Experiential diversity training and science learning for college students alongside peers with intellectual and developmental disabilities

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Short title: Learning science alongside peers with disabilities
ABSTRACT

Diversity, equity and inclusion (DEI) training can benefit STEM students. However, typical college settings often limit college students' exposure to adult peers with intellectual and developmental disabilities (IDDs), a historically marginalized group. To lower this barrier, we developed a continuing education program, Lifelong Learning with Friends (LLWF), aimed at adults with IDDs on a large university campus, which provides diversity training to college students. In this program, undergraduate and graduate students from scientific and education disciplines are recruited to volunteer as peers and helpers. LLWF has reached hundreds of students with and without IDDs each year and more than 1,500 over the past 12 years. In our program, college students gain DEI training through learning sophisticated academic topics, including sciences, alongside adults with IDDs. Almost half (42%) of surveyed LLWF college volunteers did not have prior exposure to people with IDDs. Following program participation, we found that, irrespective of prior exposure, nearly all (98%) of volunteers had elevated their expectations of people with IDDs and reported increased interest in IDDs-focused research, education, social interaction, and advocacy. Additionally, college volunteers reported that they improved their science communication by seeing how science could be taught to a broad audience that includes adults with IDDs. We therefore suggest that other universities may consider our LLWF model to enhance DEI training by expanding opportunities for neurotypical students to befriend and learn science alongside adults with IDDs.

Introduction

There is rising demand to expand the scope of training for future scientists, physicians, and science educators to incorporate real-world experiences through experiential diversity training [1]. Students beginning medical school often report feeling unprepared to relate to patients whose backgrounds or identity differ from their own [2–4]. This highlights the need to address STEM students' inexperience outside of the classroom and in the real world. A major way to address this issue is by encouraging STEM students to seek experience with new and marginalized populations through paid or volunteer activities outside of the classroom. These experiences can be paradigm shifting and life changing; however, studies have shown that some current diversity training efforts need improvement. For one, they often are inconvenient because many are off campus and not for formal academic credit [5]. For those taught in the classroom, general diversity training aimed at STEM and medical students often relies on methods such as perspective taking, goal setting, or stereotype discrediting [6]. Simply discrediting socially unacceptable stereotypes can still inadvertently cause negative indirect biases [7–9]. Although these classroom methods can lay important groundwork for respecting and appreciating diversity, students likely benefit more from spending time with people from diverse backgrounds rather than reading about them [10,11].

Although both out of and in-classroom DEI training often focuses on critical diversity issues, such as race, gender, and socioeconomic status, most diversity equity and inclusion (DEI) training initiatives often overlook intellectual and developmental disabilities (IDDs). Many professionals entering medical and STEM fields report little to no prior formal training with people having IDDs or special education, despite people with IDDs representing a significant
percentage of their future clientele [12–14]. This demographic is also particularly valuable for
STEM students to interact with because of the growing percentage of college students and the
professional workforce identified as neurodiverse. Growing awareness of broader neurodiversity
proves the commonality of conditions like autism spectrum disorder (ASD), Down syndrome,
and other IDDs, with an estimated 15-20% of the general population exhibiting some form of
neurodivergence [15,16].

For decades, the Special Olympics has offered DEI experiences for the public to learn about
people with IDDs. Special Olympics has two programs under their umbrella that have made
strides in establishing mixer DEI experiences for college students: Unified sports programs and
Best Buddies. Unified sports programs allow for athletes with and without disabilities to
participate in organized athletic events and games together while also serving as a platform for
building friendships, improving self-esteem, and promoting social acceptance among athletes
without IDDs [17–21]. Similarly, Best Buddies is a nonprofit volunteer organization that
promotes positive one-to-one interactions among high school and college students with and
without IDDs, organizing monthly meetups, community hangouts, and routine communication
via email, phone call, texting or social media [22,23]. Both Unified sport programs and Best
Buddies utilize neurotypical participants to serve as similar age peers in athletic and social
activities. However, recreationally inclusive programs may not succeed in demonstrating the
level of what adults with IDDs are capable of learning and showing interest. This often-
unappreciated goal is especially important to counter and better contextualize the “intellectual
disability” label that assumes people with IDDs have no interest in or ability to learn
sophisticated subjects in a college setting.

We sought to combine elements of diversity training with experiential learning with a novel
platform, Lifelong Learning with Friends (LLWF), to connect mostly STEM and pre-medical
college students to peers with IDDs. By offering academic material to college students, we offer
a form of engagement with adults with IDDs that have unique strengths that complement
recreational programs through Special Olympics. LLWF offers courses on a variety of diverse
academic, cultural, and personal-development topics to adults with IDDs who learn alongside
neurotypical college students in a nearly 2:1 reverse-inclusion format. Neurotypical college
students volunteer in courses as class peers learning novel material while having the potential
to gain meaningful experience interacting with people with IDDs. Typical DEI training is most
often completed in short professional workshops, involving educational approaches like cultural
humility training, or identifying bias [24]. LLWF is a unique way to achieve DEI training but
through firsthand experience with people with IDDs rather than learning about them in a less
personal workshop.

We wanted to determine if LLWF served as a valuable experiential diversity training opportunity
for college student volunteers (hereafter referred to as volunteers). We surveyed volunteers
before and after volunteering to assess their participation in LLWF as (1) an opportunity to meet
and gain meaningful experience with people with IDDs, (2) a convenient and enjoyable
volunteering experience, and (3) an inspiration for career development or advocacy in the
disability field. We hypothesized that most volunteers would have little to no firsthand
experience with peers with disabilities prior to volunteering due to limited opportunities for
interaction. Because students who have little contact with peers with disabilities often overestimate the debilitating severity of disability [25,26] we also hypothesized that most volunteers would report little to no knowledge of adult peers with disabilities participating in age-appropriate activities, such as playing sports, taking courses, or having a job. Additionally, we hypothesized that most volunteers would rate their experience volunteering with LLWF as convenient, enjoyable, and transformative to raise their expectations of people with IDDs. Finally, we wanted to determine if LLWF influenced some volunteers to pursue careers in fields related to IDDs.

Lifelong Learning with Friends

Lifelong Learning with Friends (LLWF) is a reverse-inclusion college education program aimed at adults with IDDs that has been running continuously for 12 years at the University of Texas at Austin (UT). Reverse-inclusion classrooms recruit neurotypical students into special education settings to foster positive peer interaction, model age-appropriate behaviors, and offer academic support if needed [27,28]. LLWF utilizes the reverse-inclusion dynamic to allow for bi-directional social and academic learning between students with IDDs and volunteers. LLWF offers a range of courses over academic and recreational topics that are typical of a neurotypical college curriculum but are commonly unavailable to adults with IDDs. Adults with IDDs are able to select courses à la carte, allowing them to pick courses suited to their personal interests rather than adhering to more rigid degree plans typical of other PSE programs aimed at adults with IDDs. For comparison, the two other postsecondary education programs aimed at adults with IDDs in Austin (STEPS at Austin Community College and E4 Texas at UT Austin) offer more conventional training in remedial academics and independent life skills, paired with either general career training or personal attendant training, with limited options to customize their experience.

LLWF provides course topics that also appeal to volunteers, in part by introducing new material. Our science courses both complement and supplement their degree plan with topics that they otherwise would not have time to pursue. Volunteers are free to sign up for classes that appeal to their personal interests. Examples of past course topics include forensic science, pharmaceutical drug discovery, marine science, and more (Figure 1). Courses are offered year-round in the evenings on weekdays and on Sunday afternoons, allowing college volunteers to easily fit them into their school schedules. Each course consists of six classes that meet once per week for 2-3 hours. Volunteers spend the entire class time with adults with IDDs.

For some, it may be hard to imagine how reverse-inclusion courses with sophisticated topics including science can be effective for students with and without IDDs. To engage students with a wide range of abilities and different limitations, our instructors have employed learning strategies involving universal learning design (ULD) approaches. Some ULD methods we utilize in our science courses include perceptible information (using a variety of illustrations, precise simplified language, and written directions to present curriculum), tolerance for error, as well as size and space for approach and use (ensuring that size of projected or printed content is large enough and uncluttered) [29]. To keep adults with IDDs and volunteers engaged, our courses also feature hands-on interactive activities, wet-lab demonstrations featuring one-on-one
support, independent inquiry, and expert guest lecturers. Examples of past LLWF courses are provided in Figure 1.

Public visibility of our students with IDDs on university grounds can demonstrate to volunteers and others that people with IDDs belong in higher education settings. All classes start at a campus cafe, where students with IDDs and volunteers converse freely for the first half hour. This social period presents a unique bidirectional learning exercise where adults with IDDs learn to reinforce their own age-appropriate behavior and social interactions with volunteers while volunteers learn first-hand about IDDs. Students then go to a nearby classroom in an adjacent building to engage interactively on the topic of the day. The classroom is on a floor with undergraduate science teaching labs, whereas upper floors house biomedical engineering, pharmacology, and toxicology research labs. Importantly, both the cafe and the classrooms are in an active and popular area, located in the heart of the campus, rather than in an area segregated from college students. By meeting at a popular cafe on campus and holding class in STEM buildings, our students with IDDs are better able to immerse themselves into university culture. Likewise, this on-campus location makes it convenient for STEM students to attend.

**Recruiting and training college volunteers**

Undergraduate and graduate students, most of them interested in pre-med, neuroscience, and education fields, were recruited through university forums, list servs, and student organizations. Some students majoring in Education used LLWF participation as a required service-learning project (SLP) for their university course “Individual Differences”, which focuses on basic concepts, issues, and ways to accommodate people with disabilities. Other STEM students volunteered as an assignment in an upper level Neurogenetics course. Most volunteers, however, participate without course requirements. All volunteers are expected to attend every class, participate in classwork and discussions, and complete homework assignments.

During a 45-minute, mandatory orientation for all new volunteers, college students learn that they were expected to assume five roles during volunteering, regardless of course topic:

1. **Mentor** - When needed, college volunteers were encouraged by the instructor to assist students with IDDs in learning class topics. Examples include mediating small group activities, helping to scribe during worksheet assignments, amplifying or clarifying quieter or shyer students' voices or written responses to enable participation in class discussion, or aiding in hands-on projects with students that required fine-motor skill support.

2. **Peer** - College volunteers are especially valuable in modeling age- and college-appropriate behavior, such as fostering reciprocal conversation, respecting personal space, basic classroom etiquette, and more. We have found that volunteers are in a unique position as peers to guide adults with IDDs towards age-appropriate behavior and learning that may be more effective than guidance from a parent or teacher figure because the adults with IDDs often want to emulate them [30,31].

3. **Student** - Volunteers have the unique opportunity to experientially learn about the science and social science of disability by befriending and learning alongside adults with IDDs. Many of our college volunteers are interested in the professional fields of medicine
or education but may have limited opportunities to learn from people with IDDs, a potentially significant portion of their clientele base, outside of the classroom. Volunteering with LLWF allows college students to connect with and learn from adults with IDDs in real life instead of reading about them in class.

(4) **Friend** - Many adults with IDDs are challenged at making friends due to difficulty in communication and/or relative isolation from similar-age peers. Like neurotypical people, social outlets outside of family and caretakers greatly enrich the quality of life for people with IDDs [10,32,33]. LLWF provides a valuable platform for adults with IDDs to re-enter the community and be introduced to college students similar to their age to form friendships.

(5) **Advocate** - Volunteering with LLWF will hopefully change the volunteer’s expectations on the capabilities of people with IDDs. Volunteers are encouraged to bring what they learn about people with IDDs into their daily life at school and their future careers in medicine, education, and research.

Volunteers are trained to provide meaningful support for a variety of IDDs, such as one-on-one mentorship, redirecting to focus on class topics, or aiding in written assignments. Experienced course instructors (most often from special education fields) offer supplemental information regarding the social experience of volunteering, such as how to foster reciprocal conversation and support each student with unique IDDs. Instructors also lead a 10 minute debrief with volunteers after each class, which allowed volunteers to privately share their firsthand observations of IDDs. This debriefing period helps volunteers to better understand some of the behaviors typified by different IDDs, especially for volunteers inexperienced with people with IDDs. With the help of our experienced course instructors, volunteers were coached on how to provide disability-competent support. For instance, volunteers would have firsthand experience with repetitive behaviors or intense restricted interests typified by autism spectrum disorder, or speech intelligibility issues and impulse control common in some individuals with Down syndrome.

**Many college volunteers had little to no firsthand experience with people with IDDs**

We sought to determine how many volunteers had firsthand experience with adults with IDDs prior to volunteering. We also sought to determine how many volunteers knew adults with IDDs that were involved with age-appropriate activities, like having a job, or playing sports, and if they had ever experienced people with IDDs being included in their classes. Over time, we administered pre-course surveys that evolved to include more questions, which accounts for the varied sample size (n = 112-131).

We hypothesized that many college students do not have experience with people with IDDs. Consistent with this idea, we found that we recruited two categories of volunteers. Nearly 54% of our volunteers reported having firsthand experience with people with IDDs (with 42% reporting having little to none) and 49% had previously socialized with people with IDDs (42% had not). (Figure 2A and 2B).
Many adults with IDDs participate in jobs and sports, but we hypothesized that most neurotypical people may not be aware of these activities and potential of adults with IDDs. Again, consistent with our hypothesis, we found that 47% of volunteers were aware that they had met an adult with IDDs with a job, 40% were aware that they knew a person with IDDs who played sports, and only 30% had experienced people with IDDs being included in their school classes (over 50% of our volunteers reported that they had likely not for each question) (Figure 2C, 2D and 2E). Despite many volunteers having little experience with people with IDDs, we found that motivations for volunteering often involved a desire for helping and understanding people with IDDs (Supplemental Figure 1).

**College volunteers reported LLWF as a convenient and enjoyable experience that bolstered their professional interests**

In another portion of the post-course survey, volunteers were asked questions regarding enjoyment and the accessibility of volunteering with LLWF. We found that over 94% of surveyed volunteers enjoyed socializing with adults with IDDs, and almost all reported that the time, day, and duration of the course were convenient (Figure 2F, 2G, and 2H). When asked if they wanted to volunteer in future courses, 98% responded “Definitely Yes” (Figure 2I). When analyzing our volunteer signup system that dates to 2016, we found that we held a high volunteer retention rate, with 63% of volunteers returning for subsequent semesters (n = 470) even though there was no requirement to re-enroll. We also found that 32% of volunteers signed up for more than one course on different topics in the same semester. Because many of our volunteers are in the later stages of their undergraduate career, a natural phase out of the program is expected. Throughout our 12 years of operating LLWF, we have recruited and retained especially dedicated and enthusiastic volunteers who have volunteered for multiple classes each semester, stayed within LLWF for several years, or have transitioned to instructors for LLWF. Affectionately termed as “super volunteers”, LLWF has greatly benefited from these consistent and passionate volunteers.

We were interested in determining if volunteering with LLWF had positively influenced or intensified volunteers’ interest in fields of study related to IDDs, such as medicine, education or research. We included an optional free-response section on our post-class survey that asked volunteers if LLWF had any impact on their professional aspirations. We found that many students further developed their interests in medicine, education, and research by incorporating diverse perspectives and their positive experience volunteering (Supplemental Figure 3).

**LLWF raised college volunteers’ expectations of adults with IDDs**

We wanted to determine if volunteering in LLWF courses had changed volunteers’ expectations of adults with IDDs. Despite the bimodal distribution in terms of prior experience shown in Figure 2, we found a unimodal response with nearly all (98%) of students responding that the course had changed their expectations of people with IDDs (n=109) (Figure 2J). We hypothesized that volunteers with little experience with people with IDDs would predictably raise their expectations after meeting students in our program because they had likely not met many adults with IDDs participating in challenging and age-appropriate activities, like working at a job,
playing in sports, and participating and learning in sophisticated topics in a college classroom. For the group of volunteers that had prior experience with people with IDD, we hypothesized that their expectations still changed possibly because LLWF encourages adults with IDDs to learn sophisticated academic topics that are typically aimed at neurotypical adults, which is unique compared to most adult special education programs. To test these two hypotheses, we asked follow-up questions regarding volunteers' change in expectations, represented in the table below (Supplemental Figure 2). Many discussed surprise about being able to relate with students with IDDs, or were impressed that adults with IDDs were able to participate meaningfully during class.

DISCUSSION

An important outcome of LLWF is the benefits the STEM volunteers receive. The opportunity to meet and befriend adult peers with IDDs may benefit their careers by galvanizing IDDs-focused research and care or inspiring them to actively seek experience with neurodiverse groups. Common STEM volunteer opportunities, such as shadowing a physician or working within marginalized communities, can be passive learning, time-intensive, require off-campus transportation, and interfere with the demanding class schedule of college students. Competitive pre-medical and STEM students with career-related motivations for resume-building can capitalize on LLWF serving as a convenient and interactive experiential diversity training experience located in the heart of campus. UT students often use LLWF as a mandatory sanctioned voluntary activity for their for-credit classes, such as the education course “Individual Differences” and an upper-level neuroscience lab course about neurogenetics. Additionally, volunteering in programs such as LLWF satisfies the growing interest in implementing diversity, equity, and inclusion principles to diversify medical and STEM fields [34]. DEI training can be an important force for reducing health care disparity, improving patient outcomes, and reducing the communication barrier between scientists and physicians with the general public [35,36].

Volunteering in programs like LLWF may help establish a much-needed dialogue between STEM students and neurodivergent audiences. By fostering students’ interpersonal communication, it encourages a more balanced STEM education experience through incorporating diverse perspectives and liberal arts teaching methods [37–39]. By design, college STEM training often lacks integration of liberal arts and humanities, which may limit STEM students’ ability to adopt different pedagogies and delivery methods to relate to others outside of their field. It is the responsibility of aspiring physicians, researchers, and educators to have strong communication skills to foster the public understanding and appreciation of science [40]. Many assume that STEM experts in their field should naturally be able to communicate well to a layperson audience, but the increasing specialization, conventions of academic publishing and presentations, and lack of formal communication training result in the ever-growing gap between scientists and the public [41,42]. Effective communication in science requires training and ample practice. DEI programs like LLWF incorporate diversity perspectives by engaging college students with people with IDD, encouraging them to share university space and begin practicing accommodating communication styles, satisfying equity and inclusion ideals. Serving as class peers and providing one-on-one support to adults with IDDs allows volunteers to practice effective ways to communicate with an atypical audience.
The limited contact between students with and without disabilities throughout schooling has likely led to negative attitudes towards the inclusion of students with IDDs in academic settings. Studies have shown that young students with limited contact are more likely to 1) perceive students with IDDs as more impaired than reality, 2) believe that students with IDDs should only participate in nonacademic classes, and 3) avoid social interaction with a peer with IDDs, particularly outside of school [25,26]. Moreover, the “intellectual disability” label, while chosen to replace prior offensive terms, still conveys low ability and interest to learn sophisticated subjects [43]. Without meaningful exposure to people with IDDs, these negative stereotypes and low expectations of people with IDDs learned through most American school systems and societies have limited opportunity to be rectified [44,45]. An opportunity for encouraging exposure and inclusivity is missed by the exclusion of peers with IDDs in formal education settings. Despite the growing movement for inclusive learning [46], many people with IDDs remain segregated to special education classrooms, often with restrictive academic curriculum and limited exposure to neurotypical peers [47–50]. By design, postsecondary education options that are historically aimed at neurotypical students have been generally inaccessible to adults with IDDs. Although the development of organizations, including Think College, are connecting more adults with IDDs with opportunities for inclusive higher education, many adults with IDDs have limited options to be included in age-appropriate college settings without having to be largely independent, technology savvy, or to have consistent access to transportation [51].

Greater attention is needed regarding post-high school outcomes and quality of life for adults with IDDs. Many adults with IDDs have limited chances for social interaction, poor vocational options, lower rates of postsecondary education involvement, and lack of transportation [52,53]. Compounding factors, such as financial hardship, lack of consistent and quality IDDs-trained staffing, and poor community support likely contribute to the often unfortunate professional and social outcomes for adults with IDDs [54]. Improving social networks for people with IDDs has far reaching benefits. For instance, expanding social personal networks of people with Down syndrome can mitigate cognitive decline and the development of Alzheimer’s disease [55]. Many IDDs-transition specialists suggest that coordination with either postsecondary education institutions or local agencies that provide employment support can provide bridges to a more self-determined and secure future [52,53,56]. LLWF presents opportunities for adults with IDDs to make adult friends, pursue their interests in formal higher education settings, and encourage inclusion and advocacy among neurotypical peers. In the future, we hope to determine to what extent LLWF has directly improved post-high school outcomes and quality of life for adults with IDDs in a longitudinal study.

Factors to initiate, sustain and replicate LLWF

The successful initiation and development of LLWF over a decade ago relied on six key factors:

1. A founder or director with the passion and drive to develop a program that provides a college-level education to adults with IDDs
2. A sponsor for the program to take place
3. Instructors, preferably with experience in special education or IDDs services
4. College students interested in volunteering as class peers
(5) Adults with IDDs and their caretakers interested in postsecondary education options

We found that there are benefits of having a tenure-track professor initiate LLWF on our university campus. A tenured professor may have access to reserve classrooms on campus, such as conference rooms and science labs, that an outside instructor or non-tenure track professor may not. Professors also may more easily recruit peer professors, graduate students, and postdocs to serve as guest lecturers, which help fortify learning in our courses. In turn, college professors may use initiation of a similar program to LLWF as an impactful outreach project in education and science grants (e.g. National Science Foundation, Beckman Foundation, and Howard Hughes Medical Institute). If potential program founders have family members with IDDs, then they may also gain additional assistance from their support organizations by providing a more compelling personal account to develop the program when communicating to people unfamiliar with IDDs.

Replicating our program may be particularly successful if done in collaboration with the school’s neuroscience department, as there is rapid expansion of neuroscience undergraduate programs. As a tenure-track professor in the neuroscience department, our program founder was well-positioned to recruit STEM undergraduate students interested in volunteer opportunities. Because conditions like ASD, Down syndrome, Williams syndrome and many other IDDs directly impact neurodevelopment and function, neuroscience students interested in cognitive development and function have the unique opportunity to experientially learn about these disorders directly from adults with IDDs. We attribute much of our success in recruiting and retaining volunteers due to the rapid growth of majors relevant to IDDs study and service. From 2017 to 2022, neuroscience represented one of the fastest growing majors at UT with a growth rate of 50% (about 750 to over 1100 students). Additionally, outreach to similar IDDs support organizations in Texas, such as Down Syndrome Association of Central Texas (DSACT), Autism Society of Texas, Adults Independent and Motivated (AIM), and Best Buddies, have helped advertise LLWF to potential students in and outside of Austin.

Continuation and adaptation of LLWF during Covid

In response to the global COVID-19 pandemic, LLWF pivoted to offer virtual courses for the first time beginning in the spring semester of 2020. Since its inception in 2010, LLWF exclusively operated as an in-person program hosted on UT campus. Due to CDC protective guidelines and university closure, LLWF discontinued in-person courses in consideration of adults with IDDs in spring 2020. Adults with IDDs are considered a high-risk group for COVID-19 secondary complications, exhibiting 11 times higher odds of dying from COVID-19 in the first two months of the pandemic compared to non-disabled people [57,57]. For example, people with DS in general often exhibit a higher prevalence of respiratory tract infections and immune dysregulation, which makes them especially susceptible to serious complications and potential mortality from COVID-19 [58–60]. Additionally, many adults with IDDs live within residential group homes or with elderly family members, which presents the additional threat of community-based spread [61–64]. To mitigate the spread of infection, many adults with IDDs became homebound, with limited opportunities to socialize and participate in the community. Unlike many neurotypical people their age, people with IDDs are often less technology-savvy and...
participate less on social media platforms and online based communities, further limiting their means of socialization beyond live-in family members for the duration of the pandemic [59,65–70].

Although switching to an online format was done out of necessity, the transition proved to be a serendipitous opportunity for LLWF to expand. For the first time, students and volunteers far from Austin were able to join our program, with volunteers and students from over 11 states and 22 universities now regularly attending courses to date. Since the successful implementation of a hybrid alternate online or in-person format in late 2020, LLWF has offered a greater number of courses offered per year and reached more students with IDDs and LLWF volunteers than ever before (Figure 2K, 2L and 2M). From interactions with new adults with IDDs and their families, we also found that an option for virtual PSE is especially attractive to those who are wheelchair bound, have limited access to transportation, or live in smaller areas without many IDDs services. For instance, students who are bedbound due to muscular dystrophy have participated in our online courses using eye-directed communication software. Additionally, the online format encouraged adults with IDDs to become more technology-savvy, with many adults with IDDs now comfortable navigating Zoom online classrooms, performing independent internet searches, creating basic PowerPoint presentations, and utilizing online resources like YouTube for educational purposes. Given that Covid and related illnesses will continue to circulate and present greater risk to certain adults with IDDs and their families, bolstering in-person courses with an online option may represent a working strategy to replicate programs like LLWF at additional colleges.

Limitations

Although an important mission of LLWF is to provide volunteers the opportunity to witness adults with IDDs be afforded the dignity to take courses on mature topics like their college peers, we found that many families were reluctant to enroll their students with IDDs in certain course topics that they reported seemed controversial, complex, or too mature. Courses that were popular with neurotypical college students, such as “Psychology of Science Fiction”, “Fun with Science: Viruses”, “Fun with Cultures: World Religions”, and “Art of Frida Kahlo” often received below the minimum enrollment requirement from adults with IDDs (6 students). Nevertheless, we succeeded in securing better enrollment on some courses with mature topics by later re-marketing them with more lighthearted titles and descriptions in later semesters. For instance, a course originally focused on business and marketing gained better enrollment in subsequent semesters when rebranded as the more palatable “History of Walt Disney”, and a course on intimacy and consent was retitled as “Romance in the Movies”. We also merged previously unsuccessfull drier topics, such as math or etiquette, under course topics with a more fun context. For example, whereas math and etiquette were unpopular courses, we found that a “It’s My Party!” course that combined these topics was popular since students worked together to budget and plan a catered banquet in the UT Tower.

When LLWF originated on UT campus over a decade ago, we struggled at times to achieve societal acceptance and buy-in from the university to host an inclusive education program on campus. Some administrators and university services were reluctant to support LLWF because
several university policies inadvertently created barriers to the establishment of LLWF on campus. For instance, policy dictates that many campus rooms and equipment are reserved for exclusive use by undergraduates in certain majors, but not to the public outside of the university. While basic policies like this are important to the general protection of university spaces, they inadvertently restrict adults with IDDs from integrating into typical college settings unless they have strong ties to an in-group advocate. To gain university buy-in, we reframed our requests, explaining that our program primarily benefits university students by teaching them about disabilities. Conversely, certain organizations off campus, such as restaurants and some guest lecturers were not interested in our program if we advertised ourselves as mostly helping college students. To surmount this problem, emphasizing that our program benefits students with IDDs spurred their involvement. These problems and solutions demonstrate how LLWF’s reverse-inclusion format can offer an unexpected strategy to gain wider buy-in. Better understanding of the impact of LLWF can be achieved through further evaluations. Because the authors are involved with LLWF, future studies by outsider participants with either expertise in continuing education or scientific outreach programs would be valuable.

CONCLUSION

LLWF presents a new way to add to inclusive education options on campus, while providing a valuable experiential volunteering activity that instills core principles of DEI training in college students. Providing more opportunities for inclusive higher education not only improves social and professional outcomes of adults with IDDs, but also can encourage a more inclusive society by improving the expectations and impressions of people with IDDs. Inclusive education (IE) programs on neurotypical college campuses, like LLWF, benefit both neurotypical and students with IDDs alike. IE programs encourage neurotypical students to learn alongside students with IDDs, improve their academic communication skills, and enhance societal acceptance of people with IDDs. IE programs like LLWF may be readily implemented at other higher education institutions to enhance inclusivity in academic settings and provide a valuable platform for neurotypical students to befriend and learn alongside adults with IDDs.

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| Crime Scene Investigation (CSI): Forensic Science | Have you ever wondered how professionals are able to track down criminals from just a few items? & details from a crime scene? & Come explore the basics of crime scene investigation by learning about different evidence collection techniques and looking inside the minds of famous movie super villains and real criminals. | 1. Become familiar with common forensic science skills for evaluating crime scenes effectively.  
2. Introduce famous forensic psychology terms, e.g. the Rorschach inkblot test and the MacDonald trial.  
3. Gain a better understanding of the criminal justice system and how it may affect those with disabilities. | Students enjoyed湿-lab demonstrations of fingerprint lifting and blood spatter analysis to learn and practice common CSI techniques. For example, students used various common crime scene weapons, such as hammers and blunt objects, to create different profiles of blood spatter.  
Students learned about the concept of competency to stand trial and how criminal investigations affect people with and without IDDs from a forensic psychologist guest. |
| Seeing is Believing: Optical Illusions | Have you ever heard the phrase “I can’t believe my eyes”? Well, maybe you shouldn’t! Our eyes and brain appear to be tricked by the seeming magic of optical illusions, but actually provide clues to how our brain is designed to work. Come explore how optical illusions fool us. | 1. Learn about and identify different parts of the human visual system.  
2. Gain an understanding of properties of the visual system that impact our daily lives, e.g. color blindness, depth perception, and motion sickness.  
3. Learn about how optical illusions inspired art. | Students participated in group activities, such as taking a color blindness test and going on a virtual museum tour of optical illusions in art. Students also did in-class, at-home demos where they viewed their own retinas and found their blind spots. Students also enjoyed hearing from a guest presenter who shared his experience of living with color blindness. |
| Fun with Science: Dangerous Animals | Animals are not just cute and cuddly - some are outright dangerous. Here, we will learn fascinating facts about some of the most dangerous animals including fanged snakes, sharks, and crocodiles. Aside from these popular predators, we will also learn about dangerous poisonous cone snails, shocking electric eels, and deadly mosquitoes. | 1. Learn about the most common unexpectedly dangerous animals.  
2. Understand how dangerous animals use their abilities to attack and defend in their natural habitat.  
3. Learn that dangerous animals underappreciated behavioral strategies. | Guest experts visited the class virtually to share their research, e.g. Dr. Bruce Jayne on tree climbing snakes, Dr. Lindy McBride on human-influenced evolution of mosquitoes, Dr. Daphne Soares on how alligators detect ripples in water to attack prey, Dr. Ashley Rowe on scorpion-eating mice, and Dr. Harold Zakon on powerful tricks deployed by electric eels. Students worked in groups to design their own dangerous animal species inspired by real animals discussed in class. |
| Stop Motion Animation | Let’s bring your ideas to life! Over the six-week course, students will brainstorm ideas and write short stories or make music videos. Everyone will create artwork to be used, and collaboratively edit and sound track their work. The course will culminate in a showcase of the physical materials created and the work produced. | 1. Learn about the various stages of production using stop motion animation.  
2. Practice writing and producing short animation stories.  
3. Become familiar with common software and stop motion production services for beginners. | Students enjoyed demo videos of stop motion animation utilizing different materials, such as paper, clay, and 3D objects. Students then began scripting their individual stories, developed their storyboard, and created the additional artwork with various art mediums needed for the complete animation story. The students final project, which was a culmination of the 6 weeks class work, can be viewed here: UT Informal Classes - Stop Motion Compilation. |
| The Wonders of Space | Are you curious about what exists beyond Earth? Have you ever wondered about our planetary system? Come on a journey through space to the outer spiral of the Milky Way galaxy. Become an astronaut who takes an in-depth look into the planets in our Solar System. | 1. Gain a comprehensive understanding of astronomers and astronauts and how their discoveries informed us about outer space.  
2. Become familiar with the planets in our solar system and classify them based on their characteristics. | Students enjoyed in-class demos on solar system phenomena, such as how rockets propel via explosion, how planets rotate, and how the rings on planets move. Each class engaged in interactive activities, such as constructing a solar system wall visual or playing educational games, like bingo, for vocabulary acquisition. Students also enjoyed virtual presentations from the McDonald Observatory from astrophysicists and an in-class visit by a rocket scientist. |
| Fun with Science: You and Your Genes | Why do some people have their mother’s nose or their father’s chin? Or why do some people have freckles run in families? Our genes are our bodies’ instruction manual and can influence everything from how tall we are to whether or not we think cilantro tastes gross. Here, we’ll learn how our genes make us who we are! | 1. How traits are inherited  
2. A gene is made up of a portion of DNA that is carried on chromosomes.  
3. We all have variation in our genes that accounts for some of our individual differences.  
4. We can inspect our own genetic sequence to infer information about our traits and ancestry. | Students isolated DNA from their cheek cells in our science lab. Students modelled the genetic cycle, chromosomes, and genes using Play-Doh. Chromosomal segregation and recombination were modeled by moving, cutting, and splicing long patterns strips of paper in the classroom. We secured a reduced rate for interested students to participate in personal genetic analysis using 23andMe. One class member with IDD who had been adopted shared how discovering their ancestry affected them. |
| Fun with Science: Alzheimer’s Disease | Among your elderly friends and relatives, you probably know someone who is suffering with Alzheimer’s disease (AD). In this course, students will learn about the history of AD, how it may be caused and treated, as well as help a research lab in searching for a cure to this devastating disorder with hands-on lab experiments. | 1. Understand symptoms, potential causes, and treatments for AD.  
2. Learn how researchers model AD using a simple animal model and screen for potentially beneficial therapeutic compounds with lab activities. | Students heard from and interviewed caretakers for individuals with AD. Students learned which part of the brain is susceptible to degeneration by handling a real preserved human brain with gloves. Students visualized degeneration of fluorescent neurons in a nematode model of AD and screened two dozen drugs for neuroprotective effects based on Sae-Lee et al., 2020 [23]. Students worked in groups to visualize key molecules in AD (e.g. A-beta, TAU, microtubules) by constructing healthy and AD neurons using Play-Doh. |

**Fig 1. Previous LLWF science courses.** LLWF courses include a range of sophisticated academic material typically covered at universities.
Prior Experience with People with IDDs (A-E)

- **A.** n = 131
  - Any firsthand experience with people with IDDs?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **B.** n = 132
  - Have you ever socialized with people with IDDs?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **C.** n = 132
  - Have you met an adult with IDDs with a job?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **D.** n = 132
  - Have you met a person with IDDs who played sports?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **E.** n = 132
  - Were people with IDDs included in your school classes?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

Enjoyment and Convenience of LLWF (F-I)

- **F.** n = 109
  - Did you enjoy socializing with the adults with IDDs?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **G.** n = 109
  - Was the time and day of your course convenient?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **H.** n = 109
  - Was the duration of the course convenient?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

- **I.** n = 109
  - Would you want to volunteer in future classes?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

Changed Expectations (J)

- **J.** n = 109
  - Did the course change your expectations of people with IDDs?
  - Yes
  - Somewhat
  - Neutral
  - Somewhat
  - No

Program Growth (K-L)

- **K.**
  - Number of LLWF Students with IDDs
  - COVID-19 Pandemic
  - LLWF exclusively in-person format
  - Hybrid format

- **L.**
  - Number of LLWF Volunteers
  - COVID-19 Pandemic
  - LLWF exclusively in-person format
  - Hybrid format

Fig 2. Pre- and post-course survey responses of volunteer participants and program growth over time. Prior to volunteering with LLWF, volunteers responded to several questions regarding their prior experience with people with IDDs (A-E). In post-course surveys, volunteers were asked to rate enjoyment and convenience of LLWF volunteering (F-J). In another portion of the post-course surveys, college students were asked if their expectations of people with IDDs changed after volunteering with LLWF (I). LLWF has utilized slightly different versions of pre-class surveys as the program has expanded, which accounts for the variation in sample sizes across survey results. LLWF course and enrollment numbers since its inception in 2010 were analyzed to measure program growth over time (K-M).