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Defining the Value of Educational Equilibrium for Immigrant and At-Risk Youths Through Art Education in the 2020s and Beyond

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The purpose of this study is to explore the inefficiencies of a one-size-fits-all curricular structure that has no bearing on the anthropological behavior of unique learners. Little is known about cultural relevance in learning through artistic means such as the visual arts, especially for unique project-based learners. This paper is a methodological consideration of a specific visual arts teaching approach for global application in the effort of shaping a “world of many centers.” Attention is given to the natural principles of ecological psychology, identifying the construct of the anthropological respectability of indigenous voices globally, and clarifying related scientific perception-action. The goal is to replace the archaic one-size-fits-all, colonial, “global north” practice with a creative culture-friendly learning paradigm that connects comfortably across disciplines and is adaptive to the teaching of science, technology, engineering, and mathematics. As per Silverman (2012), empirical evidence identified the differences between the visual and spatial learner--auditory and sequential learner as critical learning curves that are commonplace among adolescents in general and is linked to cultural conditioning variables. The findings of the study address the unique responsiveness of learners by their aptitude. They point to the universal theoretical respect of a cross-cultural paradigm that is the basis for a unique socio-political model for non-European learners. This phenomenological study aims to establish a collective societal opportunistic premise that will help to carve out a respectful multiverse principle for the future without bias. The study seeks to define the global reality in which diversity, ethnicity, racial orientation, religious and sexual convictions, and social interest allow learners to be themselves within the scope of their uniqueness without sociopolitical hindrance.

Art education, multiverse, pluralistic, anthropological, cultural-identification

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1. Introduction

The value of educational equilibrium for immigrant youth speaks directly to the problem of educational methodology application (the way education is done) for immigrant students. It directs its attention to the critical need for educational procedures to be grounded in genuine differentiated teaching and learning that takes each student's cultural orientation and background into consideration. This study addresses crucial observations and documented the results by using the Antecedent Behavior Consequence (ABC) Observation Form, The Matrix for Assessing Level of Consensus in a Focus Group, and the Matrix for Assessing Nonverbal Communication and the McNeil's Classification of Gesture and Ekman's Neurocultural Model, while sharing a creative approach toward a solution by using a learning method that allows students to inquire through a creative portal. The students' attention is directed to and about themselves for themselves within environs to which they feel connected and belonging. In this scenario, immigrant students create knowledge meaning for themselves and rely on their compelling educational continuum rather than becoming lost in a factious space of hopelessness. A compatible argument on cultural politics and education was put forth by Armitage, Bishop, Featherstone, and Kellner (n.d.).

The inefficiencies of the one-size-fits-all curricular structure speak to the overlooked interdisciplinary components that have been revealed through studies of neuroscience and education associations (Hermida, 1970) on the issue of conceptions that link to cultural anthropology (the study of human societies and cultures and their development) as indicated in the article "Glimpsing the Neuroscience of Creativity" (2020). The general hypothesis seeks to link broad-based misconceptions concerning neuroscience with education. Questions surrounding the hypothesis bring the ramifications of cultural connotation as a key component of learning into focus: the when, the why, and the how. Therefore, as suggested by Hermida, Segretin, Soni García, and Lipina (2016, pp. 457-472), it is safe to say that neuromyths studies hold the key to further understanding the dangers and injustice of a one-size-fits-all curricular structure— "the prevalence of misconceptions about the brain and belief in what has been termed 'neuromyths' in the realm of education."

2. Statement of the Problem

The statement of the problem rests with the relevance of art education as an educational construct in helping to shape the development of a "many centers" concept. The plan is to establish cultural, anthropological, socio-political, and economic independence for the people of the Caribbean and people of non-European origins in the 2020s and beyond. Therefore, focus is placed on teaching across centers and margins from an art education perspective with an emphasis on the needs of at-risk youth.

The research indicates that students from countries outside of Europe and the United States are often at risk and tend to perform better in countries where highly selective immigration policies exist. They tend to lean on their culture and the education that they brought with them as students as indicated in the document, "Helping Immigrant Students to Succeed at School – and Beyond" (OECD, 2015, p. 2). It is understood that, for the most part, immigrant students display little or no interest in understanding or conforming to the imposed teaching methodology of the west.

As indicated in The Project Zero and the Making Learning Visible projects, as investigative art-based learning progresses, the relevance of art education as pivotal to unique learners speaks volumes. This further highlights the benefits of somatic knowledge relationships, Siegesmund, (2004) (which involve the senses, perceptions, and mind-body action and reaction) in terms of the development of more student-centered culture-focused learning and assessment processes drawn from unique project-based curriculum structures and applicable school reform proposals (Seidel et al., 2010). These are arguably

associated with environmental, social, socioeconomic, health, cultural-anthropological, and psychological issues, as suggested by Crawford (2007) and reinforced by Warde (1960) and Cavanagh (2011).

3. The Probable Cause of the Problem

The evidence, as outlined in the literature, indicates that much work is needed in bringing respectable value and justice to the traditionally disenfranchised peoples of the world. The National Assessment of Educational Progress (2011) raised questions regarding the natural abilities and educational aptitude and tendencies of unique groups of adolescents, especially Blacks, Hispanics, and other non-European groups. Boaler, William, and Zevenbergen (2000) found that the general problem with mathematics in the field of adolescent education outside the students' cultural comfort zones indicates the need for increased focus on understanding the learners, their learning styles, and emotional states. The ability of these groups to articulate, comprehend, react, and construct thought-processing needs in a didactic form of understanding seems to vary from the expected norm of the imposed educational structure and process, which they are made to perform (Warde, 1960). From the perspective of the educator, the obvious question here may be taken from the King James Bible, "How can we sing the Lord's song in a strange land?" (Psalms 137:4, King James Bible).

Interestingly, "ethnomathematics" fosters a diversified approach to the study of mathematics across cultural barriers (Gutierrez & Irving, 2012, p. 6). Dewey posited that the practice of the rote memorization of facts does not produce genuine knowledge and that true knowledge comes from examining and learning from personal experiences (as cited in Warde, 1960). This speaks directly to the rite of passage that is a known phenomenon throughout antiquity by the indigenous peoples of the world.

4. Background and Justification

The question surrounding intellectual skills and forms of thinking also addresses the inseparability of form and content and brings into focus the critical fundamentals of relationships as in the subtle meaning of an image, a poem, or a performance irrespective of its visual or auditory content. In a January 2000 invitational meeting held in Los Angeles for education arts and youth funders and organized by the Geraldine R. Dodge Foundation and its affiliates, the paper entitled "Learning and the Arts: Crossing Boundaries" (National Art Education Association, 2014) provoked a comprehensive debate. This document provides compelling information and methodology supporting this writer's argument on the importance and place of art education in a constantly evolving, knowledge-based global economy (National Art Education Association, 2014). Thus, an effort should be made to develop the imagination as integral to the natural educational agenda (Consortium of National Arts Education Associations, 1994).

5. Audience

The audience was comprised of at-risk youths in a south Florida alternative high school. As indicated by the Florida Department of Juvenile Justice (2011), the problem of educational deficiency concerns among juvenile delinquent youths in South Florida affects mostly African American, immigrant, and Hispanic youth, rather than European American youth. Further, it is reported that growth in the privatization of correctional facilities has heightened the challenges for at-risk youths while making incarceration a thriving business in the state. Therefore, deficiencies and disparities in the handling of immigrant youths in the wider educational sector are scrutinized as they relate to social, cultural, and psychological conditioning and the behavior of the youths in question (Norbeck & Alexander, 2018, p. 1).

6. Methodology

This phenomenological study describes how at-risk youths in an alternative high school in South Florida experienced a freehand drawing exercise, and it examines the value of the drawing exercise to educational understanding from a fun-filled, comfortable teaching and learning approach. The lesson was based on the drawing of basic geometric forms, and it investigated how the understanding of the youth differed in a new approach to the teaching of geometry" or "The lesson was based on the drawing of basic geometric forms and on a new approach to the teaching of geometry" to which questions were asked (Nelson, 2017). Focus was given to the issue of students' challenges in grasping the knowledge of visual and spatial aspects of geometry that was made possible through the freehand drawing exercise (Public Broadcasting System, 2013). Gutiérrez and Irving (2012) explained the importance of cultural and ethnic considerations in harnessing the skill and creative understandings of unique students. In addressing the wider issue of interest in the discipline of mathematics among immigrant adolescents, Gutiérrez and Irving (2012) referred to such study as "ethnomathematics" (p. 6).

7. Qualitative Research Approach

In this single case, qualitative, phenomenological approach, the holistic and meaningful characteristics of a real-life phenomenon were retained. The "how" and "why" and behavior of the subjects could not be manipulated. In this scenario, the task of moving learning from a socially enthusiastic discipline through the visual arts to the interrelated components of the basic elements and principles that are applicable to basic geometry was accomplished. The phenomena of mathematical paradigms in two and three-dimensional figures that help students to understand the correlations between disciplines from both two and three-dimensional perspectives as is the case with M.C. Escher design drawings and the use of the "golden ratio by Leonardo da Vinci (Nelson, 2017) and as indicated by Yin (2014), who expressed the issue as "a phenomenon seems to be unique or extreme" (p. 47). Yin (2014) mirrors an empirical inquiry that validates a contemporary phenomenon within the parameters of its real-life context.

The study population were 12 immigrant Black male youths from a South Florida alternative high school. The writer looked at the contextual conditions that allowed him to establish the necessary rapport and trust with the subjects and easily gain their confidence and interest in the study. This allowed the researcher to establish an insider's perspective of the students' experiences to the phenomenon in a constructivist paradigm (Nelson, 2017). In this approach, learning is (a) contextual in that it takes into account students' prior knowledge; (b) active with hands-on work and critical analysis rather than rote learning, and (c) social with team projects and peer interaction ("Studies on Learning Spaces," 2017).

8. Participants

Inclusion criteria were used to determine the target population, and the sample was selected based on the scientific objective of the study. The participants for this study were 12 Black male students between the ages of 15 and 20 who were considered at-risk students in an alternative high school program jointly affiliated with the Florida Department of Juvenile Justice and the Florida Department of Education. Eight students were immigrants from Haiti and Jamaica. All the participants showed little or no interest in geometry. They were identified and selected through archival data such as their end-of-course grades. Data was also taken from the Florida Comprehensive Assessment Test from the previous year, with a focus on basic geometry education needs as observed and recommended by the students' teachers in conjunction with the school district and an education program that reflected their math scores over a given period (Nelson, 2017).

9. Data Gathering Method

Data were gathered through interviews comprised of short, open-ended questions; the focus group; participant observation; visual materials; pre and post intervention drawing and geometry activities; and nonverbal communication in addition to the drawing activity analysis (visual materials). A short interview was conducted and a questionnaire about the freehand drawing experience was administered. The interview allowed each participant to discuss his experience in his own words. The students received and completed consent forms before the study and had the option of withdrawing from the study at any time if they wished. Breaks were allowed as needed (Nelson, 2017).

10. The Connection Between Art and Visualization, Math, and Conceptualization

Considering the previous discussion on the general problem of mathematics and the applicable theories of both Jung and Dewey, the issues relating to psychological conditioning, learning processes, and the approach to learning take center stage. These issues highlight the unavoidable correlation between art and visualization, between math and conceptualization, and within other creative intersections that link mathematics and art. Thus, one can refer to a line drawn with a straight object compared to one developed by one's abstract perception, which no longer resembles or refers consciously to any specific object in the real world. It is also interesting to note that the problem of basic mathematical understanding has become an issue of concern regarding the implications of the Common Core Standards for students with mathematical difficulties. This brings focus to the correlation between art and geometry—pattern analysis, as stipulated by Kalantari defined the interconnection of the visual arts and mathematics in the polynomiography of his Voronoi diagrams highlighting interlocking sections and subsections of a parent entity and its more popularly embraced derivative Kalantari, (2000). Also, the writer believes that the importance of aligning and applying freehand drawing lessons to the principles of basic geometry correlates with Dewey's historical understanding of the origin of the genuine knowledge structure, which he related to the practice of examining and learning from one's personal experiences (Garrison, 2016).

11. Understanding Surface Area and Other Geometric Relationships from Seeing and Drawing the Transition of Lines to Shapes and Shapes to Form

Cone

It is critical to note that there are several types of cones that may confuse students. The educator must know that the right cone that has its axis as its altitude. This means that the cone from the top of the cone (the very tip of it) to its base must be perfectly aligned with the circular bottom so that a 90° angle is at the center of the circle. It is important also to understand that the radius of the circle forms an elliptical structure in the eyes of the artist that is linked to the geometric calculation of circumference.

If the cone is cut open, it would look like the diagram.

Cylinder

To understand the surface area of a cylinder, students should know the surface area of a rectangle. This is simply because the rectangle, when placed in a circular formation, creates a cylindrical structure with two circular ends. Teachers may demonstrate this by rolling a rectangular piece of drawing paper into a cylindrical form for the students to see. Another good example of this is the way labels are wrapped around a can by following the form of the can. As is the case with other geometric solids, students may be taught to construct the cylinder by using a template like the one shown above. It is easy to see that the cylinder is made of a rectangle that is curved to form the body with two circles at either end.

Cube

The cube is an immensely popular structure in the eyes of the artist. Its six equal sides are only distorted when the logic and principles of perspective are added as an understandable practice in optical illusion. To even construct the cube by using a template like the one shown above. It is evident that the cube has six equal square sides. From a geometric standpoint, it is easy for the student to understand the total of $6 \times a^2$.

Pyramid

Artists usually draw or paint square pyramids as they are more readily understood. They usually see and measure the surface areas or “the sum of the areas” of the four triangles and the square base from a visual perspective. As a result, factors such as the slant height are calculated visually. Therefore, it is understood that a square pyramid sits on a square base. It is easy to tell when the pyramid is a “right pyramid” as the apex will be directly above the center of the base. Otherwise, it is an oblique pyramid. As is the case with other geometric solids, students may be taught to construct a square pyramid by using a template like the one shown above. It is evident that the pyramid in this case has four equal triangular sides and a square base.

Sphere

The sphere is another of the popular geometric solids that the artist uses frequently, as it is widely seen in everyday life. It is basically seen as a completely round ball that is built on the principles of the perimeter of a circle, which is also known as the circumference. The artist visualizes the sphere as having the same lateral surface area as a cylinder although it curves from all points. The circumference is equidistant from the center. For the artist, the sphere is a circle that is shaded carefully by applying the applied logic of physics: light and dark rendering to create an illusion of three dimensions. The radius is the straight line from the center.

12. The Importance of Cultural and Environmental Conditioning

Historically, it has been understood that cultural and environmental conditioning as well as genetically acquired characteristics are integral entities that dictate the learner’s level of accomplishment. Also, “the essential role of image-based, nonlinguistic thinking as in visual thinking, qualitative reasoning, and imagination” must be realized (Costantino, 2007, p. 2). Reference is made to the “transmission of

hereditary character” (Boero, 2000, para. 41) from the perspective of the teaching and learning of some early educational concepts such as mathematics being integral in the molding and transformation of the student’s consciousness. As a result, there is an urgent need to study, understand, and apply scientific interpretation to these “natural and social phenomena,” as they relate to learned conceptions, both formal and informal, in the student’s everyday experience (Boero, 2000, para. 41). The problem regarding the genesis of basic geometric understanding among at-risk adolescents, as demonstrated in the five basic geometric forms activity see p.10, was described in Jung’s work, including a variety of connective behavioral patterns that are expressed by human beings at varying levels of environmental and social conditioning (Carl Jung Resources, 2016b). Jung maintained these patterns arise from a common, deep substratum of the mind he referred to as the “collective unconscious” (Carl Jung Resources, 2016b). Jung (2016a) used the word “archetype” to describe the persistence of patterns. He suggested that these behavioral patterns are learned, and they arise from the so-called collective unconscious (Carl Jung Resources, 2016b). Also important is how anxiety can affect emotional responses by shutting down the logical functioning of the brain, as in the case of “categorical thinking” (Goleman, 2005, p. 295), and by activating primal survival instincts speaks to the behavior of some adolescents with a variety of so-called “social problems.”

13. The Impact of Racial and Ethnic Disparities

Statistics have revealed racial and ethnic disparities in the juvenile system. According to Krisberg (2008), the impact of these disparities and deficiencies in the structure of adolescent education in Florida is gravely affecting ethnic minority and immigrant youths and is creating a high percentage of juvenile criminals. Serious questions are raised by this phenomenon. The situation brings into focus the educational methodology in Broward County, and therefore the researcher sought to revisit studies of human conditioning and understanding.

The interesting question is how natural human abilities and educational tendencies to react, articulate, comprehend and construct thought impact political direction that affects policy structure and the broader development of necessary basic human resources in a didactic form of understanding. According to the article “Ensuring the Future of At-Risk Youth” (2011) on the Annie E. Casey Foundation website, the plight of at-risk youths in America speaks directly to the spike in juvenile incarceration. Alarmingly, the statistics show that the United States has one of the world’s highest youth incarceration rate on a cross-national comparison scale of 0 to 350 (“Ensuring the Future of At-Risk Youth,” 2011).

14. The Relevance of the Concept of “Many Centers”

Promotion, creation, and dissemination through respectful collaboration without the caveats of the traditionally religious, racial, cultural, socio-economic, and political divide is key to the successful development of a “many centers” concept. If social innovation and design thinking are to make sense, the establishment of a mind-shift, the changing of mind-sets, a change in the levels of perceptions to foster respectful global humanity, and a social science educational premise is required. This can be reached if the focus is placed on building up the nation’s capacity to effectively collaborate and put the necessary political structures and respect for differences in place. Attention must be paid to the finer details of cultural anthropology, geography, sociology, and related social theory to foster a workable middle ground in the design for the “Pluriverse” (the world as conceived according to a theory of pluralism).

As indicated by Escobar (2018) in his explanation of “radical interdependence, autonomy, and the making of worlds,” an example of the relevance and need for “the concept of many cities” today is the graphic 1884 legacy of the colonization of the French in Africa. This crime, which is a plot of exploitation and disenfranchisement that continues to plague the continent of Africa to this day, is discussed by

African Union Ambassador Dr. Arikana Chihombori-Quao in the video Africa—The pact of continuation of colonization (ElectionsKenya, 2019). In this gripping video, the ambassador “expressed her unhappiness with how the sustained colonization by France is responsible for the siphoning off of \$500 billion from the African continent every year” (Elections Kenya, 2019). On the heels of postcolonialism issues and the 1884 decolonization period in Africa, it is apparent that the use of economic and socio-political influential forces by the “west to spread their hegemony to the other parts of the world” (Elections Kenya, 2019) in a neocolonialist way is still happening.

15.Relevance to the Discipline

The importance of understanding specific learning theories and the transfer of the learning process as indicated by neuropsychologists and art education pragmatists suggests the relevance of the “right-brain/left-brain” phenomenon and more recent neuroscientific discoveries. While it may be safe to argue that the study of creativity is in its infancy, the available research on the topics of cognition and intelligence creativity has a long way to go before it will receive the full merit it deserves. The question is when will neuroscientific proofs be allowed to help reshape the common curricular structure to reflect new teaching approaches?

Theron Fairchild of the Department of International Business and Management at Kanagawa University in Japan indicated that neuroscientific studies are providing some valuable insight as to what the creative phenomenon is (at least neurologically) (Fairchild, 2014). He commented on the development of the biological sciences concerning the “nature of the creativity-psychopathology connection” as the portal through which the united components of both explanatory creativity as well as applied creativity “foster better problem solving, decision making, and adaptive necessities” (Fairchild, 2014, p. 1). Berry, Poortinga, Breugelmans, Chasiotis, and Sam (201, p.1) stated that they “examine the relationship between the science and practice of psychology as it has developed in the western world and the need for a culturally informed, relevant and appropriate psychology for all the world's peoples.

This brings into focus the nature of the broader process and the how and why of education that is made transportable (Oregon Technology in Education Council, 2013). The logic, Taylor (2007) explained, is contained in the lines drawn, which could not be drawn in any other way. The implication, then, is that early civilizations underscored the educational premise of geometry, which encapsulated social, physical, and metaphysical dimensions. This made the scientific understanding of natural laws as concrete as those observed in the archetypical shapes of a circle, a square, and a triangle (Taylor, 2007). This is supported in depth by the differences between measurement and meaning in education, that shape the scientific, pedagogical, and organizational paradigms that are built on the merits of methodologies of the physical sciences (Eisner, 2008).

According to Standard 7 of the New Jersey Mathematics Coalition, “Spatial sense is an intuitive feel for shape and space. It involves the concepts of traditional geometry, including an ability to recognize, visualize, represent, and transform geometric shape” (Rosenstein, Caldwell, & Crown, 1996, p. 47, para, 1). This speaks to the broader interconnection and relationship to the strand in the mathematics curriculum and is reflected in a variety of situations in real life” (New Jersey Mathematics Coalition, 1995, p. 1). Additionally, Section 209 of Standard 7 of the New Jersey Mathematics Coalition Framework states that geometry and spatial sense is directly connected to the students’ experience of “living in a three-dimensional world” (Rosenstein et al., 1996, p. 1) because of their intuitive point of reference in the development of natural geometric knowledge. The inseparability of the strong connection between geometry and the visual arts highlights “the discovery and architectural use of the golden ratio by the Greeks, and focuses the analytical spotlight of the connectivity of art and geometry as defined in M. C. Escher’s use of tessellations” (Rosenstein et al., 1996, p. 1).

As a result, methods of explanation, illustration, and justification, such as technological input through dynamic graphic software, have produced a new technological framework for the subject (Hanna & de Villiers, 2012). The belief that geometry is a derivative of art is expressed through archaeological findings that present its earliest configurations and cultural connotations. The merging of geometry and art became the cornerstone of the Renaissance glory that created the seat of its modern objectives (Rhinehart Neas, 2012).

As per Zahavi (2018), one may conclude that such a practice does not operate on a meta-social plane. Rather, it defies any coherent body of philosophical orientation and is hinged squarely on sterile principles of a form of conventional theory (Zahavi, 2018). There is no consideration for helping students in the shaping of their self-situational and/or social conditioning or by emphasizing the interpretations of the individuals' anthropological and cultural applications (Zahavi, 2018).

16. Decolonizing and Deconstructing Education and the Conventional Academic Model

Meaningful discussion around the importance of methodology and the practice of teaching (especially as an academic-theoretical construct towards full educational liberation in support of a “decolonial praxis”) is imminent (Hajir & Kester, 2020, p. 1). The influence of colonial division in and of cultures outside of the Global South is evident in mainstream education globally despite the resilience of deep-rooted fundamentals of dominant cultural norms subjectively and objectively (Thomas, 2001). Thus, a universal voice on the decolonizing of education would speak to the leveling of the playing field and bringing more relevance to education for other people outside the parameters of “Global North” as indicated by the Pivot Conference 2020.

A call is made by Pérez and Saavedra (2017) for “onto-epistemological diversity in early childhood education and care”. Accordingly, models are strongly normative and display major components of ideology. Their partisans tend to be true believers when promulgating their positions rather than offering them for critical examination and test . . . Subjective models comprise a series of principles rather than a coherent body of theory that pays no attention to the central principles of conventional theory, but consistently rejects the idea of proposing a precisely formulated alternative. (“The Limitations of Subjective Models,” 2016, p. 1).

17. Discussion

The push for concise educational anthropology study (examining educational systems from a cultural anthropologist perspective) and implementation will drive the need for new curriculum development, theories, and practices. There is a need for territorialities—an understanding and implementation of the rudiments and theory of interdisciplinary rhythms and cultural topologies that defines the importance of social spaces, an understanding referred to as specialization. (nonverbal communication that refers to how people use territory to show ownership of areas and possessions) where people demand ownership and occupancy of their cultural space. Stockman (2015) asked, “If the multiverse is real, what does that mean for modern-day religion?”

There must be an establishment of a new order: a system that hinges on a principle of pluriverseism, which is a diversity of racial, ethnic, and religious understandings. In such a scenario, social groups would be able to maintain their traditional cultures and develop in their traditional way so that teaching may happen across centers and margins. Consequently, the concept of multiverseism must be embraced where parallels in human value become commonplace. The focus must continue to be placed on the critical necessity of postcolonial perspectives aimed at creating alternative ways of theorizing pedagogy in shaping the curriculum. Questions of identity differences, racialization, and ethnicization can only be

answered by theorizing anti-oppressive struggles and ethnic postcolonial discourse that is deeply embedded in our imperial history.

Interestingly, discussions on the promotion of cultural ideas of leadership on the topic of culture and diversity are currently ongoing through the National Council of Professors of Educational Administration (NCPEA) (Irby, Alford, Perreault, & Zellner, 2010). It will be fascinating to observe who sits at that conference table, how globally relevant and far-reaching the discussions are, and the applicability of the issue at hand.

18.Examples of Student Work

Drawing of the Five Basic Geometric Forms Activity

Examples of students work depicting visual understanding of surface area both two and three dimensionally. Defining the placement of areas and masses identifies objects in their respected space as defined by shapes and form coming together to imply space as a coexisting necessity. Observed and experienced differences between two and three dimensions in real-time are evident in the exploration of lines, line segments, shapes, lines convergence, forms, and surfaces with optical illusion and perspective.

Examples of Students' Post Intervention Geometry Activity

Note the effort to engage in actual calculations of surface areas which was not happening before the study

Before

1. Cube - 4^4

2. Cone - $V = \pi r^2 \frac{h}{3}$

3. Cylinder - $bh = [\pi] r^2 h$

4. Sphere - $V = \frac{4}{3} \pi r^3$

5. Pyramid - Multiply then $\div$ by 2

After

1. Cube - Area = $6a^2$

2. Cone - Area = $2\pi r(r + \sqrt{h^2 + r^2})$

3. Cylinder - Area = $2\pi rh + 2\pi r^2$

4. Sphere - Area = $4\pi r^2$

5. Pyramid - Area = $4^4 \div 2$

Before

1. Cone - $V = \pi r^2 \frac{h}{3}$

2. Cube - 4^4

3. Cylinder - $b \cdot h = [\pi] r^2 h$

4. Pyramid - multiply then $\div$ by 2

5. Sphere - $V = \frac{4}{3} \pi r^3$

After

1. Sphere - $A = 4\pi r^2$

2. Cone - $A = \pi r(r + \sqrt{h^2 + r^2})$

3. Cylinder - $A = 2\pi r^2 + 2\pi rh$

4. Pyramid - $A = \frac{1}{2}Ps$

5. Cube - $A = 6 \times a^2$

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