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CREATIVE VISUAL ARTS AND BIOLOGY PROCESSES: EXAMINING EMERGENT BI/MULTILINGUAL HIGH SCHOOLERS MEANINGS

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Abstract
This case study research examines how emergent bilingual and multilingual high school students construct meanings while engaging with objects during a biology lesson that integrates visual arts. Drawing on the theoretical framework of Symbolic Interactionism (SI), the study focuses on "Artistic Reformatting to Represent Interdependence among the Structures and Functions of an Animal Cell." By investigating the connections between the students' interests, beliefs, memories, and objects, as well as their social interactions with peers, friends, family, and others, the research uncovers the ways in which meanings are constructed. While visual arts integration is common in academic content, little attention has been given to its potential to support meaning-making among emergent bilingual and multilingual students. The findings of this study highlight the importance of adopting a holistic approach to visual arts education that emphasizes contemporary strategies, enduring ideas, and social interaction in engaging with content. These insights suggest that educators can enhance their teaching methods and create meaningful learning experiences for bi/multilingual students by incorporating these approaches. The study underscores the significance of visual arts in fostering personal connections and deeper comprehension of academic content among diverse student populations, ultimately promoting a more inclusive and effective educational environment.
Keywords: Animal Cell, Emergent Bi/Multilingual Learners, Communication Skills Class, STEAM, Symbolic Interactionism, Visual Arts integration.

I. Introduction

Visual arts integration has a rich history of partnerships between community arts organizations, public schools, and universities since the 1960s and 1970s (Remer, 1996; Dreeszen et al., 1999; Arts Education Partnership, 2002). These collaborations bridged gaps between arts education and other disciplines, influencing current discussions on visual arts in classrooms (Burnaford et al., 2007). Arts educators advocate for interdisciplinary visual arts integration (Cropley, 2014; Leysath & Bronowski, 2016; Marshall, 2010, 2014; Rahmawati et al., 2019; Runco, 2014; Stehle & Peters-Burton, 2019; Wilson & Presley, 2019), recognizing its potential to enhance understanding across subjects (Silverstein & Layne, 2010).

Visual arts integration offers a multimodal learning approach that fosters deeper academic comprehension and explores relevance in education, catering to learners of all ages (Cahnmann-Taylor & Sanders-Bustle, 2019). By utilizing commonalities among disciplines, it enhances overall learning experiences.

This paper investigates how emergent bilingual and multilingual high school students construct meanings during a biology lesson integrating visual arts, focusing on "Artistic Reformatting to Represent Interdependence among the Structures and Functions of an Animal Cell." Examining relevant research and case studies, the paper uncovers the benefits and challenges of visual arts integration, contributing to ongoing dialogue and inspiring educators to enhance learning experiences across diverse subjects.

II. Literature Review

STEAM Education and Visual Arts

The push for STEM education in the United States can be traced back to the launch of the Russian satellite Sputnik in 1957, emphasizing the importance of scientific and

technological advancement (Erwin, 2017). The subsequent decades witnessed significant growth and development in STEM-related fields, with the establishment of organizations like NASA and the emergence of science and engineering firms that led to groundbreaking innovations such as the first cell phone, personal computer, and artificial heart. This rapid progress highlighted the critical need for STEM education.

The National Academies of Science, Engineering, and Medicine further underscored the urgency for enhanced STEM education in a 2005 report. The report revealed that U.S. students lagged behind their international counterparts in STEM proficiency (Erwin, 2017). The report emphasized the need for a more robust focus on science, technology, engineering, and mathematics to prepare students for the demands of the 21st-century workforce.

Currently, the statistics continue to highlight the challenges in STEM education. Only 16 percent of American high school seniors demonstrate proficiency in math and express an interest in pursuing STEM careers (US Department of Education [DOE], 2015). Additionally, emergent bi/multilingual learners, who constitute a significant portion of the student population, remain underrepresented in STEM fields (National Academies, 2016).

In response to the imperative for increased interest and skills in STEM, the concept of STEAM education emerged as a new pedagogy in 2007, as discussed during a roundtable organized by Americans for the Arts (Perignat & Katz-Buonincontro, 2019). STEAM, which stands for Science, Technology, Engineering, Arts, and Mathematics, advocates for an interdisciplinary or transdisciplinary approach to teaching and learning within a defined learning context (Perignat & Katz-Buonincontro, 2019, p. 34). By integrating the arts into the traditional STEM framework, STEAM aims to foster innovation, creativity, and critical thinking skills among students.

Despite the growing interest in STEAM, more information is needed regarding the instructional approaches required to make STEAM teaching effective. Shifting from traditional education methods to focusing on the learning process is essential for successful STEAM integration (NGSS Lead States, 2013). Educators must reimagine their pedagogical practices and embrace a more student-centered approach emphasizing inquiry, problem-solving, and experiential learning.

One common misconception about STEAM education is that the visual arts are primarily focused on producing a finished product rather than engaging in learning through thinking, planning, and creating visual artwork (Perignat & Katz-Buonincontro, 2019). However, recognizing the visual arts as a process of learning and meaning-making is crucial for facilitating learning in other disciplines, particularly in STEM (Aghasafari et al., 2021, 2022; Aghasafari, 2023). Integrating visual arts into STEM education can enhance students' creativity and critical thinking skills, promote collaboration and communication, and facilitate a deeper understanding of complex concepts (Duggan, 2007; Efland, 2002; Eisner, 2002a, b; Patterson, 2015).

Educators can tap into students' artistic abilities by incorporating visual arts into STEM instruction and providing a well-rounded learning experience. Visual arts integration allows students to explore scientific concepts through artistic expression, encouraging them to approach problems from different perspectives and engage in innovative problem-solving strategies. Moreover, the inclusion of visual arts in STEM education cultivates an appreciation for aesthetics and design, skills that are increasingly valued in various STEM fields.

Emergent Bi/Multilingual Learners

Integrating visual arts into other disciplines has been shown to positively affect students, especially those who speak languages other than English (Berriz et al., 2019; Kant et al., 2018; Zhang et al., 2021). Currently, 9.6% of students in the United States are classified as emergent bi/multilingual English learners, according to the National Center for Education Statistics (2016). The Latinx population is the fastest-growing immigrant group in the United States, with nearly 60 million residents accounting for over 50% of the population

growth within a decade (Pew Research, 2019). One-third of the growth of the U.S. Latinx population has occurred in the Southern states such as Texas, Tennessee, Kentucky, Florida, Georgia, Virginia, and Alabama (Bauman, 2017). Nearly half of the Latinx population is under the age of 24 (Garcia-Reid et al., 2015; Pew Research, 2019), and Latinx students account for a quarter of the 50 million students enrolled in K-12 schools and nearly 20% of student enrollment at the postsecondary level (Vespa et al., 2018). The increase in Latinx high school graduates by 2022 will affect postsecondary admissions and enrollment (Santiago, 2011), and the Latinx population is expected to rise to over 100 million by 2060 (Bauman, 2017).

III. Theoretical Framework

Symbolic Interactionism

Blumer (1969) proposed two premises that explain Symbolic Interactionism (SI): (1) Human beings act towards things based on the meanings that those things have for them; (2) The meaning of those things arises from the social interaction that individuals have with others.

In this study, the researcher explores Blumer's first premise by examining the meanings that emergent bi/multilingual students attribute to their experiences with visual arts integration activities in their biology lessons. Students act intentionally towards a specific goal, which shapes their actions and becomes implicit in their behavior. By seeking to understand what motivates individuals and shapes their choices, students give their actions a particular sense.

The study also highlights Blumer's second premise that meaning is derived from social interaction. The researcher finds those students' interactions with peers, friends, families, teachers, and others imbue objects with meaning, illustrating how the social context shapes the meanings that students ascribe to their experiences.

IV. Research Method

Setting, Participants, and Sampling Procedure

At a mid-sized high school in the southeastern United States, we conducted a study with 20 ninth-grade emergent bi/multilingual students in a communication skills class. The class was jointly taught by two ESL biology teachers, Mrs. B and Mrs. N, and served Latinx and Asian learners between the ages of 14 and 18 who were born in eight different countries. The class aimed to strengthen students' academic English skills, encourage free expression, and promote idea-sharing, as many of the students were newly arrived in the country and had limited writing/speaking abilities. We invited 10 students to participate in the study, ultimately focusing on three due to their individual traits. Pedro displayed proficiency in visual arts (including Photoshop), Fernando showed expertise in biology, and Maria demonstrated a strong work ethic in both biology and visual arts activities. For confidentiality purposes, all names used are pseudonyms.

Data Collection and Analysis

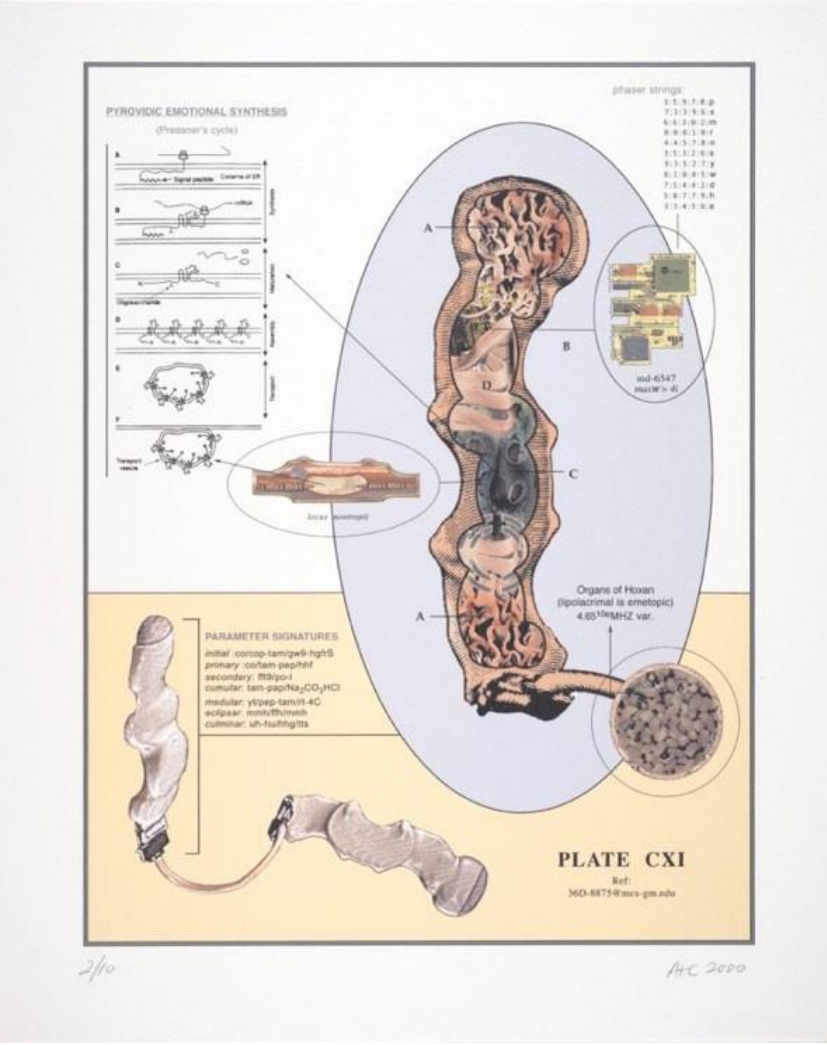
Research activities included video recordings of integrating the visual arts activities with bi/multilingual students who participated in this study. Students' visual artwork also served as data sources. The collected data were subjected to Constant Comparative Analysis (CCA) (Glaser and Strauss, 1967) to continuously compare data, including codes to codes, codes to categories, and categories to categories (Glaser, 1998).

Implementations

Most of the class time centered on work from the Naturalia series (Figure 1) by contemporary visual artists Anthony Aziz and Sammy Cucher. The students were prompted to share their interpretations of the artwork, and Pedro described it as resembling a postcard, while Maria noted the abnormal shape but recognized the connection to biology and visual arts. Fernando supported Maria's observation and emphasized how visual arts allowed them to perceive things differently. This highlights how the integration of visual arts

in the classroom facilitated a shift in perspective and encouraged the students to explore new meanings. The concept of "reformatting" was introduced, explaining how changing the context or medium of an image could lead to different understandings and insights. The artists in the Naturalia series utilized the idea of interdependence to present their designs in a postcard format. This concept served as a foundation for the subsequent activities involving Photoshop techniques.

Figure 1. Plate CXI from the Naturalia series (2000–2001), Anthony Aziz and Samm Cucher.



Source: Copyright © Aziz + Cucher (2001)

During the next session, Photoshop techniques such as masking, layering, and editing were taught to the students to create postcards illustrating interdependence through reformatting. The students actively engaged in the process, frequently asking questions and seeking clarification. The use of digital tools expanded their creative possibilities, as demonstrated by Pedro's plan to place his animal cell design on a bottle (Figure 2) and Fernando's intention to create a donut and a ring (Figure 3), reflecting his personal interests. These examples showcase how the integration of visual arts and technology allowed students to explore their individual connections and interpret animal cell components in unique and meaningful ways.

Figure 2 (left). Artistic Reformatting (Postcard) to Represent Interdependence among the Structures and Functions of an Animal Cell, Pedro, Photoshop, 2023.
Figure 3 (right). Artistic Reformatting (Postcard) to Represent Interdependence among the Structures and Functions of an Animal Cell, Fernando, Photoshop, 2023.

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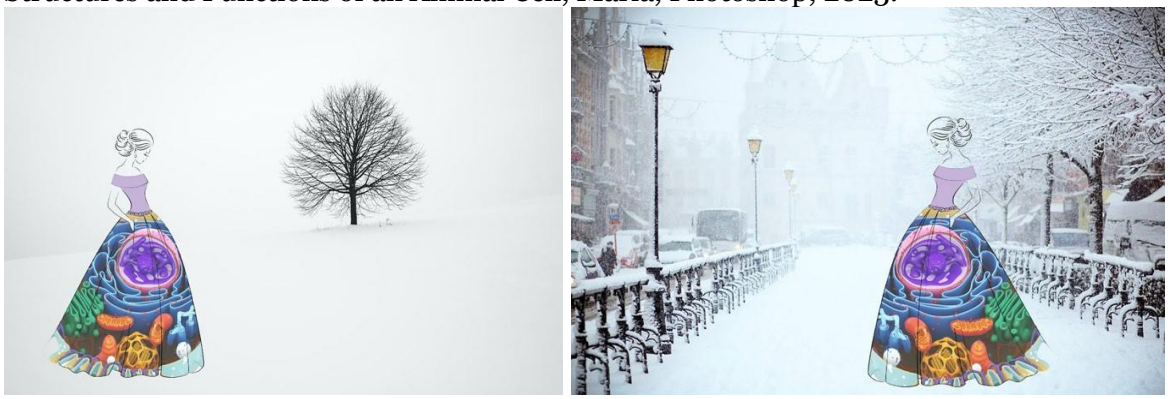
The project of creating postcard designs of animal cells provided an opportunity for students to visualize and understand the interdependence among the components. By manipulating images and applying Photoshop techniques, they gained a deeper comprehension of how each element fit together to form a cohesive structure. The challenges faced during the project, such as technical issues and limited internet access for some students, were addressed through collaborative problem-solving and individual assistance, promoting a supportive learning environment.

In the subsequent phase, students were tasked with searching the internet for animal cell images and functions to incorporate into their postcard designs. Social interaction played a significant role as students discussed and determined the animal cells they would work on. Maria's selection of wintery scenes (Figure 4) revealed her personal connection to her birthplace and family, demonstrating how the project enabled students to integrate their interests and memories into their designs.

Figure 4. Artistic Reformatting (Fashion Design) to Represent Interdependence among the Structures and Functions of an Animal Cell, Maria, Photoshop, 2023.



Source: Copyright © [2023] by [Sahar Aghasafari]

The engagement and enthusiasm displayed by Pedro, Fernando, Maria, and other students extended beyond the classroom as they voluntarily continued working on their projects after class and even during the weekend. The opportunity to share completed designs through a shared Google Drive fostered a sense of community and inspired students to explore similar ideas while still adhering to the correct process. This peer influence resulted in designs that, while sharing similarities, showcased the students' overall competence and creativity.

In a subsequent session, Pedro's animal cell design was showcased, prompting students to identify and describe the animal cell components and consider interdependence. The increased proficiency in Photoshop techniques facilitated students' confidence in discussing animal cell structures. This observation underscores how the integration of visual arts and technology empowered students to articulate their understanding using both English and their native languages.

The implementation of visual arts integration activities, coupled with the utilization of digital tools like Photoshop, allowed students to construct meaning, develop personal connections, and deepen their comprehension of the animal cell lesson. By engaging in creative processes and collaborative interactions, the students gained a broader perspective on the subject matter and nurtured their artistic and scientific skills simultaneously.

V. Findings

To investigate the meanings constructed by Fernando, Maria, and Pedro in relation to visual arts integration activities during the animal cell lesson, Constant Comparative Analysis (CCA) (Glaser and Strauss, 1967) was employed to continuously compare data, including codes to codes, codes to categories, and categories to categories (Glaser, 1998).

The analysis revealed two key findings. First, the students created meaning through visual arts-making activities by establishing connections between the content (visual arts and biology) and their personal interests, memories, and beliefs. Incorporating visual arts allowed them to go beyond rote learning and engage with the material more personally and meaningfully.

Furthermore, meaning also emerged from the students' interactions with their peers, friends, family, and others as they engaged in the visual arts integration activities. Symbolic Interactionism, as described by Blumer (1969), views meanings as social products that are formed through the defining activities of people as they interact. The students' collaborative discussions, feedback, and interactions with others enriched their understanding of the topic. For example, Pedro, Fernando, and Maria actively engaged with one another during the project, sharing ideas, providing assistance, and seeking input. The social interactions extended beyond the classroom, as the students involved their family members and friends in their visual arts integration activities. This social dimension played a significant role in inspiring and supporting the students throughout the biology lesson.

The findings indicate that the integration of visual arts in the animal cell lesson allowed Fernando, Maria, and Pedro to construct meaning by drawing on personal interests, memories, beliefs, and social interactions. The students' connections with the content and with others not only facilitated a deeper understanding of the subject matter but also fostered a sense of engagement and inspiration. This highlights the importance of incorporating visual arts integration activities to enhance student learning experiences and promote meaningful connections between academic content and personal contexts.

VI. Discussion

The findings from this study highlight the profound impact of visual arts integration on emergent bilingual and multilingual high school students' learning experiences. Through the use of Constant Comparative Analysis (CCA), it became evident that students like Fernando, Maria, and Pedro could create meaningful connections between the biology content and their personal lives. This integration allowed students to move beyond rote memorization, enabling them to engage deeply and personally with the material. For instance, Pedro's reflection that "visual arts let us see things differently" encapsulates how the visual arts facilitated new perspectives and deeper understanding.

Symbolic Interactionism, as proposed by Blumer (1969), underpins these findings by emphasizing that meanings are constructed through social interactions. The collaborative nature of the visual arts activities promoted discussions, feedback, and shared learning experiences among students. Maria noted that working on the project with her peers made the content "feel more connected to our own stories," illustrating how social interactions

enriched the educational experience. This collaborative dynamic extended beyond the classroom, involving family and friends, which further supported and inspired the students throughout the lesson.

The study's conclusions reinforce the importance of incorporating visual arts into academic lessons to enhance student engagement and learning. By utilizing students' personal interests, memories, and beliefs, educators can foster a more meaningful and holistic educational experience. The visual arts should not be isolated from other disciplines but rather integrated to tap into the diverse backgrounds and perspectives of students. This approach enriches the students' understanding and promotes creativity and inspiration. As Fernando succinctly said, "Art helped me understand biology better because it connected to things I care about."

These findings suggest that educators should adopt a Symbolic Interactionism framework to facilitate meaningful learning experiences. By creating a supportive and collaborative environment, students can construct their own meanings and engage more deeply with the subject matter. Moving forward, it is essential for educators to explore innovative approaches like visual arts integration to cater to the diverse needs of bilingual and multilingual learners. Embracing these principles can foster meaningful connections between academic content and students' personal contexts, ultimately promoting a transformative and inclusive educational experience (Blumer, 1969; Berriz et al., 2019; Zhang et al., 2021).

This study underscores the transformative potential of visual arts integration in education, advocating for its broader adoption to support diverse learners and enhance interdisciplinary learning (Perignat & Katz- Buonincontro, 2019). By recognizing the power of personal connections and social interactions, educators can significantly enrich the learning experiences of their students.

VII. Conclusions

This study highlights the value of adopting a Symbolic Interactionism framework, as proposed by Blumer (1969), to enhance teaching methods when working with emergent bi/multilingual students integrating visual arts with biology. The findings demonstrate that collaborative STEAM education provides a powerful platform for students to create personal connections and construct meaning through their interests, memories, and beliefs, as well as through social interactions with peers, friends, family, and others. The tangible outcomes of this meaning construction were evident in the visual artworks produced by the students, showcasing the integration of visual arts with academic subjects.

The study emphasizes that visual arts should not be viewed as separate from other academic disciplines, as exemplified by the experiences of Fernando, Maria, and Pedro. Incorporating visual arts into the animal cell lesson enriched the students' understanding and fostered a sense of engagement, inspiration, and creativity. By embracing visual arts integration, educators can tap into their students' diverse backgrounds, interests, and perspectives, promoting a holistic and meaningful learning experience.

This research underscores the importance of recognizing and utilizing students' personal connections and social interactions in the learning process. By creating a supportive and collaborative environment, educators can empower students to construct their own meanings, actively engage with the subject matter, and develop a deeper appreciation for interdisciplinary learning.

Moving forward, it is crucial for educators to continue exploring innovative approaches, such as visual arts integration, to enhance teaching practices and cater to the diverse needs of bi/multilingual students. By embracing the principles of Symbolic Interactionism, educators can foster meaningful connections between academic content and students' personal contexts, ultimately promoting a transformative and inclusive educational experience.

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