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Virtual Visual Art Integration and Biology: More Favor or Challenges for Emergent Bi/Multilingual High Schoolers

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ABSTRACT

As educators, we are becoming increasingly aware that delivering effective education will likely change after the coronavirus pandemic. As a result, we have an opportunity to frame teaching differently and bring innovation to the forefront. In doing so, educators explored online tools and creative ways to connect with students and found new ways to teach.Using an exploratory case study methodology and working within a theoretical framework of symbolic interactionism (SI), I investigated how virtual teaching visual arts integration and biology are more favorable or challenging for emergent bi/multilingual high schoolers. The lesson titled Using Depiction to Illustrate the Interdependent Functions of a Plant Cell was implemented. I implemented a series of visual arts integration activities with ten ninth-grade emergent bi/multilingual students at a mid-sized high school in the United States' southeastern region. Research activities took place, via zoom, in a communication skills class. The findings reveal that learning new content mediums and skills during visual arts integration activities enhances students' learning process. Moreover, emergent bi/multilingual students can benefit from face-to-face classes because they receive more practice speaking and benefit from their teacher's advice on their tasks. Nevertheless, more flexible class times and delivery methods may help students meet the many challenges created by the need to help provide for their families.

Keywords: Emergent bi/multilingual learners; communication skills class; STEAM; symbolic interactionism; virtual visual arts integration.

INTRODUCTION

As a visual arts educator, the overarching goal of my practice is to create interdisciplinary experiences using visual arts and sciences that corroborate the claim in the above quote that "scientists and visual artists share similar psychological profiles." Eiduson (1962) found that visual artists and scientists could not be easily distinguished. Visual artists, for example, tended to have diverse intellectual interests and elaborate fantasies, to be highly responsive to sensory experiences and to be motivated to find various ways to express these experiences. Scientists shared all of these characteristics.

Preissle (2008) writes that "a subjectivity statement is a summary of who researchers are in relation to what and whom they are studying" (p. 844). As qualitative researchers, we must acknowledge our own impact on the subject of study: we select particular topics of research, choose to collect data in particular ways, and interpret and draw conclusions from data in the context of our unique lens (Peshkin, 1994).

During my graduate studies, and as a multilingual educator and visual artist in the U.S., I began pursuing my research interest in the interdisciplinary study of visual arts and STEM (Science, Technology, Engineering, Mathematics). However, I quickly learned that the power of visual arts is often undervalued by other disciplines and needs to be addressed in favor of teaching and testing in science, social studies, and math. This did not surprise me. When I was a student in high school, time that could have been devoted to visual arts class was taken up by science and math classes, and some science and math teachers believed that their disciplines were much more important than visual arts. In contrast, I believe that engaging in visual arts as a learning process is vital to facilitating learning in other disciplines, specifically STEM. I started to think more deeply about how bilingual and multilingual learners are affected by school experiences and how visual arts might support their learning and their well-being in schools. Do bilingual and multilingual learners feel comfortable in, for example, online classrooms? Could the integration of visual arts into the biology curriculum positively influence their experiences? To help answer my questions, I decided to study visual arts and biology to understand how virtual teaching of visual arts integration and biology favored or challenged emergent bi/multilingual high schoolers.

LITERATURE REVIEW

Interdisciplinary Pedagogical Development

Visual arts integration gained attention in the 1960s and 1970s when arts partnerships among community arts organizations and public schools became common (Remer, 1996; Dreeszen et al., 1999). The Arts Education

Partnership (2002) reflected a growing trend of partnerships involving public schools, arts organizations, and universities. While not all partnerships included in the AEP documents focused on visual arts integration, the growth of sustained connections between art education and other disciplines contributed to the discussion of visual arts integration in classrooms (Burnaford et al., 2007).

Art educators have long promoted interdisciplinary visual arts integration (e.g., Cropley, 2014; Leysath & Bronowski, 2016; Marshall, 2010, 2014; Hadinugrahaningsih et al., 2019; Runco, 2014; Stehle &Peters-Burton, 2019; Stokrocki, 2005; Wilson & Presley, 2019). Silverstein and Layne (2010) define visual arts integration as "an approach to teaching in which students construct and demonstrate understanding through a visual art form. Students engage in a creative process that connects a visual art form to another subject area and meet evolving objectives in both" (para. 3). Visual arts integration has been used to explore "the relevance and approaches to art education connected to curriculum and instruction with learners of all ages, including teacher-learners" (Cahnmann-Taylor & Sanders-Bustle, 2019, p. 2). Visual arts integration utilizes commonalities among the many components of other disciplines.

Furthermore, since technology has become more available and accessible, computer graphics (Photoshop, Illustrator, Sketch Up, Minecraft, and other software) have allowed students to participate more fully in the visual arts in other classrooms. Moreover, the use of such programs addresses the importance of creative production and promotes hands-on learning through digital visual art making as a powerful way for students to express themselves as learners and recognize themselves as engaged in meaningful learning (Bruce, 2009; Chandler-Olcott and Mahar, 2003; Lawrence and colleagues, 2009). Hence, visual arts are significant because they cultivate the brain processes involved in knowledge acquisition and foster the higher-level skills of learning, knowing, thinking, remembering, and problem solving that are necessary for understanding concepts more deeply.

From STEM to STEAM

The emphasis on STEM in the U.S. began with the launch of the Russian satellite Sputnik in 1957 (Erwin, 2017). Over the next 50 years, the National Aeronautics and Space Administration (NASA) was created, science and engineering firms were launched (leading to the first cell phone, first personal computer, and first permanent artificial heart), and numerous councils related to math and science were formed to guide K-12 curricula. The first explicit use of the STEM acronym arose during a 2005 Congressional caucus advocating the creation of schools focused on science and engineering (Heitin, 2015). That same year, the U.S. National Academies of Science, Engineering, and Medicine indicated that U.S. students lacked

proficiency in STEM compared to students from other countries (Erwin, 2017). Currently, only 16 percent of American high school seniors are proficient in math and interested in STEM careers (US Department of Education [DOE], 2015), and bi/multilingual learners need to be more represented in STEM fields (National Academies, 2016).

One misconception about STEAM education is that the visual arts focus primarily on a finished product rather than learning through thinking, planning, and creating a work of visual art (Perignat & Katz-Buonincontro, 2019). Engaging in visual arts as a process of learning (Aghasafari et al., 2022, 2021; Duggan, 2007Efland, 2002; Eisner, 2002a, b; Patterson, 2015) and meaning-making is essential to facilitating learning in other disciplines, specifically STEM.

Emergent Bilingual and Multilingual Learners

Emergent bi/multilingual learners use two or more languages at home and in school and may also be learning English for purposes of schooling (Smith et al., 2021). Educators and teachers have documented the positive outcome of visual arts integration into other disciplines, particularly for speakers of other languages (Berriz et al., 2019; Kant et al., 2018). According to the National Center for Education Statistics (2016), 9.6% of United States students are currently classified as emergent bi/multilingual learners. The Latinx population is the largest and fastest-growing immigrant group in the United States. It continues to rise, with nearly 60 million Latinx residents accounting for over 50% of the population growth within a decade (Pew Research, 2019). One-third of the United States Latinx population growth has occurred in the Southern states, including but not limited to Texas, Tennessee, Kentucky, Florida, Georgia, Virginia, and Alabama. Nearly half of the Latinx population is under 24 (Garcia-Reid et al., 2015; Pew Research, 2019; U.S. Census Bureau, 2017). According to the United States Census Bureau (2017), 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 (Bauman, 2017). By 2060, this population is expected to rise to over 100 million (Bauman, 2017).

Theoretical Framework

Symbolic Interactionism

Symbolic interactionism (SI) (Blumer, 1969; Mead, 1934) is a sociological perspective developed in the early 20th century by American scholar George Herbert Mead. Mead (1934) believed that the individual's development was a social process, as were the meanings individuals assigned to things. People change based on their interactions with objects, and they assign meaning to something to decide how to act. "An object is anything that

can be indicated, anything that is pointed to or referred to" (Blumer, 1969, p. 10). Objects can be classified into three categories: (a) physical objects, such as chairs, trees, or bicycles; (b) social objects, such as students, priests, a president, a mother, or a friend; and (c) abstract objects, such as moral principles, philosophical doctrines, or ideas such as justice, exploitation, or compassion (Blumer, 1969, p.10). The nature of objects consists of their meanings for the persons for whom they are objects. These meanings set how they see the objects, how they are prepared to act toward them, and how they are ready to talk about it.

This study examines how virtual teaching visual arts integration and biology are more favorable or challenging for emergent bi/multilingual high schoolers. Each person uniquely perceives the world, discerning different meanings from personal interactions with various objects. Symbolic interactionism is a theory concerned with how individuals' experiences attach subjective meanings to symbols. In any action, a person constructs meaning through an interpretative process.

RESEARCH METHOD

Setting, Participants, and Sampling Procedure

After IRB (institutional review board) approval to conduct my research, over two months, I implemented a series of visual arts integration activities with ten ninth-grade emergent bi/multilingual students at a mid-sized high school in the southeastern region of the United States. Established in 1972, the school has 99 teachers and a student body of 1,490, many of whom come from low-income and/or immigrant families. The student population is mostly African American (approximately 57%), followed by Latinx (approximately 22%), white (approximately 20%), and Asian (less than 2%).

Research activities took place, via zoom, in a communication skills class that Monday through Thursday (ten sessions). Taught jointly by ESL biology teachers Mrs. B and Mrs. N, the communication skills class serviced Latinx and Asian learners aged 14 to 18 years born in eight different countries. Most of the students have newly arrived in the country. They had very limited writing/speaking skills, so the class was designed to strengthen students' academic English and encourage free expression and sharing of ideas.

Before conducting my research with students, I asked Mrs. B to give me general information about the students I would be working with. I had met Mrs. B three years prior when I conducted a pilot study with bi/multilingual students at that school. A Fulbright Teacher for Global Classrooms, Mrs. B has taught in this school zone for over twenty years and has a deep passion for nature conservation and building strong communities. While carrying out my research, I had a chance to go with Mrs. B to visit some bi/multilingual

students in their homes and saw first-hand her deep connection with the students and her earnest work to help them become problem solvers. Gaining this insight into my students' lives helped me create a real relationship with them and learn how best to help them.

Due to COVID-19, the communication skills class changed from in-person to remote. Fortunately, the school has already equipped students' laptops with Photoshop. However, the students often faced technical issues, requiring me several times to make arrangements to try to fix the problem after class. I attended the Zoom class for all research and visual arts integration activities. At first, the Zoom class was challenging for both the students and me. For example, during the first sessions, most of the students turned off their mics and camera. They used the private chat function to text Mrs. B and the public chatroom to answer questions I asked during teaching. Gradually, as students gained proficiency in Photoshop and felt more connected with me (through online and sometimes in-person interactions), they became active participants in the discussions. I selected 10 to participate. Of these, three students serve as the focus of this study due to specific individual traits: Pedro exhibited skill in visual arts (including Photoshop), Fernando exhibited skill in biology, and Maria exhibited a strong work ethic in both biology and visual arts activities. (All names are pseudonyms.)

Fernando, Maria, and Pedro (All students' names are pseudonyms. are all in 9th-grade biology. Fernando works full-time at a restaurant to help meet his family's living expenses. Pedro and Fernando were both very quiet and shy. Maria was much more vocal, partly because her English was more fluent than the other students, and she was of significant help to me as an interpreter and translator. Fernando's family speaks no English. Pedro lives with his father, sister, and an American stepmother who can help with his homework. Fernando's, Maria's, and Pedro's keen interest and talent in Photoshop enabled them to quickly learn this difficult program.

Data Collection

Research activities included Zoom video recordings of the visual arts integration activities and students' visual artwork, and my artist's journal also served as a data source. I used constant comparative analysis (CCA) (Glaser and Strauss, 1967) to continually compare data: codes to codes, codes to categories, and categories to categories (Glaser, 1998). As a method, CCA is considered synonymous with Grounded Theory (Glaser and Strauss, 1967).

I watched the Zoom videos repeatedly, taking notes and recording salient quotes from Fernando, Maria, and Pedro in my artist's journal. I also recorded my observations, thoughts, and reactions to the activities. I analyzed and reduced the data in my journal to develop my categories by constantly recoding the quotes, observations, thoughts, and reactions. Moreover, student

artwork was coded for my interpretation to determine the implications of integrating visual arts and biology in the field of art education.

IMPLICATIONS

I spent three years in the 9th-grade biology class for emergent bi/multilingual students at the high school where I conducted my research. This is a particular challenge given that the new science standards expect students to display in-depth knowledge and understanding of scientific inquiry. Biology is a complex subject; its concepts can be abstract, and students need more relations between the topics and their daily activities. Moreover, biology becomes more challenging and less meaningful because students typically prepare for tests by memorizing facts rather than understanding the underlying concepts. This poses significant challenges for emergent bi/multilingual students who, in the face of standardized testing and curriculum, are often silenced or marginalized despite the many experiences and knowledge they bring with them.

Based on my pilot study with these students and my experience as a graphic design instructor, I chose to use Photoshop for visual arts activities because it is not only an industry-standard design software but also a new skill for students to use for their future. Fortunately, the school had already purchased the necessary licenses. Access to Photoshop made it possible to create assignments that provided a learning opportunity that one of the more limited, free software programs might not. Gaining skills in this advanced software application can support students in attaining their goals and aspirations and allow them to be bold, expressive, and novel in their project presentation.

In my artist's journal, I created a table that includes "Dos and Don'ts" for technology integration (Photoshop) on the topic of the Interdependent Functions of a Plant Cell (Table 1).

Table 1

Dos and Don'ts of Technology Integration (Photoshop) in My Unit Plan, 2020

Do	Don't
Choose your favorite educational app.	Choose an app you know nothing about
Choose apps that facilitate student-to-student collaboration.	Choose apps that don't match your lesson.
Choose apps that facilitate your and your student's creativity.	Choose unreliable apps.
Choose an app that makes learning fun.	Choose apps that are hard for students to manipulate.
Choose apps that help you enjoy teaching.	Choose apps that take a long time to plan.
Choose apps that save you time.	Choose apps that may result in losing control of the lesson.
Choose apps that reflect your personality.	Choose apps that don't support your teaching style.

The lesson is built around the enduring idea of interdependence, which provokes questions about visual arts and biology. It is a broad, umbrella-like idea that guides students in understanding what it means to be human and live alongside others in the natural world. It also refers to how, often without realizing it, the natural and unnatural world, human and nonhuman, are constantly interacting on even microscopic levels. Furthermore, human beings worldwide have expressed everyday activities, inclinations, and ideas through art that make art meaningful. I selected a depiction from Julia Marshall's Five Ways to Integrate: Using Strategies from Contemporary Art (2010) to create this lesson plan.

Using Depiction to Illustrate the Interdependent Functions of a Plant Cell

Due to COVID-19, my research activities shifted from in-person to remote. The school had already equipped students' laptops with Photoshop. Although I created a lesson plan based on online teaching, students' experiences in an online class were different than I expected because students often faced technical issues, so I had to make arrangements several times to try to fix the problem after class. In addition, some students' lack of access to fast, reliable internet connections proved challenging.

I connected with the students on Zoom for the first time. I was excited and a little concerned about teaching online. When I joined the communication skills class via Zoom, all cameras and mics were off except Mrs. B, so I couldn't see any students' faces or hear any conversation. I felt disappointed and was concerned about how to implement my visual arts integration activities. If students decided to keep their cameras and mics off, how could I encourage them to participate in my visual arts and biology activities? Mrs. B introduced me to the class and what my research was about. I didn't hear any response from the students. Using Zoom's chat feature, Mrs. B privately messaged me that were sending her private texts indicating that they were interested in my research, specifically as it relates to Photoshop skills. She also told me that Pedro typically came to class late, but he arrived on time once he learned we would be doing visual arts activities.

The lesson focused on using depiction (rendering a subject from observation) to illustrate a plant cell's interdependent functions. I started by asking students: Can you think of any nonliving things you need daily? I didn't receive any answer. Then, I explained that certain nonliving things are necessary for living things to survive, such as water, air (oxygen), soil, sun, food, and shelter (home, buildings, schools). Fernando turned on his mic and said, "we wouldn't be alive if there were no air, food, and water." Maria also turned on her mic and said, "we can't survive without a home and food." Pedro texted in English and Spanish in the chatroom that family is particularly needed for survival.

Next, I introduced the work of scientific illustrator Cornelia Hesse Honegger depicting deformed insects found near nuclear power plants (Figure 1) and asked students what they saw in these artworks. Fernando said, “Something happened to these insects. They are not healthy.” He also added that lack of fresh air had affected these bugs. Following Fernando’s comments, I explained that all living things are necessary for a healthy ecosystem and showed students how nuclear waste caused unhealthy bugs. Maria added, "when we smell the dirty air, that causes us to get sick.” I explained that, like an ecosystem, a plant cell needs all its components to live. If any part is damaged, the cell becomes unhealthy. Then, I explained the term “interdependence” as living and nonliving things depending on one another. We often use interdependence to describe complex systems and see how everything is connected. I also explained that students would use Photoshop to illustrate their cell structure and interdependence ideas. Then, the class was over.

Figure 1
Scorpion Fly and Soft Bug (1988), Cornelia Hesse Honegger

The next day, in our Zoom session, all cameras and mics were still off except for Mrs. B. I taught Photoshop’s pencil tools and their functions by sharing my screen. After that, I asked students if they understood the tools or had any questions. I didn’t hear any response. I told Mrs. B that I didn’t know whether or not they understood the pencil tool. She replied that students frequently texted her privately, asking questions in English and Spanish. I asked Fernando to turn on his mic and share his Photoshop screen to explain

the process I had just described. Surprisingly, Fernando went beyond my description, explaining most uses of the pencil tool. Then, I asked him to explain one more time in Spanish for those students who were struggling to understand the content in English. As a reward for his valuable participation in the class, Mrs. B sent him lunch through a door-to-door delivery service. Pedro texted that he had experience creating visual arts with Photoshop. Maria also texted that she understood the process but needed to practice more after class to memorize all the steps. I asked all the students to practice and told them I would be available to answer any questions.

I continued the lesson, opening the class by showing students my drawing of a plant cell and asking them to find another picture of a plant cell on Google that they could use as a guide. I asked students to use Photoshop's pencil tool to draw a plant cell. Again, they texted Mrs. B with questions related to the process of illustrating their plant cell. Fernando and Maria asked to use my sample design for their plant cell since they liked it, but Pedro texted me to say he would create a new plant cell drawing. I felt that spotty internet connections, students' shyness, and lack of Photoshop skills suppressed active participation in the class.

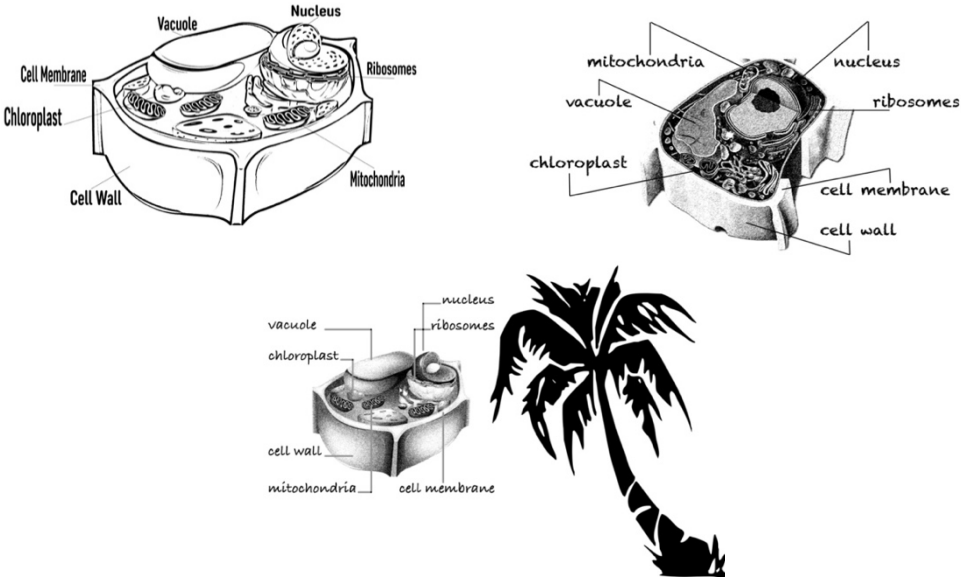
In the next session, students worked on completing their plant cell depiction. All students kept their cameras and mics off, except Maria, who frequently turned on her mic to ask questions about the functions of the pencil tool. She also shared her screen to ensure she was doing the process properly. I texted Mrs. B privately to ask how we could know whether students were working. She used the GoGuardian Teacher app (with the school's permission) to view students' screens. Most of them were indeed practicing with Photoshop. She reported that Fernando was texting Pedro in Spanish to ask questions about the pencil tool. Mrs. B and Mrs. N created a folder in Google Drive that allowed me to share all the class materials with students. At the end of the class, I asked students to share their files with me. I noticed all of them did black-and-white drawings.

On the last day of the lesson plan, I asked students to describe each plant cell component orally and place them in the correct area of the cell. Fernando turned on his mic and identified all the components, surprised at his ability to answer everything correctly. He commented, "Photoshop is cool, and I am proud of my first design" (Figure 2). Pedro continued to use the chatroom function rather than his mic. He also identified some of the components based on Fernando's explanation. Maria could also guess most of them. Fernando seemed to take a leadership role in this session to help others recognize the cell components. When I asked Pedro why he decided to use black and white since he knew how to use color in Photoshop, he texted, "Fernando and I decided to use black and white to have the same design" (Figure 4). Maria turned on her mic, explaining that "I prefer to keep my

design in black and white same as others" and added that, instead of using color, she used a tree to balance her design and be more creative (Figure 2).

Figure 2

Fernando's visual artwork (left), Maria's visual artwork (center), Pedro's visual artwork (right), October 2020



After class, Mrs. B and I discussed my concern that students may need more assistance to develop enough skills in Photoshop to complete their projects. We decided to visit students individually or in small groups. After receiving permission letters from their guardians, I visited some students, including Fernando, Maria, and Pedro. Maria behaved shyly at our first meeting in person, not talking to me. I broke the ice by complimenting the beautiful blue color of her house. She seemed to relax and replied confidently that she loved blue. We sat outside, enjoying the weather while we practiced lessons together by reviewing the ideas of interdependence in plant cells and using Photoshop tools for illustrating.

After leaving Maria's, I visited Fernando's home. My first conversation with Fernando began with him telling me that he has a full-time job at the restaurant to help meet his family's living expenses and how he was looking forward to getting his driver's license. He was very excited at the

thought of having a car one day. He went on to say that he loves biology, and the class activities triggered an interest in Photoshop and how he could use it to improve his knowledge of biology by illustrating and memorizing visual content. We discussed how interdependence helps us to understand the plant cell components and reviewed Photoshop tools for illustration.

The next day, I drove to Pedro's house. I first met with his stepmother. She complimented my project and spoke of Pedro's interest in Photoshop. When I met with Pedro, we had our first direct conversation and reviewed the plant lesson together.

FINDINGS

In analyzing the data, I used constant comparative analysis (CCA) (Glaser and Strauss, 1967) to continually compare data codes to codes, codes to categories, and categories to categories. The findings show that learning new content mediums and skills during visual arts integration activities enhances students' learning process. However, being unable to interact with the students face-to-face slowed everyone's progress, and some students' lack of access to fast, reliable internet connections proved challenging. Additionally, students' social interactions contribute to meaning-making.

Blumer (1969) argues that the meaning of an "object" exists as people make it meaningful through experience in their social interaction; it follows that students' social interaction (chatting to each other) during the visual art-making process resulted in their choosing to design their visual artworks in black and white. Despite Pedro's background in Photoshop, he also created his design in black and white, saying, "Fernando and I decided to use black and white to have the same design" (video recording, 2020). Maria also mentioned, "I keep my design in black and white, same as others" (video recording, 2020). Students' interactions with peers led them to designs consistent with their classmates. Moreover, the students learned biological and linguistic structures to learn to depict plant cells. As the students were assigned to use black-and-white illustrations, they became able to make aesthetic decisions in creating their visual artworks through their social interactions. For example, Maria included a tree "to balance my design and be more creative" (video recording, 2020). The inclusion of the tree to balance the asymmetrical design and to add interest to a black-and-white format indicates that she was able to learn the content, and her new skills make her aesthetic decisions about composition (see Figure 2). Pedro illustrated his plant cell from a "bird's eye view" to "highlight how I wanted to show my plant cell to the viewer aesthetically" (video recording, 2020). Like Maria, Pedro's skills enable him to use a black-and-white illustration from a different perspective (see Figure 2).

Although student laptops were already equipped with Photoshop software, students often faced technical issues, so I had to make arrangements

several times to fix the problem after class. In addition, many of my students had to take care of their younger siblings while their guardians were at work, or they had to work to meet their living expenses. These responsibilities caused them to miss some virtual class sessions, and I had to arrange make-up times to help them stay on track with their classmates. For example, Fernando explained that "the online class had some challenges such as online connection, but I prefer online courses since I can go for my job after that" (video recording, 2020). Pedro also stated, "Internet connection, Photoshop software issue, online class, learning online Photoshop are challenges for us as language learners, but I prefer online class to stay at home and help family duty" (2020). Maria also mentioned, "I wish we were in the class for these activities. It could be more understanding, interaction, and sharing our work, but I prefer to stay home to take care of my house stuff" (2020). The findings indicate that face-to-face classes can benefit emergent bilingual/multilingual students, as they receive additional opportunities to practice speaking and obtain valuable feedback from their teachers regarding their coursework. However, providing more flexible class schedules and alternative modes of instruction could assist students in overcoming the numerous obstacles they face in supporting their families.

By incorporating visual arts activities into biology instruction, educators can help to enhance learning by providing multiple modalities for students to engage with the material. Visual aids and digital media can help to make complex concepts more accessible and engaging for students and provide a means for students to apply their knowledge in a creative and meaningful way. Furthermore, these activities can help to promote critical thinking and problem-solving skills by providing students with opportunities to explore and manipulate biological concepts in a virtual or digital environment. By doing so, students can better understand how these concepts work and how they can be applied in real-world contexts. Overall, virtual visual arts integration and biology activities can enhance learning in biology by providing multiple modalities for students to engage with the material, promoting critical thinking and problem-solving skills, and providing a means for students to apply their knowledge creatively and meaningfully.

DISCUSSION AND CONCLUSIONS

Symbolic interactionism (Blumer, 1969) reframes how we teach bi/multilingual students. My study shows that EL students can benefit from face-to-face classes because they receive more practice speaking and benefit from their teacher's advice on their tasks. Nevertheless, more flexible class times and delivery methods may help EL students meet the many challenges created by the need to help provide for their families. Moving to remote teaching necessitated making home visits, which taught me that an effective

teacher for emergent bi/multilingual students understands their home situations, economic status, and feelings of marginalization and homesickness. As an immigrant, I should aim not just to teach the subject matter but to help students solve larger problems.

The research suggests that integrating arts and STEM subjects can positively affect student learning and engagement. However, this approach may pose challenges for emergent bilingual/multilingual high schoolers who are still developing their English language proficiency. To address this challenge, educators can implement strategies supporting language development while promoting learning in STEM and the visual arts. For example, using visual aids and hands-on activities can help to make STEM concepts more accessible to students whose English is not their first language. Additionally, educators can provide scaffolding and support to help students understand complex vocabulary and concepts.

Teachers and educators can use visual arts integration as multimodal resources in virtual visual arts, science, and communication skill classes to provide emergent bi/multilingual students with multiple means to represent and express their connection ideas. Teachers and educators should be familiar with the importance of context in the ways that virtual visual arts integration is implemented. For example, additional constraints and pressures, such as limited time and lack of access to fast, reliable internet connections in online classes, impact how virtual visual arts are implemented.

Visual arts and science educators can join forces with colleagues to provide students with STEAM avenues promoting 21st-century skills (Partnership for 21st Century Skills, 2011). For example, Photoshop can create projects that elicit emergent bi/multilingual personal meanings and showcase them to students' guardians, school personnel, and the wider community. In these noncoercive educational settings, emergent bi/multilingual students see themselves reflected in their visual artworks and curricular materials (Cummins, 2001). Moreover, by implementing strategies that support STEAM learning, educators can help ensure that all students have access to high-quality education that prepares them for success in the 21st-century workforce.

While much research focuses on what the visual arts bring to STEM subjects, I am also interested in what virtual classes in STEM might bring to the visual arts for emergent bi/multilingual students. I hope that future interdisciplinary and STEAM education research will demonstrate attentiveness, synergy (Bequette & Bequette, 2012), and reciprocal benefits across all disciplines, including the visual arts.

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