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Anna Ursyn

University of Northern Colorado

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Recommended Citation

Ursyn, Anna, "Assessing Assessment Strategies and Development of Rubrics for Knowledge Visualization-Based Instruction" (2022). *Assessment Mini Grant Reports*. 21.

<https://digscholarship.unco.edu/assessmentgrant/21>

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Assessing Assessment Strategies and Development of Rubrics for Knowledge Visualization-Based Instruction

Anna Ursyn

Abstract

In this research-based study, students learning was based on knowledge visualization tools using visuals that allow for presenting complex ideas for faster and better communication. Tools serving both for students' learning and their assessment included sketches with captions, illustrated research paper, visual presentation, timeline, short essay, homework, in-class participation, and the use of color and symbol coding. This study examines students' perception toward these learning and assessment tools used to evaluate their understanding and knowledge retention. Students who gain understanding of visual techniques and procedures gain advantage when searching for jobs. Those skills might help students acquiring abstract thinking skills, gaining self-confidence while presenting visual data, socializing with the group, and making connections between their professions and art. A survey following the course took form of students' numerical and verbal responses about their assessment of studying and being assessed on their knowledge visualization-based tasks. Results of the survey confirm the importance of knowledge visualization methods as a tool for learning and assessment of students.

Introduction

While teaching, we are dealing with a wide range of students and struggle to attain an inclusive learning environment. The practice of supporting students' distinctive needs depends on our knowledge about these needs. Teaching that agrees with learners' abilities and likings enhances their access to opportunities. When given informative rubrics, students become well-informed about our expectations about the content and form of their projects and productions. By giving us information about their reactions to our teaching, students help us to build up a productive learning environment.

This study explores how students can benefit from developing visual solutions. The intent and goal of this study is to examine how a knowledge visualization approach to problem solving, along with visual and text-based skills, can be used as a matter for a teacher's assessment **of** students. These methods of studying can be then assessed **by** students. With the use of the visuals, students would gain enhanced learning experience and hopefully enjoyment of their studying, being assessed on, an assessing by themselves. Thus, the intent of this survey study is to test the impact of a teacher's instruction and students' assessment on an outcome: students' assessment of this treatment, followed by discussion of factors that may influence that outcome.

Theoretical Assumptions

This study relates to a novel approach to visual way of learning and instruction about natural processes and the current ways we capture their essence. Theoretical background for this research draws from studies focused on the improvement of students' visual and technology-related literacy and students' perceptions on effects of technologies on their studying and learning. Margaret Boden, a researcher in artificial intelligence, cognitive and computer science stressed that new art and digital artwork are associated with an interest in technology. The ability to solve problems, find new problems, and focus on creative tasks, all depend on the creative development (Boden, 2010). Graphical ways of presentation, the use of internet and digital media by instructors and students, along with making knowledge visualization an integral part of the learning process, all support learning about advances in science. Coding as a language of art have been researched and described previously (Al-Rifaie, Ursyn, & Wyeld, 2020; Ursyn, 2020). Visual storytelling, especially digital storytelling combines visual and verbal communication. Many agree that multi-media communication using storytelling techniques can be more effective than using only dry facts (Ursyn, 2021). Also, almost all agree that visualization is useful in all disciplines and that communication is difficult without it (Lima, 2011,2017; Yau,2013). Traditionally, a school of art and design is not commonly seen as a place for technology-oriented students. However, with technologies becoming supportive of graphics and visualization techniques, it is mandatory to push students to grow in this domain. Ongoing progress in technology related solutions, from portability to networked advancements make a great impact on how students learn and how they are being assessed. Prospective employers expect from students that they understand visual presentation of data and concepts and they use colors and symbols for presentations and discussions. They are expecting that students build their own, unique quality portfolio and develop abstract cognitive thinking. Students know current technological advances but need to learn how to become confident in their own visual depiction of information. This approach creates a need for teamwork among students, which often results in an advance in their work. Thus, different ways of thinking may lead to collaboration and then new discoveries. This research study is about preparing students for these challenges by enhancing their visual and technological literacy. It is directed at students doing self-motivational explorations, keen on comprehending and later enhancing the role of images in design, sciences, computing, journalism, media communication, advertising, and marketing.

The purpose of this study

The purpose of this quantitative survey study is to collect information about students that could be later generalized from a sample to a population. Investigation, which involved several variables – measurable items that may assume a set of values – considered an assessment by students of teaching strategies (dependent variable), along with the students' assessment methods (independent variables). Besides the numeral assessment, students were asked for written comments and feedback. Data collected in this study

inform about students' preferences in studying and then their preferences in being assessed. The goal would be to come up with good strategies for grading the non-test related projects and see how it affects students' learning and their reaction to the alternative types of studying, learning, and assessing it.

This inquiry applies a double-assessment: once, the assessment of students made by a teacher, and then students' assessment of the forms of instruction and assessment of their work. Students evaluated our actions that supported their learning, both course content and their own learning effectiveness. In their written comments, they informed about their growing aptitude for getting familiar with difficult-to-grasp concepts, their attitude toward technology, and about misconceptions. Students assigned numerical values to particular tasks (forms of instruction), and wrote how their knowledge, understanding, motor skills, imagination, retention, fear factor, and efforts toward becoming technologically savvy influenced their standing in their discipline. Also, our students who are known for being collaborative and supportive, wrote about sharing the experience with peers, just setting so much sought standards for collaborative efforts. These data were collected to provide information for further analysis of the experience and outcomes, disclosing feasible options for both our instructional actions and students' learning styles.

Research questions/hypotheses

This survey asked about students' preferences about their visual learning strategies, which include making quick sketches while learning, writing an illustrated research paper, developing visual communication with peers through an illustrated presentation, organizing data in a timeline, and making illustrated homework study. These learning strategies were supported by rubrics.

Research hypothesis was that the assessment of teaching methods and students' responses can inform about the ways of involving students in more effective and attractive forms of assessment they could actually enjoy.

Design of this study

A survey was selected as the preferred type of data collection. The advantages of this format are economy of the design and the rapid turnaround in data collection. The survey form was cross-sectional, with data collected at one point in time but not longitudinal over time. Two tasks were performed in this inquiry. First, analysis was made, of students' opinions on specific forms of instruction (assessment methods) along with students' attitudes toward various ways of their learning. Second, the reworking of rubrics was made, by adapting them to the inclusive student-oriented mode. The forms of instruction selected for this study took form of graded visual projects and activities assigned to students, which then served for students' assessment. Rubrics were developed and provided to students for these three types of courses. Our assessment of students' learning involved the results of their actions. Then, assessment made by the students was examined.

Data collection

The data collection took form of questionnaires administered by a researcher; they were not biased by previous interviews, structured record reviews, or structured observations. Data were collected as numerical answers and written comments.

Population in the study consisted of students taking five different types of courses, ART 190, *Art Appreciation* – a course for non-art majors delivered online; ART 171, *Introduction to Visual Communication Design*; ART 177, *Creative Photography*; Art 437, *Computer Art*; and ART 338 *Digital Illustration and Storytelling*.

A cluster sampling was analyzed in that regard, clusters formed by particular courses and these courses' sections. Because of differences between the courses' content, it was impossible to integrate the data into one spreadsheet or a list for further analysis.

A selection process resulted from students' decisions, who choose to be a respondent. So, the proportion of the characteristics of the individuals such as gender or age could not depend on a researcher.

Instrument used to collect data took form of a message with a template of a continuous scale of numbers from 1 to 10, with 10 meaning the best evaluation, and a cover letter asking for written comments as attitudinal items. Students taking courses under this study were given a list of assessment methods they experience while taking a course. They were asked to respond to questions about various forms of studying and assess them both in a numeral and written way. A set of questions differed slightly between courses depending on the course content. Maintaining consistency in survey administration was impossible because of the differences between the courses and each course sections content: not all forms of instruction (assessment methods) were administered in some courses. Below are presented lists of assessment methods provided in the courses under study. A sample of this instrument is included below, as well as the actual responses of the students presented in the Results section. A set of questions as a list of assessment methods that students experienced while taking a course differed slightly between courses depending on the course content.

Description of the assessment methods (forms of instruction)

Students received instruction about fulfilling their tasks. Below a description of methods of assessment is provided, giving the essential features of the task and instructions given to students. Summing-up, students received and assessed the following assessment methods.

Developing Rubrics

In the three types of courses under study, rubrics were developed for tasks assigned to students: a quick sketch and art critique, a research paper, timeline, presentation on a theme chosen by each student, and homework. As an example, rubrics developed for the Art Appreciation (ART 190) course are presented below. The requirements and in some cases the guides and objectives were added.

PRESENTATION RUBRIC

Presentation requirements

1. A Title Slide with your name and class, a Title of an approved topic
2. Created in Microsoft PowerPoint with at least 20 slides, followed by References slide(s)
3. Strong evidence of scholarly research about related trends and issues
4. A strong introduction, information, and conclusion
5. Images with informational captions blending with text for better communication
6. 80% of your presentation written in your own words
7. At least five sources listed at the end of the Presentation
8. Your Presentation should generate an interesting class discussion
9. Delivery of your Presentation should be in a professional manner, no over-decorated, or special effects negatively impacting the perception of the content of your topic and message
10. Addressing classmates' questions should enhance understanding of the topic chosen
11. Remember to include References
12. Name your Presentation: Your_Name_Section_Presentation.pptx, For example, Jason Doe 970 Title of Presentation.pptx

Rubric for Presentation	Exceptional 20-18 points	Conscientious 17-14 Points	Mediocre 13-10 Points	Weak 9-0 Points
1. Quality of Research and Content	Excellent Presentation explains concepts and ideas and sets them in context. Evidence of your own research and content utilizing quality resources.	Good Presentation explains concepts and ideas and sets them in context. Evidence of your own research and content utilizing quality resources.	Limited evidence of your own concepts and ideas and no setting them in context. Weak evidence of your own research and content utilizing quality resources	No evidence of any authentic research.
2. Attention to detail, and explanation of the (approved) topic.	Excellent attention to detail and exploration of the topic, presented with interest and obvious enthusiasm.	Sufficient attention to detail, with a conscientious exploration of the topic.	Limited details, only basic information revealed.	Not nearly enough detail. Does not fulfill requirements
3. Proper Format: Cover page, cited sources, bibliography, images with proper credits	Bulls-eye with proper format, credit to sources, and required length and images to support research and keep the attention of your audience.	Good use of format but missed one of the minor requirements.	Too many of the requirements for proper format are missed	You missed the majority of research requirements. Or you did not properly source your material.
4. Thesis: Clearly states a thesis in the introduction, which is supported throughout the Presentation	Presentation exceptionally describes a theme and provides strong evidence to defend the topic.	Presentation conscientiously addresses and supports the topic.	Presentation makes a faint attempt at addressing the topic.	No effort to introduce and present the topic.
5. Quality of communication. Including proper punctuation, sentence structure, proofread, spell check etc.	Excellent quality of communication through slides and verbal presentation Well-designed and illustrated, innovative, and interesting to watch.	Good communication and presentation quality, with attention to detail and interesting points.	Acceptable presentation and communication Your Presentation would benefit from using help with writing.	Poor communication and presentation. Not presented according to college standards.

Results

Data were collected close to the end of each course taken by students during different semesters:

Spring 2017, ART 171-007, Introduction to Visual Communication Design

Fall 2017, ART 171-007, Introduction to Visual Communication Design

Spring 2017, ART 177-003, Creative Photography

Spring 2017, ART 190-972, Art Appreciation

Fall 2021 ART 171-003, Introduction to Visual Communication Design

Fall 2021, ART 171-007, Introduction to Visual Communication Design

Spring 2021, ART 190-970, Art Appreciation – non-art majors, online delivery

Fall 2021, ART 190-970, Art Appreciation – non-art majors, online delivery

Spring 2022, ART 171-007, Introduction to Visual Communication Design

Spring 2022, ART 338 Digital Illustration and Storytelling

Spring 2022, ART 437, Computer Art

1. Numeral assessment by students

In majority of cases, students responded by providing numbers and comments. The non-art majors taking one of the *Art Appreciation* (ART 190) courses responded by sending numbers, not comments (this was an online class for students out of the art area, busy and stressed by the tests).

Numeral results were downloaded into a spreadsheet for further analysis. Some students assessed only those forms of instruction (assessment methods) that were applied in the class; for example, they did not assess tests or quizzes.

Table 1 presents a summary (mean values) of answers of students taking five different courses:

ART 190, Art Appreciation

ART 171, Introduction to Visual Communication Design

ART 177, Creative Photography

ART 338, Digital Illustration and Storytelling

ART 437, Computer Art

Below are results of assessments provided by students in particular classes under the study. Data were gathered first in the Spring and Fall 2017 in ART 171 Introduction to Visual Communication Design (two sections), ART 177 Creative Photography, and ART 190 Art Appreciation classes. After that, the research was continued in the Fall 2021 ART 171 Introduction to Visual Communication Design (two sections), Spring and Fall 2021 ART 190 Art Appreciation class, and then in and the Spring 2022: in the ART 171 Introduction to Visual Communication Design classes, Art 338 Digital Illustration and Storytelling, and ART 437, Computer Art.

Sketches with captions, Short essays, and Coding using colors and icons were assessed in one class only, Art 190 Art Appreciation in Fall 2021, so they have not been included to the Table 1 and 2. Sketches with captions got an 8.4 note; short essays were assessed with a result 6.6, and coding using colors and icons got a 7.0 note.

	171-007 2017 Sp	171-007 2017 Fall	177-003 2017 Sp	190-972 2017 Sp	171-003 2021 Fall	171-007 2021 Fall	190-970 2021 Fall	190-970 2021 Sp	171-007 2022 Sp	338-008 2022 Sp	437-006 2022 Sp
Rp	7.86	5.18	6.84	7.18	5.3	6.44	6.8	5.7	4.44	4.67	4.29
Tl	6.86	5.64	6.74	8.8	5.1	6.75	6.8	6.84	5.9	4.25	6.67
H	5.86	6.90			7.45	4.83	6.8	5.2	5.5	3.57	6.71
Pre	8.5	6.30	8.68	8.1	5.9	9.63	7.4	6.3	4.7	5.0	6.33
Cl	9.57	4.90			5.45	9.38	5.4	5.18	6.1	5.2	7.0
Q		3.6	4.83	8.18	6.36	2.71	4.2	6.0	4.78	4.33	4.33
Te		3.6	4.6	7.6	5.63	2.71	3.4	6.8	4.33	3.75	4.57
Pro		8.9			8.9	9.44		8.90	7.75	10.0	8.13
Cri		7.18			7.27	9.22		6.55	7.1	8.0	8.71
Colb		5.80			7.18	8.88		7.18	4.56	5.2	4.67

Table 1. Students' assessment of activities and forms of studying

Table 2

Projects	ART 171 Into Vis Com Design	ART 177 Cr Photo	ART 190 Art Apprec.	ART 338 Digital Illustr.	ART 437 Computer Art	Mean Values
Research paper	5.85	6.84	6.57	4.67	4.29	6.64
Timeline	6.05	6.74	7.48	4.25	6.67	6.24
Homework	6.1		6.0	3.57	6.71	5.60
Presentations	7.1	8.68	7.27	5.0	6.33	6.88
In class reactions	7.08		5.29	5.2	7.0	6.14
Quizzes	4.36	4.83	6.13	4.33	4.33	4.8
Tests	4.0	4.6	5.93	3.75	4.57	4.57
Projects	8.75		8.9	10.0	8.13	8.95
Critiques	7.69		6.55	8.0	8.71	7.74

Collaboration	6.6		7.18	5.2	4.67	5.91
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Table 2. Mean values of students' assessments assigned to the five courses under study.

Data analysis and interpretation

1. Numeral assessment by students

Discussion of the variables

Data for independent variables was based on a description of teaching strategies and methods of the assessment by the teacher of the students' accomplishments of graded projects and activities. Students' graded tasks and actions included: making quick sketches while learning, writing an illustrated research paper, organizing data in a timeline, making illustrated homework study, developing visual communication with peers through an illustrated presentation, writing critiques of peers' works and actively discussing their works, and actively collaborating on team projects.

The dependent variables in the study – students' assessment of these teaching strategies and assessment methods – have been presented as means, **standard deviations, and range of scores for these variables?** The scales from 1 to 10 were consistently provided and so offered reliability of scales. Tables of the results of data analysis are provided in the Results section: first students' assessment of activities and forms of studying and then mean values of students' assessments assigned to the five courses under study. While discussing students' answers, possible response bias should be considered, as the effect of not responses on survey estimates. **Statistical *t*-test) was chosen because there was one independent variable for each question's result and a bell-shape, not a non-normal distribution of responses was observed.**

Validity of the scores: content validity – whether one can draw meaningful inferences from scores; predictive or concurrent validity – do scores predict or correlate with other results; construct validity - do items measure hypothetical constructs or concepts? Also, whether the scores serve a useful purpose and have positive consequences when they are used in further practice.

Conclusion

This research study was an answer to a need for making the students' learning more visual. A focus on equity and inclusion makes the studies on visual communication even more important. It is hard to come up with professions that do not use visuals as their tool, starting with icons, logos, or visual presentations of complex ideas made for faster and better communication and allowing to compare and then contrast data visually. Students who gain understanding of techniques, rules, and procedures involving visual communication media gain advantage when searching for jobs. They become acknowledged as visually contributing members of the company they'd work for. Learning those skills might help students acquiring abstract thinking skills, gain self confidence in visual data presentation, socializing with the rest of the group on the same level as visuals speak out equally, and to make connections between their profession and art. Introducing and testing visual methods of instruction and assessment was a response to changes in our educational environment. Receiving students' assessment and reactions to these actions provides an opportunity to further honing and refining the visual literacy of students.

Conclusions from the results for the research question can be drawn as a confirmation of a research hypothesis that the assessment of teaching methods and students' responses can inform about the ways of involving students in more effective and attractive forms of assessment they could actually enjoy. The outcomes and larger meaning of the outcomes may result in a better student-teacher communication and a stronger inclusiveness. This will provide easier access to complicated or confusing concepts, improvement of our methods of instruction and students' assessment, and a progress in retention outcomes.

Acknowledgement

The study *Assessing Assessment Strategies and Development of Rubrics for Knowledge Visualization - Based Instruction* was supported by the Assessment Mini-Grant awarded by the UNC's Office of Assessment.

Budget spent as in the Grant Proposal:

5 inks \$ 160 each = \$ 840, Books total 154.27. Total \$ 994.27

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