The Metacognitive and Exploratory Use of the Concept Map for Thematic Art History Papers in the Survey Course

Method: Mixed methods using qualitative, quantitative, and visual analyses
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SoTL Introduction

In the following article, Leda Cempellin used a three-pronged methodological approach to analyze student learning with respect to the process of concept mapping. Her results are based upon data gleaned from three sources: a questionnaire that students in one course completed five times over the course of a single semester, examples of the progression of three students' work (completed concept maps) over a single semester, and a questionnaire that students completed at the end of the term in two different courses.

With the first of these data sources, Cempellin employed grounded theory qualitative coding of student written responses to open-ended questions. Through multiple rounds of reading while noting emerging themes, she determined several key concepts that kept recurring in student responses to the same question. She then transformed this qualitative material into quantitative data by charting the numbers of occurrence of these concepts over the course of the semester in the five administrations of the questionnaire. These charts allowed her to analyze changes and consistencies in student understanding of the purpose of and comfort with concept maps.

With the examples of students' completed concept maps, Cempellin charted new territory in SoTL methodology by employing art historical methods of visual analysis to student work. She analyzed both the visual and textual/conceptual structure of the images and their development over two iterations. This method is particularly appropriate for studying the pedagogy of concept maps because they provide significant visual data about student cognition in ways that express beyond the exclusively verbal or textual.

For the final data set, Cempellin employed a quasi-experimental, two-group, post-test only design to analyze student attitudes towards concept maps. She administered the same questionnaire in two courses, one with a pedagogical intervention designed to improve students' learning through concept maps and, the other, a control group without such an intervention. While this model cannot tell us if significant changes in student attitudes occurred over the course of the semester, because a pre-test of the same questionnaire was not administered, the differences in student responses between the control and intervention group suggest that the intervention did have an effect. Similarly to her methodology with the other questionnaire responses discussed above, Cempellin used grounded theory coding to identify emerging themes in student responses to two open-ended questions at the end of the questionnaire.

The three sets of data and analysis in this article help to draw a complex picture of student cognitive development through the concept mapping tool. Cempellin's results suggest that student understanding of the tool and of course content may, depending on the student, improve with the interventions she designed, student attitudes towards the tool and interventions may diverge significantly.

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Introduction

Concept maps are defined as "graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts."[1] Concept maps originated in the 1970s, initially as a tool for students to learn scientific concepts[2] and have been widely used in health-related disciplines because they help students discern patterns in ideas that recur within different contexts and find a meaningful connection to describe their relationship.[3] Concept maps were further refined by Joseph D. Novak in the following two decades as an aid to research.[4] In 1984, Novak claimed that "people think with concepts" and therefore "concept maps serve to externalize these concepts and improve their thinking."[5] It is generally well understood that concept maps are "external knowledge representations,"[6] therefore being viable tools for brainstorming,[7] for summarizing class learning, for revising class materials,[8] for integrating new learning to preexisting knowledge,[9] and more generally as an

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[1] J. D. Novak and A. J. Cañas, "The Theory Underlying Concept Maps and How to Construct and Use Them," Technical Report IHMC CmapTools 2006-01 Rev 01-2008, Florida Institute for Human and Machine Cognition, 2008. http://cmap.ihmc.us/docs/theory-of-concept-maps.

[2] Joseph D. Novak and Alberto J. Cañas, "The origins of the concept mapping tool and the continuing evolution of the tool," *Information Visualization* 5 (2006): 175. https://doi.org/10.1057/palgrave.ivs.9500126.

[3] Concept maps have been used in nurse education classes to enhance critical thinking skills, by gathering diverse data about the patient's health issues and sketching a possible diagnosis. Marjorie King and Renee Shell, "Teaching and evaluating critical thinking with concept maps," *Nurse Educator* 27, no. 5 (September/October 2002): 214-215.

[4] Ibid., 179.

[5] Joseph D. Novak and D. Bob Gowin, *Learning how to learn* (Cambridge, UK: Cambridge University Press, 1984): 2.

[6] Minkyu Kim, "Concept map engineering: methods and tools based on the semantic relation approach," *Educational Technology Research and Development* 61, no. 6 (2013): 954.

[7] David Hyerle, "Thinking maps: Seeing is understanding," *Educational Leadership* 53, no.4 (December 1995/January 1996): 85.

[8] Martin J. Eppler, "A comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors as complementary tools for knowledge construction and sharing," *Information Visualization* 5, no.3 (September 2006): 203.

[9] David Hay, Ian Kinchin, and Simon Lygo-Baker, "Making learning visible: the role of concept mapping in higher education," *Studies in Higher Education* 33, no. 3 (June 2008): 295–311. https://doi.org/10.1080/03075070802049251.

excellent tool to boost meta-cognition.[10] This study focuses on the exploratory use of concept maps to make modifications to the paper's concept throughout its development stages[11] and addresses students' perception of its usefulness.

The class chosen for this study is a world art history II class (ARTH 212), an art history survey covering the timeline from the Late Middle Ages/Renaissance through the twentieth century; it is offered in the spring semester and continues the chronology started in fall from Prehistory through the Late Middle Ages (ARTH 211). Students come from very diverse backgrounds, taking this course to satisfy their major within the School of Design or to meet a general education requirement. The institution is a mid-size land-grant, public research university in the Midwestern region. The specific spring class chosen for this study was a small-size class of 13 students.

The author teaches this course in the more traditional linear and chronological manner, so that students develop a wide-ranging understanding of the evolution of taste across time. By contrast, the term paper requires students to develop a theme or concept that includes three to four pieces from the same culture across the ages, or from different cultures in comparable ages. Students are required to start from something familiar to them (learned in class or seen in the textbook), to perform the artwork's visual and contextual analysis, and to discern one topic of cultural significance, which will be their broad area of investigation. Then, the student looks for other pieces on the same topic, but from different eras or cultures, compares and contrasts them, and attempts to formulate an argument. This thematic approach to the written assignment requires students to explore a larger cultural idea by comparing and contrasting artworks that are separated in space or time. It strives to reconcile the hypertexual explorations that students constantly perform by navigating with their own devices on the Internet led by explorative associations of ideas, and the traditional progressive acquisition of knowledge within a more structured contextual frame, representing the way previous generations have learned to operate.[12]

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[10] Chei-Chang Chiou, "The effect of concept mapping on students' learning achievements and interests," *Innovations in Education and Teaching International* 45, no.4 (November 2008): 376. https://doi.org/10.1080/14703290802377240.

[11] Susan Ambrose, et. al, *How Learning Works. 7 Research-Based Principles for Smart Teaching* (San Francisco, CA: Jossey-Bass, 2010), 228. The authors suggest that the course instruction could have students draw several concept maps on the course content throughout the semester and have them compare the maps in order to track the deepening of their understanding over time.

[12] In recent years, the art appreciation textbook *Gateways to Art* has been presented as mimicking the hypertextual navigation that students were accustomed to within their Internet explorations. Ralph Larmann distinguished between a flowchart model to indicate the more traditional linear progression and "mind mapping," which he defined as "a planning process that is non-linear. It does not rely on a rigid conceptual structure, is more intuitive, and can be modified easily if new information is introduced. Because mind mapping is not tied to a linear structure, it allows for multiple associations and can draw from many sources of information at the same time. Mind mapping works in a way that is similar to the Internet. When one uses a hyperlink to access associated information it enhances the flow of knowledge, even though it does not promote a linear progression. College students who were born after 1990 have grown up alongside the development of the Internet, and they are uniquely able to comprehend and absorb information that is presented from disparate media sources. They feel comfortable in an environment of

Concept maps perfectly fit the contextual nature of the art history discipline: as Eva R. Hoffman suggests, concept maps help to "organize and structure large volumes of material with an emphasis on effecting connections and interactions," which is necessary to make meaning within the breadth of the art history survey.[13] Additionally, its capacity to change "according to changing contexts" enables it to adapt to "the interdisciplinary methodologies and multiple classification systems necessary to understand global culture."[14]

Since concept maps allow users to "represent or manipulate a complex set of relationships in a diagram,"[15] they can help students self-assess the adaptability of newly acquired information to the overarching theme or question the scope of the theme itself. When an issue arises, either the new information does not fit the whole concept, or students have to rethink the overarching theme and partially redo the concept map.[16]

This active and self-regulating approach is largely influenced by metacognitive theories. Indeed, Novak defines concept maps as "metacognitive tools," as they help students self-regulate and increase their learning "over time."[17] According to Ritchhart et al., the use of concept maps empowers students to become more active learners within a "constructivist epistemology," by enabling the "creation of visual entry points for learners of varying abilities."[18] This is the ideal situation within the setting of the world art history survey class, whose members come from very diverse backgrounds. Constructivism aims at helping the learners build knowledge not as a

interactivity and intuitive learning." Ralph Larmann, "Changing the Sheets: An Approach for Integrating Non-Linear Learning into Art Appreciation Texts," *FATE in Review* 31 (2009-2010): 33. Cited with permission from the author.

[13] Eva R. Hoffman and Christine Cavalier, "ARTIFACT: Mapping a Global Survey of the History of Art," in *Teaching Art History with New Technologies: Reflections and Case Studies,* eds. Kelly Donahue-Wallace, Laetitia La Follette, and Andrea Pappas (Newcastle, UK: Cambridge Scholars Publishing, 2009): 82.

[14] Ibid., 83.

[15] Martin Davies, "Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?," *Higher Education* 62, no.3 (September 2011): 280.

[16] An antecedent of the explorative approach to the assignments through concept maps is the 2006 study by Stoyanov and Kommers, who used the concept map to identify and solve ill-structured issues. The authors attribute the problem-solving capacity of concept mapping largely to its clarity and flexibility, since "The technique capitalizes on the advantages of graphical representations, without losing the flexibility and richness of the natural language system. Concept map can expresses [sic] a variety of problem-solving representations (facts, analogies, feelings) and a variety of relationships between them (descriptive, structural, causal, metaphorical)." S. Stoyanov, and P. Kommers, "WWW-intensive concept mapping for metacognition in solving ill-structured problems," *International Journal of Continuing Engineering Education and Lifelong Learning* 16, no.3/4 (2006): 300. https://www.ou.nl/Docs/Expertise/OTEC/Publicaties/slavi%20stoyanov/10%20Stoyanov1.pdf.

[17] Joseph D. Novak, "Meaningful Learning: The Essential Factor for Conceptual Change in Limited or Inappropriate Propositional Hierarchies Leading to Empowerment of Learners," *Science Education*, 86 no.4 (July 2002): 559 and 565. https://doi.org/10.1002/sce.10032.

[18] Ron Ritchhart, Terri Turner, and Linor Hadar, "Uncovering students' thinking about thinking using concept maps," *Metacognition Learning* 4 (2009): 148-149. https://doi.org/10.1007/s11409-009-9040-x.

passive, rather as an active learning process,[19] in which they "make sense of their surroundings by assimilating new information into the mental models they have previously created,"[20] thus integrating new and existing knowledge. In a constructivist sense, the concept map can be used for exploratory forays into art history by being modified throughout the process to accommodate the ever-expanding process of information acquisition.

Formulating the Research Question

Prior to fall 2018, the course instructor had sometimes required students to develop simpler forms of mind maps for large, open-ended thematic questions assigned during Midterms or Finals.[21] In fall 2018, after observing a general and worrisome progressive decline in students' writing and argumentation skills from previous papers, the course instructor decided to try introducing the concept map within the process of developing the term thematic paper, by asking students to submit both of them later in the semester. A few days after the papers' deadlines, the course instructor created and submitted to the class a set of questions, which are listed here in the **Methods** section, to understand students' perception of the concept maps' usefulness in strengthening their thematic art history papers. These preliminary results from fall, although potentially biased,[22] suggested that generally students did not perceive paper and concept maps in tandem. The course instructor started to wonder whether pushing the concept map beyond the initial brainstorming phase for the thematic paper may have a positive impact on students' self-reported behavior throughout the process and their perceptions of its efficacy. The pedagogical interventions designed for this study aimed to have students work on their concept map and paper in tandem.

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[19] Marie Gasper-Hulvat, "Active Learning in Art History: A Review of Formal Literature," *Art History Pedagogy & Practice* 2, (1): 4. https://academicworks.cuny.edu/ahpp/vol2/iss1/2. Gasper-Hulvat echoes a traditional definition of active learning as activity going beyond mere passive listening to a lecture and requiring students to do something and to reflect about it. This is a process that involves constructivist and metacognitive approaches.

[20] Sudhir H. Tandel, *Metacognition and Constructivist Approach* (Saarbrücken, D: LAP LAMBERT Academic Publishing, 2015), 23.

[21] The main difference between mind maps and concept maps is that ideas in the mind map depart radially from a core concept, while the concept map is "a top-down diagram showing the relationships between concepts, including cross connections among concepts." Eppler, "A comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors," 203. The mind map can be adapted in a small scale to work effectively in summarizing one important concept learned in class: for instance, the various elements of the fresco technique after seeing a video. The concept map can be further expanded to visualize a more complex network of relationships, such as in a thematic paper. Earlier in the semester, I introduced small exercises requiring students to draft mind maps in a few minutes on index cards to help them get used to the process of data visualization within the smaller scale that the limited class time affords.

[22] It has to be noted that, even if the data relative to the late semester questionnaire in Fall 2018 were collected anonymously, the results are potentially biased due to factors, such as students' worries on potential repercussions of their answers on their grades and their lack of awareness on how the data could be used.

Methods

In order to attempt to capture the type of dialogue established between concept maps and the thematic manuscript, in the Spring 2019 semester the course instructor planned some small activities in class and three major interventions, corresponding with different development stages of concept map and paper. The course instructor provided individualized feedback online on each of the students' submissions; students could use the suggestions to further strengthen or modify the direction of their work at each observed stage.[23] Additionally, five times periodically throughout the semester students were given the same brief questionnaire,[24] aimed at collecting data concerning the evolution of their perception of the concept map as their work was progressing through the activities and pedagogical interventions:

1. What is a concept map?
2. Is the concept map helping you understand the course materials better, and how?
3. How have you used the concept map in the course so far?
4. What is the most confusing to you about concept maps? Write down one question you have related to concept maps.

Early in January, the course instructor designed a few small activities to help students become acquainted with the way concept maps work in the much smaller scale afforded by class time: for instance, at the end of a class, students were given an index card to track a mind map that would connect the ideas of political and linguistic fragmentation in late Medieval Italy, the didactical function of art, and the distribution of visual representations in registers. This approach corresponds to a more traditional use of data visualization tools to summarize lectures. The first periodic questionnaire was submitted right after these small class exercises.

On January 22, the course instructor distributed copies of a sample paper from the previous year (with student consent and the name removed); the class discussion centered on identifying the paper's core concept, on the level the images fit the concept, and on further narrowing down and strengthening it. The first major intervention was a discussion board opening in D2L after this class activity, from January 28, 2019 to February 4. The assignment required students to write a concise narrative in answer to a few guided questions and reply to two other students. The goal was to have students brainstorm their initial ideas for the paper, discuss them with other students, and use the feedback to create a more refined topic. No concept maps were submitted at this early stage. The questions for this first discussion board asked which one was the first work the student was looking into, which W-questions (Who? What? Where? When? Why? How?) was that work stimulating, some possible overarching ideas the work seemed to inspire, whether the student was already using the concept map and how, and which source, related to the chosen artwork, the student was reading. The periodic questionnaire was presented again not long after this online sharing of initial steps among students.

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[23] Examples of this process will be discussed during the analysis of sample sets of concept maps.
[24] The questionnaire was devised with the assistance of Dr. Marie Gasper-Hulvat during our discussion on the research design.

A second major intervention was scheduled as another discussion board during weeks 7-8. Students were required to post their refined draft concept map after reading a second source, along with a narrative explaining the process of integrating new information, and summarizing another student's concept map. The overall purpose of this assignment was to test whether the concept map clearly indicated a direction and was transferrable into a narrative. The periodic questionnaire was resubmitted to the class at this time, and then once again in the eleventh week, when students were working on finalizing their concept maps and thematic papers. The finalized concept map and term paper were submitted by April 5, followed by the last submission of the periodic questionnaire and then a third intervention, in the form of a Dropbox submission of post-paper observations. This narrative required students to expand on their thinking process while making changes to the concept map and on the exchanges between the concept map and the paper.

In his 2007 study, David B. Hay analyzed the concept maps developed by a few postgraduate students on information known about a topic before and after a lecture.[25] The course instructor and author of this article has adapted Hay's visual analysis method to a selected sets of concept maps developed by undergraduate students in the ARTH 212 spring class, typifying deep learning, surface learning, and non-learning in three examples considered. Differently than Hay's approach, this study dealt with research pursued by students at home and on a topic of their choice, and therefore with a strong individual exploratory component outside of the common ground of a classroom experience.

On April 15, the course instructor resubmitted to the class an informal questionnaire that was developed the prior semester, to have some comparative data. The questionnaire included seven questions on a Lickert scale, plus two open-ended questions:
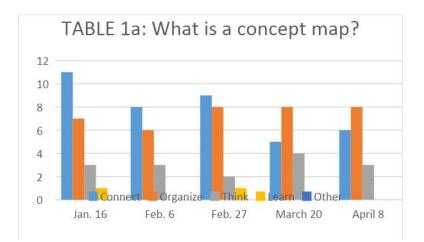
1. The concept map, as an integral part of my paper, has helped me to clarify ideas for my paper.
2. The concept map has helped me to form new questions for my paper.
3. The concept map has helped me to make meaningful connections between information and/or ideas for my paper.
4. The concept map has helped me to identify weak areas of my paper that needed further strengthening.
5. I worked with the concept map and the paper writing in tandem, using them as complementary tools and bouncing back from one to the other as needed.
6. I had to make considerable modifications and/or partially redo the concept map as I advanced through this project.
7. Overall, I believe the concept map is an ideal tool to use when approaching an art history thematic paper.
8. Applying the concept map to explore a thematic paper is a rather complex process. Please describe in detail the process you used and the challenges you faced while developing both the concept map and the thematic paper (provide concrete examples as well).

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[25] David Hay, "Using concept maps to measure deep, surface and non-learning outcomes," *Studies in Higher Education* 32 no.1 (February 2007): 39–57.

9. During the first weeks of the semester, we did some brief in-class exercises to become acquainted with the earliest steps of the paper's conceptualization. Which suggestions do you have on activities that could be implemented in following courses to aid the thematic paper's conceptualization and to make an effective use of the concept map?

Results: Periodical Questionnaire

The results of the periodic questionnaires have undergone several coding rounds, until broad categories have been identified in the students' answers: these categories roughly paralleled the grading rubrics that were used to grade the student work,[26] in turn modeled on the concept of surface vs. deep vs. non-learning analyzed by David B. Hay.[27] The broad categories specifically identified for the coding were "connect," (which included links, cross-links, and in general the nature of connecting two or more ideas), "organize," (i.e. the concept map's structure, organization, hierarchy), "think" (which includes brainstorm, understand, visualize), and "learn" (referring to the integration of old and new knowledge). That is, student responses were coded to find instances of when students viewed the concept map as useful for making connections, organizing their thoughts and information, thinking about their topic, and learning.

TABLE 1a: What is a concept map?

The question requiring students to define a concept map, illustrated in **TABLE 1a**, reveals a general progression from students' emphasis on connections towards a slightly increased emphasis on organization. A clear example consists in the evolution of the answers provided by Student F throughout the semester.[28] In mid-January, this student wrote that "A concept map is a tool used to organize thoughts and connect them together. It can start with one term or idea and
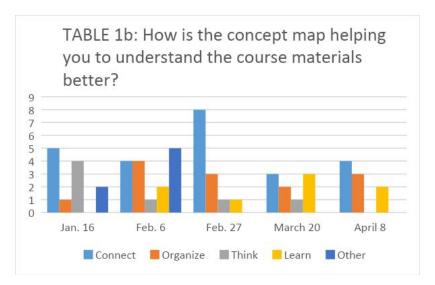
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[26] In order for coded data to be interpreted meaningfully, the scholar must perform additional coding rounds, until s/he identifies recurring patterns. Johnny Saldaña, *The Coding Manual for Qualitative Researchers* (Thousand Oaks, CA: SAGE Publications, 2013), 10.

[27] Hay's main indicators are the number of links, the presence of cross-links, a hierarchical structuring, the spatial organization in clusters, a meaningful integration of new knowledge with prior knowledge, application of acquired knowledge to new situations, and finding "breakthroughs" that produce "new patterns of understanding." Hay, "Using concept maps," 44-54.

[28] In the author's codebook, each student is identified by a letter and his/her quote summarized to identify common patterns.
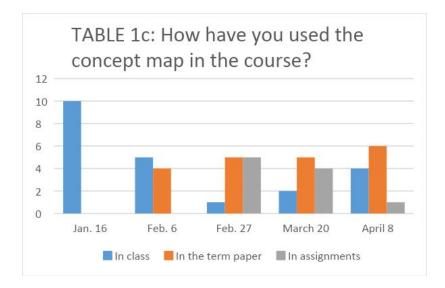
continue to add more ideas and terms." While this answer considers both links and organization, the emphasis is clearly on adding through connections. The evolving answer in early February is that a concept map "is a group of ideas arranged so the [sic] are all connected in some form by another idea or fact," with emphasis switching to the organizational element of the map. In late February, the student's answer is that the concept map is "a way to organize thoughts in a way where it can be seen how they are connected or relate," with awareness of both connections and organization, but a deeper emphasis on the nature of connections. In March, the answer is that the concept map is "an organized way to coordinate your thoughts on a particular subject," and in early April, "a way to unite all your thoughts down and group them in a more organized way," with greater emphasis on organization.

Fewer instances were observed in which students emphasized the use of the concept map to help think through an issue until the deadline for the paper approached. For instance, Student G stated in mid-January that the concept map is "a way to brainstorm and understand how different words and concepts are related to one another," which is the same answer in early February, worded slightly differently; in late February, this same student's answer is "a way of thinking through items and making connections;" in March, the answer is much bolder, "a way of thinking." The use of the concept map as a tool for learning was felt by only a tiny minority of students either within the context of reviewing class materials, or in more general terms: Student I stated in mid-January that concept maps "connect each point of lecture to enhance learning skill and quality;" Student H claimed in late February that the concept map is "a way to categorize in crosslink different clusters of ideas on a subject or thesis you are learning or working on."

TABLE 1b: How is the concept map helping you to understand the course materials better?
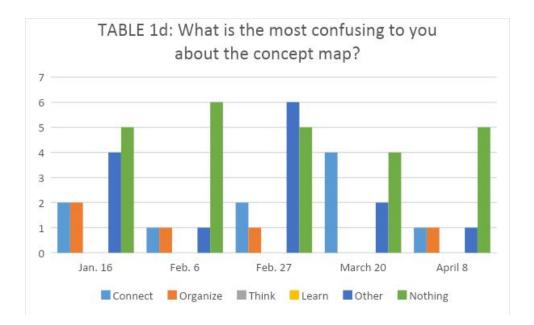
The answers to the second question, on whether the concept map helps students better understand course materials, started with almost unanimous affirmative answers earlier in the semester; however, beginning in March, almost one third of respondents began to provide a negative answer, a trend that continued throughout the rest of the semester. For instance, in early April, Student E states that "I think that the concept map confuses me more," Student K claims that "at this point I'm not sure," and Student N states that "there's no reason for one. If you can make a concept map, you must already understand the material."

The answers to the second part of the question, on how do concept maps help understand course materials better (illustrated in **TABLE 1b**), reveals that making connections between ideas was the largest result consistently throughout the semester, but with a sharp increase around the deadline of the draft concept map. The learning component increases, explained by the students, for instance, in terms of reviewing class materials (Student B in early February), of looking "at things differently which increases your learning" (Student H, early February), "to form connections that help in learning content" (Student L, March).

Those students who did not find the concept maps particularly useful claimed that the concept map would not go beyond surface learning ("it helps connects [sic] items but Im [sic] not sure it helps one go in depth," Student G, late February), and that a concept map's visualization strategy does not necessarily increase learning ("if I understand it well enough to make a map I already understand it," Student N, late February and rephrased in early April).

TABLE 1c: How have you used the concept map in the course?

Answers to the third question **(TABLE 1c)** run parallel to the progression of the in-class activities and home assignments outlined in the **Methods** section: earlier in the semester, the concept maps were used only in smaller scale (mostly in the simplified form of mind maps) for the small classroom activities; later on, as the deadlines for the discussion boards and the term paper approached, the out-of-class use of concept maps increased.

TABLE 1d: What is the most confusing to you about the concept map?

Concerning the question that invited students to reflect on the most confusing aspect of the concept maps (**TABLE 1d**), the majority of respondents at any time throughout the semester did not find anything confusing about the concept maps, which may be an indicator that the concept maps were understood at surface level. However, where doubts arose, the nature of connections was again the element most consistently recurring in the answers (e.g., "what to connect the main word(s) to first", Student L, mid-January; finding "something that correlates with both ideas," Student F, early February; "how to connect two topics as briefly and as logically as possible," Student E, March; "Sometimes it can be hard to understand why two topics would link," Student C, early April), peaking on March 20, when students were finalizing their thematic papers. Questions related to structural organization started to surface immediately ("Finding the right order," Student C; "Can concept maps just go in one direction rather than connect in multiple areas?", Student E, mid-January), but they are not as consistent throughout the semester as the concerns related to connections. Students' concerns that fell outside of Hay's categories (under "Other") are the most consistent throughout the semester, with very high peaks in mid-January and in late February. These address what looks like a degree of insecurity related to this exploratory process, including finding the breaking point between amount of information and clarity of visualization: "How to know if the concept map is correct?," Student F, mid-January; "Is there a right or wrong way to do it?, Student N, mid-January; "How long should a concept map be?," Student C, late February; "Putting the right amount of information on it. I never know whether it is too much or not enough." Student E, early April.

Results: Sample Concept Maps

The concept map was due at different stages: as a sketchy draft on February 11-15; as a more advanced draft within the Discussion Board number 2 in February 18-27; and in its finalized form as a Dropbox submission by April 5. The three sets of concept maps chosen for this analysis indicate a variety of students' levels of performance, ranging from deep learning's openness to change, to surface learning's struggle with change, to non-learning's complete resistance to change. The learning level indicators are those identified by David Hay in his experiment with a postgraduate class, in which he compared students' concept maps on a course topic before and after the class in which that topic was going to be covered. Hay's indicators of deep learning are the introduction of new concepts and integration with prior ones, connections drawn that are meaningful, and the improvement of structural organization.[29] As indicators of surface learning, Hay lists deficiencies in the integration of new concepts with prior ones, links that do not improve, and the overall structure or meaning not significantly improving.[30] As indicators of non-learning, Hay uses the "persistence of prior knowledge from the first map to the second," lack of structural reorganization, and the "absence of newly introduced concepts" or "newly developed links."[31]

As already stated, all students in the class received feedback from the course instructor on each of their submissions. Generally, most of the students' maps in the ARTH 212 Spring 2019 class can be placed in the "surface learning" category: genuine effort is visible, but with a few exceptions, rarely a radical transformation of the first map was attempted, especially as the central concept remained fundamentally unchallenged in most cases, and only some connections changed. In some cases, students significantly altered their concept maps (in a couple of instances even by adopting color-coding strategies by their own initiative or by changing the overall structure). In one instance only, were the alterations to the set of maps submitted radically transformative, as the student designed three completely different maps to explore three concepts and thus adjust the paper's vision, evidence of deep learning. One student represented the same map throughout the semester with minimal to no changes, demonstrating non-learning. A few students did not submit all the assignments that were due. The following are samples from student work to discuss the three learning levels.

Analysis of a Deep Learning Sample

Figs. 1a, 1b, & 1c show the concept maps from Student L, who has diligently fulfilled all the assignments within the course and has been involved in deep learning. These three maps are very complex structures, with links and cross-links departing in all directions; the third map's structure visually increases even further to become a more rational 'architectural' construction.

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[29] Hay, "Using concept maps," 43.
[30] Ibid., 43-44.
[31] Ibid., 44.

Fig. 1a

Fig. 1b

Fig. 1c

Figs. 1a, 1b, & 1c – Detail from the concept map submitted by Student L in Spring 2019 and its evolution from the assignment of Feb. 11-15 (submission Feb. 15), to the Discussion Board number 2 (submission of Feb. 25) to its final stage in the Dropbox submission (April 4).
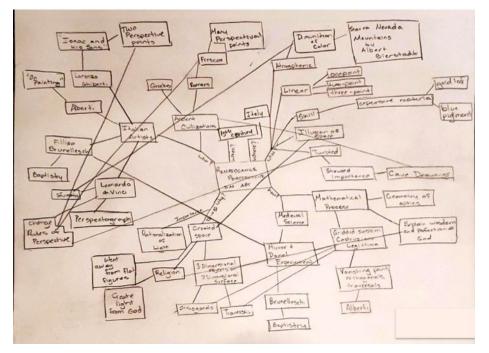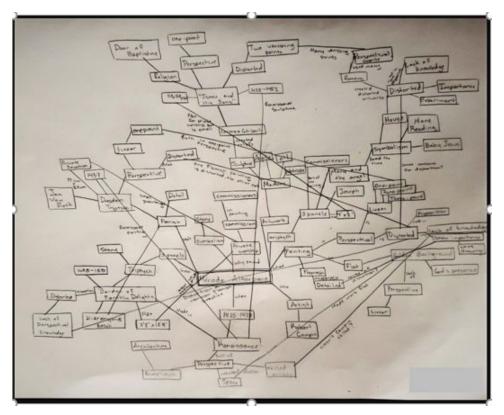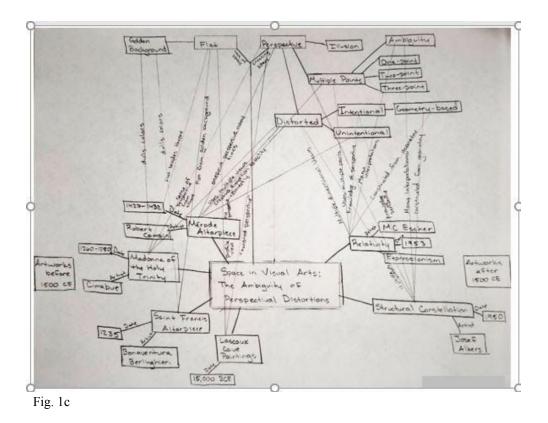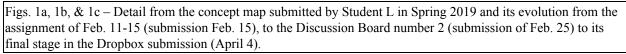
In terms of content, "Renaissance perspective" is the key idea in the first map (**Fig. 1a**). From this concept, several links depart to indicate typologies of space, from linear perspective, to the sfumato, to the twisted perspective used in ancient times and challenged by the Renaissance.[32]
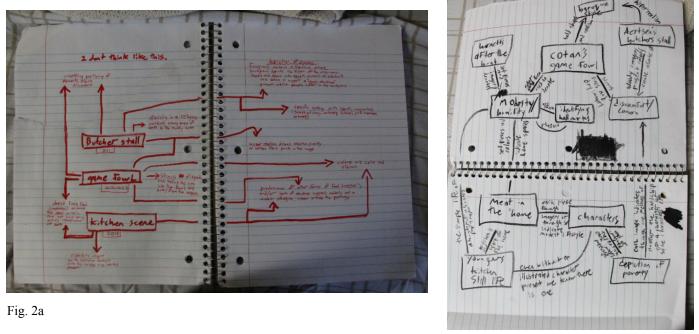
The second concept map (**Fig. 1b**) features a different key word, namely the *Merode Altarpiece* as the first painting chosen for the paper. This map starts to reconcile ideas of space related to the artwork's visual analysis with contextual elements, such as symbolism. A case in question is the golden background, which acts both as a flattening spatial element and as a symbol for the divine. The instructor's feedback on the student's reflection narrative correlated to this second map, and highlighted the potential limitations in choosing all artworks from the Renaissance, when perspective was in the process of being defined, because all the spatial distortions in painting would have the same meaning of being technical attempts. The student was suggested to move beyond the Renaissance and expand the chronology to examine the different reasons why spatial distortions and ambiguities occur at different times in the history of art.

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[32] Even though the course description indicates the Renaissance as the point of departure, the course instructor devotes the first lectures to explaining the transition from the Late Middle Ages to the Renaissance.

The last and final concept map has undergone additional major structural changes: the concept of spatial distortions has moved beyond the limits of the early, imperfect uses of perspective from the late Middle Ages to the Renaissance, to include the creation of impossible spaces in the mature Modernism. Rather than keep expanding the same concept map to reach an unmanageable degree of visual complexity, the student chose to develop variations of concept maps. The student explained in the reflection notes following paper submission, "Developing the narrative helped me organize the final concept map, but previous concept maps helped me develop the narrative" (Post-paper notes posted in D2L Dropbox on April 11, 2019). This comment indicates that concept map and paper narrative can keep progressing in dialogue with each other, which was the goal of the course instructor's teaching interventions.

Analysis of a Surface Learning Sample

Figs. 2a & 2b show the concept map from Student K, in its evolution in two stages (the student skipped the earliest submission stage). During the Discussion Board number 1, the student decided that the topic would be in the area of still life.
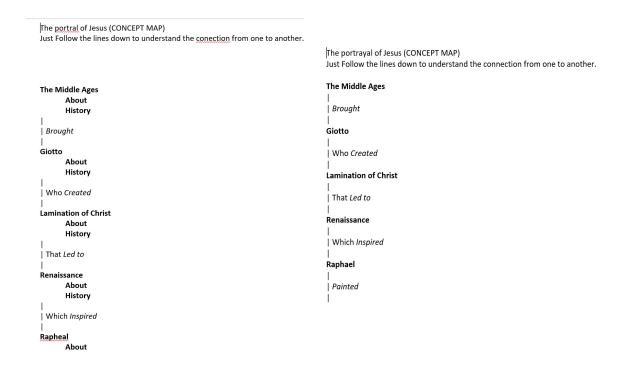

Fig. 2a

Fig. 2b

Figs. 2a & 2b – Detail from the concept map submitted by Student K in Spring 2019 and its evolution from the Discussion Board no.2 (submission of Feb. 25) to its final stage in the Dropbox submission (April 5).

The first concept map (**Fig. 2a**) shows a choice of three pieces, which in this visualization seem to have little in common, each departing in its own direction. The finalized map (**Fig. 2b**) shows content areas that are more scattered across the paper's space than the first map, with added connections between key terms that refer to contextual elements, like poverty, modesty, and

discomfort. From the content's standpoint, the second concept map is certainly conceptually deeper and more explorative than the previous map. The changes indicate that the student has put genuine effort towards improvement. However, the course instructor highlighted the absence of a central theme underlying all the chosen works. In the post-paper discussion, the student explained the challenge encountered in using concept maps beyond the initial brainstorming phase in these terms: "that is largely how I treated this concept map, as an assistive measure to help me organize my writing, which I prioritized. It was much more effective for me to conceptualize a starter paragraph with this visual organization crutch, but beyond that my former sixteen years of academic conditioning made me uncomfortable treating the concept map component of this assignment any more seriously than an aid." (Post-paper notes posted in D2L Dropbox on April 15, 2019). This map's explanation of meaning has reached further conceptual depths, but the overall structure has loosened up and lost some of the initial clarity. Perhaps the student's comment, expressing a degree of resistance against the overall process, seems to be what prevented deep learning to occur, despite the genuine effort expressed by the conceptual and structural changes.

Analysis of a Non-Learning Sample

The portral of Jesus (CONCEPT MAP)
Just Follow the lines down to understand the conection from one to another.

The portrayal of Jesus (CONCEPT MAP)
Just Follow the lines down to understand the connection from one to another.

The Middle Ages
    About
       History
|
| *Brought*
|
Giotto
    About
       History
|
| Who *Created*
|
Lamination of Christ
    About
       History
|
| That *Led to*
|
Renaissance
    About
       History
|
| Which *Inspired*
|
Rapheal
    About

The Middle Ages
|
| *Brought*
|
Giotto
|
| Who *Created*
|
Lamination of Christ
|
| That *Led to*
|
Renaissance
|
| Which *Inspired*
|
Raphael
|
| *Painted*
|

Figs. 3a & 3b – Details from the concept map submitted by Student D in Spring 2019 and its evolution from the Discussion Board number 2 (submission of Feb. 20) to its final stage in the Dropbox submission (April 5). There was no submission in Feb. 11-15.

The example in **Figs. 3a & 3b**, from Student D, indicates that, from the first to the second concept map, no new information has been added. The map has a linear organization lacking the grouping of sub-concepts in clusters and the exploration of cross-links. The instructor's feedback

on the student's narrative accompanying the draft concept map posted in the Discussion Board number 2 (**Fig. 3a**) warned that the portrayal of Christ was too broad, and suggested to start by looking at a specific artwork and narrow down on one aspect, such as Baptism, Nativity, Crucifixion, Lamentation, or Ascension; after that, to think of symbols, or placement, or expressions, or actions that can be found in works to compare and contrast. Later in the term (**Fig. 3b**), the student submitted a finalized concept map that has not fundamentally changed.

In the post-paper reflection, the student wrote: "The concept map although useful is not necessary to convey information. You can do the same exact thing with simple revision. It adds no additional benefit to the process of writing a paper. Because of this I did not use it while writing the paper other than for its purposes [sic] as an outline" (Post-paper notes posted in D2L Dropbox on April 15, 2019).
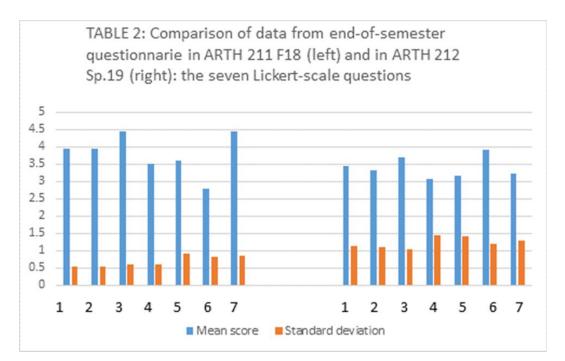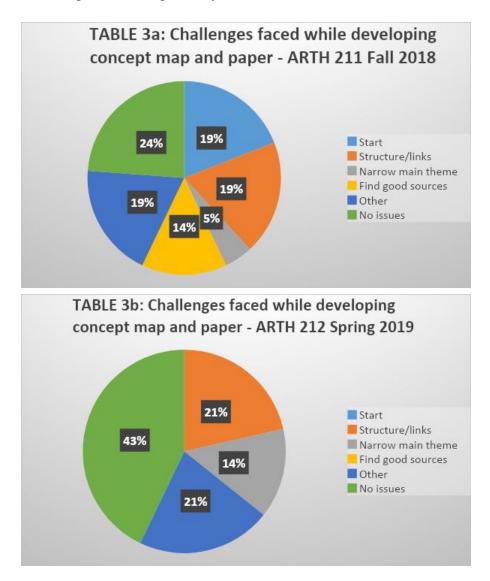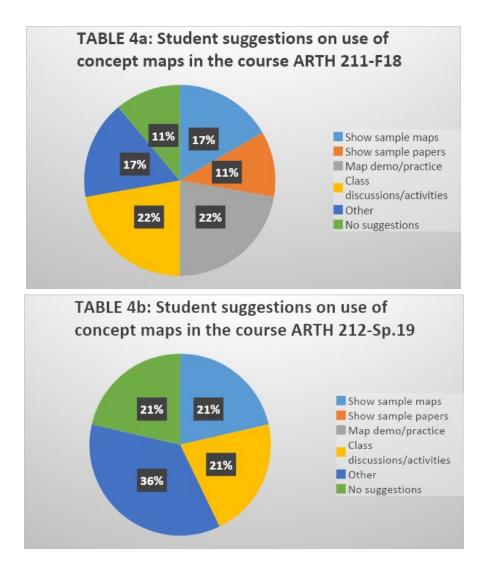
Results: Late-Term Questionnaire

TABLE 2: Comparison of data from end-of-semester questionnarie in ARTH 211 F18 (left) and in ARTH 212 Sp.19 (right): the seven Lickert-scale questions

TABLE 2 visualizes the results translated in quantitative terms, with an assigned value of 5 to "strongly agree," of 4 to "agree," of 3 to "neutral," of 2 to "disagree," of 1 to "strongly disagree." These values are shown vertically in the y-axis. The seven questions listed under the section **Methods** are numbered from 1 to 7 and displayed horizontally from left to right in the x-axis.

A steady increase of the standard deviation for all the seven questions in Spring 2019, if compared to the Fall 2018 (with the limitations due to being indirect data), indicates a diversification in the answers. Some students did not feel very comfortable in using the concept maps beyond brainstorming, and a couple of students strongly disagreed that they worked on the concept map and paper in tandem. Question 6 has the highest score, indicating that the majority of students have made the effort to rework their concept maps as their paper was progressing.

The results of the two open-ended questions numbers 8 and 9 have been coded according to recurring themes, and presented respectively in **TABLES 3a & 3b** and in **TABLES 4a & 4b**.

TABLE 3a: Challenges faced while developing concept map and paper - ARTH 211 Fall 2018

Legend	Value
Start	19%
Structure/links	19%
Narrow main theme	5%
Find good sources	14%
Other	19%
No issues	24%

TABLE 3b: Challenges faced while developing concept map and paper - ARTH 212 Spring 2019

Legend	Value
Start	—
Structure/links	21%
Narrow main theme	14%
Find good sources	—
Other	21%
No issues	43%

In Spring 2019 (**TABLE 3b**), an increased number of students than in the previous fall did not face challenges while developing the concept map and the paper in tandem. No students had issues in how to start their paper, nor in finding good sources. These results are indicators of a degree of effectiveness in designing guided assignments. Conversely, narrowing the main theme became a larger issue than in the prior semester: Student L, who has developed the sample concept map reported in the previous section, stated "The challenges I faced was [sic] how to organize my narrative with the many connections in the map and what to narrow my topic to." Student A wrote "coming up with a good theme is the hardest part about the paper."

TABLE 4a: Student suggestions on use of concept maps in the course ARTH 211-F18

Show sample maps — 17%
Show sample papers — 11%
Map demo/practice — 22%
Class discussions/activities — 22%
Other — 17%
No suggestions — 11%

TABLE 4b: Student suggestions on use of concept maps in the course ARTH 212-Sp.19

Show sample maps — 21%
Show sample papers
Map demo/practice
Class discussions/activities — 21%
Other — 36%
No suggestions — 21%

TABLES 4a & 4b allow comparison between suggestions the students had for the use of concept maps in the course. In Spring 2019 (**TABLE 4b**), student requests to see sample thematic papers and to practice maps disappear altogether, as a consequence of the activities introduced in class and listed in the section **Methods**. However, the variety of answers to this question increase significantly (under "Other"), to include practice in reverse by drawing a map from a sample paper, one-on-one instruction, and a few requests to not make concept maps a course requirement.

Discussion: Periodical Questionnaires, Sample Student Work, and Late-Term Questionnaire

This study's goal sought to verify whether an evolution occurred among students' perception on the usefulness and self-reported use of the concept maps before, during, and at the end of a set of interventions. The data collected—resulting from a questionnaire submitted periodically to the class at different points of the semester, from the analysis of three set of concept maps developed

by students, and from a different questionnaire submitted to the class after the finalized paper and concept maps were submitted—suggest that assigning undergraduate students the task of developing the concept map and the paper in tandem, which requires modifications to the concept map as the paper progresses and vice-versa, is recommended to some extent; however, this specific study produced mixed results. Through creating concept maps, students reflected more deeply on the nature of connections between two ideas, on the process of narrowing down the main theme, and on the overall structure of the concept map. As seen from the examples, one student has chosen to draw one concept map for each stage of the development of the paper's concept; the paper's narrative and the evolving scope of the concept map have fed on each other. In many other instances, however, the concept map has been treated in the more traditional way, as an initial brainstorming tool. It can be expected that some students are or become comfortable with the process of developing the concept map and the paper narrative in tandem and steadily increase their level of metacognition. However, some others will struggle in satisfying the requirements, and some will even resist or become demotivated.

Limitations and Conclusion: Concept Maps, Learning, and Motivation

Within a class, whose members come from a variety of backgrounds and have different goals, it is expected that prior knowledge and motivation act at a different scale in each individual. Studies have found that prior level of knowledge can affect students' capacity "to make more strategic use of text and diagrams and to integrate information successfully from the two sources using less mental effort."[33] Some students' answers in this study suggest that it is difficult to use the concept map beyond the initial brainstorming tool; the answer from Student K (the same student, whose sample set of concept maps has been analyzed) in the open-ended question number 8 of the late semester questionnaire reveals that "My greatest challenge was to twist my learning style to support the creation of a concept map." This seems to suggest that some students perceived the concept maps and the papers as using two different "languages," and therefore were challenged when moving between one and the other.

Another factor affecting this study has been the level of student motivation. Novak warns that modifying "existing knowledge structures" through integrating new knowledge with a previously acquired one is a choice of the student to move from surface learning to deep learning, and no amount of instructor's effort or textbook quality can substitute for this choice.[34] Darren H. Iwamoto, et al., who in recent years have conducted a study on self-regulation with undergraduate students from various backgrounds, found out that students throughout their undergraduate years display a "low level of self-regulation," which in turn stimulate "counterproductive behaviors like procrastination and disengagement."[35] In the ARTH 212 Spring 2019 class, a pattern of absences and missed deadlines and/or portions of assignments include a percentage between 72% and 79% of present respondents each time the periodic

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[33] I. Vekiri, "What is the value of graphical displays in learning?," *Educational Psychology Review* 14, no. 3 (September 2002): 278. https://doi.org/10.1023/A:1016064429161.

[34] Novak, "Meaningful Learning," 558.

[35] Darren H. Iwamoto, Jace Hargis, Richard Bordner and Pomaika'inani Chandler, "Self-Regulated Learning as a Critical Attribute for Successful Teaching and Learning," *International Journal for the Scholarship of Teaching and Learning* 11, no. 2 (2017): 4. https://doi.org/10.20429/ijsotl.2017.110207.

questionnaire was submitted. The conspicuous number of absences within this class throughout the semester makes the author speculate that poor motivation by part of the class may have been a limiting factor in this study. However, not enough data has been gathered to identify the reasons for a presumed low motivation, which could hypothetically range from some students' general poor academic performance and preparedness, to possible resentment towards being in a class identified for a study with additional work through the interventions, to even the responsibility in the choice of the topic within this particular context, which could have increased the level of students' anxiety.

Indeed, some of the students' responses in the periodic questionnaire addressed an amount of anxiety in getting the map right: the answers on question number 4 from the periodic questionnaire (What is the most confusing to you about concept maps?) addresses such insecurity and are analyzed under **TABLE 1d**. The answers seem to suggest that many students perceive the concept map not as an exploratory tool, but rather in a more structured way as an assessment tool and a sort of puzzle, whose pieces already exist but need to be found and put together correctly, in order to get the complete picture.

Finally, the analysis of individual artworks, the comparing-contrasting between two or more pieces, and the identification of an overarching concept, of which each artwork represents a unique answer, represent three levels of meaning to be included in a concept map. Perhaps it is this type of complexity that creates insecurities among many students on how to use the conceptual space of the map. If this were the case, it would be worth considering the differences that Davies highlighted between "mind-mapping," "concept mapping," and "argument mapping," each doing a different job, respectively exploring the connections among ideas, understanding the nature of those connections in their correlation with a common domain, and evaluating the connections' validity.[36] Should each of these three main operations be developed in a different map and then somehow integrated at a later phase? This could be the point of departure for additional investigations on the complexity of the multiple contextual factors in the art-historical discourse.

Acknowledgements

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[36] Davies, "Concept mapping, mind mapping and argument mapping," 280.

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