Measuring Information Fluency Instruction: Ethical Use of Images in Engineering Student Presentations

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Abstract

The ACRL *Framework for Information Literacy for Higher Education,* "Information Has Value" frame includes the knowledge practice of "articulate the purpose and distinguishing characteristics of copyright, fair use, open access, and the public domain." This is an important consideration as engineering educations continue to put emphasis on teaching technical communication skills. While technical communication can take many forms, a common form in both education and industry is the use of presentations. However, one component of the presentations that can easily be overlooked by both students and faculty is ensuring the use of images that are obtained in an ethical manner. This area of instruction is a concern to both librarians and engineering instructors as it will be a recurring task in the engineering field after graduation.

This paper presents a study examining the ethical use of images by students in presentations given for a Mechanical Engineering senior lab course. The objective of this research project was to determine if, and to what extent, integrating information fluency instruction pertaining to the ethical use of images into engineering lab sessions improves the quality of information fluency skills demonstrated in student presentations. A rubric was used to assess the use of images in student presentations for two criteria: 1) attribution and 2) use of images that have appropriate Creative Commons license, have public domain status, or are original creations. Students completed an initial lab presentation early in the semester with no information fluency instruction. Students then received direct in-person instruction in the ethical use of imagery from a librarian specifically developed for the purpose of this study. The students then completed a second lab presentation. Both presentations were scored using the rubric to compare the changes in information fluency skills of students pertaining to the ethical use of images. Then, the license type and attribution of the individual images in the presentations were determined. To better understand the trends that were captured, the measurements were also carried out on a control group from the prior academic year, where no instruction was given.

The results showed some positive gains based on the instruction. The results from rubric-based assessment indicated improvement, although these measured increases in attribution and ethical use of images could not be definitively connected to the instruction alone. The image-based assessment demonstrated a significant improvement in attribution usage in the test group after the instruction. It also showed that students reduced the use of copyrighted images, although further study will be needed to definitively correlate the improvement to the instruction. The results also demonstrated some of the challenges encountered with using the rubric-based assessment. Going forward, a combination of the quantitative methods used in this study in combination with qualitative methods may help improve this instruction process.

Background

Technical communication is an integral part of engineering education. This goal is made clear by the fact that one of ABET Engineering Accreditation Committee's student outcomes is that engineering graduates shall demonstrate "an ability to communicate effectively with a range of

audiences." Common feedback that that the authors have received from employers and alumni is the need for additional preparation in oral communications. One approach is to give students more opportunities to develop their presentations skills. However, one component of the presentations that can easily be overlooked by both students and faculty is ensuring the use of appropriate images that are obtained in an ethical manner. This area of instruction is a concern to both librarians and engineering instructors as it will be a recurring task in the engineering field after graduation.

The ethical use of images is challenging. Some of the obstacles related to image use include evaluating the accuracy of the information in an image, following copyright and fair use guidelines, proper attribution of the image source, as well as the privacy of human subjects [1]. In addition, each discipline uses visuals in unique ways. Engineers frequently use diagrams, photographs, and data-driven visuals such as charts and graphs [1]. Two of the main challenges that come up in previous literature are copyright and attribution. Walck et al. [2] point out that "one of the significant challenges in understanding copyright is accepting the deliberate ambiguity in concepts such as 'fair use' and the need for a user to take personal responsibility in accessing copyrighted materials." Weinraub [3] traces the difficulty in teaching proper attribution of images to the confusing and inconsistent guidelines and examples provided by style guides. Many citations styles are also lengthy and unwieldy to use in presentations.

It is increasingly more common for college faculty to require visuals in assignments even though they do not instruct students in visual literacy skills [1]. Student use of images is usually not closely scrutinized, but misuse of images can have serious implications in professional settings [4]. The increase in image availability through the world wide web creates an increased need for visual literacy skills. Users have to be even more careful about evaluating the images they find, in addition to being expected to use images more since they are readily available [1].

At a scale larger than just image use, student understanding of copyright and fair use show that students need more guidance from faculty. For example, in a music course, students created guidelines about copyrighted digital music that called on colleges and universities to actively educate students about copyright law and the implications of file sharing [5]. In a survey of student understanding of copyright and law, students were asked if they knew how to publish work with a Creative Commons license, use others' work published with a Creative Commons license, or search for works with a Creative Commons license. The responses showed a poor understanding of how sharing licenses such as Creative Commons work and perhaps a poor sense of recognition when they come across it [6].

When it comes specifically to ethical issues and image use, Matusiak et al. [7] collected student presentations, examined the use of images, and interviewed students about how they completed the assignment. Of the 15 presentations collected, only two of the students provided citations for the images used. Reasons that students gave for not citing images included the lack of a requirement by the instructor and the perception that images were not important enough to cite. They also mentioned difficulty in determining authorship as a reason not to provide a citation. When interviewed, students described an unspoken expectation that they should use images in presentations. Students primarily used Google Images to find images for assignments. Students also admitted that they typically did not verify the source of images that were copied from Google Images.

Librarians recognize the need to assist users in the ethical use of information and images in their guiding frameworks and standards. In the ACRL *Framework for Information Literacy for Higher Education,* the "Information Has Value" frame includes the knowledge practice of "articulate the purpose and distinguishing characteristics of copyright, fair use, open access, and the public domain" [8]. Standard Seven of the *Visual Literacy Competency Standards for Higher Education* is "the visually literate student understands many of the ethical, legal, social, and economic issues surrounding the creation and use of images and visual media, and accesses and uses visual materials ethically" [9].

Academic librarians are often asked to assist students and faculty with copyright questions [10]. A common response is to provide instruction around visual literacy in areas such as finding images and interpreting or evaluating image sources [1]. A survey of librarians about instruction related to visual literacy found that 33% of the respondents include visual literacy in their information literacy instruction [11]. The instruction includes image retrieval, file management, copyright and permissions, and creating images, posters, presentations, and other visual products. One of the examples given was a one-hour workshop to assist students with obtaining images for presentations. Another survey asked librarians about how they provide images and instruct students in the use of images [12]. The majority of responses indicated that librarians instruct students in the following ways: finding images in print and online formats, the ethical use of images, and downloading or scanning images. The most common settings for this type of instruction were at the reference desk, in individual consultations, and in formal library workshops or class visits.

Results from studies surrounding image use have generated recommendations for librarians. Some best practices have focused on broad solutions such as making links to freely available image collections readily available for users in addition to offering workshops and discipline-integrated instruction [12]. The more common solution proposed is direct instruction and the need to teach students to cite images in the same way that we teach them to cite their sources [1]. Some have advocated for active learning in the instruction of intellectual property given the higher order of learning processes required to analyze and evaluate [2]. Others have made a case for embedded librarianship in first-year courses to promote visual literacy because they can align visual literacy with the themes and assignments of the course and take an active role in the types of skills that are taught [13]. And finally, other literature recommends teaching students with strategies such as modeling cited images, constructing citations for images, and using alternate sources to cite images [14].

Regarding implementing the instruction, there is a wealth of examples of instructional activities provided by academic librarians related to copyright. In non-engineering disciplines, librarians have incorporated rights instruction into introductory music courses and mass communications courses [15], developed lesson plans for English and communications courses that use problem-solving scenarios supported by analysis and lecture [16], and taught a semester-length course about copyright to journalism and communications majors [17]. Some of the ways that librarians are structuring the content include an online course about copyright organized in three units: basics, you as the user, and you as the creator [18], a lesson plan for in-person copyright instruction, including definitions of concepts related to copyright and a fair use activity [19], and intellectual property instruction for graduate students using case studies about patent and copyright [2].

Another approach that has been proposed is to focus on rights instruction as it applies specifically to images. One library offered Creative Commons workshops [20]. The workshops presented basic information about copyright to frame the use of the Creative Commons licensing model. Then the workshop examined the license elements and types before demonstrating web searches for images with Creative Commons licenses. Another librarian delivered instruction related to the quality of image content, the image source, the image quality, where to find images, file naming and metadata, and copyright [4]. However, none of these instruction examples went on to assess the effectiveness of the instruction in changing student behavior.

Purpose/Hypothesis

This study was designed to measure the effectiveness of library instruction in an engineering lab course related to the ethical use of images in student presentations. The researchers hypothesized that after a library instruction session about the ethical use of images, students would use more copyright-free images and improve attribution of images in their presentations.

Design/Method

This study was designed to compare student presentations before and after library instruction to measure whether library instruction would change the way students used images in their presentations. This study was conducted at California State University, Maritime Academy, a small public university with majors related to the maritime industry. The course selected was a senior-level mechanical engineering lab in fluid mechanics, thermodynamics, and heat transfer. This course was structured so that students would focus on three experiments designed to illustrate concepts and instrumentation in the aforementioned fields. The students were responsible for carrying out background research, understanding the experiment, collecting data, processing the data, and developing conclusions. They were required to create presentations and technical reports based on their work. This course was only offered in the Fall semester, so the entire senior class of mechanical engineers, consisting of approximately 40 students, were enrolled. To satisfy the course learning outcomes, the students would be assessed for their mastery of technical communication, which made this course a logical choice for assessment of ethical use of images in student presentations. Before the project began, the researchers obtained approval from their campus Institutional Review Board. At the beginning of both the Fall 2017 and 2018 semesters, students in the lab course were asked to voluntarily sign a consent form to collect their presentations for this research project.

In the Fall 2018 semester, a new information fluency lesson plan was introduced by a librarian during one lab session that focused on the use of images in presentations. The researchers familiarized themselves with the details of copyright and Creative Commons licenses [10] before identifying the content that was considered relevant for the students. The lesson plan was modelled after Folk-Farber's approach [19], which used an activity to engage students in determining fair use. The learning outcomes for the instruction were:

- Students will be able to explain what copyright law is in order to ethically use images in their assignment.
- Students will be able to locate copyright-free images in order to ethically use images in their assignment.

- Students will be able to create image citations in AIAA style in order to ethically use images in their assignment.

Students were told that the goal for the session was to start the image search for their next presentation on truck aerodynamics and drag and were provided with the link to a research guide (http://library.csum.edu/me349/images). Students were asked to find two images online that they might include in their presentation. Then, the librarian defined terms surrounding copyright and usage rights and introduced fair use. The class reviewed the criteria for determining fair use. Then students gathered into their lab teams and chose one image to apply the fair use criteria to. Students wrote their responses on the whiteboards (Appendix A) and the class discussed each team's image and determination of fair use. The class briefly discussed how fair use could mean something different in the workplace than it does in an academic setting. After talking about how much time and effort it takes to determine fair use for each image used, the librarian offered Creative Commons licenses as an alternative to copyrighted materials. Students were introduced to the range of permissions granted by the different types of Creative Commons licenses and advised to read each license carefully. Students were asked to search as a team for an image with a Creative Commons license that could be used in their presentation. Once each team had an image selected, the librarian reviewed how to create a citation for the image using the appropriate style for the course. Each team then wrote the citation for their image on the board (Appendix A). At the end of the session, each team had an image and associated citation to use in their upcoming presentation. Three weeks after the session, the students delivered their presentation on the topic.

Quantitative data was extracted from the students' presentation slides through two different methods. The first method assessed the presentation overall for a given team. The presentations were assessed with a rubric designed to measure the use of citations for images and the use of images not violating copyright law (Appendix B). Scores were assigned to each presentation. In addition, presentations were broken down to where the individual images were examined. The sources of the images used for the theory portion of the presentation were identified. The instructor was able to easily identify images that came from relevant textbooks. For the other images, a thorough search, which utilized tools such as Google Images, was carried out to independently determine the original source. The images were then assigned a status of copyright, public domain, Creative Commons, or student created. The use of any relevant citation for each image was also recorded.

This study used samples of student work over a two-year period. In this senior-level engineering lab course, students enroll in lab sections of up to 12 students and form semester-long teams of 3-4 students. The control group, which took the class in Fall 2017, consisted of 20 students divided into 5 teams. This group received no information fluency instruction related to images. The test group, which took the class in Fall 2018, consisted of 42 students divided into 12 teams. The course focused on three major lab modules, during which the teams performed experiments and delivered 12-15-minute presentations covering the theory and experimental setup for the module. The presentations from the first and last modules were analyzed in this study and hereafter are referred to as Presentation A and Presentation B, respectively. For the test group, Presentation A occurred before the instruction, while Presentation B occurred after the instruction. The goal was to measure the impact of the information fluency instruction by comparing the change in performance in the test group between Presentations A and B. To

improve confidence in the results, the differences in the control group were determined as well for comparison. The rubric used for grading all of the presentations included dimensions for the use of relevant, credible images and the inclusion of citation. However, the total weight of those dimensions represented only 8% of their total grade.

Results

Rubric Assessment of Presentations

The first data set discussed comes from the rubric-based assessment of the individual presentations. Examining the attribution scoring (Table 1), there is an increase of +0.25 in the test group after the instruction. However, that increase is comparable to the increase between the same two presentations in the control group (+0.20). Overall, this result suggests that there is no significant difference between the control and test group. However, it also highlights the challenges of the rubric that was used. The majority of the presentations in the entire data set scored a 2 because they fell in the category of "Some Images Cited". Unfortunately, this means that a presentation with only one image cited scored the same as a presentation with all but one image cited. This results in a loss of resolution in the level of attribution. A second challenge is that the presentation was the collection of work by multiple individuals. In reviewing the presentations, there are often noticeable changes in style and quality in different sections of the presentation. These variations in performance within the presentation could not be captured in the rubric. Since slide authors are not explicitly identified in the presentations, it is not possible to use the rubric for individual-level assessment. These factors could be significant contributors in the lack of any significant findings from these data.

Table 1. Attribution average scores from the rubric-based assessments.

	Control (2017)	Test (2018)	Difference Between Groups
Presentation A	2.00	1.58	-0.42
Presentation B	2.20	1.83	-0.37
Difference Between Presentations	+0.20	+0.25	

The results from the rubric-based scoring of the ethical use of images shows some improvement due to instruction, although reaching a definitive conclusion again proves difficult. Only the results of the test group are provided in Table 2 because the control group scored 0 on both presentations. The test group has an increase of +0.5 after the instruction, suggesting some improvement. The score is the result of 3 of the 12 teams scoring a 2 on the rubric, while the remainder scored 0. This suggests uneven improvement and does not provide insight into what occurred with the other nine teams. Looking at the methodology, the coupling of the image being copyright-free with the requirement for license status mixes might be better resolved as two

separate dimensions. However, during these discussions, the researchers are left with the challenge of how to properly separate the dimensions in a way that would decouple the usage of copyright-free images and the license status in a meaningful and quantitative fashion.

Table 2. Ethical use of images average scores from rubric-based assessment.

	Test
Presentation A	0.00
Presentation B	0.50
Difference Between Presentations	+0.50

Overall, it is difficult to make any conclusive statements about the hypothesis using the data from the rubric-based assessment. The aforementioned problems in combination with the limited sample size leads to the development of a secondary assessment of the particular aspects of the individual images within the presentations themselves. This evaluation could help address the concerns regarding individual performance and sample size that were not captured by scoring a team's presentation with the rubric.

Evaluation of Images Used

The data based on examining individual images in the students' presentations provides a more in-depth perspective with which to examine the hypotheses. One of the key advantages of the findings is that they come from a larger sample size when compared to the team-based assessments. However, the results are more heavily weighted toward teams that use more images. In addition, the emphasis was shifted slightly. For attribution, the emphasis is placed on the use of attribution without considering if the format exactly followed AIAA standards. Similarly, for ethical use, emphasis is given to the type of image use (i.e., copyrighted, Creative Commons, or public domain) rather than whether or not they indicated license status. The results of this evaluation give a bit more insight into the changes due to the instruction.

Table 3. Citation of images data and differences.

	Control	Test	Difference Between Groups
Presentation A	64.7%	37.0%	-27.7%
Presentation B	52.4%	47.2%	-5.2%
Difference Between Presentations	-12.3%	+10.2%	

The data for the citation of images in Table 3 leads to conclusions not only about the instruction, but about other factors that may influence the data as well. This is only a measure whether students provided a reference for the image, although it may not have specifically been in AIAA format. Substantial improvement is seen in the test group after the instruction (+10.2%) and determined to be statically significant ($p<0.05$). This provides some validation of the hypothesis that the instructional activity would improve the citations in the presentations. This assessment is further supported by the fact that there was a -12.3% change in the usage of citations in the control group between Presentation A (64.7%) and B (52.4%). A potential factor that could account for this drop is the timing of Presentation B, which is given the week after the Thanksgiving holiday and one week before the end of the semester. For the students, this creates a scheduling challenge that results in a discontinuity of work on the presentation. In addition, the student generally experiences increased workload in the remaining two weeks near the end of the term. Anecdotally, a general decrease in the overall quality of these presentations has traditionally been observed. This observation is supported by the fact that the average raw overall presentation grade for the control group dropped from 85.6% to 80.1% from Presentation A to B, respectively. A similar drop (83.1% to 80.1%) in the presentation grade can be seen in the raw overall presentation grade for the test group as well. This drop in overall performance provides additional confidence in the observed increase in citation usage in the test group after the instruction.

Table 4. Use of copyrighted images data and differences.

	Control (2017)	Test (2018)	Difference Between Groups
Presentation A	80.0%	73.3%	-6.7%
Presentation B	83.7%	65.7%	-18.0%
Difference Between Presentations	+3.7%	-7.7%	

Examining the data for the use of copyrighted images shows some potential evidence for improvement through the instruction. Decreased use of copyrighted images is considered improvement because it suggests that the students were making use of search tools that limit to images with Creative Commons licenses or public domain status. Table 4 summarizes the findings for both the control and test groups. The control group has approximately 80% usage of copyrighted images, with no statistically significant difference between the presentations. The test group starts from a lower percentage (73.3%) of copyrighted image use before any instruction occurred. After instruction, there is an improvement, with a decrease of 7.7% in copyright image use in Presentation B. The data show a statistically significant ($p < 0.05$) reduction in the use of copyrighted images when comparing Presentation B results for the test group when compared to the control group. However, the -7.7% decrease in the test group between Presentations A and B cannot be considered statistically significant ($p \approx 0.13$). Therefore, while the data shows progress from the instruction, further data would be needed to definitively validate the hypothesis that the instruction reduces the usage of copyrighted images.

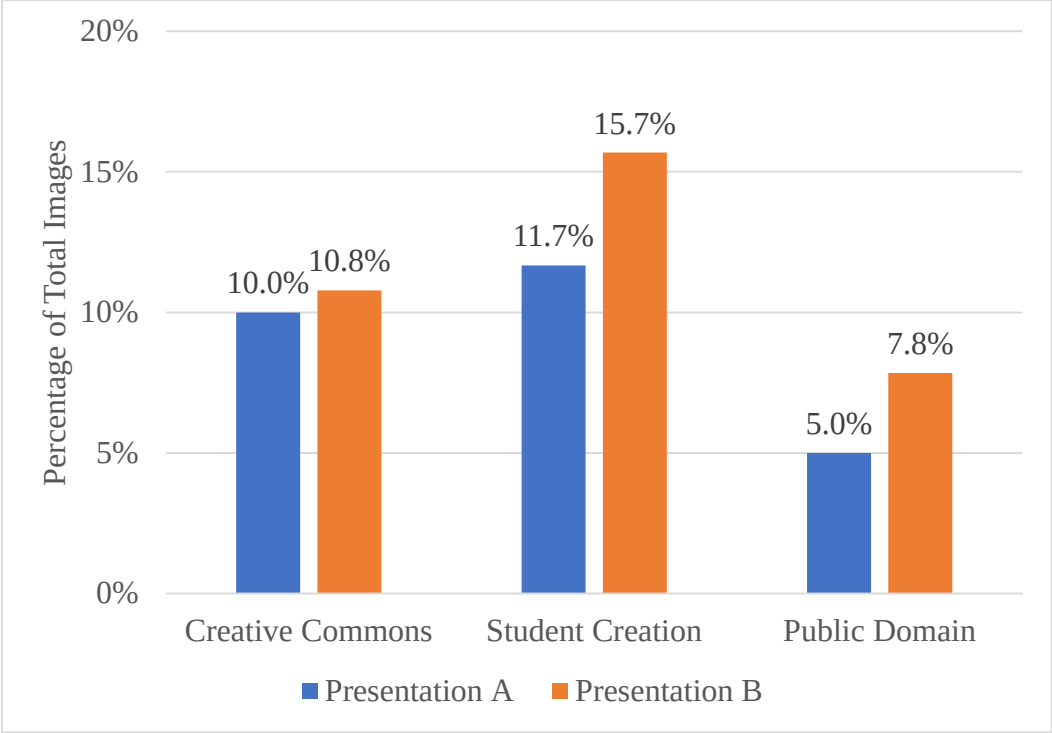

Figure 1. Distribution of copyright-free images used in the test groups' presentations.

The data for the test group can be broken down further into the types of non-copyright material used by the test group before and after instruction, as shown in Figure 1. While usage of images with a Creative Commons license stayed relatively consistent around 10%, there is detectable increase in the usage of student created and public domain images. While the sample size is too small to determine statistical significance, the data suggests awareness from the instruction encouraged students to pursue other alternatives for images. The similarity in usage of Creative Commons licensed images may be the result of the students' general use of Wikipedia and

Wikimedia as image sources based on their own search tendencies and the tendency of these sources to come up in Google searches [21].

Lastly, there is anecdotal evidence worth noting that support the value of the instruction. While the students were preparing their presentations, the instructor received inquiries from two teams regarding the documentation required for fair use. The students were permitted to use copyrighted images with the justification of fair use without a penalty to their grades. The recognition of fair use suggests that while these teams did continue to use copyrighted images, they were aware of the implications of their use. This could be considered an improvement when compared to the overall lack of awareness or understanding of fair use demonstrated when the students started the information fluency instruction. As a result, while the students may have met more of the learning objectives from the instruction, it could not be assessed in the methods used in this study.

Conclusions

Overall, the findings demonstrated some evidence that support the hypotheses of reduced use of copyrighted images and increased use of citations in student presentations. No conclusive statement about the influence of the instruction could be determined from the rubric-based assessment due to challenges stemming from the dimensions and limited sample size. The breakdown by individual images showed definite improvement in the attribution category because of the instruction, particularly when compared to the control group. Although improvement was seen in the reduced usage of copyrighted images, more samples were required to definitively draw that conclusion. Overall, the results of the instruction seemed promising in promoting the understanding of information fluency with regards to images in presentations.

Continued research in this area is needed. Influencing student behavior regarding image use may benefit from a better understanding of students approach to image selection. The anecdotal findings discussed at the end of the results suggest that additional insight could be achieved through qualitative data collection methods. Interviews or surveys of the students regarding their behavior and tendencies could help better assess whether learning objectives were achieved. In addition, it could help to understand the students' methodology and that would drive adjustments to the instruction. Another consideration to be explored would be the timing of the instruction. This work studies introduction in a mastery (senior-level) course. It would be useful to compare these findings to a study where this instruction takes place in a course (i.e., lower division) when information fluency concepts are introduced or reinforced. From an experimental methods standpoint, an increase in the number of samples collected could help improve the statistical analysis in establishing statistical significance. This can be achieved by the researchers through the expansion of the data set with new students completing the course and a review of samples of student work from previous classes.

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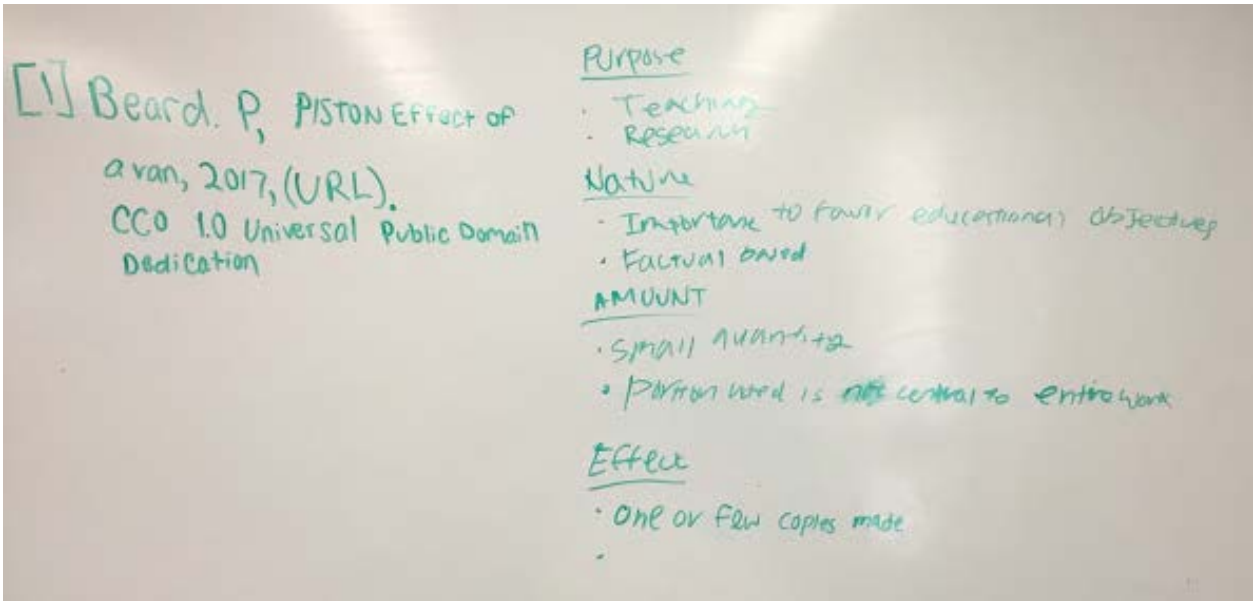
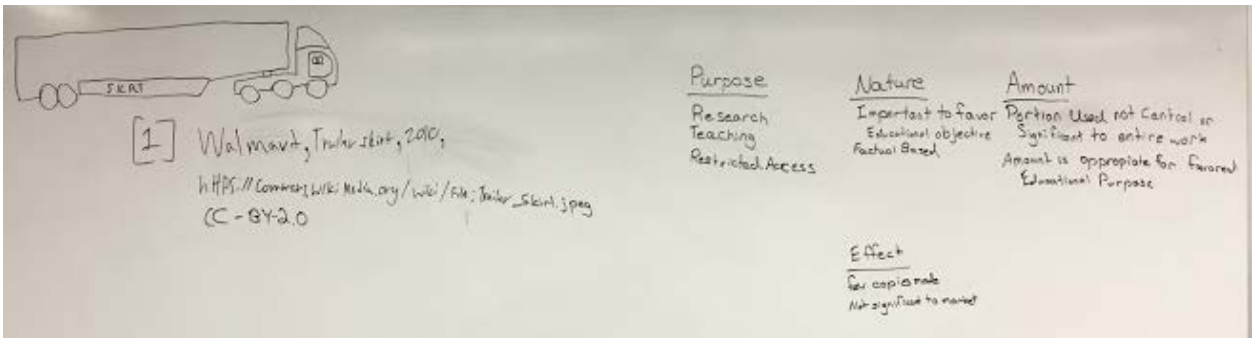
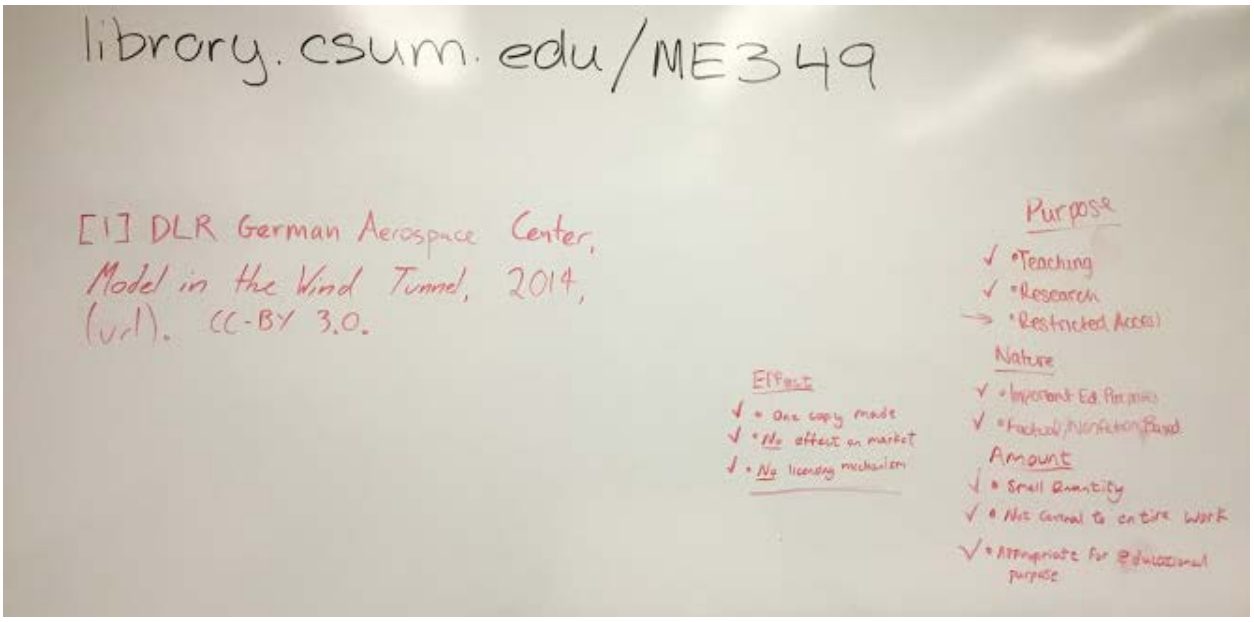
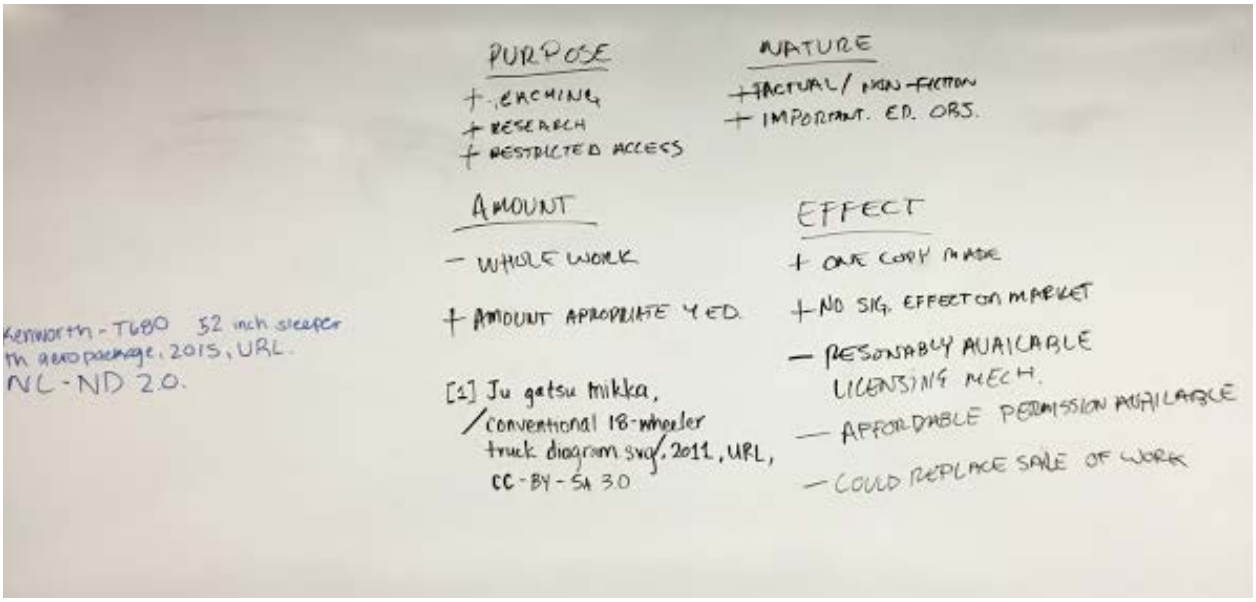
Appendix A: Student In-class Results






library.csum.edu/ME349
[1] DLR German Aerospace Center, Model in the Wind Tunnel, 2014, (url). CC-BY 3.0.
Purpose
✓ *Teaching
✓ *Research
→ *Restricted Access
Nature
✓ *Important Ed. Purposes
✓ *Factual/Nonfiction/Based
Amount
✓ * Small Quantity
✓ * Not Central to entire work
✓ * Appropriate for Educational purpose
Effect
✓ * One copy made
✓ * No effect on market
✓ * No licensing mechanism


PURPOSE
+ TEACHING
+ RESEARCH
+ RESTRICTED ACCESS
NATURE
+ FACTUAL / NON-FICTION
+ IMPORTANT. ED. OBS.
AMOUNT
– WHOLE WORK
+ AMOUNT APPROPRIATE 4 ED.
EFFECT
+ ONE COPY MADE
+ NO SIG. EFFECT ON MARKET
– REASONABLY AVAILABLE LICENSING MECH.
– AFFORDABLE PERMISSION AVAILABLE
– COULD REPLACE SALE OF WORK
Kenworth - T680 52 inch sleeper cab aerodynamic package. 2015, URL. NC-ND 2.0.
[1] Ju gatsu mikka, / conventional 18-wheeler truck diagram.svg. 2011, URL, CC-BY-SA 3.0

PUBLIC DOMAIN

↳ CANADA

PURPOSE
- scholarship
- Research
- Nonprofit/educational institution

NATURE
- Published work
- Important to favored ed/

AMOUNT
- Small quantity
- appropriate for educational purposes
- portion used not central

Effect
- one or few copies made
- no significant effect on market of potential market for copyrighted work
- Lack of licensing mechanism

[1] Oertel, H., Streamline topology of a Car Wake, 2010, https://commons.wikimedia.org/wiki/File:Car_wake.jpg CC BY-SA 3.0

PURPOSE
- Teaching
- Educational (Nonprofit)
- Research
- Restricted Access

AMOUNT
- Small quantity
- Not significant to entire work
- Educational purposes

NATURE
- Published
- Important to favored educational objectives

Effect
- No significant effect on market

[1] Pallucchini, H., COE 18-Wheeler truck diagram, 2011, URL. CC BY-SA 3.0.

Appendix B: Rubric

Use of Images Rubric

	None (0)	Beginning/Emerging (1)	Developing (2)	Proficient/Competent (3)	Exemplary/Strong (4)
Attribution	Images are not labeled or cited.	Images are labeled but do not contain sufficient information to determine the source.	Some images are cited	All images are cited but the style is incorrect or inconsistent	All images are cited using the appropriate style
Ethical Use (Use of images that have appropriate Creative Commons license, have public domain status, or are original creations)	Images do not show license status.	Images show information related to license status but do not provide enough information to determine license status	Some images show license status.	All images show license status, but not all are copyright free	All images are copyright free (with proof of Creative Commons license, public domain status, or original creation of the student)