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Xiaoning Chen

Mark Newman

Vito M. Dipinto

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# **Investigating NCE Preservice Candidates and Graduates' Visual Literacy Practices in Middle and High School Science and Social Studies Classrooms**

Xiaoning Chen, Mark Newman, Vito Dipinto

## **Abstract**

The study investigates whether secondary education science and social studies candidates transferred what they learned about visual literacy in their teacher preparation program to their practicum/student teaching classrooms. The study included qualitative and quantitative methods to document the candidates' visual literacy knowledge and practices.

The findings indicate that the candidates did employ visual literacy strategies as visuals had already been regularly used in their classrooms. But, they had limited success in implementing the strategies learned in their methods courses. In addition, they showed a good working knowledge of what visual literacy is and acknowledged its value in the classroom. They also stated that the use of visuals and visual literacy would be integral parts of their teaching in the future.



“And he [one of the students with an IEP] came up to me afterwards and he was like, Mr. Cox, that space between the beds, it could also be like the Atlantic Ocean. Yes, that’s exactly what we were trying to get to... [F]rom seeing that visual he was able to tie everything that we had been talking about together.”

—Social Studies Preservice Teacher  
Education Candidate

Figure 1 Political cartoon

### PROJECT OVERVIEW

As teacher educators, our primary goal is to equip preservice teacher education candidates with research-based and field-tested practices that they can implement in their future classrooms. The cartoon and comment above offer insight into this study, showing that candidates’ use of visuals and visual literacy strategies were influencing learning. But, how did this use reflect what candidates learned about visual literacy in their coursework? This question animated the study which had the following goals:

1. To investigate the ability of NCE Secondary Education (high school) science and social studies preservice candidates to transfer what they learned about visual literacy to classroom instruction in practicum and student teaching.
2. To assess their knowledge of visual literacy.
3. To identify ways to improve visual literacy instruction in Secondary Education courses.

Three faculty researchers recruited six pre-service Secondary Education candidates to examine how they were able to transfer what they learned in their coursework to their practicum and student teaching. Initially, three science and three social studies candidates agreed to participate, but one social studies candidate dropped out of the program. As a result, five candidates participated. The faculty and participating candidates came from a teacher preparation program at a private, non-profit university in a large metropolitan area. The candidates taught in schools throughout the metropolitan area, typically in diverse settings.

The research team employed a case study method that included surveys, interviews, classroom observations, and the collection of pertinent materials to:

- assess candidate knowledge of visual literacy (definition, role in teaching and learning);

- assess candidate ability to apply visual literacy practices learned in their methods course in their practicum and student teaching classrooms. As indicated by the above quote, the practices stressed meeting the needs of all students; and
- assess how and why candidates planned to use visuals and visual literacy in future teaching.

A related aspect was identifying visual literacy strategies that were already in use in the schools where the candidates taught.

## LITERATURE REVIEW

A common definition for visual literacy does not currently exist. Combining the ideas of several scholars, we can define visual literacy as the ability to make sense of information presented in visual images and to use visual formats to express ideas (Baker, 2015; Newfield, 2011; Rowsell, McLean, & Hamilton, 2012, p. 444). The use of visual literacy in classroom settings creates opportunities for viewers to discover, analyze, and critique meaning embedded in the interplay of visual and other modes (Rowsell et al., 2012).

Visual literacy is basic to all disciplines. The study here focuses on science and social studies. As reading and comprehending a highly abstract science diagram involves different skills than reading an everyday image (Lowe, 2000), it can be challenging for students to construct meaning from visual representations found in science texts and tests (McTigue & Flowers, 2011). Therefore, “it is essential that today's students develop the general visual literacy skills required for dealing with scientific graphics” (Lowe, 2000, 2<sup>nd</sup> para.).

Similarly, in social studies, visual literacy plays an important role. Suh and Grant (2014) noted the “visual sources play a unique role in testing the historical thinking skills of students because images are able to simultaneously show many different details, which must be inferred or carefully observed” (p. 74). In geography, Thornes (2004) has suggested that a need exists to “totally redesign the teaching of the production and interpretation of geographical visual images so that students are taught the building blocks of powerful images analysis and deconstruction” (p. 788).

While visual literacy is important to general education students in various disciplines, it also is critical for culturally and linguistically diverse learners and students with special needs. In exploring the use of multimodal materials (e.g., advertisement images) with English as a second language learners in a junior high school, Ajayi (2009) argues that multimodal texts offers diverse students opportunities to demonstrate their personal interests and understandings that reflect their social and cultural experiences. In addition, they foster critical literacy practices that empower these students. Graphic novels, with the integration of significant visual support and comprehensible texts in manageable lengths, help develop critical literacies for English language learners (Chun, 2009; Steiner, Peralta, & Boothe, 2014) and provide them with “multiple ways of accessing content, create meaning and to communicate ideas” (Steiner et al., 2014, abstract).

Given that visual literacy promotes critical thinking, Zambo (2009) suggests that while all adolescents benefit from visual literacy instruction, it is a must for adolescents with disabilities as it helps them critically examine and reflect on how images may position people with disabilities in disadvantage and perpetuate social injustice. Nikolarazi, Vekiri, and Easterbrooks

(2013), in their study of how deaf children aged 8-12 used visual resources to aid their reading comprehension, emphasize the importance of “mediated instruction in ‘visual literacy’ skills” (p. 458) that enables students to strategically use visual aids to enhance reading comprehension. Students’ literacy skills, such as reading comprehension, play a critical role in learning science content at the secondary level (Scruggs, Brigham, & Mastropieri, 2013).

Although the research has yet to generate conclusive findings that younger students recurrently benefit from visual literacy instruction in science learning, the results with adult learners are more consistent (McTigue & Flowers, 2011). Yet, there is a gap in empirical studies that explore the visual literacy instruction in the content area of science in diverse middle and high school settings (e.g., McTigue & Flowers, 2011). In social studies, a similar situation exists.

The study builds on a previous study that examined the potential impact of teachers’ visual literacy practices in supporting middle and high school students’ understanding of visually represented scientific concepts and processes. The focus of this study shifts from the in-service teachers to the pre-service candidates in the teacher education programs.

## **THE STUDY**

The three researchers were faculty members from the same private, non-profit university in a large metropolitan area of the US. All three taught courses in the teacher preparation program. One researcher was the science methods instructor who taught all the participating teachers in their teacher preparation program, was their professor in their student teaching seminar, and their NLU student teacher supervisor. The second researcher was the social studies methods instructor. The other researcher taught the ESL methods course. None of the researchers was acquainted with any of the participants before the start of the study.

The faculty team sought answers to the following research questions:

1. How and why were the Secondary Education preservice candidates able or not able to transfer what they learned about visual literacy to teaching in the classroom?
2. What did the candidates know about visual literacy (definition, role in teaching and learning)?
3. What were their plans to use visuals and visual literacy in their future teaching?

## **THE PARTICIPANTS**

A convenience sample was used to recruit the participants. While six candidates (three each in science and social studies) were initially recruited, one social studies candidate dropped out of the program. The remaining five were male. Their names (pseudonyms) and teaching positions will be described in the following paragraphs. An important point is that the Secondary Education Program employs a linked placement, meaning candidates teach in the same school and classrooms for practicum field experiences and student teaching. In addition, the methods course includes the practicum experience.

The science candidates were Luke, Adam, and Nick. Luke was placed in a suburban high school with an international curriculum to improve students’ abilities to read and use graphics in science. The school has a total of 1622 student population. The demographics break down into 52% Latino, 44% African American, and 1% Caucasian. 62% of the school is classified as low income. The school attendance rate hovers around 78%, well below the state average of 94%.

The dropout rate of 2%. Nearly 28% of students are chronically truant. 13% of students are English learners. 64% of students graduate within 4 years.

Adam was placed in a suburban public 4-year high school. The total attendance at the school is approximately 2300 students with a racial make-up of the student body consisting of 25% Asian, 4% black, 16% Hispanic, 51% white, and the remaining are some other single race or a mixture of multiple races. Approximately, 27% are from low-income families, 17% are on an IEP, 4% are limited in their English language proficiency, and 1% is chronically truant or homeless. This make-up shows a highly diverse student body.

Nick was placed in a public high school with an enrollment of 2010. There are about 75% White, 15% Asian, 5% Hispanic, less than 1% Black, and the remaining 3% are of two or more races. The school is in an affluent area. Only 6% of students are low income and less than 1% are Limited-English-proficient. About 12% of students have IEPs. The school offers a variety of science elective classes including Anatomy and Physiology, Forensics, Applied Science and Technology, Materials Science, Brain Studies, and Plant Science. The school also offers a variety of extracurricular activities including athletics, academic clubs, and performing arts. Some of the science-related clubs include a Science Club and Science Olympiad.

The social studies candidates were Tom and Kevin. Tom was placed in an urban high school with an International Baccalaureate program. It enrolls 1,300 students of whom 78.2% are low-income and 14.8% are diverse learners. Demographically, over 80% of the student population comes from minority populations, with Hispanics being the most populous ethnic group. Nine percent of the students have limited English language capabilities.

Kevin taught in a suburban high school with an enrollment of 886 students. Thirty-eight percent of the students come from minority backgrounds and 34% are low-income. The high school offers advanced placement classes.

## **METHODS**

This is primarily a qualitative study with some quantitative aspects that describes how and why the pre-service candidates used visual literacy practices in science and history teaching and learning. The data collection occurred during the 2017-2018 school year. Data came from the following four sources:

1. A survey at the beginning of the study that asked candidates about their knowledge of visual literacy, in what courses they experienced the greatest instruction on visual literacy, predicting how easy it would be to apply what was learned about visual literacy in future teaching, use of visuals and visual literacy strategies in their practicum classroom, and what challenges were anticipated in incorporating visual literacy into practicum and student teaching.
2. An interview at the end of student teaching to review their opinions on the role visual literacy plays in teaching and learning, their experiences in the classroom with visual literacy instruction, and any plans to use visual literacy in future teaching.
3. Two classroom observations to gain insight into the use of visuals and visual literacy in the classroom. For social studies, the observations were in the same class to gauge any changes over time. In science, the researcher was also the NLU student teacher supervisor. There were a total of 6 classroom observations one of which was dedicated to observing the use of visual literacy in secondary science teaching.
4. Collection of relevant lesson plans, handouts, and any other materials.

A case study method was used to examine each candidate's visual literacy practices in the science or social studies classroom. The interviews were transcribed for analysis and triangulation with the survey and classroom observation data. The field notes regarding the observations were documented and analyzed by all three researchers. The curricular materials collected were reviewed as part of the triangulation. Key words related to visual literacy practices from all data sources were identified to develop categories and themes.

## FINDINGS

The findings provide tentative answers to the research questions and also identified other areas related to the type of visuals used, the project timing, visual literacy practices in the schools, and student attitudes in using visuals.

Regarding findings that answered the research questions, the candidates:

1. Implemented visual literacy strategies, but their ability to transfer much of what had been learned in coursework was limited. The timing of the study occurred in the second half of the school year. The social studies candidates were required to either follow the routines for using visuals established by their cooperating teachers or they could somewhat “tweak” them to include ideas and strategies learned in coursework. In the case of science candidates, the cooperating teachers encouraged flexibility and innovation in their day to day teaching.
2. Had a solid, shared working definition of visual literacy. Providing a shared definition was a concern in a previous project, so it was stressed that candidates in both science and social studies define visual literacy in the same way. The methods courses focused on instilling that visual literacy was the “ability to read, make sense of, and create visuals.”
3. Planned to make visual literacy a regular part of their future teaching. The candidates experienced success both in using visuals in teaching and in employing visual literacy strategies. In part, this was due to the cooperating teacher's integration of visual literacy in teaching on a regular basis—social studies-- or the nature of the subject matter—science.

Other findings focused on the use of visuals and visual literacy in the schools:

1. Use of visuals was prominent and integrated within the routine of teaching and learning. In social studies, static images dominated while in science, videos, schematics, models, and simulations (both electronic and non-electronic) were used when appropriate. Graphic organizers also were used regularly
2. Candidates observed cooperating teachers employing visual literacy strategies to a certain degree but there was no indication that a well-conceived instructional strategy was in place or that a progressive learning sequence was being used. Rather the same or similar activity was always employed at what seemed a static learning level. In addition, there was no evidence of differentiation or accommodations for English Language Learners or students with special needs.

A third level of findings concerned student attitudes towards using visuals:

1. Students like visuals and generally preferred them to printed texts.
2. For ELL and special needs students, visuals motivated learning. They could more easily read and comprehend a visual.

The discussion below provides more detail on the findings. It is organized by research question. The other findings on the use of visuals and visual literacy in schools and student

attitudes are integrated into the research questions discussion as they are pertinent to those findings.

### Implementing visual literacy strategies

The participating candidates were able to implement visual literacy strategies to a certain degree, but their ability to transfer much of what had been learned in coursework was limited by other contextual factors. For social studies, the general finding is that the candidates were not able to transfer much of they learned about visual literacy in their coursework to the classroom. In science, the general finding is that the three candidates were able to include some aspects of visual literacy that were discussed in the secondary physical science methods course during a number of their practicum lessons.

### *Curricula changes in methods courses*

Based on the findings from last year's study of graduates of our secondary teacher preparation program, several changes were made in the curricula. In the social studies methods, a strong emphasis was placed on clearly defining visual literacy. The other revision was to attach a higher level of importance to a variety of visual literacy strategies.

The secondary education physical science methods course was revised to explicitly include the language of visual literacy in the teaching and learning of science. The idea that virtual labs are direct and obvious examples of a visual narrative is one concept that was emphasized. Often times, science teachers take it for granted that students explicitly incorporate the visual narrative into their understanding of the science concept. However, by using terms like composition, context, continuity, background and foreground, and the use of text both written and auditory are some of the ideas that were discussed as part and parcel of various teaching methodologies in physical science methods. The other revision to physical science methods is a specific assignment for teacher candidates to design and produce a lab safety artifact utilizing virtual literacy skills.

### Cases of social studies candidates

Based on the survey, interviews, observations, and instructional materials, the social studies candidates regularly implemented visual literacy activities, stressing static images, especially political cartoons, maps, and photos. They also provided handouts that included documents and graphic organizers that were completed in whole class, groups, or individually. Paintings, charts, and tables also were featured. Both candidates stated that an inquiry method was used. Tom noted that visuals were typically part of DBQs (Document-Based Questions) while Kevin generally employed visuals in PowerPoints connected to lectures and discussion.

The observations for Tom occurred in a 10th grade pre-International Baccalaureate (IB) class in U. S. History up to 1877. Performance in this class determined whether students advanced into the IB program. It followed a well-defined curriculum and inquiry model. Each lesson used a handout packet that had been developed by the cooperating teacher, with some input from Tom. According to the survey, Tom used static visuals and graphic organizers almost daily. Multimedia visuals such as video were used almost every week. Students had much experience working with visuals.

For example, Tom guided students to study the causes of the Civil War using a DBQ (class observation, February 15, 2018). The essential question was: What were the economic, political,

and/or social differences between the North and South that eventually led to the Civil War? The class focused on the election of 1860. Almost the entire session was devoted to examining visual secondary primary sources including a picture of the four candidates, a map of the results of the election of 1860, a pie chart of the population of the United State in 1860 divided into the Union and Confederacy, and a bar graph of the number of soldiers in the Union versus the Confederate armies between June 1861 and January 1865 (Appendix A).

The analysis of each visual followed the same pattern. Each visual had a question that guided the inquiry. Students read the visual, discussed ideas, and then reached a synthesis. Whole class inquiry was used to analyze the picture of the four candidates and the election map. Students in small groups of four examined the other visuals, reporting out their findings. As a conclusion, all the findings were synthesized.

Students were familiar with studying visuals and student engagement was high. The visual literacy strategy consisted of Tom asking questions, facilitating probing to identify details and to make inferences about the visual, and synthesizing findings. As a result, it was not well-defined but did involve high level skills. The second class observed used a similar approach but was devoted exclusively to group work.

An informal conversation with the cooperating teacher confirmed that the process used by Tom represented the sole visual literacy strategy employed in the class. It also hindered Tom from applying other strategies learned in his coursework. Asked if he applied visual literacy strategies in the classroom besides those used by the cooperating teacher, he said, “No, I don’t think I have done anything very different. Different source materials, but the strategies are about the same.” (Interview, February 20, 2018)

Tom described how the cooperating teacher used a scaffolded approach for the DBQ. Generally, it began with reading basic content in a photo or map and then moved to making connections to the learning, the textbook, and other sources. The last task was writing an essay to an open-ended question. A graphic organizer was used almost every time as part of the visual literacy strategy. That description also fit what Tom did in the classrooms.

But, his education on visual literacy had provided Tom with more ideas and practices. Referring to his social studied methods course, Tom stated, “I was given the most amount of information on topic of visual literacy and more importantly I was given a variety of examples of how to utilize it in the classroom.” In the interview, he expanded upon his learning explaining:

First and foremost, I learned there are different levels to visual literacy. You can’t just ask kids to identify things. You gotta go past just point and look. In order to really attain visual literacy there has to be some connection to prior knowledge. And I learned how to do that. (Interview, February 20, 2018)

While teaching allowed Tom to have students delve deeply in a visual, the Q and A strategy was applied consistently in the same way. There was no strategic design to alter the process over time to adjust to student learning, as was evident from the student work seen in the observations. Nor was any other visual strategy employed.

Kevin had a somewhat different experience. While he did observe visuals being used in the classroom, more than three times according to the survey, Kevin did not see the cooperating teacher employ a well-defined visual literacy strategy. “I did not really see much of the teaching, but I did see questions that would make them think about it,” he explained, “But I did not really see them go step-by-step, here’s how you need to do it. But I did see them ask questions about what did you see in this picture and kind of progress from there.” (Interview, April 26, 2018)

Because it did not have to follow the same structures as the pre-International Baccalaureate course Tom taught, Kevin had more leeway in designing classes. But, given the lateness in the school year, he adapted routines already introduced by the cooperating teacher.

In the two classes observed, a similar organization was used. The class opened with a brief revisiting of previous learning. Next, there was a Socratic method lecture/discussion using a PowerPoint that had students analyze various texts and record findings on a graphic organizer. The remainder of the class was group or individual work to analyze documents and complete the graphic organizer. Kevin acted primarily as a facilitator, using questions to prompt answers in the Socratic lecture/discussion and consulting when students worked individually or in groups.

Regarding graphic organizers, Kevin typically accessed templates on the internet, but also developed some of his own. He used a graphic organizer template from the Standard History Education Group for his class on the Dust Bowl (retrieved from [http://brookscollegeprep.org/sites/default/files/pictures/dust\\_bowl\\_lesson\\_plan.pdf](http://brookscollegeprep.org/sites/default/files/pictures/dust_bowl_lesson_plan.pdf)). Apparently, he developed his own organizer for studying U. S. entry into World War II (Appendix B).

In teaching the class on U. S. entry into World War II, Kevin opened with the cartoon (Figure 1) shown at the beginning of this report (class observation, April 29, 2018). The discussion of the cartoon followed a similar pattern of the previous class observed and the approach used by Tom. Questions guided the reading and analysis of the visual leading to a synthesis. High level visual literacy skills were involved. But there was not a well-plotted progressive sequencing learning.

A Socratic lecture/discussion employing a PowerPoint that showed pertinent visuals followed. He surveyed various topics from the Tripartite Pact that created an alliance among Germany, Italy, and Japan (denoted by flags), the cash and carry act with text accompanied by a picture of money, Selective Service Act with military logos and a tank, Pearl Harbor (no visual), a map of Pearl Harbor, and the declaration of war with a photo of President Roosevelt. The visuals were largely illustrations, but Kevin used questions to have students connect the visual to the text shown on the PowerPoint. The students did examine the map of Pearl Harbor.

Following the general class practice, the remainder of the class involved group work with a packet of print documents and a graphic organizer on “The Home Front—Mobilizing for Defense.” Students read the documents and completed the graphic organizer as Kevin consulted with them as needed. The graphic organizer was a basic type that provided spaces for inserting information on topics.

The visual literacy strategy was applied consistently as described whether it involved whole class discussion or desk work. In one observation, a research member saw that two students were largely not engaged. Asking Kevin about them, he explained that the level of instruction was too low for the abilities. They were likely bored.

Kevin recognized the need for differentiation but as a student teacher, he did not really know how to design something for this class. In part, the difficulty related to the fact that at least one student had an IEP and two others were foreign exchange students. Designing differentiated activities was complex and difficult, especially for a student teacher coming into the class in the second semester.

As had been true for Tom, Kevin was not able to implement much of what he learned about visual literacy in his coursework. Two inhibiting factors were the lack of implementation of a well-defined visual literacy strategy and the established class routine. As noted above, Kevin did not see much teaching that used a visual literacy strategy beyond a question and answer approach.

He also commented that using visuals was prevalent. He stated that, “I like to use a lot of different visuals, especially in PowerPoints. That’s kind of how they do the notes and lectures here.” Despite the regular use, students still had difficulty reading and interpreting visuals. He explained:

So with my lesson on Monday about propoganda I really tried to have them look at it without any direction at first to see what they thought and then try and answer a few questions. If they were struggling with it, then I would kinda go into, alright, let’s look as the details. Look at their hands, a couple of them have rings on them. How would that change things? You know, really kinda picking out those details to see how that might further things a little more. (Interview, April 26, 2018)

It seems Kevin was able to integrate some of what he learned in his coursework. Like Tom, he had learned most about visual literacy in his social studies method course. The teaching about visual literacy had been done through activities. “We went over a number of different visuals whether text, videos, photographs, kind of the whole gambit. And just kind of taught through Bloom’s Taxonomy, you know, what are the very basic things you see, identify all the way up to analyze and create.” (Interview, April 26, 2018) This progression was evident in his teaching as the inquiry into the cartoon on World War II shows.

He also used a graphic organizer from the Stanford History Education Group that involved student practicing higher level skills. This handout included various print documents that students would read, answering questions on the graphic organizer. After reading selected documents, the organizer had students develop an initial, second, and final hypothesis, supporting each one with pertinent evidence from the relevant documents.

Nonetheless, Kevin’s experience was similar to that of Tom. He did have students delve deeply into a visual using the same Q and A strategy every time. The process was not altered over time to adjust to student needs. Nor was he able to employ a different visual literacy strategy.

In summary, the two social studies candidates were limited in demonstrating their ability to transfer the variety of visual literacy strategies learned in the coursework to their student teaching as they entered classrooms where the routines for using visuals had already been well established.

#### Cases of science candidates

It was evident from the class observation and interview data that the science candidates had success in transferring what they learned about integrating the language of visual literacy to visual narrative in their teaching. In discussing the science class where Luke was observed to choose a specific cloud image to engage the students’ imagination, he explained that the reason that he chose this cloud image (Figure 2) was that he expected his students would imagine what it might be like to be on this cloud. He continued to explain that this choice and the other cloud lexicon slides were framed by his understanding of context and how the image uses foreground and background to engage the viewer’s imagination (personal communication, 4/7/2018)



Figure 2 What It Might be Like to be on the Cloud?

Working with 11<sup>th</sup> grade students on the topic of sound, Adam asked them to tell the “story” of the Doppler Effect using the image shown in Figure 3.

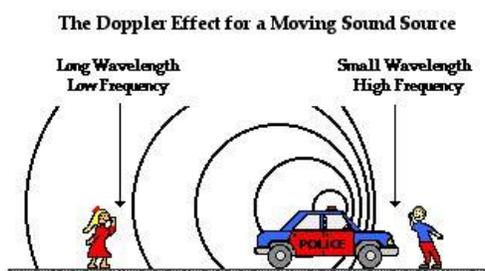


Figure 3 The Doppler Effect

He asked the students to break down the process into “scenes” in this visual narrative. Most students were able to describe the Doppler Effect from this visual accurately for a fixed observer but other perspectives like what it would be like to be in the car were not considered because the visual narrative seems to have a stationary observer as the only “protagonist.”

The three science candidates did a specific assignment to design and produce a lab safety artifact utilizing virtual literacy skills in the science methods course. Although the three teacher candidates did use some of this information in their student teaching, it appeared to be a side note rather than a “planned” focus. During observations and the interviews, none of the three science candidates expressed the use of these skills when designing their lessons in student teaching.

For example, Luke commented that he tried to present cloud types as a visual lexicon rather than one of the descriptive texts. However, he did not comment on how he approached the design of this “visual cloud lexicon.” (personal communication, 4/7/2018) Adam routinely emphasized the visual narrative in his lessons on the Doppler Effect; however, he too, did not ask students to use a specific visual literacy skill to interpret the visual narrative (class observation, 4/16/2018).

Nick tried to provide a template on the white board to assist students in “storyboarding” their problem-solving skills in their presentations (class observation, 4/19/2018). The first step/scene is to present a visual (actual or schematic) representation of the conditions stated in the problem (1). This diagrammatic visual was put at the top of the white board. Next, recording what information is known and what is being asked to find (2). These are placed flush left below the

diagram. The next step/scene is to list the possible equations that could be used in solving the problem (3). These are placed to the right of the knowns and unknowns. Finally, in the center of the white board is the systematic solution to the problem (4). Visually the white board looked something like this:

		XXXXXXXXXXXXX (1)
XXXXXXXXXXXXX (2)	XXXXXXXXXXXXX (3)	
XXXXXXXXXXXXX (4)		

Students who followed this template either by rote or conceptually were able to communicate to their classmates the most effective way to solve the problem. However, when Nick provided feedback to students on their white board presentations, he did not comment on the use or absence of this visual template.

Regarding the specific use of visual literacy language introduced in the secondary science methods course, the preservice candidates attempted to use this language in their student teaching. However, each of the teacher candidates remarked on how difficult it was to do this since most of their students have had very little instruction on how to read informational texts like the ones used in science.

#### Defining visual literacy

A finding of the previous research residency project was that participants did not have a clear definition of visual literacy. Changes were made to the science and social studies methods/practicum courses to ensure that candidates understood what visual literacy is. The common definition is that visual literacy is the ability to read, make sense of, and communicate with visuals.

Regarding social studies, the comments above by Tom and Kevin indicate that not only do they understand what visual literacy is, they also recognize what is involved in helping students become visually literate. Tom commented that visual literacy has different levels and that it involved going beyond identifying things. He also stressed connecting to prior knowledge. Kevin talked about climbing Bloom's taxonomy. In the interview, he said, "I think it gives kids something to connect with and gives a deeper thinking." (Interview, April 26, 2018). The quote accompanying the cartoon at the beginning of this report provides an example of Kevin's thinking on what visual literacy is.

The science candidates indicated in the survey that even though some of them were exposed to the concept of visual literacy in a few other courses, it was in the science methods that they came to a solid understanding of what visual literacy was and how to apply it in science teaching and learning. Nick's comment that "visual literacy is being able to get information out of an image, or some sort of graphic, and understanding the concepts that they are trying to be portrayed through it" (personal communication, Apr. 18, 2018) showed that making sense of visuals is a big part of visual literacy. Luke suggested in the survey that visual literacy was more than just understanding. Instead, other aspects of visual literacy included "moving students from understanding the information contained in the visuals to understanding why the creator chose this medium and what their agenda is in creating this particular artifact." (survey, Feb. 27, 2018).

### Future plans on using visual literacy in teaching

All candidates indicated that visual literacy would be a foundation of their future teaching. The preparation in coursework combined with practical experience in the classroom teaching during practicum and student teaching apparently had a profound effect on their ideas about teaching and learning. Seeing how their cooperating teachers used visuals and teaching visual literacy strategies was another way for the candidates to confirm the important role visual literacy played in teaching and learning.

All candidates strongly agreed that visual literacy would be an important component of their future teaching. The survey asked them: “Based on your experiences in the practicum field experiences, how easy would it be for you to apply what you have learned about visual literacy into your future teaching?” They answered: “somewhat easy,” “easy,” or “very easy.”

Asked to explain their answers, Tom wrote in the survey that, “I often use primary source analysis in teaching history and visual literacy is excellent for maps, photos and other image based learning.” In his interview, he said, “I think it is going to be a driving force behind most of my curriculum planning. I think it is really a great way to foster discussion and engage students with content.” In his survey, Kevin noted the important role that visuals play in teaching and learning, explaining, “Visuals are an important and commonly used tool for teaching, Visual literacy just focuses in on how and why to use the visuals, making it more effective.”

Outside of accessing sources, neither of the social studies candidates saw any major challenges to integrating visual literacy into their future teaching. But they did identify some needs. Tom thought the biggest difficulty was findings visuals that appealed to students. In his interview, Kevin said he was looking for better ways to use videos that went beyond a “reading guide or video guide where you spell everything out” (Interview, April 26, 2018). Kevin was talking about ways that would more deeply engage students in independent learning.

All three science candidates indicated in the survey that due to the nature of subject matter (e.g., physics, earth and environmental science), visual literacy would be easy and applicable to apply what they had learned to future teaching. Further, they frequently observed their cooperating teachers used and created multiple types of visuals in teaching. While Adam noted that he often observed visual literacy strategies being explicitly taught, Nick indicated that he had never seen his cooperating teacher directly teach visual literacy skills.

In addressing challenges to integrating visual literacy into their future teaching, Nick did not anticipate any. Interestingly, Adam shared the concern on his drawing skills as he saw these skills were critical to visual literacy in science education. Luke, however, unveiled the core of visual literacy by stating that “one of the biggest challenges will be moving students from understanding the information contained in the visuals to understanding why the creator chose this medium and what their agenda is in creating this particular artifact” (survey, Feb. 27, 2018).

In addition, both social studies candidates connected future use of visual literacy to meeting student needs. They stressed that visual literacy activated student engagement, fostering discussion. Kevin suggested students prefer visuals to printed text but that using both could improve learning. He explained that:

Actually kids prefer, I feel like they prefer visual more than actually reading a text. They feel like reading a text is kind of boring. So I find that visuals kind of will help enhance it. You know if we got the text and we got the visuals next to it that you can match up with it. They may just remember it a little more. (Interview, April 26, 2018)

Asked about the impact of use of visuals and visual literacy on English Language Learners and students with special needs, both social studies candidates described positive effects. Tom stated in the interview that:

For the EL students, it has been really, really helpful. When we work with images, they are so much more engaged and, I mean, part of that is they can see rather than have to read a text. The rest of the students, the same thing, but to a lesser degree. (Interview, February 15, 2018)

His comments provide further evidence on how visual literacy can improve engagement for all students.

Kevin connected his comments to two foreign exchange students in his class and to his own learning style. While the foreign exchange students had gained proficiency in English, they had still needed help with vocabulary.

Referring to assignments, Kevin noted, “If they have a choice between like drawing something or writing something, they usually go with drawing. I can tell I do like having that option. It’s kind of knowing your strengths.” He continued, stating that people learn in different ways and that he is a visual learner. Connecting that thought to his foreign exchange students and, by extension, all English Language Learners, he explained that visual literacy practices have been beneficial. “The English language can be really tricky especially in a text but if you look at a picture you talk about how it connects to things so it’s easier to understand it” (Interview, April 26, 2018).

Three science candidates also noted how visual literacy was an effective way to support English Language Learners and students with special needs. For instance, Nick commented that

I think it [visual literacy] definitely can help explain the concept if there are students with language difficulties. A picture doesn't have any words in it if it is just a picture with no words. So looking at that it can help them understand the concepts and reinforce the concepts. They can think about the picture in whatever language that’s most comfortable for themselves. And if you highlight portions of it, maybe say in a way that’s clear to all students then that can them get through the concept, help everybody. (personal communication, 4/18/18)

#### **SUGGESTIONS FOR IMPROVEMENTS IN SECONDARY EDUCATION PROGRAM**

A major purpose of the Faculty Research Residency is to provide ideas based on evidence from school classrooms on how to improve NCE teacher preparation programs. As noted above, the previous research residency indicated a need to ensure that candidates could define visual literacy, that they had a common definition.

Based on the current project, it seems that the candidates are exposed to the concept of visual literacy in several courses. They include content area literacy and methods and materials for English Language Learners prior to the methods courses. Nonetheless, in those courses, the candidates were not provided with a clear definition or a framework to increasingly develop their knowledge on the concept. Thus, one recommendation is to develop a common definition for visual literacy among NCE faculty and incorporate it in the teacher preparation coursework. This way candidates can build upon their knowledge on visual literacy progressively as they advance in the teacher preparation programs.

Confirmed by data from the candidates, the curricula in the methods course does prepare them well to teach visual literacy. But, current practices in schools somewhat work against implementing those practices in the classroom. In social studies, a vague strategy was consistently employed based on having students answer questions, discuss the answers, and complete a graphic organizer. There was no progressive sequence or differentiation witnessed by the candidates, nor any major deviation from the standard Q and A format. In science classrooms, a similar situation existed. While visuals were used prevalently, the candidates did not consistently observe how visual literacy strategies were explicitly taught. Neither was there a progressive sequence clearly outlined in the curriculum.

In an informal conversation with a social studies cooperating teacher, a project researcher asked about progressive skill sequencing. The teacher acknowledged that she had not considered that option but thought it was a good idea.

The first suggestion for improvement is to better inform cooperating teachers about the more robust visual literacy preparation provided candidates. If the option arises, perhaps, provide professional development for the teachers. In this way, cooperating teachers will be more aware of visual literacy and be more able to provide candidates opportunities to practice what they have learned in practicum and student teaching.

A second area of improvement concerns visuals. There are two issues. The first is the perennial quest for relevant visuals that fit securely within the instructional plan. Not sure much can be done here besides enhancing design efforts to include identifying pertinent sources. Another relates to the use of videos, where more innovative approaches might be introduced in the methods course.

A third area of improvement emerged more because of what was not evident than what was discovered in the project. No specific accommodations were witnessed for English Language Learners, students with social needs, or students with high ability levels. Kevin's comment about his two bored students combined with the lack of materials seen for English Language Learners or students with special needs suggest teacher preparation coursework provide a solution. In this case, the recommendation is for greater coordination among pertinent faculty to share existing and develop new resources related to visual literacy for all students.

## **CONCLUSION**

This project examines how and why the preservice teacher candidates transferred what they learned about visual literacy from the methods courses to their practicum. The findings shed light on the successes as well as challenges for candidates to effectively implement visual literacy strategies in their classrooms. The successes include that candidates had a solid working knowledge to define visual literacy and acknowledged its value in teaching and learning. However, the challenges that hindered candidates' ability to implement visual literacy strategies are the established classroom routines and lack of implementing a well-defined visual literacy strategy from the cooperating teachers. Suggestions to improve the secondary education programs are proposed to enhance candidates' ability to implement visual literacy strategies in a progressive learning sequence in order to meet all students' needs.

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## Appendix B. Graphic Organizer for Studying U. S. Entry into World War II

Date \_\_\_\_\_ Name \_\_\_\_\_ Hr \_\_\_\_\_

**The Home Front – Mobilizing for Defense****Americans Join the War Effort**Stories in the *Japan Times*:**Selective Service**

Selective Training and Service Act:

Why needed:

Training length:

**Expanding the Military**

Women's Auxiliary Army Corps (WAAC):

Jobs during war:

**Recruiting and Discrimination**

The dilemma for minority groups:

African American quote: "*Just carve on my tombstone, . . .*"

Mexican American soldiers:

African American soldiers:

Asian Americans soldiers:

Native Americans soldiers: