

Multimodal Information Literacy in Higher Education:

Critical Thinking, Technology, and Technical Skill

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ABSTRACT

This chapter addresses technology in education, multimodal texts, and information literacy in a STEM research-focused university setting. Students produce multimodal content in first year composition classes, but composition instructors lack the skills required to teach students multimedia technology. Librarians respond to the needs of the faculty and students they support. Library instruction takes place within the composition class (course-integrated or “one-shot” instruction) or in a multimedia classroom at the library. The librarians bring technical skills as well as a grounding in information literacy, and their instruction increases students' written, sonic, visual and data literacy. As a result, students become more savvy content consumers as well as creators.

Keywords: Visual literacy, Sonic literacy, Data literacy, Metaliteracy, Multimedia, Academic libraries, STEM

INTRODUCTION

Information literacy is a lifelong skill developed through experiencing a range of media formats and learning to think critically about the content these sources provide (Abid, 2004). The Association of College and Research Libraries (ACRL), the higher education association for librarians, establishes standards and practices for academic libraries, including guidelines and outcomes for information literacy instruction. Before the explosion of online information in the late 20th and 21st century, library content was primarily textual, and academic libraries provided bibliographic instruction, that is, teaching students how to use library resources such as indexes, catalogs and finding tools. Even as ACRL developed

competency standards for information literacy (2000), these focused on information seeking and an outline of tasks and performance measures to assess student skills. The 2016 ACRL Framework for Information Literacy for Higher Education (ACRL Framework) begins to widen the definition of information literacy, seeking not only to develop skills used in college classes, but also to prepare students to use information beyond their college career. Additionally, it recognizes students' role as information creators. The ACRL Framework also seeks to establish greater librarian-faculty collaboration, so that librarians become partners with faculty across disciplines in developing student research and scholarship practices.

At the Georgia Institute of Technology (Georgia Tech), students begin learning how to communicate within their disciplines in their first year, in English composition courses that emphasize multimodal communication. Most English 1101 and 1102 instructors are postdoctoral fellows engaged through the Marion L. Brittain Postdoctoral Fellowship. The Brittain Fellows build courses around appealing themes, and students complete multimedia assignments and work in a digital environment. The Writing and Communication Program (WCP) emphasizes the importance of students as savvy content creators. Students have many platforms to communicate and share ideas through social media. The increasingly seamless integration of many different media formats into digital content available on a mobile device gives almost endless opportunities for consumption and creation. Any student with a smartphone can post a video of themselves giving an opinion or, as recent events have demonstrated, can broadcast police encounters, protests, meetings, and other events in real-time. However, this capability does not mean that they use rhetorical tools effectively or critically. In collaboration with Georgia Tech teaching faculty, the Georgia Tech Library teaches conceptual and technical skills in multimodal formats.

This chapter will address technology in education, multimodal texts, and information literacy in a STEM research-focused university setting, using the Georgia Tech Writing and Communication Program and the Georgia Tech Library instruction program as a case study. Librarians and composition instructors have a shared set of goals and a history of collaborating; the authors will discuss how librarians respond when composition instruction emphasizes multimodal communication. The authors will discuss how the definition of information literacy changes when the information is audio, visual or data. As librarians who provide expertise in technology, including multimedia software, data visualization, audio and video editing, and digital publishing, the authors will discuss how to incorporate information literacy into instruction on technological concepts.

BACKGROUND

ACRL has variously defined information literacy as the ability to respond to the need for information by locating, evaluating and effectively using the needed information (1989, 2000). Additionally, it is set of abilities encompassing not only information discovery, but also awareness of the information ecosystem, its production processes, values and ethics, and how information users are also participants in the creation of new knowledge (2016). In creating the *Framework*, ACRL nullified its previous competency standards, which were a series of tasks and performance outcomes. It now offers flexible, interconnected core concepts, based in part on the emerging theory of metaliteracy, as defined by Mackey and Jacobson (2014). Metaliteracy includes “the collaborative production and sharing of information in participatory digital environments” (p. 1). In other words, 21st century students, as participants in online environments, are approaching information discovery as seasoned information consumers and creators, and the 21st century librarian's approach to information literacy reflects this new reality.

In 2002 the Association of American Colleges and Universities (AAC&U) called for increasing expectations for college success, to meet the demands of the new knowledge culture and the flood of online information. These challenges require that college education “shift from remembering facts to finding and evaluating information” (*Greater expectations: a new vision for learning as a nation goes to college*, p. 6). In addition, today's students intentionally develop skills in self-directed information seeking and evaluation, integrating and transforming what they learn into new knowledge. The ACRL

Framework calls on students to take responsibility for creating knowledge, learning to use information, data, and scholarship ethically.” UNESCO declares that an information literate person is “a responsible information seeker, knowledge creator and innovator, who is able to take advantage of a diverse range of information and communication tools and media.” (*Global Media and Information Literacy Assessment Framework: country readiness and competencies*, 2013, p. 17) Indeed, the present definition of information literacy is beginning to incorporate multimodal communication; students can read, understand and create in multiple modalities (Carlito, 2018).

Since 2002 the New Media Consortium (now EDUCAUSE) has been charting the expansion of technologies for teaching and learning, and U.S. college students are arriving on campus with a high level of “digital fluency” (Becker et al., 2018, p. 7). However, in a 2016 report, faculty from the Stanford History Education Group (SHEG) summarized the abilities of middle school, high school, and college students to evaluate information from online sources with a single adjective: “bleak” (Wineburg, McGrew, Breakstone, & Ortega, p. 4). These students, characterized as “digital natives,” might be able to run an online search but fell short when evaluating the results for trustworthiness, based on fact or opinion, or from an unbiased or a politically motivated source.

A variety of organizations, institutions, and researchers are currently engaged in improving the “bleak” picture of the 21st century student’s information literacy. In addition to their 2016 and 2017 reports identifying the skills gaps of middle school, high school and college students, and historians, SHEG’s website identifies a set of competencies around determining information sources, finding evidence of authority or reliability, and using outside endorsements to ascertain credibility. To help develop these competencies, SHEG provides classroom materials including assessments and rubrics. SHEG asserts that civic online reasoning, the ability to assess the credibility of online content, is a critical 21st century skill (“Civic online reasoning,” 2019).

Project Information Literacy is a nonprofit institute that researches college students from a variety of institutional settings in an ongoing national study. Through surveys and interviews, they study how these “early adults” solve everyday problems at school, at work, and in their personal lives, by finding, evaluating and selecting information (“Project Information Literacy,” 2019). In 2009 they reported that students suffer from information overload and an inability to distinguish credible sources among the vast resources at their disposal (Head & Eisenberg). A subsequent report found that students struggle with the “open-endedness” (Head & Eisenberg, 2010, p. 3) of the sea of information, which inhibits their forming a research question in order to begin their search, as well as determining when to stop searching. First year college students must adapt to a larger and more complex library landscape, to navigate scholarly databases, and to understand academic journal articles. Fortunately, they do consider their librarians and English composition instructors to be helpful resources, when they take advantage of their assistance. (Head, 2013).

As students make the transition to college, they face the challenge of developing and advancing their research skills. They may also face self-imposed limitations. The literature shows that students often overestimate their own proficiency as researchers (Gross & Latham, 2013; Shoeb, 2011), and that they usually do not appreciate the importance of information literacy until they have already experienced its benefits (Kim & Shumaker, 2015). Walton and Hepworth (2011) found that information literacy is most accurately viewed as a cognitive process that requires time, as learners incorporate changes in their understanding of information literacy. Therefore, the early college years are an ideal time to (re)introduce information literacy skills.

Traditional information literacy in higher education focuses on academic research skills, positioning scholarly information as the most reliable sources of information and evaluating documents within their own context. This approach has merit and strongly connected to the labor the students will perform in the academy; it is best teaching practice to directly tie classroom content to the assignment (Dick, Carey, & Carey, 2005). While academics continue to publish written accounts of their scholarship, students are

applying scholarly information in a variety of multimodal projects. In addition, Students are not always required to use conventional, scholarly sources of information. This calls for a transformation of information literacy instruction. Recent scholarship describes new scenarios where librarians not only teach searching and evaluating written resources, but also the ethical reuse of copyrighted material, and how to use software applications for publishing and presenting knowledge (Cordes, 2009). A library instruction session might include evaluating infographics, searching for images, or creating a toolkit of free/almost free resources for class presentations (Carlito, 2018). In this way librarians serve not as gatekeepers of knowledge, but as an enabling force in the transformation of ideas. Their “role as information professionals can enable literacy skill in others so they might become self-supporting, civic oriented citizens” (Cordes, 2009, p. 16).

Information literacy is a complex, often unfamiliar set of skills that cannot be mastered in a single instruction session. Only 19% of colleges and universities require for-credit, semester long information literacy classes which can adequately cover and evaluate the skills that are part of the *ACRL Framework*. Many librarians teach information literacy competencies as part of a “one-shot” session, which is generally a 50-to-75-minute stand-alone class integrated in existing course (Cohen et al., 2016). This is the case at Georgia Tech, where there is no specific, for-credit information literacy requirement for undergraduates. Therefore, Georgia Tech librarians work to include both technical and critical skills in their instruction.

Librarians and English composition instructors have similar goals in reaching undergraduate students, and they have a history of working together (at least as far back as Barbara Fister’s presentation on “Common Ground” to ACRL in 1992). The literature contains many descriptions of these collaborations, as well as comparisons of the frameworks guiding the professionals engaged in instruction (D'Angelo, Jamieson, Maid, & Walker, 2017; D'Angelo & Maid, 2004; Fister, 1992a, 1992b; Mazziotti & Grettano, 2011; McClure & Clink, 2008; McClure & Kramer, 2016). Like ACRL, the Council of Writing Program Administrators introduced outcomes and a framework outlining critical skills (2014; 2012). Since 2004, the Georgia International Conference on Information Literacy has brought together library, writing and education professionals from K-12 and higher education to discuss aspects of information literacy important to their communities (Ziegler & Richardson, 2009). Georgia Tech hired a First Year English Instruction Librarian in 2008 to be embedded in the WCP, a relationship that has remained in place ever since. To support the librarian embedded in the WCP, the Georgia Tech Library employs a team approach to instruction.

At Georgia Tech, first year students take one or two 1000-level English composition classes (English 1101 and English 1102), offered through the WCP and primarily taught by Britain Fellows. The WCP operates under two primary guiding principles: “communication is rhetorical,” and “communication is multimodal,” and follows an approach defined by the acronym “WOVEN: Written, Oral, Visual, Electronic, and Nonverbal” (“Guiding principles | Writing and Communication Program,” 2019). Students produce multimedia presentations, websites or posters in addition to traditional research papers. Instructors, who are primarily Britain Fellows, build courses around themes from film, popular culture, science and technology (Kashtan, 2015). The goal of English 1101 and 1102 is for students to “have learned how research lends authority to the formulation of arguments and to the construction of ideas” (“Composition Courses | Writing and Communication Program,” 2019).

The WOVEN approach suits the student body at Georgia Tech. In 2018-2019, first year students are true post-Millennials, for whom online communication is a normal part of life, and most are attracted to STEM (science, technology, engineering, and mathematics) classes, topics, and fields. All incoming Georgia Tech students have a declared major, and in 2018 the majority of first year students (55%) are entering the College of Engineering, followed by College of Sciences (16%) and College of Computing (13%) (Carlito, 2018). As described by a former English 1102 instructor:

Georgia Tech's students tend to be extremely technologically savvy and interested in visual media such as film and video games, which makes topics like comics and gaming particularly appropriate for 1102 courses. Thus, a multimodal approach to first-year writing was both more relevant to this student body and more useful to their future professional lives than was an approach that emphasized traditional written communication. (Kashtan, 2015, p. 149)

The Georgia Tech Library supports the campus curriculum through a variety of educational programs. In addition to information literacy, research methods and workshops most commonly associated with library instruction programs, the Georgia Tech Library also offers technology-rich workshops ranging from data visualization and analysis to video and audio editing ("Library workshops & instruction support," 2019). This training and support largely grew out of the library's close connection with the WCP. In response to the specific needs of this department, the library's educational program has grown to include training on software, hardware and related topics. These course-integrated activities have been well received, not only in the WCP, but also across campus in a variety of disciplines.

Several learning theories underpin the information literacy work at the Georgia Tech Library. The goal in employing these approaches and philosophies is to guide the librarians in using best practices. The teaching team's approach is eclectic, incorporating theories that work well for the local context and learners. When planning to teach, the librarians engage with an instructional design framework. The ADDIE model (Kurt, 2017), the backwards design approach of Wiggins and McTighe (2005), and the work of Dick and Carey (2005) inform the librarians' methodology. Instructional design provides a focus for developing class activities to support the desired outcomes. Librarians tailor the learning objectives of the class session to students' needs and specific assignments, using instructional design guidelines to form relevant and measurable goals. The information literacy one-shot is focused on active discussion of concepts and hands-on practice with tools.

Transparent design, as described by Winkelmes et al. (2019), is another theory supporting the authors' teaching approach. Transparent design banishes the mystery of an assignment or class activity's purpose, replacing it instead with clarity about the "why" of the assignment and how students' learning will benefit them inside and outside the classroom. It also clearly describes the tasks and expectations required to complete the assignment and provides illustrative examples of completed work. This level of transparency provides increased student motivation, because students understand the purpose of the exercises. This is especially valuable for teaching students who are primarily majoring in engineering or the sciences, and not pursuing studies in the humanities.

Vygotsky's theory of the Zone of Proximal Development also informs instructional practice at Georgia Tech. This theory defines the Zone of Proximal Development as the difference between what a learner can do currently, and how he or she can perform at a given cognitive or behavioral task with appropriate help. This approach is widely known in college classrooms as "scaffolding." Through conversations with and assistance from a knowledgeable peer or mentor, learners can make sense of more complex problems or tasks and undertake them effectively on their own. It is valuable to note that Vygotsky's work emphasizes the collaborative nature of learning; gaining skills and understanding happens through social interaction (Silverman, 2011).

MULTIMODAL INFORMATION LITERACY IN HIGHER EDUCATION

Key Concepts

There are central concepts around which traditional scholarly research skills revolve. The teaching team of librarians mixes many of the guidelines and knowledge practices of the *ACRL Framework* with practical concerns around the competencies needed for a specific assignment. While each session is unique to the faculty and the work the students hope to accomplish, key foundational ideas remain the

same. As previously discussed, “one-shot” style instruction is the norm in many academic libraries and at Georgia Tech. It is neither advisable nor possible to try to cover the *ACRL Framework* and its interlocking dispositions in their entirety in a single session. The Georgia Tech teaching team has prioritized the following elements of the *ACRL Framework*:

Information has value: There are many approaches to the value of information, both within the *ACRL Framework* and from the Georgia Tech Library teaching team. As knowledge practitioners, students are encouraged to discuss the power and authority of scholarly work. At an engineering and STEM-focused institution, the immediacy of accurate, authoritative information can be illustrated through the work they will likely do in later years. The research that they access has specific relevance to practical concerns of construction, consumer safety, or patient treatment. Librarians also make explicit the literal, economic value of scholarly information. The content that they use as students is purchased or leased through a multi-million-dollar collections budget which is largely subsidized by their tuition. Georgia Tech, in support of Georgia Tech Library, secures this access because it is vitally important to the function of research and scholarship. This transparency reduces the abstract, intellectual value of these documents for the students.

Research as inquiry: As students assume the practices of scholars in the academy, they are learning that research begins with a question without a predetermined answer. Faculty at Georgia Tech introduce the knowledge practices around this frame in their assignments; they require their students to use multiple sources and justify their choices. The most common example of this is a semester-long assignment which results in a research paper, device, or an expressive work that requires an annotated bibliography. Georgia Tech librarians stress that students’ work must be guided by the available documentation and existing evidence. Librarians do give the novice scholars some structure, such as recommendations for where credible scholarship can be found. They then refine what may be an unworkably large thesis into smaller, answerable pieces.

Searching as a strategic exploration: Students may be oriented towards certain sources of information, but they then need guidance to best exploit them. Discipline-specific databases can be both intimidating and confusing. At Georgia Tech, teaching the rudimentary skills of strategic searching is a small but essential portion of each class. Librarians contrast a simplified explanation of how resources such as Google and Google Scholar function with the intellectual labor required by most academic resources. Librarians emphasize the importance of using the best tool for certain work. The berrypicking nature of the search is explicitly discussed, as are techniques such as pearl growing (Bates, 1989). This integrates the necessary skills of the research process to what is known about the actual practice of information seeking behavior. As 97% of the Georgia Tech Library’s physical collection is located off campus, browsing and serendipitous discovery is inhibited ("Library Next," 2019).

Data Literacy

As research has become increasingly collaborative and networked, data has become more valuable as a scholarly product. Research data comes in several varieties: it can be observational, computational, and experimental (Borgman, 2007). In addition to statistical data, text, images, audio and video have also been widely used as research data. As the value of data as a publicly accessible research output increases, so does the demand for the skills required to make full use of this resource, which drives the Library to develop data literacy instruction (Shorish, 2015). Scholars from different backgrounds approached data literacy from various emphases. Schield (2004) defines data literacy as being able to access, assess, manipulate, summarize and present data. Calzada Prado and Marzal (2013) add the management, handling, and ethical use of data. Schneider (2013) argues that research data literacy shares a strong parallel with information literacy. These definitions dovetail into the *ACRL Framework*.

The Institute of Museum and Library Services funded the Data Information Literacy project led by Purdue University, the University of Minnesota, the University of Oregon, and Cornell University to scan the landscape and enumerate the key data literacy competencies (Carlson, Johnston, Westra, & Nichols,

2013). This initiative concluded a list of data literacy core competencies to cover both tool- and theory-based skills. Tool-based areas include data processing and analysis; databases; and data discovery, visualization, quality, conversion, and interoperability. Theory areas consist of data management, preservation, curation, and reuse; metadata; cultures of practice; and ethics (Carlson, Fosmire, Miller, & Nelson, 2011). In practice, most libraries focus on a subset of areas on this list.

Data is contextual and cultural. Created in specific cultures and time, data is shaped by the environment and authors' perspectives. Concepts familiar with scholars today, such as gender and racial equality, were sparse in literature, perceived differently, or nonexistent in the past. Likewise, concepts familiar to one culture might be totally foreign to another. Understanding the social and historical background in which the data was created helps students search, identify, and analyze data for their research. The data itself must drive the narrative, and students struggle with using data to prove an existing hypothesis. When conducting data analysis, students learn to avoid presumptions and wait for the story to surface from the data. In this process, critical discernment and reasoning are crucial in the acquisition of data literacy (Association of College and Research Libraries, 2000).

Critical evaluation of data is a necessary step to answer a research question. Students soon discover that one data source does not provide enough information to answer their research questions. With the open data movement, researchers welcomed a new world of more easily accessible data from governmental organizations. While open data is an important development, students and researchers quickly found out that it is usually not enough to answer most questions. Government-created, open data has a macro nature and its primary focus on is on social-demographic information. In order to answer more micro-level questions, other data sources need to be integrated. Having enough data about one issue from different angles, whether historical or current, is the first step towards a successful data-driven project.

Sonic Literacy

The ability to use audio tools to communicate ideas can open avenues of creative expression and give students more diverse opportunities to demonstrate their knowledge. At Georgia Tech, librarians teach the technical operation of audio editing tools, while simultaneously teaching how these tools fit in an information landscape. This aspect of information literacy is what Comstock and Hocks refer to as “sonic literacy” (2006). Students now find new opportunities to contribute to the media landscape with socially engaging technological tools, and to engage in dialogue and feedback outside of the more “structured forms and institutional contexts” of traditional media (Kahne, Hodgin, & Eidman-Aadahl, 2016, p. 10). They need to know how to evaluate and communicate information beyond the thoughtfully composed critical writing assignment.

Whitney states, “a combination of exposure to existing sound studies literature and audio-based assignments can enhance students' sensitivity to sound on theoretical, aesthetic, technological and historical levels with the hope that they will carry this consciousness throughout their scholarly careers” (2008, p. 42). Projects that encourage students to synthesize their learning across multiple modes foster awareness that crosses disciplines and imparts skills that students can take with them beyond their college experiences. How an audio work is constructed and presented to an audience is a significant component in the teaching of sonic literacy. Students learn that recorded sound is not merely a mirror capture of the audio that exists in reality, but rather it is an artefact of choices that are made to construct that audio. The listener will also be processing it through a cultural and audiological framework (Comstock & Hocks, 2006). The elements of sound play a role in “setting the mood, building the atmosphere, carrying the narrative, directing attention, and developing themes” (McKee, 2006, p. 352).

Spinelli (2001) argues that modern media consumers are sophisticated enough to understand when the audio that they are listening to is composed rather than a naturalistic recording. Spinelli discusses the potential for rhetorical exploration of foregrounding audio editing techniques, particularly in the digital age, as opposed to the more linear, seamless audio editing popularized by both radio and magnetic tape technologies. However, the BBC received numerous complaints about the heavy-handed use of artificial

sound effects in the highly popular documentary series “Planet Earth 2” (Shepherd, November 25, 2016). The highly-stylized rendition of the sound effects was jarring to many viewers. The BBC’s experiences indicate there is reason to doubt whether disruptive, foregrounding editing techniques will become entirely mainstream.

McKee (2006) describes the four main elements of meaning in sound, which are music, sound effects, silence, and vocal delivery. Others have identified an additional element of sound interactions. While some of this understanding can seem intuitive, students fail to apply these elements critically to their work (Halbritter, 2004). These sound techniques for making meaning can be modeled as in-class examples or discussed as part of the course itself by faculty. Many faculty require students to create an artist’s statement or progress document, so there can be additional context for what may be rudimentary products. The student can identify a perhaps subversive or ironical intention in their work rather than relying entirely on technological mastery.

Librarian explanations of the four main elements of sonic literacy are as follows:

Original music: Few students would compose original music for their assignments, so the careful selection and integration of music is of the utmost importance. Librarians can demonstrate to students how a sample of subdued orchestral music under a montage of stock footage of various landscapes underscores the somber mood of environmental degradation as an impact of climate change. As Halbritter (2006) discusses in the examination of the rhetoric of the soundtrack in *The Big Chill* and *Fight Club*, music can serve as cultural signaling or metaphor when aptly deployed.

Sound effects: Sound effects in support of the audio help the audience immerse themselves in the narrative or act as reference for place. McKee (2006) also lists the importance of sound effects as narrative cues. Sound effects can add to the naturalness of the pastoral scene or the frenetic pace of city life. This element is so strong that David Attenborough describes the necessity of corresponding sound in his documentaries (Burgess & Unwin, 1984) even though it is artificially created and later edited into the visual sequence. All the noise captured by the on-site visual recording was replaced by human-made effects for his works. These snippets of audio are best deployed with subtlety.

Silence: Silence, perhaps counterintuitively, denotes presence rather than absence (McKee, 2006). The abrupt ending of music, sound effects, and vocal delivery into silence can rivet the audience’s attention or a fade away can signal the end of the media.

Vocal delivery: McKee adroitly describes the importance of vocal delivery this way, “Often when listening to people speak ... we explicitly attend to the words that are stated, but we also implicitly adhere to how those words are said. Thus, meaning is carried not solely by the verbal content but ... by the vocal qualities” (p. 340). While encouraging students to achieve clarity in recording, through minimization of unwanted noise, elimination of verbal tics, and consistent and steady volume in speaking, there are also other qualities in performance to be addressed. A student may choose a soft, serious tone in describing the damage wrought by global conflict, rather than a higher pitched, louder tone. The delivery of power and authority could be contrasted against a soothing tone or the enthusiasm of an advertisement.

Visual Literacy

Educators are recognizing the benefits of incorporating multimedia into course assignments beyond subjects such as film studies, cinematography, arts and other topics typically associated with media production. Video production has been the subject of increased interest as a method for encouraging learning and critical thinking in the classroom since at least 2008 (New Media Consortium (NMC) & EDUCAUSE). Instructors found that students engaged in the process of video creation showed more self-regulated learning which fostered initiative and metacognition in their work. Examples of courses utilizing this method might include a math course that requires students to create educational videos demonstrating the process for solving complex calculus exercises (Morena, Smith, & Talbert, 2018), or

asking students in a social work program to present a topic for analysis and educate a general audience on these concepts via short videos (Teloff, Hitchcock, Battista, & Lowry, 2014).

Felten (2008, p. 60) defines visual literacy as “the ability to understand, produce, and use culturally significant images, objects, and visible actions.” Visual literacy relies on socially significant imagery in addition to the cultural constructs of authority of written literacy and cultural frameworks of sonic literacy. There are many visual modes, such as painting, sculpture, photography, and textiles; Brittain Fellows frequently chose digital video as a venue for the WOVEN curriculum. Digital video is relatively easy to share with massively democratic platforms such as YouTube, which as of May 2018 has nearly 2 billion logged-in users (Gilbert, 2018). Learning how to effectively communicate through video gives students a powerful tool for sharing their ideas.

Understanding the genre conventions for the elements of video helps the students plan and experiment, knowing that audiences bring some pre-existing cultural interpretations to what they view. The fundamental concepts in creating a cohesive video message are framing, pacing, tone and color, and sound.

The librarians give short explanations on these elements as follows:

Framing: Framing refers to how a shot is set up, or rather, how elements should be arranged in the visual field. A long shot is frequently used to establish place, while close-up shots show subtle drama and intimacy (Thompson & Brown, 2017). The sequencing of these and other shots create meaning. For example, a medium-distance shot of a conversation followed by a close-up shot on face will emphasize the narrative importance of the emotional reaction of the person in the close-up.

Pacing: The speed and duration of the scenes in a composition is pacing. Different techniques are needed to establish different paces, which in turn have different effects. Slow panning over photographs (famously deployed by documentarian Ken Burns) creates a solemn, emotional moment, while quick pans communicate speed and energy (Thompson & Brown, 2017). The length of the scene between cuts also affects its impact. Frequent, short cuts are more frenetic whereas longer, languorous cuts can build tension or create ease.

Color and tone: While mood is constructed using many different factors, color and tone are key components. The combinations of color, speed, and other features communicate emotions. The associations between color and emotional response are so tightly associated that a digital analysis of the dominant color palette in movies can accurately correlate to its descriptors and genre (Wei, Dimitrova, & Chang, 2004). In other words, movies with similar kinds of moods use similar kinds of pacing and color palettes.

Sound: The four elements of sound have been previously discussed and are still relevant for video. It is important to note here the use of sound to “anchor” an image (Duncum, 2004, p. 256). Sound changes the meaning of visual. A well-known illustration of this principle is opening sequence of the film *Jaws*. The ominous orchestral music builds dread in the audience when it anchors footage of a young woman swimming in the sea at dusk, a scene which could have a fun or relaxing tone if not for the iconic soundtrack. Thirty seconds before she is yanked underwater by a great white shark, the music signals her unlucky fate.

Teaching Information Literacy

Bringing information literacy support to the English 1101 and 1102 curriculum means making sure the students are familiar with the technological tools and platforms that are available at a large academic library at a research institute. Effective use of these tools and platforms requires more than just knowing where to click. The librarian can bridge the gap between the students’ initial development of a research question and the successful application of that question to a library database search. The librarian first meets with the Brittain Fellow to find out specifics of the assignment that requires research in library

resources. The librarian then creates a set of learning objectives for the library instruction session based around what students will need to be able to do for their assignment. This could be formulating a research question, developing a search strategy with synonyms and Boolean operators, or choosing an appropriate database for the subject of a written assignment.

Typically, instruction must include overviews of databases that contain peer-reviewed literature; it is in library instruction sessions that most students search peer-reviewed academic literature for the first time. Students have pre-existing familiarity with search boxes, but they unfamiliar with the computing operations that make them function. The librarians at Georgia Tech explain the entirety of the research lifecycle, from the fundamentals of scholarly communication to algorithms. Students learn the importance of peer-review and that the tools they learn in-class are the ones that their professors use as research professionals. Scholars' ideas are not just there to fill in a pre-determined blank on an assignment; students discover how these ideas have been rigorously researched and vetted in order to be shared, used, and further developed by other scholars.

Once the students have been introduced to the databases, librarian instructors conduct both hands-on and interactive activities to formulate questions and explore content. Interactive activities can include collaborating to create a list of search terms. Students may not intuitively understand how their research question can be used as a starting point to extract useful information from a database, so librarian instructors emphasize the importance of the indexed metadata. The librarian instructors work with the class as a whole or in small groups to help students create possible terms or search strategies and get feedback in class discussion. An activity that often follows the search discussion is a think-pair-share exercise, in which the students first try some possible search terms on their own. Then after a few minutes, the student is paired with another student to discuss their search experience and share feedback with each other. The end of the exercise involves the student pairs sharing their conversations with the class. These activities mirror the peer-review process and iterative nature of scholarly research.

A successful English 1101 or 1102 session will leave students with an understanding of what kind of information academic databases contain and how those databases make information retrievable. It will give the student confidence that they can query the database for relevant information.

Teaching Data Literacy

Georgia Tech embraces the culture of using data for research and teaching. This extends beyond the expected data-heavy programs in science and engineering, to the programs in business, design, and the humanities. English 1101 or 1102 instructors, although they are teaching introductory classes, also experiment with innovative use of data for class projects.

In these classes, data literacy is discussed recursively throughout the students' research cycle, from data discovery, processing, and analysis to visualization. Students are prompted to answer two questions:

1. What is (in) your data?
2. Is your data able to answer your research question?

The focus of library embedded instruction in English 1101 or 1102 classes is to answer these questions.

Research is a discursive practice in which ideas are formulated, debated, and weighed against one another over extended periods of time (Association of College and Research Libraries, 2016). In practice, students often find themselves needing to revisit data literacy principles and their application into individual research projects. To facilitate ongoing conversations on data literacy, librarians schedule an additional session following classroom instruction for data-driven projects. These sessions occur right before the assignment deadline so that students can receive help from librarians and review their projects. Students delve deeper into their process, discuss concerns, or reflect on the research experience and final deliverables in these sessions. They also gain an opportunity to communicate with their peers, giving and

receiving feedback from each other. Their instructor may also be present and available for advice. This improves the work through an iterative process of instruction, revision, discussion, and review.

Teaching Sonic Literacy

Some key learning objectives for multimodal projects include the students' ability to apply problem-solving to address technical issues; to analyze and interpret media; to select appropriate media; to develop content for an intended audience; and to create an effective narrative or compelling story. Students first learn how to construct an audio narrative through activities such as storyboarding and making editorial choices in sound. Teaching storyboarding techniques is an effective tool in both visual and sonic literacy. It is a low-stakes challenge for students to design the flow of their narrative on paper before using any electronic editing tools. The successful completion of a storyboard ensures students have worked through any difficult rhetorical sections of their project.

A librarian might develop a lesson plan around the selection of appropriate media for an audio project, in which students will learn about two important concepts. Students first must know how both copyright and licensing are applied to media resources, and then they must be able to find media that is licensed for reuse in their projects. While librarians inform students that they have copyright on the content that they create (17 U.S.C. 201), they also caution students about how to use or re-purpose content created by others. The class specifically addresses how to use effective and legal media to convey a message. Most students will not compose their own music or create sound effects, so librarians encourage them to use databases with this media for which rights for reuse have already been established.

All four elements of meaning in sound are displayed in the sonic tracks of an audio file. These tracks appear as layered bands of content which display the waveform of the audio. The waveform takes the form of a sine wave that “describes a depiction of the pattern of . . . amplitude in the time domain” (Federal Agencies Digital Guidelines Initiative, 2018). Both major media editing platforms used by Georgia Tech students, Audacity and iMovie, show these waveforms. The students can do quick edits visually, muting spikes of sound in the waveform or cutting out noise, or other unwanted sound elements. Librarians guide the students through use of these techniques on various software platforms. Students eventually take their ideas and craft them into compelling stories through the mastery of techniques such as looping, fading in and out, and volume adjustments. When possible, librarians use open source audio technologies in teaching these courses.

The courses not only focus on the technical end of creating a sonic landscape, but also challenge students to address their emotions and reactions to what they hear. Creation and editing of electronic audio files therefore provide useful acquisition of practical skills, while also giving students an understanding that sound information can still be manipulated technically and editorially to present a distinct point of view. Presenting the students with unique sounds, podcasts, music and aural stimuli prompts self-reflection and metacognition. This internal analysis can foster self-directed learning and ultimately the mastery of one form of media literacy (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010).

Teaching Visual Literacy

Visual storytelling skills are applicable in many disciplines. The video projects assigned in entry-level classes taught by librarians tend to center around a particular genre or research topic. Common examples include an analysis of popular media, a service-learning campaign, a faux newscast, or a political call to action. These video genres are already familiar forms to the students, and as noted by Miller (2010, p. 267), allow them to “focus on redesigning the genre for their own interests and representational purposes.” Few undergraduate assignments at Georgia Tech are open-ended, purely expressive works; faculty will likely discuss the conventions of the narrative format required by the project. Faculty also generally provide a basic framework for this work upon which students can build. These classes give students an environment to enrich both their technical communication skills and comprehensive

understanding of a given course topic. Students integrate technical skills, self-expression, and general comprehension.

Video is a complex integrated media project, so much like sonic assignments, storyboarding is an essential part of the planning process. Students draw or sketch out each visual segment of their video with the accompanying narration or sound underneath it. Piecing together the content students need to shoot or collect reduces the amount of editing they must perform (Thompson & Brown, 2017).

Many faculty members have recognized the utility of this and use the storyboard as a first draft of the work. This gives them an early opportunity for feedback. Students may need to define key takeaways, identify a target audience or viewership, and explore compelling imagery. The video assignments frequently have an accompanying research paper component, tying back to following more traditional scholarly output. Students often work collaboratively to discover appropriate resources and distill information down to its core components in order to effectively communicate their message to a broad audience (Teloff et al., 2014). While students are demonstrating their ability to conduct research, they are also demonstrating the ability share their understanding of the work in a high-quality video.

Students then draft potential scenes, brainstorm ideas for footage, and identify online resources to support their creative content. By the time students get to the editing room, they should have a clear vision of what they want to communicate and what footage they will use. In essence, this process amounts to creating a visual thesis. The librarian-led class is the next step for students to learn video editing skills. Librarians supply some sample digital media and model the creative techniques, while allowing the students to participate in informal, ungraded video creation activities during the session. These activities build confidence provide for those who may be overwhelmed by the technical skill associated with editing. Copyright concerns over the reuse of existing media remain the same as audio editing and require similar lesson plan.

Early in the process, students learn to work in layers within a chosen software. The students create layers of video using visual media, the uppermost being the most dominant. The audio waveforms are additional tracks, generally set below the visual. The importance of audio quality is emphasized; it is just as – if not more – important than visual content. Through techniques such as drag and drop, students can see the many discrete pieces that come together to form a cohesive whole. Video-editing tools such as iMovie are appropriate software for most courses and meet the needs of both proficient and novice students. Entry-level editors allow students to draft a short video after a single 50-minute session. They can receive feedback through practice showings and peer evaluation. It is worth noting that video production and editing toward a final product is time-intensive. Rendering (the final processing and exporting of the video into its finished product) can take hours on its own. It is necessary to repeat this point often in any training.

General Assessment Strategies for Teaching Information Literacy

Assessment is an ever-present challenge in all facets of library instruction. Schilling and Applegate (2012) and Oakleaf (2008; 2014) have published comprehensive overviews of assessment methods for library instruction. These include student self-reported measures of confidence and librarian-created assessments such as fixed-choice tests (usually pre-tests and post-tests), which can demonstrate levels of competence with information skills. Other measures include qualitative input from students, such as journals or attitude surveys, or feedback from instructors on perceived quality of student work. Some librarians take an active role in measuring student work, either evaluating in-class performance (such as searching skills) or analysing the quality of student output on assignments.

When teaching technology for information literacy purposes, the challenge is to assess both the student's grasp of the technology as well as the student's grasp of the concept of information literacy. The frustrations of assessing one-shot library instruction for information literacy skills are similar to other types of one-shot instruction: namely, that time is short, collaboration with the regular instructor is

necessary, and it requires developing useful assessment tools (Wang, 2016). When evaluating how a digital media skill is applied to concepts of information literacy, traditional tools such as tests and quizzes are not ideal, as they tend to address whether the student can answer or complete a specific task. Therefore, a quiz is “unlikely to shed much light on the complex process of student information literacy” (Buchanan & McDonough, 2017).

In a one-shot library instruction setting, formative methods of assessment can guide the instructor from the initial determination of the skill and mastery level of the students in the class. This enables the instructor to tailor the class to meet the needs of the students as the class progresses. Formative assessment is used to improve learning by providing regular formal and informal feedback throughout the instruction period (Broussard, Hickoff-Cresko, & Oberlin, 2014). Ideally, the librarian would reconnect with the instructor to review finished products or projects of assignments for which a librarian provided instruction. While the librarian wouldn't necessarily participate in the grading of such projects, a librarian could benefit from knowing whether their instruction was effective.

It is important to note that no one assessment strategy is applicable to any form of library media instruction for digital literacy. As Bowles-Terry and Kvenild point out, assessment is context-specific (2015). A librarian instructor should seek out examples of many different practical and useful assessment styles. ACRL's former standards defined over one hundred learning outcomes from which competency measures can be derived. However, the *ACRL Framework* does not define specific learning outcomes, giving librarians the freedom – and the responsibility – to create meaningful outcomes for teaching and assessment.

Local Considerations

English 1101 and 1102 are the only English composition classes required for Georgia Tech students to graduate. The additional courses from the social sciences and humanities comprise six total credit hours of electives from which students may select. Georgia Tech is a STEM-focused institution; therefore, it is possible students may only encounter a critical cultural engagement in their courses with the Brittain Fellows. The extent of the critical engagement, too, depends on the Brittain Fellow's choice of topic and assignments ("Core Area C," 2016). At Georgia Tech, rigorous investigative or research papers are typically reserved for the senior-level capstone project. Librarians at Georgia Tech are in a bind to explore the intellectual underpinnings of the work while also covering the competencies students will need to be successful in their class.

In addition, the emphasis for instruction at the Georgia Tech Library is on conventional forms of audio and video editing rather than critique. As previously discussed, students generally do not come to Georgia Tech with a mastery of technical skills for the projects they are taking on in English 1101 and 1102. At the same time, classes for these skills are missing on the curriculum. Given that the instruction and expertise that the librarians provide is in support of the curriculum as a whole and the goals of the specific class, the faculty are in control of the subject area. Within the 75-minute session window, librarians work to engage students through a shared understanding of media literacy. Students do not have identical consumption habits with each other or the librarian, though they may be familiar with common genres. In today's splintered media landscape, consumers can customize their media experiences easily, and librarians often have to show a piece of media in class to establish a common understanding of a particular technique or narrative device. Creating mutual understanding takes precedence over interrogating media itself.

However, there is a strong demand for and interests in using data across the curriculum. This disciplinary focus nurtures a strong data culture on campus and offers different channels to discuss data literacy. At Georgia Tech Library, data literacy is integrated into both workshops and course-integrated instruction. Faculty members at Georgia Tech tend to experiment with innovative ways of conducting research and

sharing the results. Shorish (2015) states that empowering students to be responsible for the data that they generate and instilling in them the recognition that their data could be used to build further knowledge should be an integral part of the research process. Some instructors pilot digital means of delivering and sharing students' projects, others encourage students to continue and expand their class projects into larger scale research for possible presentation opportunities. Students own their projects, and helping them to understand this is an important role for Georgia Tech librarians. Understanding that they can advance their work into scholarship and contribute to future research motivates students to be more rigorous about data literacy.

Local Strategies for Assessment

The limitations on class time and librarian involvement in these classes make it difficult to assess dispositions or long-term integration of information literacy competencies. Current assessments at Georgia Tech consist primarily of pre- and post-testing in the classes, taking up no more than five minutes of class time. While the results are promising, the focus is on specific search skills and key concepts rather than long-term retention of these concepts. Another practice that stimulates more reflection and conversation is to cut the lesson plan into small sections. After every section, librarians ask checkpoint open-ended questions that require some analytical thinking to answer. These checkpoint questions serve as an informal way of assessment. However, the outputs of these classes are as diverse as the Brittain Fellows themselves. There is no control to see how library interventions may affect student work.

The one-shot session format is not always adequate for introducing totally novel concepts or technologies. Instructors often expect librarians to cover multiple topics, such as searching various types of resources, evaluating resources, introducing data analysis and visualization with several different tool demonstrations. Most sessions are formed as lectures with minimal classroom interaction for students to practice or discuss their own project design. The requests for workshops and classroom instructions from the campus are far beyond a small team's capacity to accommodate them.

One example of an assessment challenge a Georgia Tech librarian faced was use of the HathiTrust, a publicly accessible digital books repository, for an English 1101 class. In this case, the HathiTrust was used for conducting digital humanities research. Throughout the semester, the Data Visualization Librarian taught five sessions about searching, downloading resources within the HathiTrust virtual machine, conducting basic text mining in the HathiTrust to extract key text information, exporting the information outside of the HathiTrust, and formatting and visualizing the exported data. This series instruction involved data literacy skills, humanities concepts, and analysis and visualization tools. It was difficult to assess the learning outcomes with traditional tools such as pre- and post-testing. In order to understand students' learning, the librarian asked the faculty member to share the final class projects as an evidence of their data literacy practices. Even after this effort, knowing the long-term retention of data literacy skills remains nebulous.

Technical Skills Considerations

Georgia Tech teaching faculty sometimes assume that students come to college already having mastered skills, such as basic video or audio editing, in high school or other training programs. Georgia Tech librarians often interact with freshman students in their first or second semester to campus. What librarians have observed in these entry level classes is a propensity and natural interest to explore topics related to engineering and technology, but this does not equate to a comprehension or proficiency in multimedia technology skills.

The concept of the digital native is pervasive in higher education (Brown & Czerniewicz, 2010). This was popularly defined and later championed by Prensky (2001). A digital native is someone born after 1980 who is raised with access to many different technologies as well as possesses the ability to navigate and create in all of them. Because of this, Prensky calls for significant changes in teaching methodology, if not content, to meet the needs of this new generation. While the major pedagogical shifts suggested by

Prensky are mostly absent from Georgia Tech curriculum, there is a persistent belief that all students come to the academy with a high degree of technological ability. The Brittain Fellow quoted in the introduction, Kashtan (2015, p. 149), typifies this by stating, “Georgia Tech’s students tend to be extremely technologically savvy ...” Faculty expect students to be or quickly become adept at using multimedia and data software. However, these abilities have not been observed by Georgia Tech librarians.

While the concept of the digital native has been entrenched in academia for nearly twenty years, the existence of this student is not supported by empirical evidence. In addition to the important discourses of colonization touched off using the term “native” (which will not be addressed here), there is a substantial body of work countering these and other claims made in Prensky’s (2001) original article. The critical review of Bennett, Maton, and Kervin (2008) shows a significant collection of evidence that belies the existence of the digital native. The authors categorize the embrace of the concept in higher education as a kind of academic moral panic. Students born after 1980 may use internet-enabled devices, but they are not engaged with much content creation. It has been intimated that these post-Internet cohorts may become keen users of technology and information over time, but this has not been borne out by research. Kirschner and Bruyckere (2017) gathered case studies with a global scope and concluded that the digital native does not exist. Any fundamentally different treatment of these students inspired on an idea of technological competence is based on a false premise. Students need to be introduced to and instructed on the fundamental skills of multimedia tools.

The amount of labor required to create media that are both technically excellent and academically rigorous is very high. Many experienced faculty members therefore make media and data intensive assignments a group project. However, the workflow of group editing for multimedia or data-driven projects is a significant organizational and technological challenge for the students. Software applications for audio, video and data processing can be operating system specific. This presents a barrier for students owning different devices. Furthermore, some of the most popular tools used for various tasks are optimized for individual computers. These do not support guarantee the consistency of file formats and editing changes as they would on cloud-based, text editing tools.

Additional provisions for students must be made and communicated to the faculty when technical work is to be completed in a public lab. Students must be able to save projects in progress since they will be working at multiple computers. This is not necessarily an intuitive process, and the necessity of external hard drives and similar devices must be prioritized for anyone working in public labs. These devices must also have a large storage capacity.

FUTURE RESEARCH DIRECTIONS

This model of multimodal information literacy only addresses a certain set of students: first-year undergraduate students at a STEM research-focused university. The emphasis in this particular subset of students is on multimodal communication using digital platforms in the composition curriculum. Upper level undergraduate or graduate students, distance students, students at other kinds of institutions, or composition programs following other pedagogies, would present a different set of challenges and a different environment in which librarians would face them. Furthermore, there are other modalities, such as web, gaming, and software design, that are for now out of the reach of librarian intervention at Georgia Tech. However, the authors contend that any academic library can provide information literacy instruction to match the needs of its campus stakeholders. On campuses where multimedia technologies have become part of literacy instruction, librarians can take on new skills to support them in creative ways. There are numerous methods to gather feedback from campus stakeholders in order to shape new instructional offerings, for example, the authors presented stakeholder analysis methods used at Georgia Tech at the 2018 LOEX Conference (Holdsworth & Valk). Part of the library’s mission is to bridge a skills gap on campus, whether that is learning research skills, scholarly publishing and copyright, data visualization, or media literacy. The future of the academic library will hinge on collaborating with

faculty and academic units, integrating library instruction with other instruction efforts on campus, and keeping up with pedagogical trends.

CONCLUSION

The hyper-democratic nature of the media landscape, in which anyone with internet access can become a publisher, makes information literacy and critical thinking skills more important than ever. These fundamental competencies are a complex, interlocking set of skills that are best explicitly taught. Academic libraries, like the Georgia Tech Library, frequently take on this role for the populations they serve, especially as there is no longer an environment of information scarcity; a simple internet search can have millions of results. Academic libraries may lose their monopoly on providing access to scholarly information with the rise of file sharing services, legality notwithstanding. Teaching students to be able producers and consumers of media is an instructional priority with increasing urgency.

At the Georgia Tech Library, the authors work in a distributed team of instructors who can cover multimodal information literacy. The librarians who teach scholarly literacy are the same faculty who teach data visualization, video production, and podcasting. This is an effort not only to match the WOVEN curriculum that is required by the English 1101 and 1102 classes, but also to provide holistic support. The acts of editing a video or preparing a dataset for visualization reveal the deliberate choices in which content creators shape their message in ways that mere description cannot do alone. They are making the same set of choices enabled or limited by the same set of tools. While the rhetorical devices for content creation are dependent on modality, the underlying concepts of information literacy remain the same. Lifting the veil on content creation in the ways currently supported by librarians may inspire students to critically examine other parts of their media experiences.

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KEY TERMS AND DEFINITIONS

ACRL Framework: The Association of College and Research Libraries defined six key interconnected concepts, referred to as frames, supporting information literacy instruction. These frames are not prescriptive.

Berrypicking: The theory that information-seeking behavior follows a meandering process, in which serendipitous discovery and changing needs shape the search question itself.

Course-integrated: A library-based instruction session, coordinated with faculty and occurring during regular class time, that is directly connected to an assignment or learning outcome.

Embedded librarian: A relationship with a class or instructor marked by continuous, deep engagement by the librarian. Librarians may teach multiple classes, hold office hours, or take part in grading assignments.

One-shot: A self-contained class that occurs once with a certain set of students and is not part of an ongoing series of lessons.

Pearl growing: A search strategy that has two parts. The bibliography of a relevant document is examined for additional references. The article may also be checked to see if it has been cited by more recently written literature.

STEM: An acronym that stands for science, technology, engineering, and mathematics.

WOVEN: An acronym that stands for written, oral, visual, electronic, and nonverbal. This represents the multimodal curriculum.