Strategic Library™

On Educating Patrons on Privacy and Maximizing Library Resources

BY T.J. LAMANNA

ABSTRACT
Libraries are one of our most valuable institutions. They cater to people of all demographics and provide services to patrons they wouldn't be able to get anywhere else. The list of services libraries provide is extensive and comprehensive, although unfortunately, there are significant gaps in what our services can offer, particularly those regarding technology advancement and patron privacy. Though library classes on educating patrons' privacy protection are a valiant effort, we can do so much more and lead the way, maybe not for the privacy industry but for our communities and patrons. Creating a strong foundational knowledge will help patrons leverage these new skills in their day to day lives as well as help them educate their families about common privacy issues. In this column, we'll explore some of the ways libraries can utilize their current resources

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as well as provide ideas on how we can maximize their effectiveness and roll new technologies into their operations.

Though many libraries have policies on how they deal with patron privacy, unfortunately some policies aren't very strong and oftentimes staff isn't trained in the details of these policies.

Fortunately, for libraries who don't have these necessary policies, there are some, such as the San Jose Public Library, that offer their own as a framework.[1] Those that do have a strong comprehensive policy must make sure they are enforcing and regularly updating it to comply with new technologies being released. It's a daunting task, but as Article VII of the Library Bill of Rights says, "All people, regardless of origin, age, background, or views, possess a right to privacy and confidentiality in their library use. Libraries should advocate for, educate about, and protect people's privacy, safeguarding all library use data, including personally identifiable information."[2] This means we have a responsibility to our patrons to do everything in our power to protect them and teach them to protect themselves.

This requires a concerted effort not just for technology and IT librarians, but for all library workers. A privacy policy means little if those on the front lines are either unaware of the policy or unsure how it is to be implemented. Therefore, all library staff should both understand the fundamental reasons behind library privacy policies and be trained in maintaining them. Libraries may consider implementing this training

during staff development days or offer independent training sessions as needed.

Since the introduction of the Patriot Act, libraries stopped collecting patrons' reading habits, but so many library integrated library systems (ILS) snag massive amounts of patron information we are unaware of. I've been administering our ILS for over two years and I just found another space where items are being unnecessarily retained that I didn't notice before. An instance such as this calls for limiting personally identifiable information (PII) to what is strictly necessary.

In limiting the PII gathered in the first place, library staff should consider the following questions: What information do libraries really need to collect to offer library cards or programming? Does your library really need patrons' date of birth or gender? Probably not. If so, you shouldn't be collecting it, and if you do, make sure you anonymize the data. Using metrics is vital to how libraries function, receive funding, and schedule programming. You can still use the information, but it should not be connected

to a patron in any way.

After educating staff, we can educate patrons on developing better and safer practices regarding personal privacy and security in their daily lives. Practical examples range from teaching patrons how to create strong passwords and backup sensitive files to explaining how malware works and what the "cloud" actually is. This is a start, but it goes far beyond that. I've served many patrons who, even after taking courses on the subject, are overwhelmed by the security measures needed to protect themselves. This isn't necessarily a sign that our classes are ineffective, but it does imply that new tactics are needed. Let's look at a few examples.

Another version of PII that we often overlook are security measures such as closed-circuit television (CCTV) or security/police officers in our buildings.[3] They often are either forgotten or outside the purview of the library itself. As the College of Policing states, "CCTV is more effective when directed at reducing theft of and from vehicles, while it has no impact on levels of violent crime."[4] While there are justifications for bringing this technology into the library, they should only be set up where needed, taking great care not to point them at patron or staff computers. If CCTV is needed, make sure to follow local retention laws and remove the footage as soon as its time has expired. This idea applies to all collected information. There is no reason to archive data beyond the date they can be destroyed as it puts the library and its patrons in a compromised position.

Law enforcement in the library is a tough thing to argue against in our current political climate. But studies have shown that police presence does little to deter crime and may actually disproportionately impact marginalized communities.[5] Consider the purpose of law enforcement personnel and if their presence is actually necessary to the proper functioning of your library. In the event that you should have law enforcement come in with a subpoena that requires you to turn over your patron data, it's important to have a canary warning that can be removed so your patrons understand what has happened.[6]

Another way libraries can lead the way in protecting patron privacy both inside and outside the library is by supporting legislation that bans facial recognition software. This type of technology is becoming ubiquitous, but places have already started pushing back and libraries can be the epicenter of this movement. It's already been banned in Oakland,[7] San Francisco[8] (one of the homes of this technology), as well as Somerville, Massachusetts, with groups like the Massachusetts Library Association unanimously putting out a moratorium on facial surveillance, which is the practice of recording ones face to create user profiles.[9] There are other states that are working down this path and it's overwhelmingly heartening to see libraries step up and in front of something they know would damage our communities. We ought to be activists, standing on the front lines and showing our patrons our deepest commitment to them.

Surely there are greater strides we can make, such as revising WiFi policies. WiFi is one of the most used services libraries offer and many libraries don't use it to their full potential. For instance, some libraries turn off their WiFi when the building is closed, severely limiting patrons' usage. It's a service we pay for and there is no reason it shouldn't be available at all times. Your IT service should make sure the WiFi is secure (it should be where it's available at all hours or not). Unlimited access to WiFi becomes invaluable to users who need it for emergencies including completing work or accessing important online services when the library is closed. While we do have limited bandwidth and IT services must actively maintain WiFi security, libraries should make sure it's available to the public as often as possible.

Now that we've covered using bandwidth when we aren't open, let's talk about libraries with excess bandwidth. No resource should go unused in the library. We have a limited budget and we should make sure every penny is used to serve our communities. One fantastic use of excess bandwidth — especially during closed hours — would be to set up a Tor relay in

your library, an anonymity network that allows people to surf the internet with extra security and privacy in mind. It's quite easy to set up and you can limit how much bandwidth it uses so you aren't shorting anyone in your library. It's a service used by groups such as journalists or activists who want to make positive change in the world and need a safe place to do so. Some are concerned that the Tor network is used for malicious intent but the Tor Project, the organization that runs the network, constantly works to ensure nothing like that is taking place. Also, anything solicitous you can find on the Tor network is available on the regular internet including places like Facebook or Craigslist, so the stigma of the network should be taken in context. The Tor Project routinely monitors the network and searches out illegal material (there are no hired killers on the Tor network). Given all this, you could help the network greatly by just partitioning a small amount of your bandwidth.

Libraries have the unique ability to be transformative. Unlike other non-profits or organizations, we have the ability to pivot. We can both change directions as needed and pave the way for our communities as leaders in the movement toward patron privacy. I leave you with a quote from Hardt and Negri: "...we share common dreams of a better future."[10] That should be our motto. ∎

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FOOTNOTES:
1 "Our Privacy Policy, San Jose Public Library, accessed August 15, 2019, https://www.sjpl.org/privacy/our-privacy-policy.
2 "Library Bill of Rights," American Library Association, last modified January 19, 2019, http://www.ala.org/advocacy/intfreedom/librarybill.
3 "Importance of CCTV in Libraries for Better Security," accessed August 14, 2019, https://www.researchgate.net/publication/315098570_Importance_of_CCTV_in_Libraries_for_better_security.
4 "Effects of CCTV on Crime," College of Policing, accessed August 14, 2019, http://library.college.police.uk/docs/what-works/What-works-briefing-effects-of-CCTV-2013.pdf.
5 "Do Police Officers in School Really Make Them Safer?" accessed August 14, 2019, https://www.npr.org/2018/03/08/591753884/do-police-officers-in-schools-really-make-them-safer.
6 "Canary Warning," Wikipedia https://en.wikipedia.org/wiki/Warrant_canary.
7 Sarah Ravani, "Oakland Bans Use of Facial Recognition Technology, Citing Bias Concerns," San Francisco Chronicle, July 17, 2019, https://www.sfchronicle.com/bayarea/article/Oakland-bans-use-of-facial-recognition-14101253.php.
8 Kate Conger, Richard Fausset, and Serge F. Kovaleski, "San Francisco Bans Facial Recognition Technology," New York Times, May 14, 2019, https://www.nytimes.com/2019/05/14/us/facial-recognition-ban-san-francisco.html.
9 Sarah Wu, "Somerville City Council Passes Facial Recognition Ban," Boston Globe, June 27, 2019, https://www.bostonglobe.com/metro/2019/06/27/somerville-city-council-passes-facial-recognition-ban/SfaqQ7mG-3DGulXonBHSCYK/story.html.
10 Michael Hart and Antonio Negri, Multitude: War and Democracy in the Age of Empire, (New York: The Penguin Press, 2009), p. 128.

Creating Culturally Safe Learning Spaces and Indigenizing Higher Education

BY KEVIN BROWN

PREPARING THE PLANTING FIELDS

The Indigenous Nations Library Program (INLP) is a unique library program within the University of New Mexico College of University Libraries and Learning Sciences. Founded in 2004, INLP developed a specific Indigenous library service strategy focused on contextual information literacy and culturally sensitive services (Brown, 2017). In the beginning, INLP was situated in a hard to find location on the second floor of the historic west wing of Zimmerman Library. This location was small and inhibited INLP from offering a variety of learning spaces (Brown 2017). Related, INLP Librarians at the time were not afforded the flexibility to design a library space for Indigenous students. Furthermore, specific places for learning were not available as the program space was one large room containing one large table for both research consultation and studying. It was comfortable, warm, and unfortunately cramped. A new space that would satisfy the ambitions of the librarians working there was needed.

In 2011, INLP was rehoused in a highly visible section of the Zimmerman Library. The new location, still on the second floor, was formerly the office suite of the Dean of University Libraries. This place allowed for a prominent display of indigeneity with a beautiful entryway mural entitled, *Planting the Seeds of Knowledge,* emphasizing that this program space is a unique location for Indigenous studies, people, communities, and knowledge. In other words, indigenizing the space with this specific art publicly stated this place was INLP's. The murals were painted by Sixtus and Susana Dominguez, together known as Ansulala'. This space unlike the previous
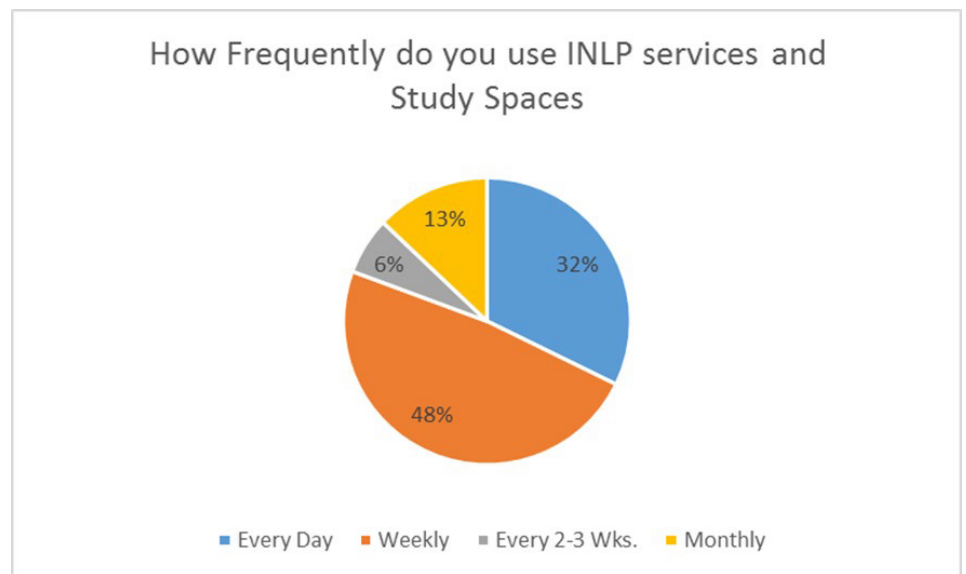

Figure 1. Frequency of Use of INLP

one has drop-in study rooms, a computer lab space, conference and meeting rooms, and a social gathering area. This is profound for Indigenous students, especially because they are yearning for spaces and places that reflect their Indigenous considerations. This yearning for a connection to the essence of Indigenous personhood and its relationship to the physical environment - land. Similar to planting, cultivating learning is paramount in this place as plants are for the livelihood of Indigenous existence. Moreover, this space allowed for the development of learning spaces devoted to the consciousness of Indigenous presence and learning (Brown 2017). This relationship is unique at the University of New Mexico because many of the students are living and learning on the ancestral lands of their people. INLP attempts to break down physical and social barriers Indigenous students face in western academic environments. This tenu-

ous because INLP resides within western-academic spaces. It is the integration of Indigenous pedagogy along with western academic knowledge disciplines are where INLP finds its true purpose, to advocate and intellectually orient Indigenous knowledge in a culturally safe space.

INDIGENOUS STUDENTS ON THE RACIAL BATTLE LANDS

There is no place in the Western Hemisphere where Indigenous people have not lived. This acknowledgement is crucial because an Indigenous student on a university campus may feel alienated and unsafe due to the current built environment and interaction with non-Indigenous people. The constructed university environment overlays the memories of Indigenous people and at times erases, ignores, and subdues Indigenous existence (Lipe 2018).

Indigenous students must contend

> ## » Academic performance is the biggest consequence of this negotiation upon Indigenous students, partly due to the divergence in cultural values and norms.

with this relationship of a colonially fixed learning environment on the surface of a multifaceted and dynamic perspective of Indigenous landscapes. This is a complicated balance because land in Indigenous existence is dynamic. (Goeman 2015). In the minds of students, they are, "deconstructing the discourse of property and reformulating the political vitality of a storied land" (Goeman, 2015, p. 74) as well as reconciling their existence in an academic environment. Brayboy (2015) suggests that Indigenous students are, "in the racial battle lands" in colleges because of the alienation and discrimination students face in a western academic environment (p. 45). Goeman states that the land that was once Indigenous now accommodates colonial government policies of land ownership and negotiating property boundaries with a restriction of Indigenous bodies on reservations. This colonial-imposed mindset of segregation due to the reservation systems which isolated Indigenous people to occupy "strict gender and racial hierarchies." (2015, p. 83). Related, Brayboy verifies the racial battle land that Indigenous students face because long held views of Indigenous people in America as either extinct or should be bounded within reservation limits are prominent tropes Indigenous students face on university campuses.

Due to these circumstances, Indigenous students huddle close to culturally familiar places because it reinforces their identity but also enacts a reconstitution of Indigenous lifeways. There is a connection to culturally safe places that reminds them of home, a place to be comfortably themselves. Indigenous students at universities often occupy cultural centers or student service areas, (Shotton, Yellowfish, Cintrón, 2011) asserting that these places are necessary for the persistence of students to graduate (p. 57). In these culturally safe places on university campuses, Indigenous students shed their academic anxiety and become their true selves. For instance, native specific centers are the refuge areas for success in colleges and universities.

D.L. Brown (2005) prescribes to the notion that, "having a place where Native American students feel like they belong and feel comfortable is extremely important to their success in higher education (p. 93). The strength of students should be celebrated because they are negotiating these spaces because, "Indigenous identities are internally questioned" and making decisions based on how culturally safe spaces are for them is a survival skill (Windchief and Joseph, 2015, p. 269).

Academic performance is the biggest consequence of this negotiation upon Indigenous students, partly due to the divergence in cultural values and norms. Stephen Sawyer in a unique study, *Investigating Policies and Procedures of the University of New Mexico on Native American Student Persistence* (2001), details a situation where, "traditional values of cooperation and group harmony often conflict with the value placed on individual achievement and interpersonal competition in academia, versus European- Christian values" (p. 51). Related, students often face potential conflicts with community obligations and the will to academically succeed. Sawyer discusses a bicultural identity of Indigenous students, "upon entering school, students are caught in the crossfire between the forces that seek to push them to succeed in the dominant system and those that seek to pull them back into the traditions and culture of their families of origin" (2001, p. 52).

Students' success at the university level is due to Indigenous faculty, staff, and programs situated in native spaces. In an empirically supported study Rebecca Covarrubias and Stephanie Fryberg surveyed Indigenous students about the representation of self-relevant role models and their academic success. Their study revealed that, "exposing underrepresented Native American students to a self-relevant role model significantly increased school belonging relative to role models that are self-irrelevant or ethnically ambiguous" (Covarrubias and Fryberg, 2015, p. 13). Students who have had a close family mem-

ber graduate from college significantly contributes to success as well because they view their family members' success as attainable to theirs (Covarrubias and Fryberg, 2015, p. 15). Potentially, each student who graduates scaffolds academic success to their kin and children, supporting the need for culturally safe learning spaces for Indigenous students to establish among themselves, supportive academic and cultural links. This interaction among Indigenous peers creates an ecological vehicle to manifest spiritual growth, information capture, and academic success.

SPIRITUAL ECOLOGY & BUILT PEDAGOGIES
INLP's foundational mission was to provide a specific place for Indigenous critical consciousness. The program architect, Mary Alice Tsosie, envisioned a place for Indigenous learning (Brown 2017). She commissioned a painting in the conference room and computer lab that focused on the "interconnected web among the tribal nations of New Mexico...together, water, mountains and stars create an integral spiritual ecology and promote Indigenous critical consciousness" (INLP Mural Handout). The muralists, Sixtus and Susana Dominguez collectively known as Ansulala, invoked an ideological position developed by Santa Clara Pueblo Professor, Gregory Cajete, called spiritual ecology.

Spiritual ecology and its relationship to Indigenous learning, "at its innermost core, is education about the life and nature of the spirit that moves us" (Cajete 2004, 42). In Cajete's view, the 'spirit' is actively situated in the environment; understanding these forces enables a deeper and fuller meaning of life (2004,43). It is the spiritual ecology that an Indigenous person is enveloped with a deeper level of awareness of the environment, the movement of energy between ecological channels, an intimate understanding of their existence not in the moment but of the continuity of their ancestor's presence. The murals represent a visual thesis of this awakening of the spiritual dimensions of the environment in a graphical illustration.

> » **When the internet revolution occurred, libraries had to compete with information being widely accessible through powerful search engines, such as Google, and popular compendiums like Wikipedia. Library spaces shifted to incorporate digital learners with emphasis on book storage decreasing with the advent of e-books.**

The learning environments of large university campuses are often fast paced and alienating. This alienation of the body is also related to the possible replacement of Indigenous values and knowledge by Eurocentric discipline- specific courses. Alejandro Lopez and McClellan Hall (2007) recognize this dilemma in their study of Native students in the Bureau of Indian Affairs school system. They write, "it is common knowledge that native children who are placed for long periods of time in school environments that lack any sign of their culture are prone to fare poorly academically, not because they are mentally sluggish, but because they are emotionally depressed and sensorially deprived" (Lopez and Hall 2007, 32). The INLP Murals were the first concrete changes to this space once it was transferred to INLP librarians, illustrating that your ways of knowing and your ways of existing have a place here. Further, it demonstrates the capacity of students to become malleable in their learning process, with a simple acknowledgement that Indigenous ways of knowing is intersecting with Western higher education concepts.

INLP's creation of a physical space allows for the intersection of Western academic knowledge systems with Indigenous knowledge systems on a daily basis. Martin Nakata calls this palimpsest of knowledge systems a "cultural interface" of information (2002, 285). He further states that both knowledge systems are "not strictly about the replacement of one with the other, nor the undermining of one by the other. It is about maintaining the continuity of one when having to harness another and working the interaction in ways that serve Indigenous interests, in ways that can uphold distinctiveness and special status as First Peoples" (Nakata 2002, 286). INLP is a living embodiment of Nakata's cultural interface model that requires consistent staffing and a dedicated space for this model to work harmoniously.

BUILT PEDAGOGIES

Libraries are meant to be public spaces and hail from Western concepts of literary learning which contrasts with Indigenous learning traditions. Indigenous learning is done in two interrelated ways: apprenticeship and orality. In apprenticeship the learner is paired with a skilled and knowledgeable person, most likely an elder, who activates the information taught through demonstrations and interaction (Findsen et al. 2017). This intergenerational transmission of information reinforces the reverence of elders in a community. They are the living libraries of a community. Through them and their knowledge lies the key for transforming ideas, formulating identity, thinking critically, and supporting community morality (Findsen et al. 2017). Another key component of Indigenous learning is the need for oral communication to convey rich information such as tonal emphasis on words, emotion and feelings. In a comparative study between orality and literacy, Walter Ong detected in oral cultures, the reliance on memory recall, repetitions, and information is closely aligned to their lived world (1988: 34-41). Compared to the library system of storing knowledge on a literary compendium such as books and databases, oral based knowledge is deeply integrated with intergenerational communication; elders in a community are deeply important in that process. Literary knowledge requires a full understanding of writing mechanics, grammar, writing styles, and an individualized process of learning (Ong 1988). It is through this learning process that libraries have designed its own buildings and facilities to support this learning tradition. INLP in this process makes it a unique case study in learning spaces as it looks to blend multiple learning processes in one place.

Architecturally, libraries reflect the philosophies of the designer. Torin Monahan refers to this as "built pedagogy" or the "architectural embodiments of educational philosophies" (2002: 5). This type of peda-

gogy reflects an understanding that social settings constructed in a space, within the structure of a larger space allows for some designer choices which greatly influence learning (Chism, 2006, p. 2.5). Learning spaces can exist for quiet and isolated contemplation or to bring people together through collaborative learning. The drive behind the selection of learning environments is motivated by the learning style of the learner. In the early designs of libraries, most spaces were highly specified with physical spaces designated for library collections with rows of shelving units dominated most of the architectural designs of libraries (Turner, Welch, and Reynolds, 2013).

When the internet revolution occurred, libraries had to compete with information being widely accessible through powerful search engines, such as Google, and popular compendiums like Wikipedia. Library spaces shifted to incorporate digital learners with emphasis on book storage decreasing with the advent of e-books. Libraries shifted the physical space to include other novel and attractive spaces such as maker spaces and learning commons (Turner, Welch, and Reynolds, 2013). This movement also shifted away from traditional teaching methods centered on "teaching culture and toward a culture of learning" (Bennett 2003, 10), meaning that a full understanding of learning pedagogy centered on social learning rather than teaching the mechanics of literary culture. Maker spaces and learning commons complimented the socialization of learning, where students manage the spaces depending on the learning purpose (Bennett 2003, 38). Although books and other library resources are still a priority of a library core service areas, institutions are balancing the needs of students while supporting the curriculum of the academic programs within the university (Turner, Welch, and Reynolds 2013).

A GATHERING PLACE

Mary Alice Tsosie envisioned a space for

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Indigenous students that she simply called A Library-Gathering Place [It was later renamed The Gathering Place.] (A Library Gathering Place for Native American Students at the University of New Mexico). This simple gathering of Indigenous students and people was a novel idea centered on Indigenous existence in a western focused built pedagogy:

"...As a one of a kind program – located at a library – students will have flexible access to a space that reflects their culture and language while providing them with tools and resources to excel in their chosen academic fields – without barriers and hardships they have historically faced in the past – barriers that have kept many Native American Students from completing their college education" (A Library Gathering Place for Native American Students at the University of New Mexico, 2).

In an earlier article I provided additional information on the nature of library services through INLP contexts such as Indigenous librarianship, contextual information literacy, advocating and supporting Indigenous knowledge, and collection development (Brown 2017). However, the true nature of INLP's success is its physical learning environment in that it is the one place on campus where students can fully absorb ideas and information in a culturally safe environment. Mediated spaces such as INLP facilitate the cognitive process of reflection, thoughtful discussion, and active participation in rationalizing ideas. INLP provides this environment with one specific caveat, to acknowledge cultural learning and manufacture spaces in which to learn comfortably.

INLP provides study rooms designed for communal learning with easily moveable furniture that students routinely reconfigure as the need arises. This type of flexible study space allows different learning styles to be acknowledged and allows for learning to be a communal act of creation. Self-selection is crucial in this environment because most other university learning spaces, specifically instruction classrooms, are fixed towards a built-in hierarchy of professor/lecturer as the focal point. Deborah Bickford

and David Wright (2006) advocate for a community focus to learning that should be a primer for designing learning spaces (4.1). They both lean toward social cognitive learning where, "in a community, the learners...are enriched by collective meaning-making, mentorship, encouragement, and an understanding of the perspectives and unique qualities of an increasingly diverse membership" (Bickford and Wright 2006, 4.2, 4.3). INLP prescribes to this learning theory as well because Indigenous learning traditions are communal and discussed rather than instructed (Findsen et al. 2017). Learning in this context is experienced and shared. For instance, students often compare course notes and/or content with each other and discuss meaningful topics, as in How does this information differ from my Indigenous existence, for example. Naturally, a unique information ecology is formulated by students critically discussing academic content related to their Indigenous experiences.

Indigenous librarian, Loriene Roy, recognizes this phenomenon and theorizes this social behavior as Indigenous Ecology (2015, 385 & 394). Unlike Cajete's spiritual ecology which is an understanding of the spiritual forces of life and the environment as a *learning process*. Roy proposes an Indigenous Ecology model of an "effective *learning environment* that not only reflects Indigenous worldview but also provides a centering point for understanding comparable LIS [Library Information System] and social justice ethics, values, epistemology, methods, technique, service and practice. (2015, 385). Roy defines Indigenous ecology:

"...as both a space and a system that confirms a connection to land through the process of story. Story is the life of the individual set within the history and traditions of the community. Story documents the past while adding new actions to the record...Specifically, the Indigenous ecology is the place where learning takes place. Within this Indigenous ecology, the "ideal" process of this learning is "a dialogue and political negotiation (consistent with the notion of diplomacy) of diverse perspectives and interests, rather than the idea of intervention

in a mechanical system of feedback loops..." (Morrow, 2009, p. 29).

Consideration of an Indigenous ecology is beneficial even in locations far removed from tribal homelands. Thus, the Indigenous Ecology as learning space can be effective even if the learners are living far from Native communities." (2015, 394)

Learning spaces, specifically INLP group study rooms are drop-in, unlike study rooms in other UNM libraries, which are reservable for up to 2 hours. Limiting the amount of time a student may use for a study room interrupts the learning flow but in the case of INLP, students discuss and study with other students throughout the day. INLP librarians have observed students using the study rooms all day for studying and relaxing. The study rooms are large enough for up to 10 students, 4-6 students are the average per study room. An added bonus is privacy, each of the drop-in study rooms are equipped with doors so conversations within the rooms are kept between the occupants. In addition, this barrier enables students to be comfortable and learn without being accosted or harassed. Another positive of a drop-in study room model is that students can request permission to study with other students rather than an exclusive reservation model, students in INLP have the potential to engage with other Indigenous students outside their academic network, which facilitates community relationship building. Students use the drop-in study rooms 35% of the time as they visit INLP (**Figure 2**).

Other spaces in INLP include a conference room that holds up to 20 people. Unlike the drop-in study rooms, this room can be reserved for to 2 hours. This room is reservable due to greater demand for the room. For instance, this room is designed for communal instructional learning and collaborative meetings. Native American Studies courses have been taught here, students have given and practiced presentations in this room, student organizations regularly hold meetings in this space, and faculty reading groups are held here. This room is also accessible to outside organizations and class groups. To accommodate everyone and
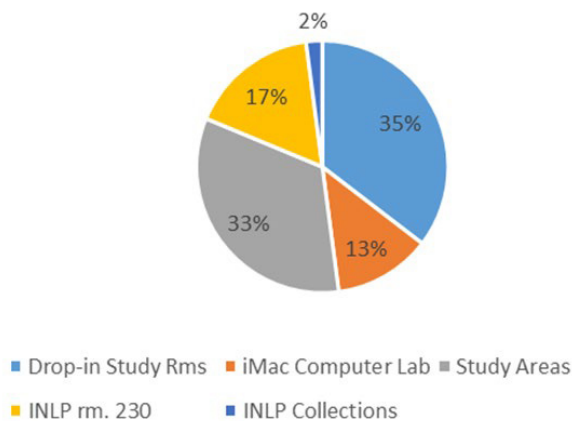
Figure 2. Frequency of INLP Learning Space Use

mediate scheduling concerns, this room benefits from a web platform scheduling calendar called LibCal. . This room has technological accommodations including a drop-down screen, projector, and computer monitor. The system is integrated with a Crestron signal controller so visiting patrons can sync their personal device or use the base computer. Finally, this room has beautiful cabinets embedded in the wall structure that INLP recently made available to student organizations to house their memorabilia, archives, and historical items for display and safekeeping. They are known as the INLP Community Cabinets, so far seven student organizations have reserved a community cabinet. The community cabinet program is designed to establish community in the space by giving a piece of the program space to the students.

As INLP spaces evolves to meet the changing needs of its users, the computer lab has been reevaluated and repurposed. Originally, the goal of the computer lab was to provide technological accommodations to students who do not have access to a computer. However, head counts and login sessions statistics show that the computer

lab use has dropped significantly within the past couple of years (Figure 2). Today, this room has been converted into a multi-functional learning space which includes lounge furniture, a large study table, and computers. This decision was ultimately decided upon because the program requires more study and learning spaces. Operationally, INLP was nearing full capacity.

COMMUNITY STATISTICS

During the nascent stages of INLP's program history, operational statistics were rarely recorded and detailed records of INLP's impact on student learning and academic success was only verified through anecdotal comments. Today, INLP program statistics are recorded and calculated, this priority of numerical tracking is crucial for creating an institutional memory and understanding the program impact upon Indigenous students at UNM. An added benefit of collecting data is its use in grant applications, program priorities, strategic planning development, and evaluating the growth of the program.

One of the largest sets of data recorded is headcount data. Headcount entries are

significant because they record hourly use of INLP spaces, rather than gate counts, which record total entries into INLP. Simply, headcount statistics are records of patron use of a space for a duration of time within a specific time frame (Gerke and Teeter 2017). INLP has been recording headcount statistics since 2012 with results showing a general rise. For the first time in program history, 10,000 headcounts were recorded during the academic year 2016-2017. Unfortunately, INLP does not collect race or identity information so the actual number of Indigenous students visiting INLP is not known, but through casual conversation, personal information was discussed by Indigenous students. Results show that intimacy of the INLP program allows for personal interaction daily where conversations other than academic topics are normal. Topics of discussion include homesickness, cultural responsibilities in ceremonies, community politics and government issues, as well as family and kinship topics.

Headcount data was further evaluated when INLP hosted an Open House on March 23, 2017 to gather information for strategic planning. INLP was interested in information related to the frequency of visits, awareness of INLP programs and services, as well as satisfaction with learning spaces. INLP also wanted to be aware of students' perspectives on INLP contribution to college success and whether INLP provides a safe and inclusive learning space. (**See figures 1-3.**)

Survey results reflect a special relationship between students and INLP learning spaces, with 32% of students visiting INLP every day and 48% of students visiting every week (**Figure 1**). Related, 35% of students use the drop-in study rooms and 33% of students use other study areas that are not the drop-in study rooms, while INLP Conference Room (rm. 230) is preferred 17% of the time (**Figure 2**). Combined with the rate of returning visitations compared to the overall Indigenous enrollment data, this
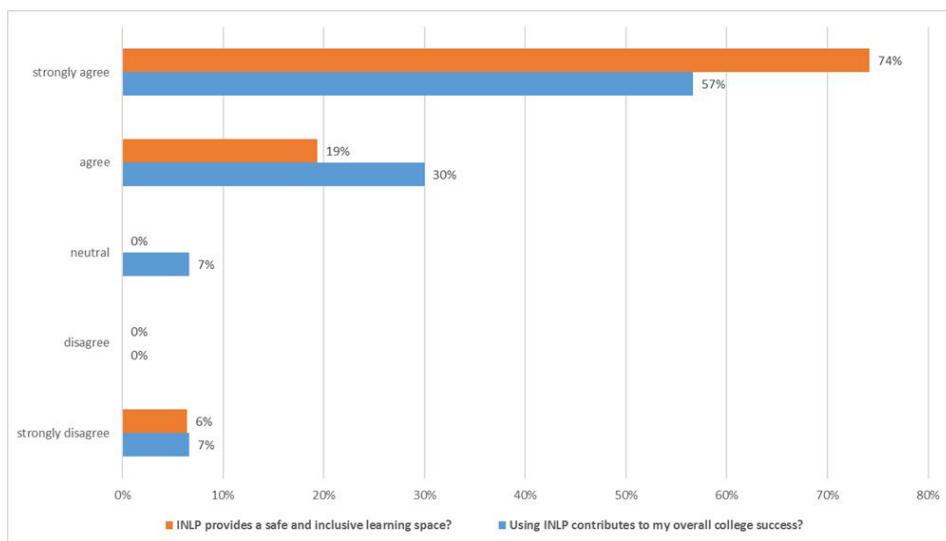
Figure 3. INLP Impact on Student Success

study shows that places of cultural safety are important for student learning. It is also further testimony to the adage, if you build it, they will come, especially Indigenous students in places of racial isolation will gather to places of cultural familiarity.

This cultural familiarity is important for overall student success as students agree (30%) and strongly agree (57%) that INLP contributes to their overall college success, while 74% of students strongly agree that INLP provides a safe and inclusive learning space (**Figure 3**).

To sum up, students use INLP for the drop-in study rooms and other study areas every day and they feel that INLP provides a safe and inclusive learning environment that ultimately helps them succeed college. The success of INLP learning spaces is related to the freedom and autonomy to create spaces of learning.

INDIGENOUS SPATIAL SOVEREIGNTY
A degree of sovereignty of Indigenous spaces in its pure form is the ability to self-direct and design spaces to connect Indigenous people to culturally familiar spaces. INLP as a program had the greatest luxury of autonomy in part because of University

Libraries leadership. They enabled INLP to self-govern; Mary Alice Tsosie took full advantage of this ability to experiment with INLP's programmatic role. True self-determination came when INLP was transferred from its original location to its current location (Brown 2017). The ability to respond to student needs is the greatest benefit of an autonomous learning environment, meaning it enables a quicker response to student needs and concerns without bureaucracy and authoritative processes. Creative control to indigenize this space is the greatest benefit of allowing distinct programs to flourish and experiment with learning spaces.

Mary Alice Tsosie indigenized the office suite with murals and created a community learning environment. This program space design was emphasized by changing the norm of library spaces. The idea of this space was eloquently written as it says, "[INLP Learning Spaces] will change the institutional patterns by providing Native American students with an environment that acknowledges and builds upon their skills and abilities, reflects their cultural context of learning...ALGP will be student-focused, affirm tribal identity, while igniting their creativity in their course of

study, where it be engineering, science, art, music, medicine, law or education" (A Library Gathering Place for Native American Students at the University of New Mexico, 6). INLP librarians, past and present, were looking to reinvent how learning spaces can be designed for Indigenous students. The theoretical lens of built pedagogies, spiritual and Indigenous Ecology, as well as cultural interface are all intertwined in INLP learning spaces while the spatial sovereignty allows for these paradigms to be activated. It is important that the physical environment enables other activities to flow through it. Tim Ingold, an anthropologist states that, "Environment is a relative term — relative, that is to the being whose environment it is.... Thus, my environment is the world as it exists and takes on meanings in relation to me, and in that sense it came into existence and undergoes development with me and around me" (2000, 20). In this instance, Mary Alice Tsosie recreated an Indigenous environment for students to manifest their cultural practices of learning and construct an Indigenous community in the middle of racial battlegrounds.

Furthermore, this point cannot be overstated because this relationship is not merely having a place to be Indigenous but having the ability to connect to Indigenous land. Mishuana Goeman (2015) discusses the powerful relationship of land as the foundation to Indigenous existence. She says, "land as meaning-making place because that is at the heart of Indigenous identity, longing, and belonging... Indigenous peoples make place by relating both personal and communal experiences and histories to certain locations and landscapes — maintaining these spatial relationships is one of the most important components of politics and our identity" (2015, p. 73). INLP negotiates this by being inviting for Indigenous people and philosophy. You come as you are, and we cultivate you in your growth. Each student entering INLP is metaphorically planting seeds of knowledge. ■

» **To sum up, students use INLP for the drop-in study rooms and other study areas every day and they feel that INLP provides a safe and inclusive learning environment that ultimately helps them succeed college. The success of INLP learning spaces is related to the freedom and autonomy to create spaces of learning.**

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REFERENCES

"A Library Gathering Place for Native American Students at the University of New Mexico." INLP Office Files. Indigenous Nations Library Program, Zimmerman Library. University Libraries, University of New Mexico.

Bennett, S. 2003. Libraries Designed for Learning. Washington, DC: Council on Library and Information Resources, November, Accessed May 17, 2018. **https://www.clir.org/pubs/reports/pub122/**

Bickford, Deborah J. and David J. Wright. 2006. "Community: The Hidden Context for Learning in Learning Spaces." In *Learning Spaces.* Edited by Diana G. Oblinger. Educause: Washington, D.C. pp 4.1- 4.22.

Brayboy, B. M. J. 2005. "Toward a tribal critical race theory in education." *Urban Review,* 37:5: 425–446.

Brown, D.L. 2005. "American Indian Student Services" in *Serving Native American Students.* Edited by M.J. Tippeconnic Fox, S.C. Lowe, and G.S. McClellan. Jossey- Bass: San Francisco. pp. 87-94.

Brown, Kevin. 2017. "The Role of an Indigenous Nations Library Program and the Advancement of Indigenous Knowledge". *Collection Management* 42:3-4: 196-207.

Cajete, Gregg. 1994. *Look to the Mountain: An Ecology of Indigenous Education.* Kivaki Press: Durango, Colorado.

Chism, N. Van Note. 2006. "Challenging Traditional Assumptions and Rethinking Learning Spaces" in Learning Spaces. Edited by Diana G. Oblinger. Educause: Washington, D.C. pp. 2.1 - 2.12.

Covarrubias, Rebecca and Stephanie A. Fryberg. 2015. "The Impact of Self-Relevant Representations on School Belonging for Native American Students." *Cultural Diversity and Ethnic Minority Psychology.* 21: 10-18.

Findsen, Brian, Barry Golding, Sabina Jelenc-Krasovec, and Bernhard Schimdt-Hertha. 2017. "Mā Te Ora Ka Mōhio / 'Through Life There Is Learning'." *Australian Journal of Adult Learning.* 57: 3 : 508-525.

Gerke, Jennie and Keith Teeter. 2017. "Counting Heads: Building Space Assessment into your Library Assessment Plan." ACRL Conference. Baltimore, Maryland. Article Accessed.9/19/2018.

Goeman, Mishuana. 2015. "Land as Life: Unsettling the Logics of Containment" in *Native Studies Keywords.* Edited by Stephanie Nohelani Teves, et al. University of Arizona Press. pp. 71- 89.

Indigenous Nations Library Program. 2012. "INLP Mural Information Sheet." Handout, Indigenous Nations Library Program.

Ingold, Time. 2000. *The Perception of the Environment: Essays on Livelihood,* Dwelling, and Skill. Routledge, New York.

Lipe, KaiwipunikauikawÐkiu. 2018. "Toward Equity and Equality: Transforming Universities into Indigenous Places of Learning" in *Reclaiming Indigenous Research in Higher Education.* Edited by Robin Starr Minthorn and Heather J. Shotton. Rutgers University Press, Newark, New Jersey. pp: 162-177.

Lopez, Alejandro and McClellan Hall. 2007. "Letting in the Sun: Native Youth Transform their School with Murals." *Reclaiming Children and Youth* 16:3: 29-35.

Monahan, Torin. 2002. "Flexible Space & Built Pedagogy: Emerging IT Embodiments". *Inventio.* 4:1: 1-19.

Nakata, Martin. 2002. "Indigenous knowledge and the cultural interface: Underlying issues at the intersection of knowledge and information systems". *IFLA Journal*, 28:5/6: 281–291.

Nardi, B., & O'Day, V. 1999. *Information ecologies: Using technology with heart.* Cambridge, Massachusetts: MIT Press.

Ong, Walter J. 1988. *Orality and Literacy: The Technologizing of the World.* Routledge Press.

The University of New Mexico Office of Institutional Analytics. 2017. "Spring 2017 Official Enrollment Report Albuquerque Campus". Accessed May 23, 2018. **http://oia.unm.edu/facts-and-figures/documents/spring- 2017-oer.pdf**

Roy, Loriene. 2015. "Advancing an Indigenous Ecology within LIS Education." *Library Trends* 64:2: 384-414.

Sawyer, Stephen. 2001. *Policies and Programs of the University of New Mexico on Native American Student Persistence.* Unpublished Dissertation. University of New Mexico.

Shotton, Heather J., Star Yellowfish, and Rosa Cintrón. 2011. "Island of Sanctuary" The Role of An American Indian Culture Center" in *Culture Centers in Higher Education: Perspectives on Identity, Theory, and Practice.* Edited by Lori D. Patton. Stylus Publishing, Sterling, Virginia. pp: 49-62.

Turner, Arlee, Bernadette Welch, and Sue Reynolds. 2013. "Learning Spaces in Academic Libraries – A review of the evolving trends." *Australian Academic & Research Libraries.* 44:4: 226-234.

Windchief, Sweeney and Darold H. Joseph. 2015. "The Act of Claiming Higher Education as Indigenous Space: American Indian / Alaska Native Examples." *Diaspora, Indigenous, and Minority Education.* 9:4, 267-283.

Girls Tech Camp

» Librarians inspire adolescents to consider STEM careers

BY SUZANNE C. STAPLETON, MELODY ROYSTER, NEELAM BHARTI, STEPHANIE BIRCH, JEAN BOSSART, SHANNON BUTTS, TARA TOBIN CATALDO, SARA RUSSELL GONZALEZ, VALRIE MINSON, SAMUEL R. PUTNAM, AND CHRISTINE YIP

Table 1: Campers' Grade Levels[1] and Schools Attended

Year	6th grade	7th grade	8th grade	Total # of Campers	# of Unique Schools
2016	8	12	2	22	6
2017	12	5	4	21	8
2018	12	9	2	23	12

[1]Rising grade levels (i.e., forthcoming school year). Note grades for 3 campers in 2016 and 1 camper in 2017 were unconfirmed.

INTRODUCTION

In the United States, the proportion of educational degrees women have earned in science and engineering has remained steady since 2006, nearly half of all bachelors, 44% of masters, and 41% of doctorate degrees awarded in 2016 (NSF 2019). However, there is wide variation in gender representation in various disciplines; the proportion of women pursuing degrees in some science, technology, engineering, and math (STEM) fields has been declining since 1997 (NSF 2019). Some of this is due to reduced interest among female students. As part of a public university, librarians at the University of Florida (UF) seek opportunities for outreach to our local communities, particularly activities that address this imbalance in STEM representation by women. Research has shown that encouraging girls at an early age and exposing them to technology can generate interest in STEM and increase their confidence (Watermeyer 2012; Archer et al. 2013). Thus, library staff at the Marston Science Library (Marston) designed Girls Tech Camp (GTC), a week-long technology summer camp for middle school girls.

The GTC was designed to provide a safe space for girls to explore new technology in fun and creative ways. Emerging technologies can create opportunities to blend creative design and interactive art, while also developing foundational STEM skills. Balancing science and math with art encourages a creative approach that minimizes fears and offers a forum for both education and expression. Freed from expectations to "get it right," participants are excited about learning. In addition, the camaraderie of a creative approach builds a community of young women helping each other learn new STEM skills. Limiting this camp to girls also removes the influence of societal gender role biases, providing a safe space for girls to grow and challenge themselves (e.g.,

Archer et al. 2013; Tanner 2009). This paper describes the development and operation of the camp, including recommendations for holding similar camps based on lessons learned. Assessment of the camp is further evaluated through interpretation of responses from camper surveys.

LITERATURE REVIEW

Providing supportive, encouraging, and diverse role models of women scientists can broaden gender perceptions towards science-related career paths (Archer et al. 2013). The idea that science and math are for boys still persists in the minds of many young people (Adamuti-Trache and Andre 2008), and changing this perception requires a conscious effort from educators and families. Tanner (2009) discusses possible ways to more equally distribute resources, attention, and time towards girls in science education, challenging educators to develop an "equal eye." Watermeyer (2012) builds on this concept further through the development of software that connects mentors with girls to foster experiences in the different STEM fields. Young girls need to see that careers in the sciences are an attainable goal. This is especially important for girls that show an interest in STEM disciplines (Blakemore et al. 2009). K-12 girls and boys show no significant difference in their abilities in mathematics and science. They differ, however, in interest and confidence level in STEM subjects (Peterson & Britsch 2011). Lower levels of girls' confidence in STEM subjects may result from a multitude of sources, including societal and cultural

assumptions, such as a perceived lack of encouragement based on underrepresentation of female role models in the STEM disciplines (Graff 2013; Yazilitas et al. 2013).

Actively cultivating interest in STEM for young girls can play a critical role in engaging and keeping them involved (Broadley, 2015). Research investigating gender preference and pedagogical approaches show that girls tend to gravitate towards relationship-based careers (Aeschlimann et al. 2016; Archer et al. 2013). Developing educational programs that capitalize on existing interest in the sciences is one way to increase young girls' motivation toward the STEM disciplines (Blakemore et al. 2009; van Langen 2015). Studies show that creative, inquiry-based learning techniques can further engage young minds and increase STEM confidence (Kim 2016; ERCA 2016).

Marston is in a unique position to combine pedagogical and inquiry-based learning addressed in the literature. Success in encouraging girls to pursue STEM studies requires a multifaceted approach. By using existing makerspace technology at Marston (3D modeling and 3D printing) and female camp leaders as role models, GTC provided hands-on learning experiences and increased exposure to a university setting to help girls envision themselves studying STEM in college. Similar girls-only programing designed to support and increase girls involvement in STEM include Girls Who Code, a nonprofit developed by Reshma Saujani in 2012 and Girls in Technology, led by the Women in Technology Committee in 2019. Additional organiza-

tions serving girls are listed in the National Girls Collaborative Project.

CAMP PREPARATION
Proper planning and preparation was important to the success of the camp. Planning started approximately 6 months prior to the camp with frequent team meetings. Immediately after each camp, a retrospective was held to note what went well and what activities and logistics should be changed for the following year. Since instructor availability was a key factor in determining which technologies to offer, a week in mid-July that did not conflict with major conferences, personal travel, and other popular area camps became the optimal time.

Location
One major decision was planning the venue for the camp with enough space for at least 23 campers and access to the required technology (i.e., 3D equipment, Arduinos, iPad docking station, and computer lab). Marston Science Library was chosen as the camp venue because it provides direct access to most of the technology used in the camp, its conference room could comfortably hold the campers, and it was convenient for Marston staff and faculty who are familiar with the technology to participate as camp volunteers. Marston is one of six libraries on the University of Florida campus. This free-standing, five-story building houses collections in agriculture, earth sciences, engineering, life sciences, mathematics, and physical sciences. This branch library employs 12 library faculty and 12 staff in a highly collaborative environment.

Marston offers an array of services, including active makerspaces for 3-D printing and scanning, an augmented/virtual-reality mobile-application development lab, and technology available for circulation, including iPads and Arduinos. In addition to the conference room and adjacent computer lab (40 workstations), GTC also used the staff lounge for food storage and preparation.

Parent/guardian access to Marston is a challenge, because there is no public parking within a five-minute walk of the building. To remedy this situation, camp staff were located outside the building for one hour in the morning (Drop-off) and afternoon (Pick-up), with additional staff members shuttling campers between the outside location and the primary camp room. Drop-off and pick-up were coordinated using two copies of a binder that contained the

Time	Monday Video & 3D	Tuesday AR	Wednesday Video & Coding	Thursday Coding & Crafting	Friday Video & Showcase
8:00	Drop-off Starts/CIT Training				
8:30	Icebreakers	Explore Time/Icebreaker	Explore Time	Explore Time	Explore Time
9:00	Intro	AR/Scavanger hunt	Video/ONE Button	Coding	Video
9:30	iPad distribution / Group picture	AR	Video/ONE Button	Coding	Video
10:00	Morning Snack	Morning Snack	Morning Snack/Paper airplanes	Morning Snack	Morning Snack/Speed stack competition
10:30- 11:30 am	Video	AR	Video/ONE Button	Coding	Video
12:00	Lunch				
12:30	Outside time				
1:00- 2:30pm	3D	AR	Coding	Crafting	Finish up projects
3:00pm	Afternoon Snack	Afternoon Snack	Afternoon Snack	Afternoon Snack/ Pi Recitation	Finish up projects
3:30pm	3D	Breakout Box	Coding	Crafting	Camp Showcase
4:00pm	Explore Time	Breakout Box	Explore Time	Explore Time	Camp Showcase
4:30pm	Pick-up / Explore Time				
5:00pm	All girls picked up				

Figure 1. GTC Sample Week

names of authorized adults, signatures of guardians at arrival and departure, camper allergies and medical issues, emergency contacts, and volunteer schedules. Adults signing out campers were required to present a photo identification each afternoon to ensure they were authorized.

Staffing and Training
GTC was staffed in accordance with the American Camp Association standards (ACA 2016). To support outreach efforts to the greater community, UF Libraries administration allowed library faculty and staff to spend a portion of their work time as camp volunteers. In 2016, camp staff included nine Marston staff and librarians plus 11 instructors and volunteers from both within and beyond the UF Libraries.

A call was made in early 2017 to request volunteers from beyond the science library. In 2017, 15 UF Libraries staff members and three instructors from outside the libraries participated. Additionally, three girls who attended the 2016 camp returned as Counselors-In-Training (CIT) for the 2017 camp. In 2018, similar numbers of staff participated, including five CITs, furthering our mission to provide role models for the campers as well as providing leadership opportunities in STEM for the CITs.

Staff training was a critical component in preparing for the camp. The UF Department of Youth Conference Services required all camp staff to complete online training on working with youth, submit a background check complete with fingerprinting, and provide the names of all participants for

campus-wide insurance coverage. For the 2016 camp no advanced staff training was provided for activities, which meant that camp staff had to quickly learn each activity as it was taught and then turn around and help campers with that activity. To ease this process, advanced training sessions were scheduled for most activities in following years. Training sessions for volunteers were held weekly during the four weeks leading up to camp. They provided an opportunity to troubleshoot potential problems and revise lesson plans when needed.

Registration and Evaluation

A registration application was the primary opportunity to communicate with both campers and their guardians prior to the start of camp. Paper applications were used, due to strict information protection rules of online applications for children under 13 years of age (U.S. Federal Trade Commission 1998). Application elements included: camper and parent/guardian contact information, grade and name of middle school, emergency contact information, names of those allowed to pick up the camper, food allergies, medical concerns, t-shirt size, how they heard about the camp, behavior rules, photo and video waiver, release of liability, and policy for withdrawing from the camp. In upcoming years the photo release form will include local news outlets to meet media interest. Staff worked with the UF Department of Conference Services to create the registration form, establish a cancellation policy, and manage scholarship applications. Prior to camp, staff received Internal Review Board approval to use anonymized survey data from campers in research or educational projects. We developed an anonymous survey instrument in Qualtrics and solicited campers' responses each year at the end of camp (see **Appendix 1: GTC Evaluation Form**). In 2016, 19 campers completed the survey, and 21 completed it in 2017. Unfortunately, in 2018, the survey was distributed one week after the camp concluded, and only 4 responses were received. The survey measured camper self-assessments of their camp experience. It enabled the camp leaders to adapt camp activities from year to year and measure progress on camp goals to promote interest and confidence in STEM among middle school girls.

Budget

A camp budget was developed to include all estimated purchases such as supplies,

snacks, and camp insurance. The camp registration fee was set at $80 for 2016 and increased to $100 for 2017 and 2018. These rates, lower than other area camps, were possible due to the extent of in-kind support. Registration fees enabled two full scholarships plus purchases of supplies and a small gift certificate as appreciation to non-library instructors. Repurposed library promotional materials were donated to the camp (e.g., pencils, folders, water bottles, staplers, and sunglasses).

Each camper received a bag of supplies on their first day of camp that included a USB drive, camp t-shirt, water bottle, and folder with computer account information. Campers were required to bring their own lunch or money to purchase lunch on campus.

Camper Profile

Girls Tech Camp was open to rising 6th, 7th, and 8th grade girls. Many of the campers in 2016 were children of UF faculty and staff who learned about the camp through word of mouth. To increase diversity in 2017 and 2018, the camp was advertised to local outreach programs, such as Partnership for Strong Families and area middle school science teachers and guidance counselors. Two full scholarships were offered to encourage participation of underrepresented youth. Registration to area outreach programs began one month prior to general registration, since camp spaces filled up quickly in previous years. Table 1 shows the grade distribution and schools represented each year as reported in the camper applications.

Managing Technology and Logistics

The management of technology was an important component to the camp. Each camper was assigned an iPad mobile device for the duration of the camp, checking the iPad out in the mornings and back in at the end of each day. Two weeks prior to camp, several mobile applications were installed on the iPads including Adobe Premier Clip, Adobe Spark, Aurasma (renamed HP Reveal in 2018) and SAWBO (Scientific Animations Without Borders). The iPads were used for augmented reality and video production sessions. They were also very popular during Explore Time. Desktop computers in the nearby computer lab were used for 3D modeling and computer coding sessions (with Unity, MIT Scratch, and Arduino scripting) and greenscreen video editing (Adobe Premiere Pro). During the week of camp, all iPads and computers were removed from

Library IT update cycles in order to prevent inadvertent removal of software that would impact the flow of instruction.

Account management is one of the greatest challenges of a technology camp. To protect the identity of minors on the Internet, each camper was assigned a female scientist alias for their web and email accounts. Since mobile devices (iPads) were used as the main personal computing device in this camp, transferring files to and from desktop computers through a shared drive (e.g., Google Drive or Dropbox) was necessary. Campers worked in teams of 4-6 girls for several activities, so we created team folders in the shared drive for easier file sharing. Camp counselors also used the shared drive to access material for the final Camp Showcase. Campers were given a flash drive, so they could save copies of their work to take home. Only aliases assigned to each camper were used in file and folder names, and folders were erased at the end of camp. No content was published online with public access.

Prior to camp, a handout was prepared for the campers listing their login information and a master copy retained in the camp leaders notebook. Login information included:
- Temporary university accounts for access to UF computers and the wireless network
- Email accounts for every camper
- Username and passwords for accounts in software used (e.g., Adobe ID, Tinkercad, Aurasma/HP Reveal)

CAMP ACTIVITIES

Camp activities were scheduled for the campers to learn and create with new technologies. Female instructors were preferred to serve as inspiration and to tell the campers about their experiences as women in STEM fields. Four multi-day activity tracks were developed and revised each year based on camp evaluations. In the initial year, the camp activity tracks were 3D modeling & printing, video production, computer coding, and crafting with technology. The camp schedule in 2017 was modified to include more challenging coding activities and to offer augmented reality instead of Arduino circuitry. In 2018, we employed larger themes to better integrate various tracks (**see Figure 1**). For instance, activities in both 3D modeling/3D printing and augmented reality were integrated into
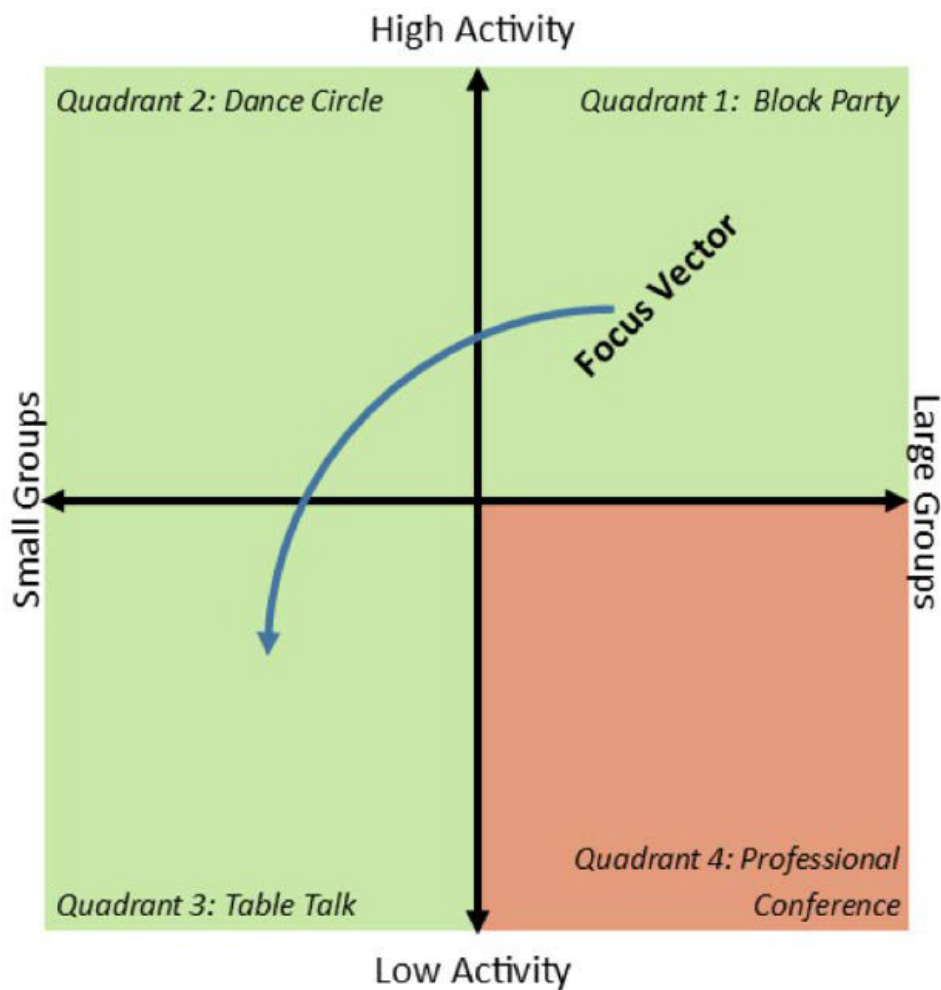
Figure 2. GTC Icebreaker Matrix

team projects to design and build enhancements of a children's book for use by visually-impaired readers.

Camp activities were designed for middle school youth age range of 10-14 yrs old. In 2016, camp leaders discovered that prior experience and aptitude of learning new skills varied widely, such that the time allotted for each camp activity was not always adequate. Certain activities would have benefited from additional time for troubleshooting. Therefore, in planning for the 2017 camp, short activities were built in throughout the day that could be easily omitted if other activities took longer than expected due to skill level or technical difficulties. This allowed the campers to have time to learn to troubleshoot their own technology issues, which is an important skill when working with new technologies. Developing resilience and perseverance in the face of failure and frustration is a laudable, though often unrecognized, objective itself.

Other activities included researching a female scientist, designing prosthetics for kids, and fun filler activities such as

competitive cup stacking and outdoor cornhole games. Field trips included visits to the Computer Science and Engineering Robotics Laboratory and the Library's One-Button Studio, where the campers created their own videos.

Each year, the camp concluded with a Camp Showcase celebration, including cake and drinks. Guardians, campers' families, and all camp staff and volunteers were invited to Marston for the final two hours of camp. Each camper displayed products she had created during the week, and guests were welcomed and invited to circulate to view the campers' displays.

MAJOR THEMES
3D Technologies
The UF Libraries offer extensive 3D services, and, thus, it was a foundational technology for the camp, using instructors from the Libraries' staff. 3D printing continues to be popular at Marston, since its introduction in 2013 for instruction, research, and pleasure. As manufacturing technology develops, a broader range of 3D printers

are available -- including low-cost models, multi-filament heads, and those that print a variety of mediums, including food. Developing knowledge, confidence, and skills with 3D modeling and printing is expected to enhance users' employability.

After a broad overview of 3D technology and demonstrations using portable printers, campers learned basic 3D modeling using Autodesk's Tinkercad software. Each camper made a custom name tag, an activity that incorporated most of the modeling commands and was small enough to print out by the end of camp. Additional activities included using Structure 3D scanners to scan each other and to design and model new prosthetic hands, an engineering challenge extended by GRiP (Generational Relief in Prosthetics), a university student club developing affordable prosthetics for area youth. The most popular 3D activity in 2017 was the 3D food printer, Pancake Bot™, activity led by Alix Freck, Children's Librarian at the Alachua County Public Library. Campers designed pancake models and enjoyed eating them after they were "printed." In 2018, 3D activities focused on multimodal learning, inspired by Colorado University - Boulder's Tactile Picture Book Project (Yeh 2016). Teams of 4-6 campers selected a page from "The Very Hungry Caterpillar" (Carle 1969) and created 3D versions of the page with text in Braille. Instructors from the public library provided the Braille machine and taught the campers how to use it to create their pages. Following the Camp Showcase at the end of the camp week, the 3D printed boards were donated to the Tactile Picture Book Project.

Coding
Computer coding is a fundamental aspect of digital literacy, and coding skills are highly desirable in the job market. In 2016, Shaundra Daily, faculty in the UF Department of Computer & Information Science Engineering, led the coding activities for GTC based on her research in affective computing, creating technologies that understand human emotion (Radiya-Dixit 2017). Daily introduced computer coding with Virtual Environment Interactions (VEnvI), a "software and curriculum for blending movement and programming, which offers a novel and embodied strategy of engaging 5th and 6th grade girls in computational thinking" (Daily et al. 2015).

During this highly interactive day the campers learned the Cha-cha-slide line dance and then programmed their com-

puter avatars to perform the same dance routine. Dr. Daily's coding activities were popular with the campers; however, some girls wanted to be challenged with a more difficult programming language.

In 2017, a local programmer joined GTC to teach game development using the free Unity software and scripting language C++. Campers were led through basic exercises to introduce Unity's interface and shown how to program a sprite to move around the screen. This activity proved to be quite challenging, since Unity is a professional-level game development software and most of the campers lacked experience with programming structure and syntax. In 2018, a community college librarian with experience teaching coding to youth in summer camps joined the GTC instruction team. Campers gained computer programming skills through a series of increasingly difficult coding challenges using MIT Scratch. This workshop was successful, because campers could either focus on learning the basics or jump to the advanced projects, depending on their interest and experience.

Crafting with Technology

Creativity was a major theme throughout the camp to increase interest in technology activities. Each year, technology-related craft activities were scheduled for one full day to give campers an opportunity to express themselves by mixing art with technology. The two primary activities were creating greeting cards using paper circuitry and sewing bracelets with conductive thread, batteries, and LED lights. During the first year, it became clear that most campers had limited prior sewing experience. The staffing ratio was increased in subsequent years to enable successful project completion by beginning sewers. Campers also used Arduino Uno to craft movable paper models. Arduinos are open-source low-cost microcontrollers that require simple programming to control diverse sensors and motors. With this activity, campers learned to connect circuits and write basic instructions to make model parts move, such as a making a paper head turn. This activity required a moderate level of knowledge and skill. Paper heads were decorated by hand and then mounted onto microprocessors.

The crafting activities were split over two days after the first year in order to allow more time for campers to catch up during free time, if needed. Observation and camper surveys revealed some frustration
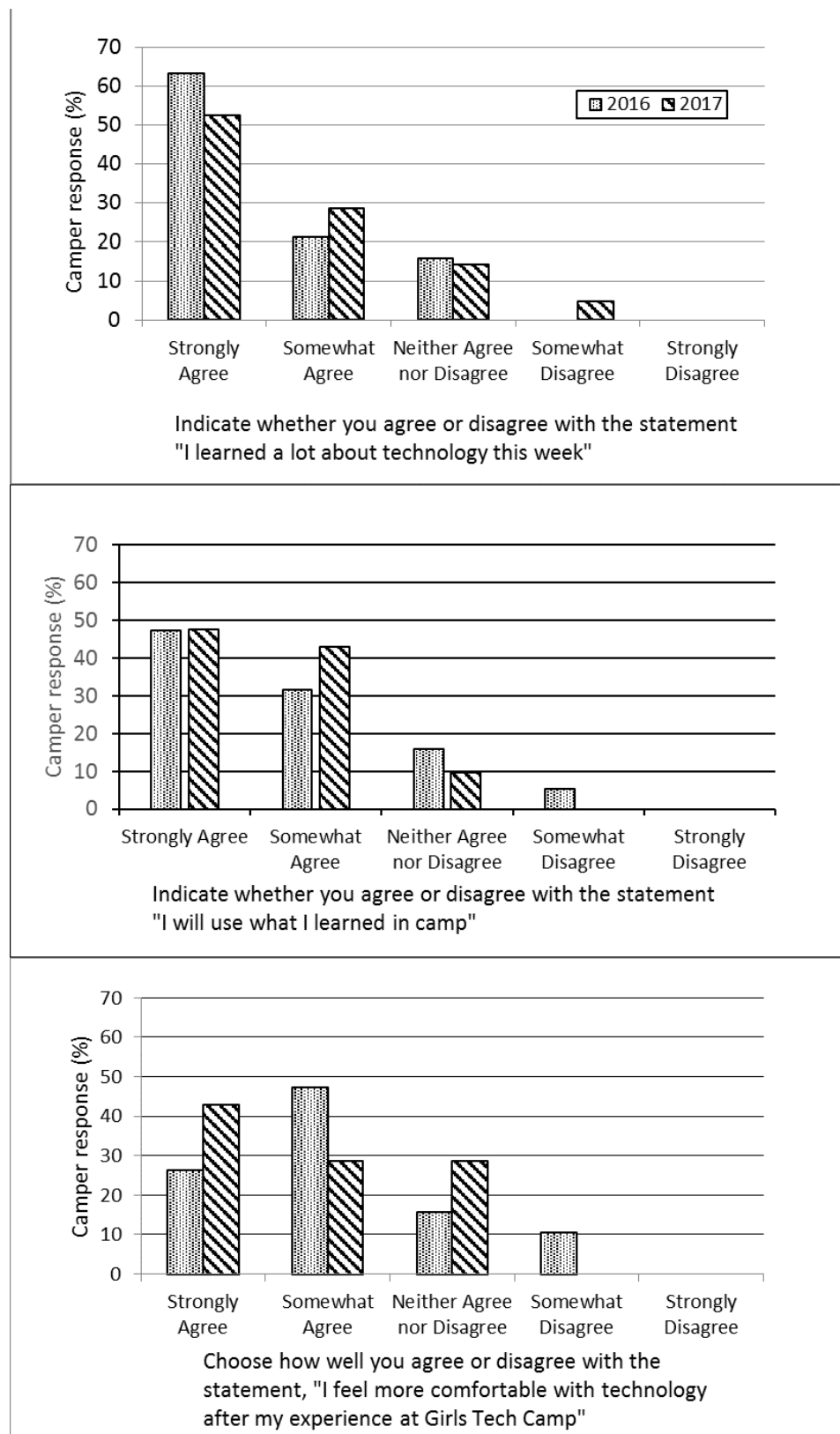

Figure 3. Camper responses in 2016 (grey stippled) and 2017 (diagonal striped) to GTC evaluation questions.

with mastering tactile projects. Instructions for the LED circuitry greeting cards were revised to improve clarity, and project items were pre-packaged prior to the camp to save activity time. Erin Winick, a UF alumna with a jewelry business based on 3D printing, SciChic, shared her story via Skype with the campers describing how her interest in crafting with technology evolved into a small business.
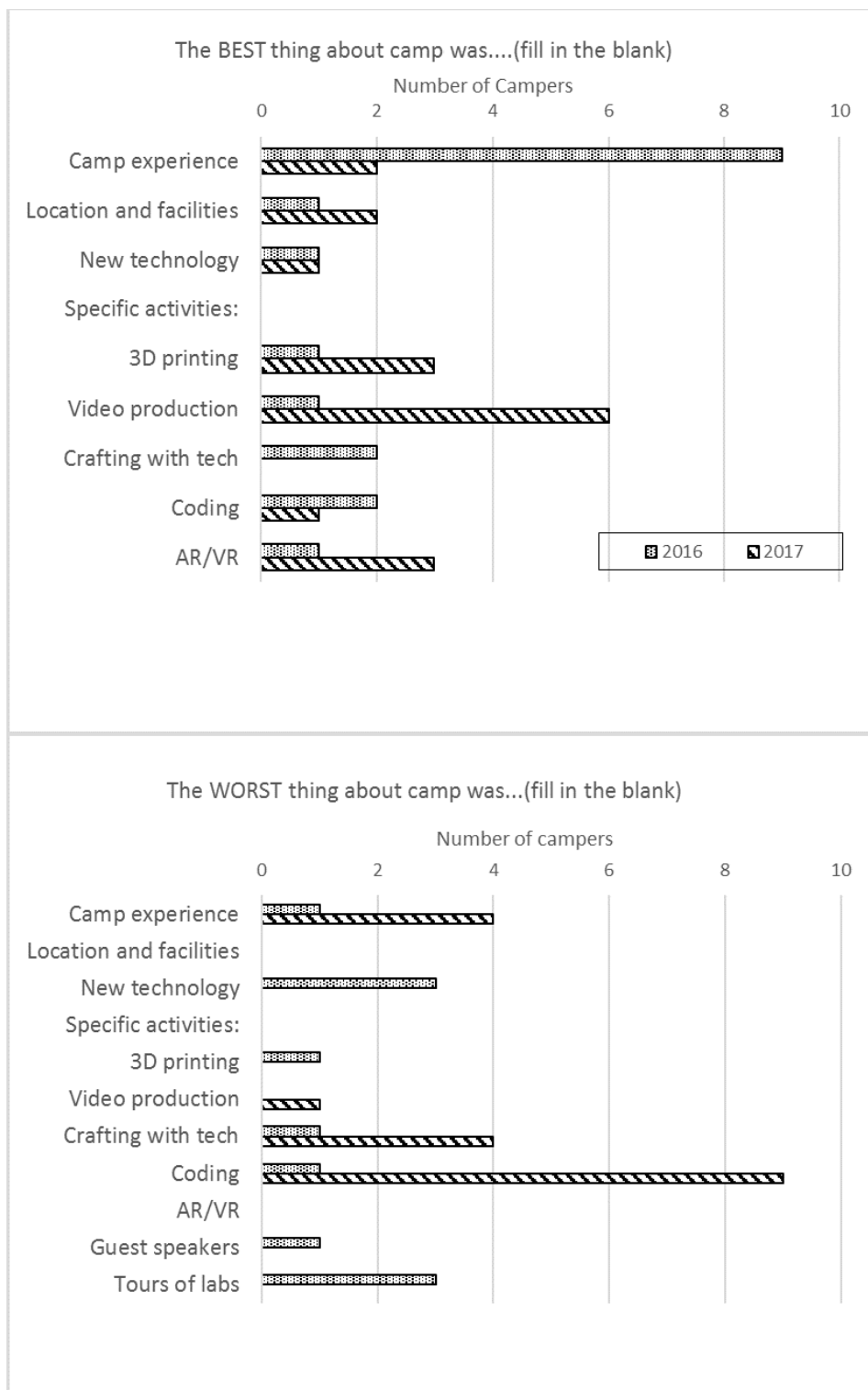
The BEST thing about camp was....(fill in the blank)

Number of Campers

Category	
Camp experience	
Location and facilities	
New technology	
Specific activities:	
3D printing	
Video production	
Crafting with tech	
Coding	
AR/VR	

Legend: 2016 2017

The WORST thing about camp was...(fill in the blank)

Number of campers

Category	
Camp experience	
Location and facilities	
New technology	
Specific activities:	
3D printing	
Video production	
Crafting with tech	
Coding	
AR/VR	
Guest speakers	
Tours of labs	

Figure 4. Camper responses in 2016 (grey stippled) and 2017 (diagonal striped) to GTC evaluation open-ended questions.

Augmented Reality

Augmented reality (AR) was added to the camp in 2017 and 2018. Augmented reality is the practice of overlaying or adding digital content to the real world. The current best-known example of AR is the popular Pokemon Go!, a mobile app that allows players to collect digital creatures overlaid on the user's surroundings. Campers were introduced to AR using the free app, Aurasma, and learned how to overlay images and short videos when viewing a "trigger" image or text using the iPad's camera. Prior to the start of the camp, the augmented reality instructor created a series of AR triggers just outside the main building. During camp, the AR day started with a scavenger hunt activity, where the campers searched in teams for augmented signs in the plaza outside the library. The rest of the day was spent augmenting children's books using either photos or videos. Each team selected a book and then used storyboards to plan out how to augment the book's text. The teams could use images found online or create their own. To help with creating content, participants were provided with a small box of costumes and supplies to create additional props using paper and markers. The day concluded with each team presenting their augmented story to the rest of the camp.

Video Production

Videos are increasingly the most popular format for information. On their first day, campers were thrilled to be assigned an iPad to use on site and encouraged to take lots of pictures and videos throughout the week. Campers were introduced to video production with a challenge to create a "video diary" of their camp experience. At the end of each day, iPads were checked back in and recharged. The campers quickly found camera settings and apps to add artistic flair to their photographs.

Adobe Spark products (Post, Video) and Adobe Premier Clip were featured, since they are free and intuitive programs designed for mobile devices. On the first day of camp, campers learned to create Adobe Spark Posts and save them to their iPad. Adobe Spark Post allows users to create "social graphics," akin to digital posters or postcards, where text and graphic design elements are combined with digital photographs.

Campers visited a professional video production site on a field trip to the UF Libraries' One Button Studio. The dedicated studio space provides high quality lighting, recording-quality acoustics, and is equipped with a greenscreen. Campers were invited to develop either a video diary of their camp experience, a news story about camp, or an instructional video featuring a new skill learned at camp. Each team of campers were encouraged to develop a script and use storyboards to plan video action prior to visiting the One Button Studio. A box of props and costumes as well as paper, tape, and scissors was popular for video production. At the studio, every camper acted in a video, whether alone, in pairs, or as a team. Each team was allotted 30 minutes of recording time at the One Button Studio. In order to incorporate the videos created at the One Button Studio with images on their tablets,

» **Explore Time coincided with drop-off and pick-up times by parents, so that campers' staggered arrivals and departures caused minimal disruption to group activities.**

video files were edited in the computer lab using Adobe Premiere Pro. Editing in Adobe Premiere Pro was necessary to replace the greenscreen with a desired image or video and to change the file into a non-proprietary format. Edited video files were transferred through Google Drive onto iPads, where campers used Adobe Premiere Clip to combine different elements into one final video. The file transfer process and number of video-editing programs proved challenging and required extra staff support.

Fortunately, software upgrades to the One Button Studio in 2018 resulted in direct file compatibility.

A password-protected folder in Google Drive was created for campers to share photographs and videos for remixing by other campers. Campers saved copies of their final video and favorite images onto their flash drive to take home. Videos and images were displayed during the Camp Showcase at the end of the week.

ADDITIONAL ACTIVITIES
Icebreakers and Explore Time
Daily icebreakers are short activities that we used as camp began to increase energy, introduce camp attendees to one another, and set a welcoming, inclusive tone to the camp. We categorized all icebreaker activities into a four-quadrant matrix, depending on the activity level of the game and the number of individuals in the group (see Figure 2). Quadrant 1 contains active icebreakers with a large number of people, akin to a large, energetic block party. Quadrant 2 activities are also active but designed for a small group of people, including, for example, a dance circle.

Quadrant 3 consists of low activity for small groups, such as small-group table talk. Quadrant 4 describes low activity for large groups, such as typical at a large professional conference.

Quadrant 4 activities were not employed as icebreakers at GTC.

The first camp activity began in Quadrant 1, as high-activity, large-group games create the most fertile opportunity for positive interactions with a large number of individuals. These Quadrant 1 games aid in removing inhibitions and increasing interac-

tions among the campers. The next activity was selected from Quadrant 2 to shrink the group size and focus on establishment of relationships within smaller groups, such as the camp teams. Lastly, Quadrant 3 activities moved small groups into a lower energy game to create intimacy among group members. Quadrant 3 activities create a foundation for relationships that will grow throughout the camp.

Unstructured Explore Time was offered at the beginning and end of each day. Explore Time serves a variety of purposes: time for campers to individually practice and go deeper with previous instruction, opportunities to socialize and build friendships, and quiet time for recharging. No expectations were placed on campers during these times. Explore Time coincided with drop-off and pick-up times by parents, so that campers' staggered arrivals and departures caused minimal disruption to group activities. A variety of activities were offered for Explore Time, including flying miniature drones, origami, coloring pages, and Legos. The most popular pastime was use of the iPads, followed by the competitive Speed Stacks® cup game. Lunchtime outdoors with cornhole and four square were popular in 2016. Explore Time also provided an opportunity to test reactions to proposed activities. In 2017, a group Breakout® box puzzle during Explore Time was well received and incorporated into the 2018 camp schedule. Individual and team contests in Speed Stacks® cup stacking and recitation of the digits of pi, planned for the final day of camp, prompted girls to practice during Explore Time.

Breath of Fresh Air: Field trips and Guest Speakers
Field trips and guest speakers were welcome additions to GTC. Field trips to research labs and the One Button Studio on campus provided fresh air and a change of scenery from the conference room and adjacent computer lab where the camp was hosted. Guest speakers augmented one of the missions of the camp - to provide role models of women working in STEM fields.

Hosting the camp on the university campus provided convenient field-trip options within walking distance. Girls visited

2-3 labs in the Computer Information Science Engineering department, where graduate students described their research in acoustics and robotics. A short walk to the One Button Studio, a video recording studio in another library branch, was popular each year.

Young, female speakers at different career stages were invited to provide advice and inspiration to campers in person and through video conferencing. Jessica Bergau, the founder of GRiP, (Generational Relief in Prosthetics n.d.) shared why she started the student club during her sophomore year and how she developed skills and experiences through the club's activities that led to her first post-collegiate employment. Erin Winick described her entrepreneurial path from engineering student to founder of SciChic, an online business of 3D printed jewelry, where "we work hard to develop STEM-inspired fashion and inspire young girls to get involved with science and engineering." In 2017, Erin received the Young Entrepreneur Award from Florida's Governor Rick Scott. Alix Freck, Children's Librarian from the Alachua County Library, taught campers to print their own 3D pancakes with Pancake Bot™. Two graduate students, Emily Brooks and Shannon Butts, were inspirational as instructors of Crafting with Technology, Arduinos, and Augmented Reality. UF Assistant Professor in Entomology Andrea Lucky included campers in a citizen's science project to collect ant species to aid biodiversity research.

By providing role models of women at various stages of STEM careers (undergraduate and graduate students, established research faculty, and non-academic professionals), campers can more easily visualize paths towards developing a career in STEM.

RESULTS AND DISCUSSION
Participant Feedback
The camps in 2016, 2017, and 2018 were successful in cultivating campers' interest and confidence in using technology. Feedback from campers and parents was extremely positive, with participants stating they gained new knowledge about technology. Each year, over 80% of the campers strongly agreed or somewhat agreed

with the statement, "I learned a lot about technology this week" (**Fig. 3a**). Nearly 50% of the campers found the new information useful (**Fig. 3b**). Most importantly, campers indicated increased confidence using new technology as a result of participating in the GTC. Confidence is an important indicator of future success for college women in STEM fields (Brandt 2015). Over three-quarters of campers in 2016 and 2017 agreed with the statement, "I feel more comfortable with technology after my experience with Girls Tech Camp" (**Fig. 3c**). Response rates to camp evaluations are highest when evaluations occur during camp; in 2018 only 17% of campers completed surveys distributed one week after camp, whereas response rates were higher in 2016 (86%) and 2017 (91%).

Through the online evaluation, campers listed their favorite camp activities and the best and worst things about camp. In all three years, 3D printing and modeling was the campers' favorite activity, and Augmented Reality was second favorite both years it was offered. Video production varied in popularity each year, perhaps, partly due to the numerous steps and programs necessary for greenscreen editing. Coding activities proved the most challenging to match to the girls' broad range of experience and interest.

Four themes emerged from the open-ended responses to the best and worst thing about camp: camp experience, location and facilities, new technology, and specific activities. The "camp experience" theme included comments related to making friends, "being able to design and create things," the structure of the days, and snacks provided. In 2016, nine campers rated aspects of camp experience as the best thing about camp, especially spending time with friends (Fig. 4a). In 2017, four campers rated aspects of camp experience as the worst thing about camp, listing complicated drop-off/pick-up procedures and too much unstructured time (Fig. 4b).

Comments in the "location and facilities" theme highlighted the positive impact of hosting the middle-school camp on a university campus. Specific activities appeared in both best and worst things about camp each year. Offering a range of activities is beneficial to meet diverse preferences of campers. For example, while one camper listed too much unstructured time as the worst thing about camp, several other campers listed it as the best. Similarly, working with new technology appeared as

Table 2. GTC Technology Used

Software	Hardware
Adobe Premiere Clip	Arduino Unos
Adobe Premiere Pro	Braille Typewriter
Adobe Spark products (Post, Video)	iPads
Arduino scripts	LilyTiny microcontroller
Aurasma/HP Reveal	Pancake Bot™
Autodesk's Tinkercad	PC Computers
MIT Scratch	Printrbot Play portable 3D printer
Scientific Animations Without Borders (SAWBO)	Structure 3D scanner
Unity	
VEnvI	

both the best and worst thing about camp, revealing some campers' excitement and others' frustration in acquiring new skills. Camper feedback is especially helpful when large proportions of campers share similar opinions. For instance, based on the nine campers who listed coding as the worst thing about camp in 2017 (Fig. 4b), we recruited a new instructor and employed a new coding interface for the 2018 camp. Enlisting dynamic instructors with experience working with youth is important to maintain camper interest in all topics.

COORDINATOR REFLECTIONS
Each year, we attempted to use freely available software when possible, to enable campers to continue to explore their interests and skills after camp ended (see **Table 2**).

Another point of discussion is the need to respond to the emotional well-being and group dynamics of the campers. Camp leaders stepped in to help restore calm when frustration levels with activities or other campers occasionally arose. Embedding CITs within each team of campers increased camp leaders' ability to respond to issues. It was helpful to have an adjacent room reserved and used as needed for a quiet space.

Training volunteers to assist in camp activities emerged as a greater need than anticipated. Volunteers included library staff, as well as three to five high school girls who participated as Counselors-in-Training (CITs) in 2017 and 2018. In 2016 camp volunteers were expected to follow the instructors during camp and then immediately assist campers with the hands-on activities or troubleshooting. This didn't lead to efficient time manage-

ment and may have contributed to some activities taking longer than planned. In 2017, "train the trainer" sessions were held prior to camp to provide time for volunteers to experience each task. This was important, too, because librarians from other branches, less familiar with STEM, became camp volunteers. Volunteers provided valuable feedback to refine instructions for clarity. In 2018, each Counselor-in-Training was assigned to one team of campers to increase their engagement with campers and serve as a resource for campers with questions. This arrangement worked well, and the CITs provided valuable insight into the campers' attitudes, successes, and challenges.

Following camp each year, camp leaders met to review camper evaluations and share and record successes and challenges of the camp while details were still fresh.

CONCLUSION
The Girls Tech Camp hosted by University of Florida Marston Science Library has been successful in meeting the objectives of encouraging middle school girls to improve their interest and confidence in STEM. During the first three years of this week-long summer camp, over 60 middle school girls increased their technology knowledge and skills and had fun doing so, through a variety of interactive activities. In addition, participants developed friendships with peers, experienced a slice of college campus life, and interacted with female role models working in STEM fields in a range of career stages. Campers shared their excitement in the camp evaluations. When prompted to "tell us anything else you want us to know about Girls Tech Camp" in the evaluation,

the most common response was to offer the camp again or extend it.

One camper expressed this sentiment, "Why was it so short! I wish it could have been longer!" Hosting minors in an academic library required not-insignificant preparation by library staff, who are accustomed to working with young adults. An iterative process to revise and improve the camp is key to its success.

Refining the camp each year was beneficial both to better meet needs of participating youth and to respond to changes in technology used in camp activities. This was, perhaps, most evident in the Coding activities, where finding the best-fit instructor and software required several revisions. Technology upgrades in software required annual revision of educational materials and training of staff. An important lesson learned was to remove technology from nightly software updates during the camp to avoid mid-camp disruptions. On the other hand, technological upgrades from year to year can be beneficial, as we experienced, for instance, with more efficient video editing procedures that resulted from software upgrades to the library's One Button Studio.

In summary, UF Libraries' dedication to the vision of this outreach activity remains strong. However, the extensive amount of dedicated staff time to handle preparation and implementation is significant. One alternative under consideration is to partner with existing local summer camp programs and focus library efforts on instruction of STEM activities. In 2019, UF Librarians will lead STEM activities for youth attending area summer camps while GTC is on hiatus for one year. Regardless of the format, academic libraries can reach out to middle school girls with interactive technology activities to foster greater interest and confidence of girls in STEM. Hosting a technology camp for middle-school girls on a college campus can encourage participants to pursue further studies in STEM and lead to better female representation in STEM fields in college and beyond. ∎

Acknowledgements

REFERENCES

Adamuti-Trache, M. & Andres, L. 2008. Embarking on and persisting in scientific fields of study: Cultural capital, gender, and curriculum along the science pipeline. *International Journal of Science Education* 30(12):1557-1584. DOI: 10.1080/09500690701324208.

Aeschlimann, B., Herzog, W. & Makarova, E. 2016. How to foster students' motivation in mathematics and science classes and promote students' STEM career choice: A study in Swiss high schools. *International Journal of Educational Research* 79:31-41. DOI: 10.1016/j.ijer.2016.06.004.

American Camp Association (ACA). 2016. *ACA Standards that relate to staff screening, supervision, and training* [Internet]. Martinsville (IN): American Camp Association, Inc.; c2019 [cited 2019 Apr 22]. Available from https://www.acacamps.org/resource-library/accreditation-standards/aca-standards-relate-staff-screening-supervision-training.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. & Wong, B. 2013. 'Not girly, not sexy, not glamorous': Primary school girls' and parents' constructions of science aspirations. *Pedagogy, Culture & Society* 21(1):171-194. DOI: 10.1080/14681366.2012.748676.

Blakemore, J.E.O., Berenbaum, S.A. and Liben, L.S. 2009. *Gender Development*. New York (NY): Psychology Press.

Brandt, R. 2015. Why do undergraduate women persist as STEM majors? A study at two technological universities. *Proceedings of the ASEE Annual Conference & Exposition*, p1-31.

Broadley, K. 2015. Entrenched gendered pathways in science, technology, engineering and mathematics: Engaging girls through collaborative career development. *Australian Journal of Career Development* 24(1):27-38. DOI: 10.1177/1038416214559548.

Carle, E. 1994. *The very hungry caterpillar*. New York (NY): Philomel Books.

Daily, S.B., Leonard, A.E., Jorg, S., Babu, S., Gundersen, K. & Parma, D. 2015. Embodying computational thinking: Initial design of an emerging technological learning tool. *Technology, Knowledge and Learning* 20(1):79-84. DOI: 10.1007/s10758-014-9237-1.

Educational Research Center of America (ERCA). 2016. *STEM classroom to career: Opportunities to close the gap*. Farmingdale, NY: Educational Research Center of America.

Generational Relief in Prosthetics (GRiP) [Internet]. [n.d.] Gainesville (FL): University of Florida; [cited 2019 Mar 6]. Available from https://www.bme.ufl.edu/labs/grip/.

Graff, U. 2013. 'Too pretty to do math!' Young women in movement and pedagogical challenges. *Pedagogy, Culture & Society* 21(1):57-73. DOI: 10.1080/14681366.2012.748683.

Kim, H. 2016. Inquiry-based science and technology enrichment program for middle school-aged female students. *Journal of Science Education and Technology* 25(2):174-186. DOI: 10.1007/s10956-015-9584-2.

National Science Foundation (NSF). 2019. *Women, minorities, and persons with disabilities in science and engineering,* NSF 19-304 [Internet]. Arlington (VA): National Science Foundation [cited 2019 May 14]. Available from https://ncses.nsf.gov/pubs/nsf19304/.

Peterson, K. & Britsch, B. 2011. *GSE/EXT National Girls Collaborative Project: Building the capacity of STEM practitioners to develop a diverse workforce.* EdLab Foundation: National Science Foundation.

Radiya-Dixit, A. 2017. *Duke research blog: Creating technology that understands human emotions* [Internet]. Durham (NC): Duke University [cited 2019 May 7]. Available from https://research-blog.duke.edu/2017/01/30/creating-technology-that-understands-human- emotions/.

Tanner, K.D. 2009. Learning to see inequity in science. *CBE Life Sciences Education* 8(4):265- 70. DOI: 10.1187/cbe.09-09-0070.

U.S. Federal Trade Commission. 1998. *Children's Online Privacy Protection Rule (COPPA), 16 CFR Part 312* [Internet]. Washington, D.C.:U.S. Federal Trade Commission [cited 2019 May 17]. Available from https://www.ftc.gov/enforcement/rules/rulemaking-regulatory-reform- proceedings/childrens-online-privacy-protection-rule.

Van Langen, A. 2015. Girls and STEM choice in Dutch education: The strong gender segregation and the good practice of the stimulation policy. *Gender Studies and Research* 13:26- 39.

Watermeyer, R. 2012. Confirming the legitimacy of female participation in science, technology, engineering and mathematics (STEM): Evaluation of a UK STEM initiative for girls. *British Journal of Sociology of Education* 33(5):676-700. DOI: 10.1080/01425692.2012.678751.

Yazilitas, D., Svensson, J., de Vries, G., & Sararso, S. 2013. Gendered study choice: A literature review. A review of theory and research into the unequal representation of male and female students in mathematics, science, and technology. *Educational Research and Evaluation* 19(6):525-545. DOI:10.1080/13803611.2013.803931.

Yeh, T., Forsyth, S., Stangl, A., & Dalton, B. 2016. *Tactile picture books project: Critical making in libraries to broaden participation in STEM*. University of Colorado - Boulder: National Science Foundation.

WCAG 2.1 and the Current State of Web Accessibility in Libraries

BY CARLI SPINA

INTRODUCTION

Web accessibility is a key to ensuring that web-based content is available and usable for all users. Beyond this, under certain circumstances, it is also a legal requirement in the United States and many other countries in the world. Though this topic has been considered by those creating web content for decades now, web accessibility standards are dynamic, and frequently have failed to evolve quickly enough to stay up to date with growing online capabilities, new use cases, and new technologies. In addition, web accessibility standards have yet to meet the needs of all individuals with all types of disabilities, meaning that additional work is continually needed to ensure that all users have access to web content.

The latest example of this continuing process is the release of Web Content Accessibility Guidelines (WCAG) 2.1 in June of 2018. These new standards further develop and supplement the existing WCAG 2.0

guidelines to improve accessibility for users with certain types of disabilities that have previously been underserved and to take into account changing technology usage patterns. While compliance with WCAG 2.1 will not ensure that web-based content is accessible to all users, it is an important standard against which content can be measured and provides guidance on improving accessibility for individuals with various types of disabilities. However, to ensure greater accessibility of online content, libraries should not simply strive towards compliance with WCAG 2.1, but should establish best practices and workflows that make functional accessibility a priority at all stages of the online content development process. This article considers WCAG 2.1 and presents options that will acknowledge the importance of compliance while also ensuring broader accessibility of online content.

The Development of the Web Content Accessibility Guidelines

As the internet has developed, so too have web accessibility standards. One of

the key players in web accessibility has long been the World Wide Web Consortium (W3C). This international group is responsible for developing the standards for the web, and in 1996, several members of the W3C turned their attention towards web accessibility, ultimately founding the Web Accessibility Initiative (WAI) (Dardailler, 2009). Since that time, this group has worked on developing guidelines intended to ensure that content on the web is accessible to users with disabilities. The first set of web content accessibility guidelines was released as WCAG 1.0 on May 5, 1999 (Chisholm, Vanderheiden, & Jacobs, 1999). These standards proved important in their reach, but, as Power, Freire, Petrie, and Swallow note, by all metrics "the impact of WCAG 1.0 on improving the accessibility of the Web remained quite low throughout the period of its use" (2012, p. 433).

Almost ten years later, WCAG 2.0 was released on December 11, 2008, having been designed to "make content accessible to a wider range of people with disabilities,

including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these" (Caldwell, Cooper, Guarino, & Vanderheiden, 2008). WCAG 2.0 aimed to apply "more broadly to different types of Web technologies and to more advanced technologies" and to be "more precisely testable with automated testing and human evaluation" (WAI, 2009). This approach represented a large scale reimagination of the guidelines and it was at this point that the "success criteria" were added to the guidelines to simplify the testing process. The release of WCAG 2.0 also saw the introduction of the three conformance levels of A, AA, and AAA, where Level A represents "the minimum level of conformance" and Level AAA represents conformance with all success criteria (W3C, 2016). This approach offers web content creators the ability to set conformance level goals that meet their own specific needs or the institutional or governmental requirements set forth for their content.

WCAG AND THE LAW
Since the publication of WCAG 1.0, WCAG has grown to be a dominant standard for web accessibility. In the United States, WCAG standards have long played a role in the enforcement of web accessibility. In July of 2010, the U.S. Department of Justice went as far as to publish an Advance Notice of Proposed Rulemaking, setting forth the idea of "adopt[ing] the WCAG 2.0's 'Level AA Success Criteria' as its standard for Web site accessibility for entities covered by titles II and III of the ADA [Americans with Disabilities Act of 1990]" (Nondiscrimination on the Basis of Disability, 2010). This approach was not ultimately adopted, however, and a recent letter from the Department of Justice regarding web accessibility made it clear that "absent the adoption of specific technical requirements for websites through rulemaking, public accommodations have flexibility in how to comply with the ADA's general requirements of nondiscrimination and effective communication" (Boyd, 2018).

Nonetheless, despite the fact that it is not the official standard under the ADA, WCAG 2.0 has remained important to the enforcement of web accessibility in the United States. Pursuant to a rule released in January of 2017 by the Access Board under Section 508 of the Rehabilitation Act, "the Revised 508 Standards and 255 Guidelines

incorporate by reference the Web Content Accessibility Guidelines (WCAG) 2.0" which they describe as "a globally-recognized and technologically-neutral set of accessibility guidelines for Web content" (Information and Communication Technology Standards and Guidelines, 2017). Practically, they go on to explain that this means that "all covered Web and non-Web content and software—including, for example, Web sites, intranets, word processing documents, portable document format documents, and project management software—is required, with a few specific exceptions, to conform to WCAG 2.0's Level A and Level AA Success Criteria and Conformance Requirements" (Information and Communication Technology Standards and Guidelines, 2017).

While Section 508 of the Rehabilitation Act, which applies specifically to federal agencies, does not have the same reach as the Americans with Disabilities Act, WCAG has also been used as the standard for web accessibility in a number of settlement agreements, resolution agreements, and consent decrees under the ADA and the Rehabilitation Act of 1973 (United States of America v. Teachers Test Prep, 2018; United States of America v. National Museum of Crime and Punishment, 2015; United States of America v. Louisiana Tech University and the Board of Supervisors for the University of Louisiana, 2013), including a few related to online content provided by libraries (Lanzilotti, Cossaboon, and the National Federation of the Blind v. Atlantic Cape Community College, 2015; University of Montana v. the U.S. Department of Justice, 2014; Penn State University v. National Federation of the Blind, 2011).

Internationally, many countries look to WCAG for their own legal standards of web accessibility. The European Union has set forth accessibility standards that apply to all member countries in their Directive on the Accessibility of the Websites and Mobile Applications of Public Sector Bodies (European Parliament and the Council of the European Union, 2016). This directive set the minimum requirement as standard EN 301 549, which incorporated a number of WCAG 2.0 success criteria in setting accessibility standards for use within Europe (European Telecommunications Standards Institute, 2014). Approaches in other countries have been mixed with many, including Australia, Ireland, Israel, Italy, the Netherlands, Switzerland, and the United Kingdom, integrating WCAG into their laws and others, such

as France, Germany, and the Republic of Korea, creating their own adaptations of WCAG for use in their country's laws (Education & Outreach Working Group, 2018). Though China, India, New Zealand, and Taiwan have not integrated WCAG into their laws, they all rely on WCAG for voluntary or mandatory policies (Education & Outreach Working Group, 2018). While it is true that there are other countries that have taken completely different approaches to online accessibility or have not enacted such laws at all, it is clear that WCAG has had a significant impact on web development around the world.

HOW ACCESSIBLE IS THE WEB?
Despite the widespread adoption of WCAG 2.0, compliance is far from universal, and even content that complies with the guidelines may not be fully accessible to all users. In the wake of earlier data that found a significant majority of popular websites were not accessible, Lazar, Beere, Greenidge, and Nagappa (2003) studied a mixture of governmental, nonprofit, and commercial websites in the Mid-Atlantic region. They found that only one site was accessible under the standards of WCAG and Section 508, with forty-six sites being marginally inaccessible and three sites being moderately inaccessible under the WCAG standards. They also found thirty-four sites being marginally inaccessible and fifteen sites being moderately inaccessible under the standards of Section 508. A follow up study of the sites found that despite some improvements, such as increased presence of alternative text, "on average, the 50 web sites increased the number of accessibility flaws over this time period. Web sites had actually been made more inaccessible" (Lazar & Greenidge, 2006, p. 289).

The problems identified in these studies are hardly regional ones. A 2004 study of forty-five websites selected from top online product or service providers found that none of the websites evaluated met the requirements for Level AA or Level AAA conformance to the guidelines and only 9 percent met the Section 508 criteria (Loiacono & McCoy). A more recent review of websites from the private sector found that "in total 12 percent of the analyzed Web sites passed the accessibility evaluation, while the vast majority failed" (Leitner, Strauss, and Stummer, 2016, p. 251).

The field of education is also struggling with web accessibility. A recent study of a

sample of K-12 schools' websites found that "nearly two-thirds of schools failed at least one of the measurable WCAG guidelines. 89.3 percent of schools had contrast issues, which typically represent a WCAG failure. 95.5 percent of school home pages had a detectable error of some kind, with the average site having over 24 errors" (Kimmons & Smith, 2019). Similar studies around the world have found ongoing accessibility issues with higher education websites as well (Alahmadi & Drew, 2017; Ahmi & Mohamad, 2015; Ringlaben, Bray & Packard, 2014). Overall, research suggests websites across all sectors have significant accessibility issues that present barriers for users with disabilities as they navigate the web.

WEB ACCESSIBILITY IN LIBRARIES

Given the general state of web accessibility, it is perhaps unsurprising that library web content is not consistently accessible or that web accessibility is not always an institutional priority. In fact, a 2006 survey of web developers at libraries randomly selected from the Carnegie classification list found that less than 40 percent of respondents' institutions required or recommended that web content comply with ADA web accessibility requirements (Connell, 2008). Despite this lack of institutional requirement, many libraries have turned to WCAG 2.0 to set their standards for accessibility. A recent survey of the members of the Association of Research Libraries found that 67 percent of respondents used Level AA conformance to WCAG 2.0 as criteria for their web accessibility testing, and 12 percent of respondents went further to use Level AAA conformance as their criteria (Spina & Cohen, 2018).

Unfortunately, the general lack of focus on accessibility at the institutional level at many libraries appears to be accompanied by a lack of actual accessibility as well. A 2012 study of sixty-four library websites in Ontario, Canada, found that none of the websites were compliant with WCAG 2.0 and, in fact, the sites "on average, contained 14.75 WCAG 2.0 accessibility errors" with a particular predominance of WCAG issues on library homepages (Oud, 2012, p. 14). Other research has found similar results. In a longitudinal study of library and library school websites in North America, Schmetzke and Comeaux found that, as of the Summer of 2006, "despite improvements over the past 4 years, library and (even more so) LIS school Web sites (particularly those in the U.S.) still tend to contain many accessibility barriers,
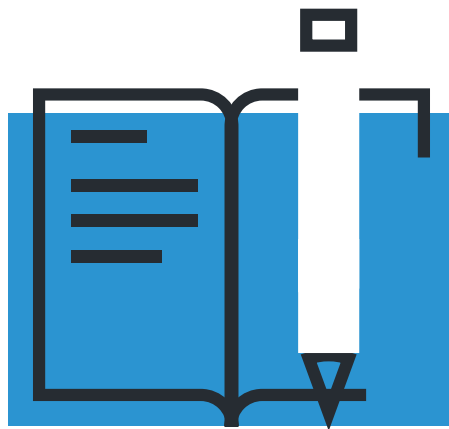
and thus they continue to exclude, unnecessarily, some potential users" (2009, p. 150). When they revisited the same websites in 2010 and 2012, they found that "unfortunately, since 2006 the overall percentage of approved pages has plateaued; it remained at 61 percent both in 2010 and 2012," though they did note that "the average number of errors per page has decreased steadily and considerably. From 4.8 errors per page in 2002, to 3.6 in 2006, to 2.3 in 2010, it has dropped all the way down to 1.7 in 2012" (Comeaux & Schmetzke, 2013, p. 22). Despite finding some areas of improvement, the authors noted that "the fact that two out of five library web pages are still plagued with at least one Priority 1 error, and that this percentage has not improved in the last six years, is worrisome" (2013, p. 25). A more recent study of public library homepages found that of 122 members of the Urban Library Council, only 7 library's homepages had no Section 508 compliance issues (Liu, Bielefield, & McKay, 2019).

While library websites are attempting to make at least some improvements to their accessibility, they are far from the only stumbling blocks that individuals with disabilities encounter when it comes to web-based library resources. In their 2010 study of thirty-two databases, Tatomir and Durrance found that "nine sites (or 28 percent of all databases) were rated as moderately accessible, nine sites (or 28 percent of all databases) were rated as marginally accessible, and 14 sites (or 44 percent of all databases) were rated as inaccessible... No database included in the study was rated as largely accessible" (2010, p. 588). In a study of Voluntary Product Accessibility Templates (VPAT) provided by database vendors to document their products' accessibility, DeLancey found that "vendors reported being fully compliant with 64 percent of the checkpoints they deemed

applicable, and partially compliant with a further 24 percent of applicable checkpoints" (2015). Though this imperfect level of accessibility compliance might already be a cause for concern, a further investigation of the databases' actual accessibility found that "in 37 cases, the information provided on the VPAT was incorrect: the scan found compliance issues where the VPAT stated "n/a" or full compliance. This indicates a VPAT inaccuracy rate of 19.6 percent," which the author went on to note likely would have been higher if additional testing had been done (DeLancey, 2015).

Multimedia content from libraries and library vendors has proved similarly problematic. A study that evaluated vendor webinars and tutorials based on a WCAG 2.0-based checklist found that none of the webinars were accessible, "none of the screencast or video tutorials tested were completely accessible, and all failed in at least one checklist item" (Oud, 2016, p.11). Though some tutorials were found to be at least somewhat accessible, "59 percent of vendors omitt[ed] usable captions and 50 percent present[ed] tutorials that couldn't be found on the page or played by people using screen-reading software" (Oud, 2016, p. 13). Libraries have tended to do little better when creating multimedia tutorials in-house. Clossen and Proces reviewed tutorials created by seventy-one libraries at public, R1 institutions and found "serious accessibility problems in the areas of captioning videos and appropriate heading levels" as well as "concerns in many other elements of video and Web tutorial creation" (2017, p. 822–823).

ADDITIONS IN WCAG 2.1

Released in June of 2018, almost ten years after the publication of WCAG 2.0, WCAG 2.1 represents the latest stage in the development of WCAG. Rather than replacing WCAG 2.0, this document serves to expand the existing guidelines to better serve those who were not adequately considered in the existing guidelines and to take into account new use patterns, particularly related to mobile devices. According to WAI, "WCAG 2.1 was initiated with the goal to improve accessibility guidance for three major groups: users with cognitive or learning disabilities, users with low vision, and users with disabilities on mobile devices" (Kirkpatrick, A., O Connor, J., Campbell, A., & Cooper, 2018). It is important to note that, as is frequently the case with web acces-

sibility fixes, many of the changes required to comply with WCAG 2.1 will increase the flexibility and customizability of the user experience and will therefore also improve the user experience for all users.

Rather than replacing WCAG 2.0, WCAG 2.1 supplements it by reproducing the entirety of WCAG 2.0 and then "adding new success criteria, definitions to support them, guidelines to organize the additions, and a couple additions to the conformance section" (Kirkpatrick et al., 2018). This approach means that "if you want to meet both WCAG 2.0 and WCAG 2.1, you can use the 2.1 resources and you don't need to bother looking at 2.0" (WAI, 2018a). This backwards compatibility means that existing web content can simply be further refined to meet the new success criteria. In addition to maintaining all existing elements of WCAG 2.0, it is important to note that this new content is based on the same four underlying principles as WCAG 2.0, namely that all content must be perceivable, operable, understandable, and robust.

In total, seventeen new success criteria have been introduced in WCAG 2.1. Of these, five are Level A, seven are Level AA, and five are Level AAA. All of the new success criteria fit into the existing WCAG 2.0 structure, having been added to the end of the relevant guideline for clarity. Many of the new success criteria cannot be checked through automated tools alone, particularly since several include exceptions for essential functionality. This makes it even more essential for content creators to design with WCAG 2.1 in mind rather than simply relying on automated tools to catch and correct mistakes after the fact.

NEW LEVEL A SUCCESS CRITERIA
Two of the Level A success criteria aim to improve usability for those using speech recognition software. Criterion 2.1.4 covers keyboard shortcuts that could be inadvertently triggered while speaking to a device, such as when an unknown shortcut deletes content if the user says a particular phrase. To address this issue, any shortcut that is "implemented in content using only letter (including upper- and lower-case letters), punctuation, number, or symbol characters" must be able to be turned off, reconfigured to work with other keys, or activated only when the relevant section of the code has focus (WAI, 2018b). Criterion 2.5.3 addresses the fact that the visual labels on user interface components often have text that does

not match their underlying, invisible programmatic name, which can then become "an unknown hidden command for speech input users that can be accidentally activated without the user knowing what has happened" (Campbell, Cooper, & Kirkpatrick, 2018). Given that they offer user experience improvements for anyone who uses speech inputs or voice-to-text tools, these success criteria will not only improve accessibility, but will also have a wider impact on user experience.

The remaining three Level A success criteria are focused on making motions, gestures, and movements more forgiving. This ensures that the content is accessible to users whose fine motor skills are limited as well as those who may use assistive tools that limit their ability to interact with their device in these ways. Criterion 2.5.1 ensures that all actions that can be done with a gesture, such as pinching to zoom or swiping to navigate, can also be done without complex motions. It is important to point out that this success criterion is limited in scope and only "applies to author-created gestures, as opposed to gestures defined on the level of operating system or user agent" (Campbell et al., 2018). Criterion 2.5.2 seeks to minimize the impact of accidental or mistaken clicks or touch events by requiring that either nothing happen until the up-event (for example, when the user lifts their finger from the touchscreen) or that the event can be cancelled or reversed with ease and without significant impact. Criterion 2.5.4 focuses on offering alternatives for actions that require users to move their device in specific ways, such as the feature on some mobile devices that allows users to shake their device to undo their last action, or

requires the user to move in specific ways to activate features. Offering alternatives can make these features accessible to a wider range of users and in more settings, such as when the device in question is mounted in a stationary position. All three of these success criteria do acknowledge that noncompliance may sometimes be essential and therefore allow for exceptions. However, in many cases, creative design solutions can offer alternatives that will offer more flexible options for users in a wider range of situations and with diverse needs.

NEW LEVEL AA SUCCESS CRITERIA
The largest number of new success criteria fall within Level AA. The seven new success criteria at this level cover a range of different types of use cases and will be useful to a wide range of users. Criterion 1.3.4 is an excellent example of the range of possible user experiences that can be improved by focusing on these success criteria. It requires that content not require a particular screen orientation (such as landscape) to display properly unless there is an integral reason that it is required. One of the primary use cases driving this success criterion is that of users who operate a mobile device that is mounted to an assistive device, such as a mobile phone mounted to a wheelchair. However, designing to allow this type of flexibility will also benefit those who are using a device temporarily mounted in a stand in their vehicle and those who mount devices in a public space for use by visitors. Similarly, 1.3.5, which deals with input fields, not only benefits those with disabilities that may make it difficult for them to input information due to learning disabilities such as dyslexia or dyscalculia, but also those who are in a hurry or prefer not to memorize this type of information. This success criterion ensures that form fields that request information have the necessary attributes or metadata associated with them so that they can be filled out automatically.

WCAG 2.1 also includes several Level AA success criteria that are designed to improve the user experience for individuals with low vision. Criterion 1.4.10 addresses reflow, which is the adjustment of content to remain visible in the width of the window even after the user zooms in on content. To achieve this, the success criterion requires that content reflow for "vertical scrolling content at a width equivalent to 320 CSS pixels [and] horizontal scrolling content at a height equivalent to 256 CSS pixels" (WAI,
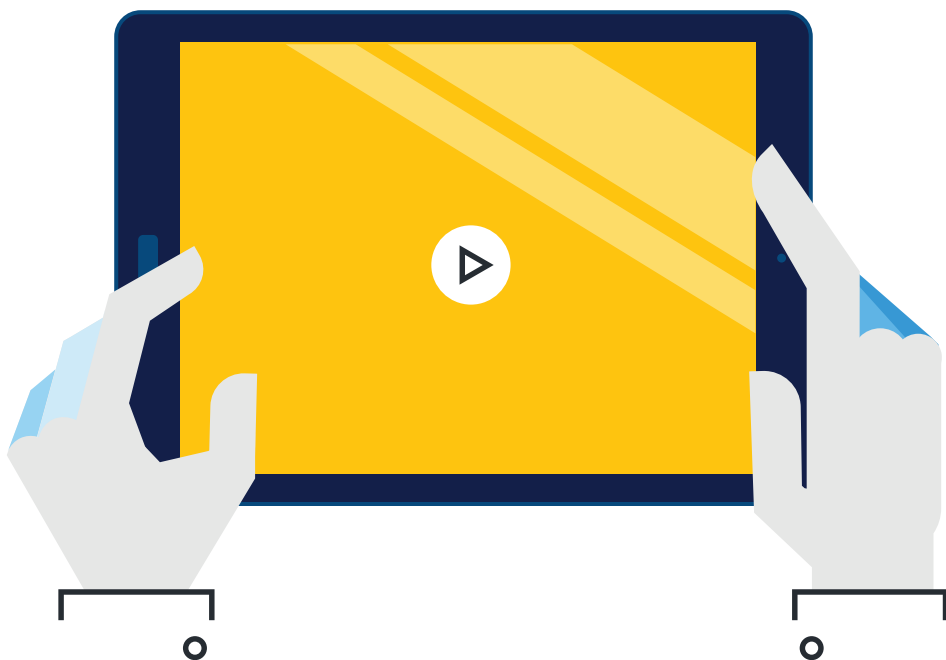
2018b). Criterion 1.4.11 adds a contrast requirement for content that is not text, including both user interface components and graphics. This means that elements in forms, buttons, visual effects, and similar features must have at least a 3:1 contrast ratio compared to the adjoining colors and elements. Criterion 1.4.12 is another guideline focused on allowing users to customize their own experience to improve usability. This success criterion requires that web content that is created using tools that allow for style overrides must allow users to change the line spacing, post-paragraph spacing, letter spacing, and word spacing of textual content. It includes minimum standards for each of these elements, but great flexibility would, of course, meet the needs of a wider range of users. Criterion 1.4.13 ensures that any content that becomes visible on hover or keyboard focus should be able to be dismissed on demand, persist if the user moves the pointer within the newly visible content, and remain visible until the user takes an action unless it is no longer valid. Taken together, these success criteria will offer users with low vision a much-improved user experience as they navigate compliant web content and will also offer features that many other users will likely appreciate as well.

The final Level AA success criterion, 4.1.3, pertains to status messages and requires that they can be programmatically determined by assistive technologies so that they can convey the information to the user even if the user is not able to navigate to the status message on the page. Currently, many status messages remain invisible to assistive technologies such as screen readers, unless the user brings the focus on to them. In cases when the user may not even be aware that messages have appeared on the page, it is difficult or impossible to find the message to focus on it. This success criterion will give users of assistive technology the ability to customize how they receive status messages and to ensure that they do not miss key information.

NEW LEVEL AAA SUCCESS CRITERIA

Level AAA is the most advanced compliance level for WCAG and is the most difficult to achieve. In fact, W3C's documentation notes that "it is not recommended that Level AAA conformance be required as a general policy for entire sites because it is not possible to satisfy all Level AAA Success Criteria for some content" (W3C, 2016). Nevertheless, the five new Level AAA success criteria in WCAG 2.1 should not be dismissed out of hand. They offer important features that can be key to building truly inclusive web content and even where they cannot be entirely met, designing with them in mind can help to improve the overall accessibility of web content.

Criterion 1.3.6 asks that elements of the user interface, such as icons and regions, have metadata associated with them so that they can be automatically customized for the needs of the user. This might mean converting icons with text to symbols or allowing users to apply the same symbols that they are familiar with across sites and applications. This supports people with vary-

ing cognitive needs, but also opens the door to personalization and customization more generally. Criterion 2.2.6 is also primarily focused on supporting people with varying cognitive needs, but serves the interests of all users. It requires that users be notified of any periods of inactivity that could lead them to lose their progress or unsaved data. The success criterion does allow an exception if the information is preserved for longer than 20 hours, and the documentation actually recommends retaining information for 20 hours as a best practice (Campbell et al., 2018), but more generally, the expectation is that compliant features will include information about any cutoff periods. It is worth noting that the documentation also acknowledges that the decision on how to handle this data might depend on privacy regulations in the relevant jurisdiction and recommends considering that before making a decision on how to approach this element (Campbell et al., 2018).

Criterion 2.3.3 builds on existing guidelines about content that can cause seizures or physical reactions, to specifically contemplate that animations that start upon interaction should be able to be disabled unless they are essential. Criterion 2.5.5 is designed to address the size of target areas, an issue that impacts both users with and without disabilities, particularly on small screens such as those used for mobile devices. The use case example given is, in fact, one that many users can relate to: "The buttons are so small, I hit 'Cancel' when going for 'Submit'. Then I have to start all over again" (WAI, 2018b). This success criterion offers some exceptions, such as when there are alternatives available on the same page, the author does not have control over the target's size, or there is an essential need for it, but in general, the target's size should be at least 44 by 44 CSS pixels. Criterion 2.5.6 states that there should be no restrictions placed on the number or type of inputs used and "users should be able to switch input mechanisms at any point should the user determine that certain tasks and interactions are more easily accomplished by using an alternative input mechanism" (Campbell et al, 2018). This ensures that users have the flexibility to use their preferred approach to enter data or interacting with content and also incorporates the flexibility necessary to work with a variety of combinations of assistive devices since each user has their own preferred suite of tools.

THE CURRENT STATUS OF WCAG 2.1

In the recommendation document, W3C acknowledges that "significant challenges were encountered in defining additional criteria to address cognitive, language, and learning disabilities, including a short timeline for development as well as challenges in reaching consensus on testability, implementability, and international considerations of proposals" (Kirkpatrick et al., 2018). It is important to note, however, that these new guidelines do not represent a final answer nor will they ensure complete accessibility for all users. Though they do extend beyond the topics covered in WCAG 2.0, it is clear that future work in these and other areas will be needed to continue to improve accessibility. However, this is not a reason to delay implementation of the recommended changes. In fact, the Accessibility Guidelines Working Group has already stated that they recommend "that sites adopt WCAG 2.1 as their new conformance target, even if formal obligations mention WCAG 2.0, to provide improved accessibility and to anticipate future policy changes" (Kirkpatrick et al., 2018). Though WCAG 2.1 may not achieve total accessibility, it is an important step towards more inclusive and usable web content creation practices.

WCAG 2.1 AND THE FUTURE OF LIBRARY WEB ACCESSIBILITY

It will take time to know what the long-term impact of WCAG 2.1 will be, but early signs suggest that it will gain traction. Companies that provide tools and services related to accessibility compliance are already beginning to release tools that incorporate advice about complying with WCAG 2.1, including Level Access (Avila, 2018) and WebAIM (Smith, 2018). By September of 2018, EN 301 549, a European standard entitled "Accessibility requirements suitable for public procurement of ICT products and services in Europe," had already been updated and now "directly references WCAG 2.1," which represents an even more complete integration of the guidelines than had been seen in previous versions of EN 301 549 (Abou-Zahra, 2018). But, even if it is not ultimately widely adopted as a legal standard, it is clear that work in this area will have to continue. As is evident from past web content accessibility guideline versions, new technologies will likely arise that are not clearly addressed by existing guidelines. Evidence of this can already be seen in W3C's recent launch of a Pronunciation Task

Force that will involve those with expertise in a wide range of technologies, including assistive devices and accessibility, to ensure that text to speech technologies are usable by all (Sajka, 2018). In addition to the issues presented by new technologies, WAI's Accessibility Guidelines Working Group is already at work on another version that "is expected to be a more substantial restructuring of web accessibility guidance" (Kirkpatrick et al., 2018). And, researchers have noted that "while technical compliance with accessibility guidelines would be a first step, websites may be technically compliant without being particularly usable for screen reader users" (Mulliken, 2017, p. 116).

Without a significant investment in and prioritization of web accessibility, libraries will be unable to offer an equitable experience to individuals with disabilities, both as library patrons and as library employees. The evidence demonstrates that current practices are not sufficient to allow most libraries to achieve even minimal compliance with WCAG 2.0. To meet the standards set by WCAG 2.1 and to be positioned to address new accessibility challenges presented by emerging technologies, libraries must make a clear commitment to accessibility. At a time when competition for resources exists at many libraries, this will necessitate devoting time and money to accessibility as well as working to ensure that it remains a priority on an ongoing basis.

One way that libraries can make a public commitment to accessibility is by sharing an accessibility statement online that provides specific standards to which they will adhere. These can take a variety of formats, as long as they set forth a standard that the library will commit to on an ongoing basis. The Hannon Library at Southern Oregon University specifically states that the library's website will comply with WCAG 2.0, conformance level AA, as well as detailing the

schedule on which accessibility checks will happen and even the tool they use (Southern Oregon University, n.d.). Harvard Library not only specifies that their web content follows WCAG, but also uses the page to recruit participants for their "accessibility testing participant pool" (Harvard Library, n.d.). Other libraries are already beginning to cite WCAG 2.1 in their accessibility statements (Ray Howard Library, 2019; Brookline Public Library, n.d.). The Michigan State University Libraries maintain an entire section of their website which details their accessibility efforts, including the accessibility of online content, collections, and services (MSU Libraries, n.d.). Regardless of the format of the accessibility statement, the important aspect is to have documented compliance practices and standards that can provide accountability about web accessibility.

Even libraries that cannot share a public accessibility policy can develop internal policies, procedures, and timelines for web accessibility that ensure that it remains at the forefront rather than falling to the side. These policies can cover not only the standards that web content will adhere to, but also how accessibility will shape collection development decisions. A recent survey of Association of Research Libraries members found that only 33 percent of respondents had included accessibility considerations in their collection development policies (Spina & Cohen, 2018), but this is an area that is ripe for growth. Considering accessibility at the point of purchase or subscription has the potential to have a huge impact on how accessible library collections are, which is particularly important for online vendor content, which generally cannot be edited by the purchasing or subscribing library to improve accessibility. The first step towards considering accessibility as part of the collection development process can be collecting VPATs from all vendors, but, as previously discussed, VPATs are not always accurate (DeLancey, 2015), which has motivated some libraries to move beyond this. While some libraries do internal accessibility testing for databases and other electronic resources, the libraries of the Big Ten Academic Alliance have come together to "fund third-party accessibility evaluations for select vendor e-resources based upon recommendations from the member libraries and the platforms that the majority of the consortium owns or is considering for purchase" and have also developed and publicly shared standardized language about

> **From a user's perspective, it is also important to have a way to get in touch with the appropriate person at a library when they are not meeting their obligations. All of the policies discussed above provide contact information so that individuals can reach out to the library if they encounter accessibility issues.**

accessibility that libraries can negotiate to insert into vendor agreements (Big Ten Academic Alliance, n.d.).

From a user's perspective, it is also important to have a way to get in touch with the appropriate person at a library when they are not meeting their obligations. All of the policies discussed above provide contact information so that individuals can reach out to the library if they encounter accessibility issues. Giving users a sense of what to expect from the library and a way to communicate any issues that they have is a key to ensuring that individuals with disabilities will have the information that they need to plan how they will make use of the library, but it is also an important part of ensuring public accountability around web accessibility. These documents are a useful first step towards making accessibility a permanent commitment and giving notice to the library community of this obligation so that they know that this is an area that will be a continued priority even in the face of other competing demands. This ensures that patrons, staff, and other stakeholders all have an avenue for holding the library accountable for meaningful accessibility of all web content.

Policy statements are only the first step towards meaningful progress on accessibility and, in fact, do very little to improve accessibility without a simultaneous commitment of resources. Though a growing number of libraries are hiring individuals with accessibility expertise or tasking specific staff with accessibility compliance, far too often accessibility falls outside the scope of everyone's job description or is hastily tacked on without budgeting a realistic amount of time to the ongoing accessibility auditing and improvement that is necessary for a library to offer a truly equitable and accessible experience for users with disabilities. Libraries need to move towards a model of clearly assigning accessibility tasks and ensuring that the individual or

individuals asked to do this vital work have the necessary training, support, authority, and resources to make meaningful strides towards accessibility. Without this dedication of resources, libraries will never manage to achieve ongoing compliance with basic accessibility standards, much less offer equitable access for individuals with disabilities.

A key piece of allocating sufficient resources to accessibility work is determining the nature of the work to be done. Currently, automated accessibility testing using free or subscription-based tools is a central element of accessibility work. However, these tools can produce incorrect results whether over-reporting errors (Ng, 2017) or missing major problems entirely (Vigo, Brown, & Conway, 2013). These significant limitations taken together with the fact that the existing WCAG standards do not take into account every possible aspect of accessibility clearly demonstrates the need for a more integrated approach to meaningful web accessibility. Rather than relying only on automated tools that attempt to test against WCAG, those tasked with maintaining the accessibility of web content must develop workflows that integrate accessibility testing into overall user testing work. One of these new approaches is to develop expertise in manual testing with available assistive technologies. While no one person will be equally proficient at all possible assistive technologies, the ability to navigate web content with these tools for testing purposes is key to ensuring equitable access for those who use these tools. Moreover, an important part of serving the library's community is having an understanding of which of these tools is most commonly used by your users, which can often be done by partnering with users who use assistive technologies and the organizations that serve them. This takes accessibility work beyond basic conformance to minimal standards and towards a true focus on accessibility as

one aspect of user experience.

User testing that involves individuals who regularly use assistive technologies is a vital complementary piece of this process. A key tenet of user experience work is that "even the most well thought out designs are assumptions until they are tested by real users" (Loranger, 2014). It is vital to involve individuals with disabilities and who use assistive devices in any usability testing processes. Generally speaking, best practices suggest that such individuals be offered the opportunity to use their own technology configured the way that they typically use it to determine how the web content in question works for them under their normal circumstances. Some libraries, such as the Harvard Libraries, maintain an "Accessibility Testing Participant Pool" and use institutional computers but allow participants "to bring their own keyboard, refreshable Braille display, or other input device to use during test sessions" (User Research Center at Harvard Library, n.d.). Either of these approaches can change the dynamics of testing, but it is vital that UX practitioners develop tests that involve individuals with disabilities and become familiar with these best practices so that they can gain an understanding of the actual accessibility issues presented by their web content.

Libraries also need to consider accessibility when considering the adoption of new technologies. Too often libraries make decisions about acquiring and using new technologies and consider accessibility of those technologies only afterwards. This can already be seen in the case of topics that have gained interest in recent years such as immersive technologies (including augmented reality and virtual reality), data visualization, and voice-user interfaces. Libraries cannot wait for groups like WAI to make pronouncements or develop guidelines. Instead, they must work to develop their own accessibility testing policies and procedures and integrate this work into the

> Despite the ongoing work needed in this area to ensure usability for individuals with disabilities, the release of WCAG 2.1 offers a perfect opportunity for libraries to expand their efforts to achieve and even exceed compliance with these standards, which are now designed with a specific aim of making web content accessible to previously underserved users.

process of evaluating new technologies. A model of this approach is Temple Libraries' Digital Scholarship Center, where Jasmine Clark and Jordan Hample are working "to adapt Web Content Accessibility Guidelines (WCAG) to fit VR" (Clark, 2018). In the future, libraries must make accessibility a central component of their decision-making processes when selecting technologies to adopt and tools to invest in and they must be willing to contribute to the ongoing work of developing accessibility standards and practices for these new technologies.

CONCLUSION

Despite the ongoing work needed in this area to ensure usability for individuals with disabilities, the release of WCAG 2.1 offers a perfect opportunity for libraries to expand their efforts to achieve and even exceed compliance with these standards, which are now designed with a specific aim of making web content accessible to previously underserved users. It is imperative that web developers continue to improve their own accessibility practices, involve individuals with disabilities in their user experience testing processes to ensure that they achieve their accessibility goals, and strive to meet the highest levels of success criteria found in WCAG 2.1 or even exceed them where the success criteria do not adequately address the institution's technologies or use cases.

Libraries should take this opportunity to examine their own accessibility practices and make a serious and ongoing commitment to improving the accessibility of their existing web content, involving individuals with disabilities in their UX work, and centering accessibility from the beginning in conversations about newly emerging technologies. Only through this continuing effort will it be possible for patrons and employees with disabilities to have equitable access to online library content and will libraries be well-positioned to achieve their goal of offering accessible content and

services as new technologies, use cases, guidelines, and standards emerge. ∎

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REFERENCES:
Abou-Zahra, S. (2018, September 13). WCAG 2.1 Adoption in Europe. Retrieved from **https:// www.w3.org/blog/2018/09/wcag-2-1-adop tion-in-europe/**
Ahmi, A., & Mohamad, R. (2015). Web accessibility of the Malaysian public university websites. In Proceedings of International Conference on E-Commerce (pp. 171–177).
Alahmadi, T., & Drew, S. (2017). Accessibility evaluation of top-ranking university websites: Accessibility rates from 2005 to 2015. *Journal of Open, Flexible and Distance Learning*, 21(1), 7.
Avila, J. (2018, June 22). WCAG 2.1 in AMP (Accessibility Management Platform). Retrieved from **https://www.levelaccess.com/wcag-2-1-in- amp/**
Big Ten Academic Alliance. (n.d.). Library e-resource accessibility — testing. Retrieved from **https://www.btaa.org/library/accessibility/ library-e-resource-accessibility — testing**
Boyd, S. E. (2018, September 25). Letter to the Honorable Ted Budd. Retrieved from **https:// www.adatitleiii.com/wp-content/uploads/ sites/121/2018/10/DOJ-letter-to-congress.pdf**
Brookline Public Library. (n.d.). Website accessibility statement. Retrieved from **https://www. brooklinelibrary.org/website-accessibility- statement/**
Caldwell, B., Cooper, M., Guarino, L, and Vanderheiden, G. (Eds.) (2008, December 11). Web content accessibility guidelines (WCAG) 2.0. Retrieved from **https://www.w3.org/TR/ WCAG20/**
Campbell, A., Cooper, M., and Kirkpatrick, A. (Eds.)

(2018, December 7). Understanding success criterion 2.5.3: Label in name. Retrieved from **https://www.w3.org/WAI/WCAG21/Under standing/label-in-name.html**
Chisholm, W., Vanderheiden, G., & Jacobs, I. (Eds.) (1999, May 5). Web content accessibility guidelines 1.0. W3C. Retrieved from **https://www. w3.org/TR/WAI-WEBCONTENT/**
Clark, Jasmine. (2018, November 7). Progressing towards an accessible VR experience. Retrieved from **https://sites.temple.edu/ tudsc/2018/11/07/progressing-towards-an- accessible-vr-experience/**
Clossen, A., & Proces, P. (2017). Rating the accessibility of library tutorials from leading research universities. portal: Libraries and the Academy, 17(4), 803–825.
Comeaux, D., & Schmetzke, A. (2013). Accessibility of academic library web sites in North America: Current status and trends (2002–2012). Library Hi Tech, 31(1), 8–33.
Connell, R. S. (2008). Survey of web developers in academic libraries. *The Journal of Academic Librarianship,* 34(2), 121–129.
Dardailler, D. (2009, June). WAI early days. Retrieved from **https://www.w3.org/WAI/history**
DeLancey, Laura. (2015). Assessing the accuracy of vendor-supplied accessibility documentation. Library Hi Tech, 33(1), 103–113. doi: **10.1108/ LHT-08-2014-0077**
Education and Outreach Working Group. (2018, March 21). Web accessibility laws & policies. Retrieved from **https://www.w3.org/WAI/ policies/**
European Telecommunications Standards Institute (2014, January 27). Accessibility requirements suitable for public procurement of ICT products and services in Europe. (EN 301 549). Retrieved from **https://www.etsi.org/deliver/ etsi_en/301500_301599/301549/01.01.01_6 0/en_301549v010101p.pdf**
European Parliament and the Council of the European Union (2016, October 26). On the accessibility of the websites and mobile applications of public sector bodies. Directive 2016/2102. Retrieved from **https://eur-lex.europa.eu/legal- content/EN/TXT/?uri=CELEX%3A32016L2102**
Harvard Library. (n.d.) Accessibility. Retrieved from **https://library.harvard.edu/accessibility**
Information and Communication Technology (ICT) Standards and Guidelines, 82 Fed. Reg. 5790–5841. (2017, January 18). Retrieved from **https://www.gpo.gov/fdsys/pkg/FR-2017-01- 18/pdf/2017-00395.pdf**
Kimmons, R., & Smith, J. (2019). Accessibility in mind? A nationwide study of K-12 Web sites in the United States. First Monday, 24(2). doi: **10.5210/fm.v24i2.9183**

Kirkpatrick, A., O Connor, J., Campbell, A., & Cooper, M.(Eds.) (2018, June 5). Web content accessibility guidelines (WCAG) 2.1. W3C. Retrieved from **https://www.w3.org/TR/WCAG21/**

Lanzilotti, A., Cossaboon, M. and the National Federation of the Blind v. Atlantic Cape Community College, Consent Decree (CV 15-3656, D. of New Jersey, July 7, 2015). Retrieved from **http://www.atlantic.edu/documents/nfb_lanzailotti_atlantic_cape_consent_decree.pdf**

Lazar, J., Beere, P., Greenidge, K. D., & Nagappa, Y. (2003). Web accessibility in the Mid-Atlantic United States: A study of 50 homepages. Universal Access in the Information Society, 2(4), 331–341.

Lazar, J., & Greenidge, K. D. (2006). One year older, but not necessarily wiser: An evaluation of homepage accessibility problems over time. Universal Access in the Information Society, 4(4), 285–291.

Leitner, M. L., Strauss, C., & Stummer, C. (2016). Web accessibility implementation in private sector organizations: Motivations and business impact. Universal Access in the Information Society, 15(2), 249–260.

Liu, Y. Q., Bielefield, A., & McKay, P. (2019). Are urban public libraries websites accessible to Americans with Disabilities? Universal Access in the Information Society, 18(1), 191–206.

Loiacono, E., & McCoy, S. (2004). Web site accessibility: An online sector analysis. Information Technology & People, 17(1), 87–101.

Loranger, H. (2014, August 10). UX without user research is not UX. Retrieved from **https://www.nngroup.com/articles/ux-without-user-research/**

Montana State University Libraries. (n.d.). The MSU Libraries' Accessibility Statement. Retrieved from **https://lib.msu.edu/general/accessibility/**

Mulliken, A. (2017). There is nothing inherently mysterious about assistive technology: A qualitative study about blind user experiences in U.S. academic libraries. Reference & User Services Quarterly, 57(2), 115–126. doi: **10.5860/rusq.57.2.6528**

Ng, C. (2017). A practical guide to improving web accessibility. Weave: Journal of Library User Experience, 1(7). doi: **10.3998/weave.12535642.0001.701**

Nondiscrimination on the Basis of Disability; Accessibility of Web Information and Services of State and Local Government Entities and Public Accommodations, 75 Fed. Reg. 43460–43467 (proposed July 26, 2010). Retrieved from **https://www.gpo.gov/fdsys/pkg/FR-2010-07-26/pdf/2010-18334.pdf**

Oud, J. (2012). How well do Ontario library web sites meet new accessibility requirements? Partnership: The Canadian Journal of Library and Information Practice and Research,7(1). Retrieved from **https://journal.lib.uoguelph.ca/index.php/perj/article/view/1613**

Oud, J. (2016). Accessibility of vendor-created database tutorials for people with disabilities. Information Technology and Libraries, 35(4). Retrieved from **https://ejournals.bc.edu/ojs/index.php/ital/article/view/9469/pdf**

Penn State University v. National Federation of the Blind, Settlement Agreement. Docket#03-11-2020 (2011, October 11). Retrieved from **http://accessibility.psu.edu/nfbpsusettlement/**

Power, C., Freire, A., Petrie, H., & Swallow, D. (2012, May). Guidelines are only half of the story: accessibility problems encountered by blind users on the web. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 433–442). ACM.

Ray Howard Library. (2019). Accessibility policy at the Ray Howard Library. Retrieved from **https://library.shoreline.edu/accessibility**

Ringlaben, R., Bray, M., & Packard, A. (2014). Accessibility of American university special education departments' web sites. Universal Access in the Information Society, 13(2), 249–254.

Sajka, J. (2018, December 6). APA announces pronunciation task force [Blog post]. Retrieved from **https://www.w3.org/blog/2018/12/pronunciation-task-force/**

Schmetzke, A., & Comeaux, D. (2009). Accessibility trends among academic library and library school web sites in the USA and Canada. Journal of Access Services, 6(1-2), 137–152.

Smith, J. (September 27, 2018). Dinolytics Release and WAVE Roadmap [Blog post]. Retrieved from **https://webaim.org/blog/dinolytics-release-wave-roadmap/**

Southern Oregon University. (n.d.). Hannon Library accessibility. Retrieved from **https://inside.sou.edu/accessibility/hannon-library-accessibility.html**

Spina, C. & Cohen, M. (May 2018). SPEC Kit 358: Accessibility and universal design. Association of Research Libraries. Retrieved from **https://publications.arl.org/Accessibility-Universal-Design-SPEC-Kit-358/**

Tatomir, J., & Durrance, J. C. (2010). Overcoming the information gap: Measuring the accessibility of library databases to adaptive technology users. Library Hi Tech, 28(4), 577–594.

United States of America v. Louisiana Tech University, and the Board of Supervisors for the University of Louisiana System, Settlement Agreement Under the Americans with Disabilities Act. DJ #204-33-116 (July 22, 2013). Retrieved from **https://www.ada.gov/louisiana-tech.htm**

United States of America v. National Museum of Crime and Punishment, Settlement Agreement Under Title III of the Americans with Disabilities Act. (2015, January 13). Retrieved from **https://www.ada.gov/crime_punishment_museum/crime_punishment_sa.htm**

United States of America v. Teachers Test Prep, Settle Agreement Under the Americans with Disabilities Act. DJ #202-11-346 (2018, June 18). Retrieved from **https://www.ada.gov/ttp_sa.html**

University of Montana v. the U.S. Department of Justice, Office for Civil Rights, Resolution Agreement. OCR Reference No. 10122118 (2014, March 10). Retrieved from **https://nfb.org/images/nfb/documents/word/agreement_university_of_montana_03_10_2014.doc**

User Research Center at Harvard Library. (n.d.). Accessibility testing participant pool. Retrieved from **https://urc.library.harvard.edu/accessibility-testing-participant-pool**

Vigo, M., Brown, J., & Conway, V. (2013, May). Benchmarking web accessibility evaluation tools: Measuring the harm of sole reliance on automated tests. In Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility (p. 1). ACM.

WAI. (2009, January 15). How WCAG 2.0 differs from WCAG 1.0. Retrieved from **https://www.w3.org/WAI/WCAG20/from10/diff.php**

WAI. (2018a, June 22). Web Content Accessibility Guidelines (WCAG) overview. Retrieved from **https://www.w3.org/WAI/standards-guidelines/wcag/**

WAI. (2018b, November 3). What's new in WCAG 2.1. Retrieved from **https://www.w3.org/WAI/**standards-guidelines/wcag/new-in-21/

W3C (2016). Understanding conformance. Retrieved from **https://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html**

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