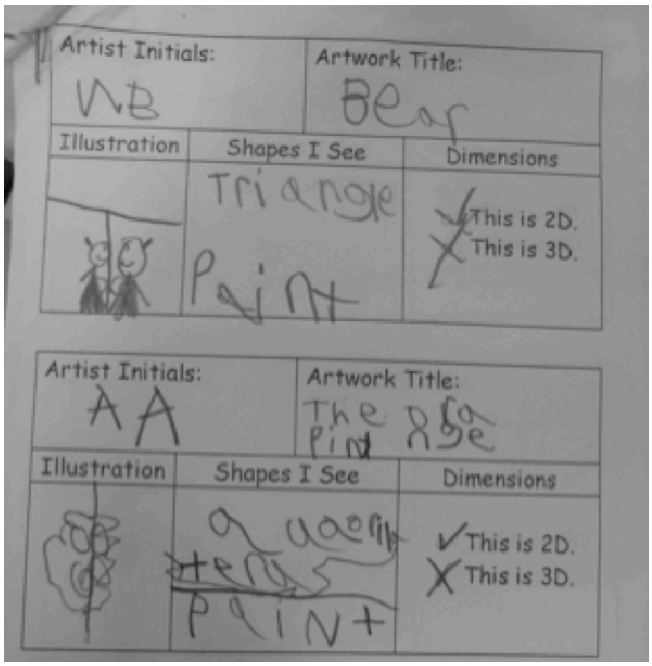


Figure C.17: MF's Showcase Chart