

Evaluating the Effectiveness of Visual Thinking Strategies

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Abstract

This quantitative study investigated the use of Visual Thinking Strategies (VTS) in a higher education course for critical thinking. Participants (n=18) were exposed to VTS through weekly exercises. An instrument was developed to evaluate the participants' responses based on Abigail Housen's Stages of Aesthetic Thoughts (Housen 1999). Their written pre- and post-treatment responses were compared to measure growth in their critical thinking skills. Key findings support growth in both the quantity of basic and the inclusion of higher level observations. Previous research has found that training in VTS increases critical thinking skills which transfer to the individual's domain, or other areas of study (Housen 1999).

Introduction

Development of critical thinking skills is one of the tenets of higher education (Yenawine & Miller 2014). Visual thinking has developed as a field within psychology using aesthetic viewing as a strategy to increase critical thinking skills. This study investigates a higher education course where Visual Thinking Strategies (VTS) is used to develop critical thinking skills by viewing and analyzing artwork. As Arnheim puts it, "Identifying what we see is an act of cognition" (Visual Thinking Strategies 1997 p. 2).

Visual Thinking Strategies is an observational process with a facilitator asking three leading questions about a visual example. The facilitator summarizes responses without evaluation, and builds the conversation from the statements. VTS has shown to be effective in evoking participation among learners (Housen 2001). It has been utilized in museums as well as in elementary classrooms to improve participants' critical thinking, visual understanding, and communication skills (Reilly, Ring, & Duke 2005).

Although VTS has been tested on elementary students (Housen 2001) and medical and nursing students (Reilly et al. 2005; Klugman, Peel, & Beckmann-Mendez 2011), there has been little research on the effectiveness of VTS on general college undergraduate students. This study assessed the growth of visual critical thinking skills of undergraduate students (n=18) from the first week to the ninth week of the term. Students were in a semester-long course on visual and critical thinking at a major Midwestern university.

An instrument was developed for this study to measure the participant's critical thinking based on Housen's Five Stages of Aesthetic Viewing (Housen 1999). Participants completed a VTS Exercise, writing their thoughts regarding Hopper paintings on the first and the ninth weeks of class, which were evaluated with the VTS instrument. Weekly verbal exercises were presented in class between these evaluations to familiarize the participants with VTS. This study measures whether there was an observable increase of critical thinking skills between week 1 and week 9.

Motivation and Significance

VTS can be used in higher education to increase effective learning and student engagement (Yenawine & Miller 2014). VTS's structured, open-ended discussions emphasize that there may be multiple correct perspectives to support an argument. VTS is also a tactic used to approach unfamiliar topics with peer collaboration.

As Philip Yenawine and Alexa Miller put it, information in the 21st century is "complex, ambiguous, changing, and requiring synthesis across disciplines" (Yenawine & Miller 2014, p. 5). For students, it is critical for them to be able to deal with ambiguity, uncertainty, collaboration, and rapid changes. VTS better prepares students through the nature of its progression: observation, asking questions, presenting an argument with evidence, teamwork, and critical thinking. In addition, VTS has been observed to be helpful for English-second-language learners and students with learning challenges as it encourages oral communication and has a facilitating figure rephrase what the student had said, potentially clarifying what the student meant to say. (Yenawine & Miller 2014).

The use of art as the visual artifact for observational study in VTS is valuable to further critical thinking skills. "The nature of artwork is ... ambiguous in meaning, multilayered, intentionally open to interpretation, and often have symbolic and abstract elements; making sense of them offers great training for our minds" (Yenawine & Miller 2014). Visual Thinking Strategies can also be used to evaluate non-art based visual material.

Literature Review

The following section will go through the history of VTS, the Developmental Theory, the five Stages of Aesthetic Viewing (Housen 1999), prior K-12 student research on VTS, and prior Medical and Nursing student VTS Research. Through this section, the importance of this VTS research as well as the gaps in VTS that have not been studied are explained.

History of VTS

Beginning in the 1970's, Abigail Housen searched for methods to increase viewer engagement with aesthetic work, and her research demonstrated that students learn best through active learning (Housen, 2001). She collaborated with Philip Yenawine, who was a museum educator at New York's Museum of Modern Art, to find a way to effectively teach and measure viewing skills (Yenawine 2013).

Housen and Yenawine designed a method to view artwork in a group environment led by a facilitator. The facilitator asks simple, but thought-provoking questions to promote discussion, which are: a) "What is going on here?" b) "What do you see that makes you say that?" and c) "What more can you find?" (Housen 2001). The facilitator asks these questions, summarizes responses, points at the specific parts of the artwork that is mentioned and does not judge or evaluate the response (Housen 2001).

Developmental Theory

Learning is most effective when the learner actively participates and is given a chance to reflect on the material. Regardless of age, individuals feel motivated to overcome the challenges in their lives. Thus, the environment that one inhabits can influence how much, how well, and how quickly he or she learns. (DeSantis & Housen 2011). These findings are important bases for Housen's Aesthetic Stages. She used Vygotsky's and Piaget's theories as the motivation for her study. She uses verbal comments to understand individuals' stage of aesthetic thought. The Aesthetic Stages are progressive. Individuals of lower Stages of Aesthetic Viewing cannot understand the art at the same depth as upper stage viewers (DeSantis & Housen 2011).

Five Stages of Aesthetic Viewing

Abigail Housen developed the five stages of aesthetic viewing after interviewing and categorizing various individuals. She had noticed a pattern emerging from the interviewees' thought processes as they examined the artwork. The stages are summarized below. (DeSantis & Housen 2011; Housen 1999)

[1] Stage I: Accountive

Viewers in this stage tell a story of what they believe is occurring based on their personal experience and emotions. They connect the solid pieces that they see within the image and create a narrative out of this that makes sense to them.

[2] Stage II: Constructive

Viewers bring their past experiences and knowledge to understand the image. Viewers may dismiss an image if what is depicted is not an accurate representation of the natural world or if high-quality craft is not shown.

Viewers also begin to show signs of interests for the artist's intentions and the message that is attempted to be communicated.

[3] Stage III: Classifying

At this stage, the viewers begin to view the art from the perspective of an expert, being critical and attempting to understand the artwork's message by using the techniques and skills that they have learned.

[4] Stage IV: Interpretive

Viewers in this stage let the artwork express itself and tell its story. Viewers appreciate the small details of the work and use their critical skills to help understand the work. They are aware that their perception and the feelings that they get out of the work will differ depending on the situation.

[5] Stage V: Re-creative

By this stage, the viewer has spent a long time observing and analyzing works of art and may be a professional art historian or a professor in a related field. They are an expert in the work, knowing the details such as "its time, its history, its questions, its travels, its intricacies" (Housen 1999).

This clarification of the different Aesthetic Stages is important as this research also involves categorizing the participants (students) thoughts of this study into these stages. The participants are not expected to be above the third aesthetic stage as that the expertise of a professional. For example comments by individuals of each stage, see appendix A.

VTs Research

Housen conducted a five-year study of 2nd and 4th graders to measure growth in their ability to use their visual critical thinking skills, developed through VTS, to observe art and non-art objects (2001). While measuring the growth of these students from their first year to their fifth year using VTS, her team also assessed the difference of growth from students with and without VTS treatment. Housen's study found that students who had gone through VTS had more growth in their first as well as the fifth year than the students without VTS and improved standardized test scores.

Philip Yenawine's book, *Visual Thinking Strategies: Using Art to Deepen Learning Across School Disciplines*, provides a number of anecdotes and explores where VTS has been applied to other subjects, such as Social Studies, Science, and Language Arts. The practice of finding evidence of VTS helped students to naturally search for evidence to support their arguments as they complete assignments and exams. (Yenawine 2013)

Visual Thinking Strategies has also been tested in a medical school environment. In 2010, medical and nursing students at the University of Texas Health Science Center San Antonio were trained to "improve their physical observation skills, increased tolerance for ambiguity, and increase interest in learning communication skills" (Klugman et al. 2011, p. 1266). Results of post-training evaluation revealed an increase in observation time and descriptive word count in their examination for patient images. Also noted was an increase in tolerance level for ambiguity and interest in learning communication (Klugman et al. 2011). These results show the effectiveness of VTS in non-art related courses and for older students.

Abigail Housen and Philip Yenawine created VTS in order to increase aesthetic viewing. However, from research and anecdotal observations, there is evidence that VTS has been shown effective for problem-solving for other subjects outside of art. By implementing VTS into the undergraduate course curricula, it may be an opportunity for the students to improve in critical thinking skills that can be used in a variety of subjects, settings, and life-long learning. Thus, the study aimed to add to the knowledge base regarding VTS in relation to its effectiveness in undergraduate students' increasing their thinking skills. The aim of the study was to determine whether consistent exposure to VTS practices will increase the student's ability to utilize thinking skills. From the prior research conducted on K-12 and medical students, we expect an increase in observational and critical thinking skills.

Methods

Participants

Our research subjects were students in an honors Visual and Critical Thinking course (n=18) at a large midwestern university. Students varied in their year in college: 33% in were first year students, 39% second year students, 11% third year students, and the remainder, 17% were fourth year students. Of these students, 55% were from college of liberal arts, 33% from the college of science and engineering, 6% from the college of business, and

6% from the college of biological sciences. The following majors were represented: theater arts, history, linguistics, finance, electrical engineering, mechanical engineering, chemical engineering, economics, sociology, physiology, neuroscience, computer engineering, mathematics, and art. Due to the variety of colleges represented, the knowledge of these students at the beginning of the course in regards to a critical examination of art is a fair representation of the general student population.

Visual and Critical Thinking Course

The instructor of the Honors Visual and Critical Thinking course held weekly VTS exercises to familiarize the students with the process. The weekly exercises consisted of the instructor projecting an image worked collaboratively to figure out what is happening within the image. The instructor used standard questions to keep the conversation going, paraphrased student responses, and pointed to aspects of the image the student mentioned with minimal interference and judgment. The instructor is a trained expert in the VTS method..

Week 1 and week 9 VTS assessments were individually completed by writing about the provided artwork rather than discussing as a class. For both exercises, the instructor projected and printed photo copies of the paintings by Edward Hopper: *New York Movie* (See Figure 1) in week 1 and *Automat* (See Figure 2) in week 9. In addition, the exercises took place in the regular course classroom, with minimal external distraction.

Hopper's work *New York Movie* was used for the first assessment, and another Hopper piece, *Automat*, was used for the second assessment. Images were chosen for their similarity in content and mood. Similar paintings were used to lower the chance of extraneous factors influencing students' responses.

Fig. 1. Edward Hopper's *New York Movie* (1927) Fig. 2. Edward Hopper's *Automat* (1939)



Procedure

[1] Collected week 1 data: administered VTS Exercise to students in HSEM 2270V on the first week of the semester. Students were provided between 10 to 15 minutes to complete the exercise.

[2] Completed verbal, discussion-based VTS sessions with the entire class for about 10 to 20 minutes during class once a week until the 9th week.

[3] Collected week 9 data: administered VTS Exercise to students in HSEM 2270V on the 9th week of the semester. Students were provided between 10 to 15 minutes to complete the exercise.

[4] Anonymized (student name and VTS Exercise administered weeks) student responses by course professor, Dr. Hokanson, to prevent possible interference of bias.

[5] Measured students' week 1 and week 9 VTS Exercise using the VTS Instrument created to calculate VTS scores.

[5.1] Quantified the number of separate thoughts written in the VTS Exercise response by parsing student responses into separate thoughts, identifying if certain thoughts are supporting observations for a concluding thought.

[5.2] Categorized each thought into the respective stage in the VTS Instrument for each student.

[5.3] Calculate the mean count from each evaluators' scores for each stage.

[6] Each student's pretest versus posttest VTS scores were analyzed using a chi-square statistic that compares their number of responses at each of the Aesthetic Viewing Stages.

Research Participation

Since this is an analysis of existing educational data, the students had a choice of whether to have their classwork analyzed or not by signing a consent form after completing the week 9 exercise. The consenting student's data and demographics were anonymized for analysis to prevent possible bias and identification.

VTS Instrument

An instrument was created for use in this study by the authors to evaluate each student's observation of the artwork from the in-class exercise. Each thought-response was scored and categorized into one of the Aesthetic Stages.

Four levels were used to categorize responses by stage. Stage 1 responses are basic observations within the image that don't include context from the outside world. Stage 2 responses showed evidence of constructing a conclusion based on specific observations they had made. Stage 2 responses may also have brought in comments based on their interpretation of their social or moral world. Stage 3 comments show the viewer has started to step outside the world of the painting and wonder about the artist's intentions. Stage 4 starts to construct meaning through symbolism. Because the stage 5 response is reserved for one who has gotten to know the art over a long period of time, Stage 5 is not applicable to this study. Stage 5 respondents are typically professionals in the field of art history. Expressed thoughts that could reasonably fit in to two categories were entered in both. Thoughts derived or developed from lower level observations were categorized at the higher level.

Thoughts 1 and 3 are scored as stage 2 as they are observations that are supported by other observations. Thoughts 2, 4, and 5 are scored as stage 1 as they are observations that point that the factual and basic details.

Since there are various ways of measuring an increase in critical thinking skills, both the overall quantity of responses and the quality of responses (the Stages of Aesthetic Viewing (Housen 1999)) were analyzed.

Results

The mean score for the number of thoughts week 1 stage 1 was 4.86 thoughts per participant. By week 9, the mean number of stage 1 thoughts per person increased to 5.92 amounting to almost an extra thought per person. Stage 2 had an average of 1.44 thoughts per person in week 1 and 3.58 thoughts per person in week 9. Stage 3 increased by 0.31 thoughts per person, and stage 4 only had responses in week 9 with a mean of .08. (See Table 1 and Table 2 for complete descriptive statistics)

Table 1. Descriptive statistics of the week 1 scores

	n	\bar{x}	M	Mo	Σ	s	Minimum	Maximum
W1 S1	18	4.86	4.50	4.00	87.50	1.76	2.50	10.50
W1 S2	18	1.44	0.75	0.50	26.00	1.51	0.00	5.00
W1 S3	18	0.08	0.00	0.00	1.50	0.19	0.00	1.50
W1 S4	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2. Descriptive statistics of the Week 9 scores

	n	\bar{x}	M	Mo	Σ	s	Minimum	Maximum
W9 S1	18	5.92	6.50	6.50	106.50	2.32	2.50	10.00
W9 S2	18	3.58	2.75	1.50	64.50	2.40	1.00	8.50
W9 S3	18	0.39	0.00	0.00	7.00	0.58	0.00	2.00
W9 S4	18	0.08	0.00	0.00	1.50	0.26	0.00	1.00

Figure 4 shows the growth of each stage for the mean scores of each week, with uncertainty bars that represent the confidence interval at 95% for each of the mean VTS scores. Figure 5 and 6 shows each student's change in their VTS scores from week 1 to week 9 for stage 1 and stage 2 respectively.

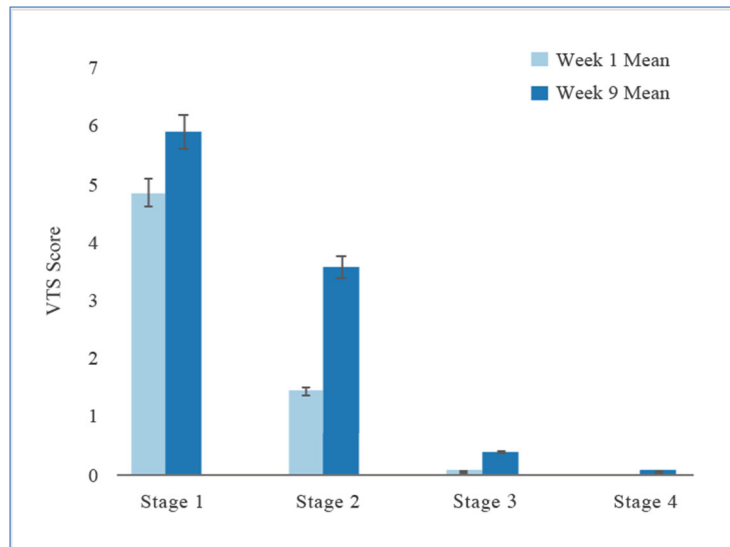


Fig. 3. Growth in Mean VTS Scores

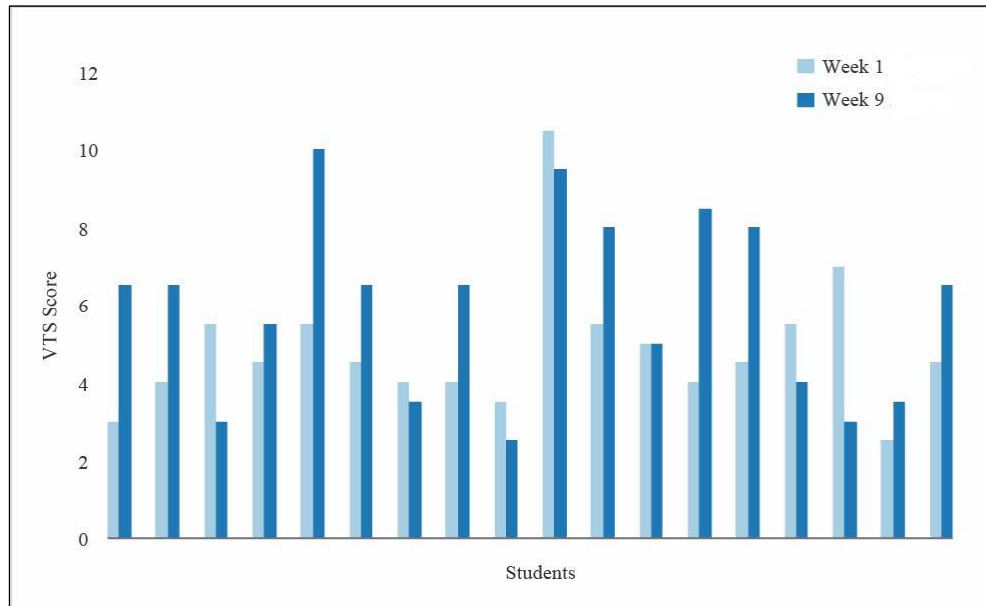


Figure 4. Stage 1 Individual Scores Comparing Week 1 and Week 9

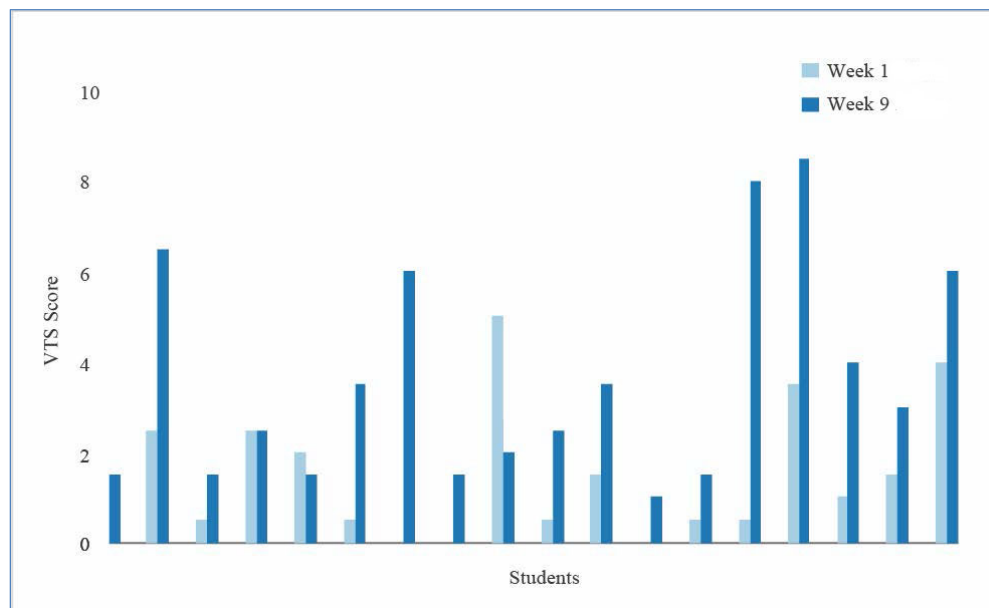


Figure 5. Stage 2 Individual Scores Comparing Week 1 and Week 9

Chi-Square Tests

Goodness of fit: In order to determine if our data showed a normal distribution, a chi-squared test for goodness of fit was performed. This test looked at the number of thoughts from a particular week and stage (i.e. week 1 stage 1) and compared that number across all 18 participants.

The results of our statistical analysis showed statistical significance in the improvement of scores from the VTS exercises from week 9 when compared with week 1. The scores were tallied and compiled into a matrix that allowed each participant to have an individual score that represented the number of thoughts they articulated in each of the stages, 1-4. (Developed from Abigail Housen's Stages of Aesthetic Thought (Housen 1999). Each student ended up with eight scores: week 1 stage 1, week 1 stage 2, ...through week 9 stage 4.

An individual chi-squared test was performed for each week and stage (7 in all since there were no scores from week 1 stage 4). Then, results from stages 2, 3, and 4 were combined as a *higher level* category for both weeks

1 and 9. All tests resulted in an extremely low probability that our data is normally distributed; rather, the data seems to be strongly right skewed.

Test for independence:

It was determined that the next step should be to analyze the data using the chi-squared test for independence. In order to meet the minimum requirement of each cell of the chi-squared matrix, the data were combined for stages 2, 3, and 4. The results of the Chi-Squared test showed $p = 0.001499$

Discussion

The study showed an increase in overall and higher stage thoughts between week 1 and week 9. This implies a significant increase in critical thinking skills as evaluated by the VTS instrument ($p < .05$). This suggests that the students in week 9 understood that they were expected to imply higher stage thinking while participating in this exercise and had the capability to do so.

These results are similar to those of the study of medical school students. The Klugman et al. study resulted in an increase in the number of words used to describe the given image (2011). In both cases, participants that had been exposed to VTS had an increase in the number of observations made while examining an image. One would surmise that exposure to this type of exercises increases students' ability to look at a puzzling image and critically investigate details and context of an image.

Instrument Reliability

The VTS instrument was designed using the Stages of Aesthetic Thought (Housen 1999) outlined by one of the originators of VTS and a draft evaluation instrument created by the instructor, a VTS expert. Therefore, it was created for this study with the specific Edward Hopper paintings in mind. There are no reliability assessments for this instrument aside from the use of the instrument on past semester student responses.

In addition, the authors recognize the variability potential for using this instrument. For instance, the qualifications for what a thought-response entails and which category each thought-response belongs are subjective determinations with possible bias to which each individual who scores a VTS Exercise will have differing opinions.

Discussion of Errors

There is very little published research on Housen's Stages of Aesthetic Development. Our instrument has very little research to validate the content, which leaves chance for a systematic error. Participant's responses are a product of their individual mood, external stresses, etc. when they completed the VTS Exercise. We were not able to select participants but have used the largest available sample.

Our results concluded that there is a statistically significant change, the absence of a Type I error can't be proven. The study was designed to reduce its likelihood. The external validity of this study was controlled by measuring the entirety of the class who studied VTS ($n=18$). The participants were of a variety of disciplines within the university and from all four years of undergraduate study.

Summary and Conclusion

This study focused on VTS that was taught in an undergraduate classroom setting at a large, midwestern university and measured all the students taking a visual and critical thinking course during fall semester of 2018 ($n=18$). Although weekly VTS exercises were completed through week 1 and week 9, the class was exposed to other aspects of critical thinking activities within this course, which may have added to their increase in critical thinking skills. In addition, because the increase of knowledge and practical application of VTS was required, it can only be generalized to students who took or will take a similar critical thinking course that includes VTS-style learning. Future work in this area could involve a longitudinal study researching various years of this particular course, or comparing performances with other courses that do not employ VTS-style learning.

The potential of VTS outside of museum studies is still in the early stages of investigation. Although studies exist on measuring skills gained through VTS (Housen 2001; Klugman et al. 2011), there is no published instrument for quantitatively measuring VTS, which is why we have created our own instrument for this study. Therefore, there is the opportunity for future work to use this VTS instrument to quantify written or verbal VTS exercises. The use of this instrument is not limited to similar studies but could be used on studies of experts in the various fields. However, it may need some modifications as the instrument was created to measure students without specific knowledge of art history and the work that was chosen for both exercises was a realistic style with a single

human figure and a recognizable context (See Figure 1 and 2). Non-subjective (abstract) art would likely give different responses and may not appropriately categorize in Housen's Stages of Aesthetic development (Housen 1999) in the same manner as the realistic paintings.

Visual Thinking Strategies is an attractive option for learning critical thinking skills because of its potential for transfer to other industries. Other studies regarding VTS have measured the transfer of knowledge from art viewing to a specific domain (Housen 2001, Klugman et al. 2011). The participants in this study had various majors so there is an opportunity to study the transferability to each participant's domain. Thus, future work in this field could involve a follow-up study that looks at the participant's transfer of gained critical thinking skills as a result of VTS.

This study showed a general increase from week 1 to week 9 in both the quantity and stage of thoughts. While week 1 results showed predominantly stage 1 thoughts without a notable count of stage 2, there was a great increase in the number of stage 2 thoughts while gaining a slight increase in stage 1 thoughts in week 9. Not only did the participants show that they are thinking more critically about the image in week 9, but their basic observation skills (Stage 1) have increased, as well. Between the two test sessions, participants' stage 1 scores increased, which suggests that they were still using their basic observation skills to build meaning for their higher level thoughts.

This study supports the notion that Visual Thinking Strategies is valuable as the results showed that there were significant improvement in visual critical thinking scores as measured by our instrument in as little as 8 weeks. This finding is important as we can infer an increase in critical thinking skills if they are engaged in a critical thinking course that integrates VTS.

Increasing critical thinking skills is critical for the success of modern students who are working with rapidly produced, evolving, and collected information. There are levels of ambiguity and unknowns in information found throughout the majority of disciplines and fields of study. In addition, undergraduate students are expected to dissect and process the knowledge that is given to them and are highly responsible for their own learning. Thus, other undergraduate institutions or programs may design critical thinking courses to include VTS exercises to develop their students' critical thinking skills. As Yenawine and Miller stated, "Visual Thinking Strategies does not teach what to think, but rather supports the discoveries students make when they are given opportunities to think in various ways" (2014).

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Appendix A Five Stages of Aesthetic Viewing

The following are comments made by individuals of each stage when viewing Picasso's *Girl Before the Mirror*. This data, collected by Abigail Housen, was used to construct the VTS instrument. The style of artwork used here is not of a realistic style, so modifications were made to categorize the data accordingly.

[1] Stage I: Accountive

"... I see... two women here... They... are looking at each other... looks like one of the women has a... misfortune..." (Housen, 1999, p. 9)

[2] Stage II: Constructive

"On that frame... or in that mirror there reflects some man's face but it's not a full face... One can see the lips the mouth, chin and half of the face... If you look at this man's face... it's the man from some other planet..." (Housen, 1999, p. 10)

[3] Stage III: Classifying

"it seems to have, the artist divides the painting into four, actually, you can also look at it in half, and it seems to be two different views of a woman of a female form..." (Housen, 1999, p. 10)

[4] Stage IV: Interpretive

"Well, the red color – is probably some aggression, and blue is, on the contrary, some feelings of rest... it's tensioned between these two colors... Here... changes, as she discovers something in herself... To my mind the point of this picture is some certain change..." (Housen, 1999, p. 11)

[5] Stage V: Re-creative

"I think it would be interesting to ... sit and watch Picasso do that because... you have this fantasy that it was this... very continuous, easy, sure, spontaneous... creation of all these forms that one flows right to the other..." (Housen, 1999, p. 11).