

The Impact of Service-Learning on Undergraduate Awareness and Knowledge of Autism Spectrum Disorder

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Abstract

As the prevalence of autism spectrum disorder (ASD) rises and individuals with ASD seek community inclusion, there is a great need for community awareness and knowledge of ASD. This study aimed to address this need using service-learning pedagogy to increase undergraduate students' awareness, knowledge, and perception of ASD. Two cohorts of undergraduate students ($N = 44$) enrolled in a course that required 30 hours of hands-on community service with individuals with ASD in addition to 3 hours per week of in-class participation. Based on students' responses to a pre- and postcourse survey as well as their open-ended case study responses, service-learning pedagogy has the potential to improve undergraduate student awareness, knowledge, and acceptance of ASD. Lessons learned and recommendations for future research are discussed.

Keywords: service-learning, autism, autism spectrum disorder



The prevalence of autism spectrum disorder (ASD) has increased over the past three decades; now 1 in 59 children are diagnosed with ASD (Baio et al., 2018). While children and youth with ASD are in child care and school, a number of professionals interact with them routinely (e.g., teachers, service providers, healthcare professionals). However, as young people with ASD seek higher education, employment, and community inclusion in adulthood, they will also interact with others in the community such as those in business, retail, recreation, and entertainment. Unfortunately, adult outcomes for people with ASD are quite poor in areas such as employment and social inclusion (Howlin et al., 2014). As more people are diagnosed with ASD, the need increases for community awareness, knowledge, and acceptance of individuals on the autism spectrum in order to improve adult outcomes. Additionally, the reauthorization of the Higher Education Opportunity Act (2008) provides more opportunities for students with intellectual

disabilities, including ASD, to attend college and become involved in the campus community (VanBergeijk & Cavanagh, 2012). Therefore, university students are increasingly likely to encounter peers with ASD on campus as well as in their future professional and social lives. Increasing awareness, knowledge, and acceptance of ASD at the undergraduate level may improve adult outcomes for people with ASD by creating peer allies within the community who are comfortable with befriending, employing, socializing with, and coworking with people on the spectrum. This study explores the utility of service-learning pedagogy to increase awareness, knowledge, and acceptance of people with ASD in undergraduate university students.

Professional Perceptions of People With ASD

Presently, the absence of standards for professional education on the topic of ASD creates vast variability in knowledge, awareness, and perception of ASD within and

across professional disciplines. In a study of over 200 teachers in the United States, Chung et al. (2015) found that the teachers were more likely to report dislike and avoidance of a student with ASD described in a classroom scenario relative to a scenario about a more typically developing student. Elementary school teachers and teachers who held special education certifications were more likely to demonstrate positive and inclusive attitudes toward students with ASD. Similarly, Park and Chitiyo (2011) surveyed 127 teachers and found that though the majority of teachers reported positive attitudes toward students with ASD, the teachers most likely to report a positive attitude toward students with ASD were female, under age 56, teaching elementary school-aged children, and had received professional development related to ASD. Teacher attitude toward students has been found to influence the success of autism interventions in the classroom (Gregor & Campbell, 2001), as well as inclusion of students with ASD in regular education classroom settings (Horrocks et al., 2008). Furthermore, teacher attitude sets the tone of the classroom and may impact how other children in the class perceive peers with disabilities. Thus, it is critical that aspiring classroom teachers and other professionals who will likely work with children and youth with ASD receive education to increase their awareness, knowledge, and acceptance of people with ASD.

Very few studies have surveyed healthcare professionals' knowledge of ASD. Golnik et al. (2009) surveyed nearly 3,000 primary care physicians for children with ASD and found that physicians reported lower perceived self-competency in treating patients with ASD. Physicians further reported a greater desire for continuing education in the area of ASD relative to treating children with chronic medical conditions and those with other developmental disabilities. Predictors of higher physician report of self-competency included having a greater number of patients with ASD, having a friend or relative with ASD, and having previous training on the topic of ASD. Unfortunately, level of physician knowledge of ASD in adult healthcare providers is similarly low. In a survey of over 900 physicians, most reported a lack of knowledge and skills needed to care for adults diagnosed with ASD (Zerbo et al., 2015).

Female students in various health and social professional degree programs (i.e., occupational therapy, speech-language pathology, social work, education, nursing) were surveyed about their attitudes toward working with people with ASD (Werner, 2011). Many students reported negative attitudes regarding the perceived difficulty of working with patients with ASD, but also some positive attitudes related to the potential reward of working with this population. Negative attitudes from preprofessional students raise concerns because these attitudes may cause them to avoid working with people with ASD once they are employed (Curl et al., 2005). In a survey of 67 speech-language pathologists across the United States, Schwartz and Drager (2008) found that although ASD was addressed in their clinical training, the majority of respondents reported that they would have benefited from additional education and training related to ASD. Most of the speech-language pathologists surveyed had accurate knowledge about the characteristics of ASD, but many of them reported a lack of confidence in providing services to this population. Both Werner (2011) and Schwartz and Drager (2008) highlighted the importance of improving education for students who are likely to work with individuals with ASD. They further suggested hands-on experiential and interprofessional learning experiences as ideal means of providing this education.

Community Perceptions of People With ASD

Huws and Jones (2010) conducted semistructured interviews about ASD knowledge and awareness with 10 lay community members. They reported that people may have strong beliefs about ASD, yet these beliefs are not always factually correct and may not be based on any actual experience with individuals who have ASD. Chambres et al. (2008) drew similar conclusions based on their work using an experimental paradigm. They asked adults to rate the behavior of a 6-year-old child as problematic or not. Responses were more positive when the raters were told that the child had ASD, suggesting that such knowledge may be enough to change one's attitudes.

Within community settings, including school, adolescents with ASD are more likely to be bullied and victimized than their peers. Furthermore, the greater their deficits in perspective taking, the more likely

they are to misinterpret bullying as nonbullying (van Roekel et al., 2010). Sreckovic et al. (2017) demonstrated preliminary efficacy for using a peer network intervention to reduce bullying and victimization of high school students with ASD, indicating that peer education and experience with individuals with ASD may be an important element in reducing bullying.

College Students' Perceptions of People With ASD

As stated previously, in recent years, increasing numbers of young adults with ASD are attending college; however, their experiences are not ideal. Many college students with ASD do not graduate (Sanford et al., 2011). Research suggests that this may be a result of bullying and social exclusion of these students (Gelbar et al., 2014). In addition, the complexity of college, including varying daily schedules, class times, and class styles may lead to incompleteness (Kapp et al., 2011). One probable cause of these negative experiences may be other students' and faculty members' lack of awareness of ASD itself (Gillespie-Lynch et al., 2015). As a result, researchers are beginning to examine college students' perceptions regarding their peers with ASD.

Tipton and Blacher (2014) recently surveyed a Southwestern campus community and reported overall ASD knowledge to be relatively high. Undergraduates scored significantly lower than graduate students and faculty, though some faculty also demonstrated limited knowledge. In addition, the authors found misconceptions among those surveyed, including that although most survey responders recognized that ASD is increasing in prevalence, many attributed the cause of the increase to vaccinations. Gillespie-Lynch et al. (2015) also identified misconceptions among university students, such as confusing ASD with other learning disabilities. The researchers suggest that these misconceptions could impact the experience of college students with ASD. Not surprisingly, research has described that those with family members with ASD demonstrated increased knowledge and were more open to having peers with ASD (Nevill & White, 2011; Tipton & Blacher, 2014). In another study, Butler and Gillis (2011) reported that behaviors associated with autism, as opposed to the diagnostic term "autism" itself, resulted in university students viewing their peers with ASD as

"different." This finding is promising in that providing behavior supports and intervention to individuals with ASD early in their school careers may help them to become more socially skilled and successful by the time they get to college (VanBergeijk et al., 2008). Gardiner and Iarocci (2014) identified that undergraduate students' acceptance of and willingness to volunteer with individuals with ASD was best predicted by both the quality and quantity of their previous experiences with people with ASD. Those students with a greater number of positive experiences were more accepting and willing to volunteer. In order for individuals with ASD to succeed in college, it is crucial that their peers be informed, aware, and accepting of ASD.

Effective means to inform undergraduate students about ASD are being explored. One example is an online training that has been used with some success to increase knowledge and decrease stigma associated with ASD among undergraduates (Gillespie-Lynch et al., 2015). Other researchers have explored a course focused on disability and its impacts on undergraduate students (Bialka & Morro, 2017). These researchers documented that educating students on ableism, including content that focused on students' own "ability privileges," led to increased student knowledge and awareness of disability and their ability privilege. As suggested by Huws and Jones (2010), direct interaction with individuals with ASD may be an effective means of increasing awareness. Although a few studies have focused on promoting awareness and understanding of disability (e.g., Bialka & Morro, 2017; Gillespie-Lynch et al., 2015), there is a need for more hands-on experiences to further apply knowledge and develop acceptance. One way to gain more hands-on experience is through engaged scholarship through service-learning.

Applying Service-Learning With Undergraduates

Service-learning is a pedagogical practice promoting active learning for students. Its overall goal is to connect classroom content to real-world experience while partnering and engaging with the community. This is accomplished via engaged scholarship with members of campus communities creating collaborative partnerships with community organizations that are relevant to the course content. Students then complete service-

learning hours at one of these community organizations with a focus on meeting both the organization's needs and the students' learning objectives. Students are able to reflect upon their real-world experiences and apply the content in the course.

Service-learning differs from clinical practicum or internship as a pedagogical tool. According to Baldwin et al. (2007), service-learning experiences are focused on community experiences, mutual decision-making, and providing services that are priorities for community partners, whereas practica or internships are more focused on practicing the skills needed to perform a particular job. Service-learning can assist students in the application of their content knowledge, as well as in the development of skills in individualizing and addressing diverse needs and priorities of individuals with disabilities and their families. These real-world experiences are often more meaningful to students than content knowledge alone, while at the same time benefiting the local community (Carrington & Sagers, 2008; Chen, 2003).

Service-learning has been beneficial in increasing students' civic responsibility, academic abilities, and life skills (Astin & Sax, 1998). When service-learning was conducted as part of an academic course, Astin and Sax (1997) discovered that the students were more committed to their communities, had a better understanding of community problems, were more prepared for future careers, and were better at conflict resolution. Able et al. (2014) found that a service-learning course for future early childhood educators led to an increased awareness of family diversity and how varying backgrounds may influence child success and parent involvement. Moreover, longitudinal studies have suggested that the positive effects of service-learning courses are enduring and include an increased sense of self-awareness, better relationships with others, and increased openness to new experiences (Jones & Abes, 2004). Similarly, Fenzel and Peyrot (2005) described that alumni who participated in a service-learning experience as part of their undergraduate career had better attitudes toward personal and social responsibility and were more involved in community service and service-related careers. Though some of these studies use service-learning to promote acceptance of and experience with people with disabilities, there is scant literature on courses with a

focus on inclusion of individuals with ASD. To our knowledge, there is a gap in the literature related to service-learning application in undergraduate settings for increasing acceptance and awareness of individuals with ASD.

Present Study and Gap in the Literature

There is a need for greater understanding of ASD in the campus community, especially as more students on the autism spectrum are attending college. Service-learning has been shown to promote students' awareness, knowledge, and acceptance; therefore, it may be a beneficial pedagogy to apply in relation to the ASD population. The present study addressed this gap in the literature by applying service-learning to an ASD course for undergraduates and reporting on the results of a survey conducted at the start and end of the course. Two primary research questions were addressed: (a) To what degree do undergraduates change their knowledge of ASD after taking an autism-focused service-learning course? (b) To what degree do undergraduates change their perception of ASD after taking an autism-focused service-learning course?

Method

The course was offered as a one-semester course for two academic years and enrolled two cohorts of students. In spring 2016, 19 students were enrolled in the course, and in spring 2017, 25 students were enrolled (total $N = 44$). Students were required to complete 30 hours of community service during the semester at one of the course community partner organizations in addition to attending the class 3 hours weekly. Course content was presented in modules with specialist guest speakers from the university and community in a seminar format designed to highlight a variety of topics in ASD across the life span (see Table 1 for class topics). Assignments consisted of reflection papers integrating course content with community placement experience, an interview about community inclusion with an ASD professional or family member, a group presentation on an evidence-based practice related to ASD, and a paper about how a popular aspect of media (e.g., movie, article, TV series, political speech) represents ASD to the community. Course learning objectives were as follows:

- Identify core symptoms of autism spectrum disorder, recognizing that these symptoms are expressed uniquely in individuals and are subject to change over the life span or with intervention.
- Describe how individuals with autism spectrum disorder and their families may face challenges in accessing school and community supports and strategies through which they may overcome those challenges.
- Explain how interdisciplinary professionals in school and community settings support individuals with autism.
- Discuss the importance of evidence-based practices in treating individuals with autism spectrum disorder.
- Reflect on personal interactions with individuals who are diagnosed with autism spectrum disorder.
- Consider how schools and communities can implement inclusive attitudes and practices for individu-

als with developmental disabilities such as autism spectrum disorder.

Course community partners included (1) a camp program offering services for individuals with ASD and their families across the life span, (2) a high school transition-to-adulthood program designed to prepare participants for a computer coding career both socially and technically, (3) one of two early intervention placements that was offered to each cohort: a clinic-based toddler intervention program or a clinic-based toddler intervention research study. Students were matched with a community placement based on ranking their interest in each placement, scheduling, and experience with individuals with ASD (i.e., early intervention community partners required more experience from volunteers).

This study was approved by the Institutional Review Board (IRB), and students were informed of their rights as participants and consented to participation. Students were also told that grading was not indicative of their participation in the study and all information they provided would be deidentified and anonymous. All of the students in both classes consented to participate in the study.

Table 1. Class Topics for EDUC/SPHS 400: Autism in Our Communities: An Interdisciplinary Perspective

Module 1: Introduction to Autism and Early Child Development
Course overview: Introductions What is ASD?
History of autism Community perception of autism and developmental disability Person-first language discussion
Ethics and professionalism: Introduction to our community partners
Early signs of autism
Module 2: Assessment and Diagnosis
Intro to screening and assessment of ASD
Language & social communication
Sensory and motor features
Restricted, repetitive interests and behaviors Sex differences
Psychiatric and medical comorbidities

Table continued on next page

Table 1. Class Topics for EDUC/SPHS 400: Autism in Our Communities: An Interdisciplinary Perspective Continued

Module 3: Family Perspective
Parent and sibling panels
Cultural perspective
Module 4: Interdisciplinary Roles
Assessment and treatment clinic teams
School teams
Early intervention teams
Module 5: Intervention
Evidence-based practice
Parent training programs
Comprehensive treatment models
Alternative treatments
Module 6: Transition and Adulthood
Outcomes in ASD
Postsecondary education
Postsecondary employment
Housing
Transportation
Relationships and sexuality
Module 7: Community Integration
Community activities and accessibility
Religion and spirituality
Self-advocate panel
Group reflections and wrap-up

Recruitment and Eligibility

All undergraduate students at The University of North Carolina at Chapel Hill were eligible to enroll in the course. A course flyer was created and posted in classroom buildings across campus as well as shared with student organizations, including groups consisting of students interested in learning more about ASD (e.g., Autism Speaks U, Best Buddies, preprofessional student organizations). After students enrolled in the course, they were eligible to participate in the study. High school students seeking course credit at the university were excluded due to high interest in the course from full-time undergraduate students. Students requesting to audit the course were also excluded, as they would not be participating in the

service-learning component and therefore unable to fully contribute to class discussion and meet course learning objectives.

The class size was capped at 20 students for Year 1 and 25 students for Year 2, with the goals of effectively meeting (1) the needs of service-learning as a teaching practice and (2) volunteer need at the community placements. Students for the first year enrolled in the course first come, first served. Twenty students enrolled as a cohort in Year 1; one dropped the class prior to the first class, and no students on the waiting list were able to fill the seat. At the end of the semester, more than 90 students were on the waiting list. These students were notified about potential enrollment the semester prior to the second year of the course.

Based on needs communicated by community partners, students who were male or spoke more than one language (e.g., English and Spanish) were selected first from the waiting list, followed by those who had been on the waiting list the longest. Twenty-five students enrolled as a cohort in Year 2 in the class and in the study.

Participants

Participants in this study were undergraduate students enrolled in an autism service-learning course at The University of North Carolina at Chapel Hill. The majority of students in both cohorts were White females. This gender imbalance is not surprising given that women are overrepresented in professions involving work with individuals with disabilities, such as education (National Center for Education Statistics, 1987–2016a, 1987–2016b), psychology (American Psychological Association, 2015), and speech-language pathology (Rowden-Racette, 2013). The students in Cohort 2 were slightly older than those in Cohort 1 because many of the students who were wait-listed for Cohort 1 as first-year

students or sophomores were enrolled in Cohort 2 as upperclassmen. One student in each class cohort self-identified as having a diagnosis of ASD. There were no significant differences between cohorts on any demographic variables. Student demographic information is presented in Table 2, including age, year of school, major, gender, and race/ethnicity.

Data were collected on student majors, minors, and career aspirations on the first day of class. Most students reported multiple majors or minors. Psychology was the most common major for students in both cohorts (*N* = 7 for each cohort), followed by exercise sport science (Cohort 1, *N* = 4; Cohort 2, *N* = 7). Exercise sport science was the most common reported major for students pursuing careers in occupational therapy, whereas students pursuing careers in speech-language pathology or audiology tended to major in psychology and minor in speech and hearing sciences. Cohorts also included some students enrolled in the human development and family studies major through the School of Education (Cohort 1, *N* = 5; Cohort 2, *N* = 3), which is

Table 2: Cohort Demographics

	Cohort 1 n = 19	Cohort 2 n = 24
<i>Age at beginning of semester (Years)</i>		
Range	18–22	19–27
Mean (sd)	20.47 (1.07)	21 (1.77)
Gender: Female <i>n</i> (%); nonbinary <i>n</i> (%)	17 (90%); 1 (5%)	21 (87%); 0 (0%)
<i>Race n (%)</i>		
White	17 (90%)	22 (92%)
African American	1 (5%)	–
Asian	1 (5%)	1 (4%)
Mixed race/other	–	1 (4%)
<i>Class Year n (%)</i>		
First year	1 (5%)	–
Sophomore	3 (16%)	4 (17%)
Junior	8 (42%)	10 (42%)
Senior	7 (37%)	9 (37%)
Unknown	–	1 (4%)

designed to prepare students for careers in education or allied health. Cohort 2 included more science majors and students pursuing medical degrees than Cohort 1 (Cohort 1, $N = 2$; Cohort 2, $N = 7$). This difference may have reflected the change from hosting the course in the School of Education to the Department of Allied Health Sciences from Year 1 to Year 2. It could also be attributed to word-of-mouth from students in related fields.

Not all students were seeking degrees in fields directly related to working with individuals with ASD. One student in each cohort (one business major and one mathematics major) did not plan to work in the ASD field. Some students, particularly underclassmen, expressed general interest in the ASD field but no particular career preferences at the time they started the course. The most common reason that students reported for taking the course was to “gain knowledge and experience for future career” (Cohort 1, $N = 19$; Cohort 2, $N = 23$).

Survey Methods

A survey was conducted at the beginning and end of the semester to assess students’ change in knowledge, confidence, and understanding of ASD as a result of the service-learning course. Students were not given advance warning that the survey would be distributed. They were encouraged to answer honestly and to the best of their ability because the surveys would be used to improve future sections of the course and inform others about service-learning courses like this one. There was minimal performance pressure since students completed the surveys anonymously and were reminded that their responses and participation in the research survey had no impact on their grade. The survey took 10–20 minutes to complete.

To address Research Question 1, the survey included a quantitative portion consisting of 20 statements. Students were directed to select one of three answer choices: “True,” “False,” or “Don’t know.” These items were based on (1) a general ASD knowledge survey that had been used successfully to measure change in ASD knowledge in faith-based community leaders and members following a day-long ASD workshop and (2) key concepts pulled from each of the course syllabus modules (see Table 1). Students responded to 10 statements regarding student confidence about their knowledge of ASD

(e.g., “I am confident in my knowledge of post-high school education opportunities for students with ASD”) and implementation of that knowledge (e.g., “I am confident in my ability to interact with someone with ASD”) using a 4-point scale (*strongly disagree, disagree, agree, strongly agree*), with a fifth option of “Don’t know.” The questions from this survey can be viewed in the Results section.

To address Research Question 2, qualitative data were collected from a case example that was included on the survey given to students before and after the class, to obtain their perception of ASD and whether that perception changed as a result of the course. The case study centered on Rob, a college student with ASD, and his preferences, interests, and activities while attending a university. The scenario described difficulties Rob experienced with other students being loud and moving things around in the study lounge. The questions following the case study were (a) whether participants had experience with students like Rob at their university, (b) how Rob is similar to and/or different from other students they have met during college, (c) what might be happening when Rob feels distressed, and (d) a request for suggested actions to take to prevent future frustrations. Students wrote answers to these questions, and all student answers from the pretest and posttest were typed verbatim and coded with the use of qualitative software (ATLAS.ti; Muhr, 2004). Codes were developed in a continuous, constant comparative approach to allow for constant revision and recoding as new ideas emerged; they were then used to develop themes both within and between the pretest and posttest data (Marshall & Rossman, 2016; Saldana, 2016). The pre- and post-case study responses for Cohort 1 and Cohort 2 were coded separately and then compared and contrasted to identify any changes in student perception. These changes, which we refer to as themes, were observed in both cohorts.

Results

Responses to Research Questions

Research Question 1: *To what degree do undergraduates change their knowledge of ASD after taking an autism-focused service-learning course?* The 20 true/false knowledge survey questions were analyzed by calculating a total score for each student at each time

point. “Don’t know” responses were counted as incorrect for the purpose of analyses. A mean total score was calculated for each cohort at each survey time point. Mean survey scores were analyzed using *t*-tests to determine differences in mean scores from pretest to posttest for each student cohort. Cohort 1 ($n = 19$) demonstrated significant differences in mean total survey scores from pretest to posttest (pretest mean = 12.63; posttest mean = 16.05; $t = 5.14$, $p \leq .01$). Cohort 2 ($n = 25$) showed very similar changes in mean score and significant differences from pretest to posttest (pretest mean = 12.88; posttest mean = 16.28; $t = 6.59$, $p \leq .01$). Since there were similar changes in both cohorts and groups were not significantly different on any demographic variables, the cohorts were combined ($N = 44$) and mean differences were still significant (pretest mean = 12.77; posttest mean = 16.18; $t = 8.39$, $p \leq .01$).

The 10 Likert scale items examining confidence levels of knowledge and implementation (Table 3) were analyzed by calculating a mean total score for each item at pretest and posttest for the two cohorts combined. “Don’t know” responses were omitted (i.e., counted as missing data) from these analyses because it was not possible to ascertain the degree to which the student felt confident. Based on chi square test results, significant changes occurred in mean confidence ratings for all survey questions except Question 7: “I am considering a career in working with individuals with Autism Spectrum Disorder.” About a quarter of the students responded “Don’t know” for this question. There were also several ($n = 6$) “Don’t know” responses for the question about confidence in being able to identify a young child who is at risk for ASD, although most students indicated that they were confident that they had the most up-to-date information about the early signs of ASD and that they could explain that information to friends and family by the end of the course.

Research Question 2: To what degree do undergraduates change their perception of ASD after taking an autism-focused service-learning course? The qualitative written student responses to each of the case study questions focusing on Rob, the college student with ASD, on the pretest and posttest were typed, uploaded, and coded using ATLAS.ti software. Student responses were coded using one level of descrip-

tive codes specific to each question such as “Difference: Has Few Friends” and “Solution: Rob May Use Headphones.” Codes were then analyzed, compared, and contrasted using a constant comparative method to determine themes that illustrated changes in student perceptions from pretest to posttest. Specifically, the frequency of responses was analyzed to determine whether more or fewer students responded in a certain way following the course.

Cohort 1 data were coded first, and those codes were applied to the coding process of Cohort 2, with a few novel codes added for Cohort 2, including “Distress Caused On Purpose.” Four themes related to changes in student perception between pretest and posttest responses stood out as most noteworthy: (1) increased involvement of Rob in the solution, (2) decreased separation of Rob, (3) increased awareness of sensory processing differences, and (4) increased education about Rob. A summary of these themes with quoted student responses at pretest and posttest is provided in Table 4.

Summary of Student Responses by Case Study Question

Experience With Students Like Rob. Student responses in regard to whether they had experience with students like Rob at the university were quite variable. In Cohort 1, the number of students who answered “yes” to this question increased from pretest to posttest, and the number of students who answered “yes” decreased slightly in Cohort 2. Some students noted that they had experience with someone like Rob, but not within the university, and these answers were coded as “somewhat.”

Rob’s Similarities to and Differences From Other Students. Students across both cohorts noticed similarities with other students at the university regarding Rob’s hobbies, interests, and academic aspirations. These views of similarities did not change between pretest and posttest. Students also reported differences between themselves and Rob, including Rob’s reporting that he does not need friends. Students also highlighted that he is different in his lack of desire to be social and participate in social activities. One student reported: “He is similar in that he seems focused on schoolwork but different in the way he talks about friends. Most people at UNC tend to find some type of niche that they make friends in.” Much as with similarities, there was little differ-

Table 3: Results of Quantitative Survey (N = 44)

Survey question	Number of “Don’t know” responses	Precourse mean	Postcourse mean	Chi-square test results
1. I am confident that I could identify a young child who is at-risk for ASD.	6	2.45	3.19	$X^2 (3, N = 82) = 30.60, p \leq .01$
2. I feel that I have the most up-to-date information about the early signs of ASD.	2	2.05	3.45	$X^2 (3, N = 86) = 83.19, p \leq .01$
3. I am confident in my knowledge of post-high school education opportunities for students with ASD.	1	2.02	3.36	$X^2 (3, N = 87) = 80.75, p \leq .01$
4. I am confident in my ability to interact with someone who has ASD.	2	3.39	3.75	$X^2 (2, N = 86) = 10.32, p \leq .01$
5. I am confident about my knowledge of treatments that can help people with ASD.	2	2.17	3.27	$X^2 (3, N = 86) = 66.17, p \leq .01$
6. I know where to find accurate resources for people with ASD and their families.	2	2.40	3.48	$X^2 (3, N = 86) = 51.04, p \leq .01$
7. I am considering a career in working with individuals with Autism Spectrum Disorder.	9	3.40	3.51	$X^2 (3, N = 79) = 3.71, p \leq .29$
8. I am confident in my ability to explain the characteristics of individuals with ASD to friends and family.	1	2.74	3.73	$X^2 (3, N = 87) = 39.18, p \leq .01$
9. I am knowledgeable about the types of early intervention services for children with ASD.	0	2.27	3.39	$X^2 (3, N = 88) = 65.23, p \leq .01$
10. I am knowledgeable about the types of services and supports students with ASD receive while enrolled in school.	2	2.29	3.34	$X^2 (3, N = 86) = 57.43, p \leq .01$

ence between comments on the differences between Rob and other students between pretest and posttest.

What Might Be Happening When Rob Feels Distressed. Both cohorts attributed Rob's distress to his dislike of noise and need for routines and consistency. One important theme observed across cohorts from pretest to posttest included an increased awareness of sensory processing differences (see Table 4). This was observed in both cohorts, although more so in Cohort 1. Cohort 2 appeared to have a greater understanding of sensory processing coming into the course, which may be the result of many of the students in Cohort 2 having medical-related majors, suggesting that they may have had prior exposure to neurological concepts such as sensory processing. Although it should be noted that some of the concepts of challenges related to sensory processing such as Rob's dislike of noise and disruption of routines were present in pretest responses, many students adjusted their answers to integrate sensory-specific terminology.

Actions to Prevent Future Frustrations. Many of the most interesting findings from this case study arose from the final question regarding what actions students would take to prevent future frustrations for Rob. A theme emerging from both Cohorts 1 and 2 indicated their increased appreciation for full inclusion of students with ASD. The first theme that was observed in both cohorts was "Increased involvement of Rob in the suggested actions to prevent future frustrations" (Table 4). Students went from solutions that focused on taking control themselves (e.g., telling the RA, telling the group what to do) to more inclusive ideas such as facilitating a conversation between Rob and the group. Although some students included Rob in the solution in their pretest answers, the number of students who included Rob in the solution at posttest increased substantially across both cohorts.

Aligning with the increased involvement of Rob in the solution and full inclusion of Rob, a theme among suggestions for preventing future frustration that was observed in Cohort 1 was "Decreased separation of Rob." A few students suggested a solution of Rob studying alone in the pretest, and no students suggested that in posttest. Thus, students seemed to understand that separating Rob and excluding him from the group is also not an effective solution. Interestingly,

none of the students in Cohort 2 suggested that Rob should study alone, although students in Cohort 2, both pretest and posttest, did suggest taking Rob elsewhere if he becomes agitated.

Another significant theme observed in the final question for Cohort 1 included an increased number of students who suggested "Educating others about Rob" as a solution in the posttest versus the pretest (see Table 4). Though there was not an observed increase in Cohort 2, a high number of these students suggested this at both pretest and posttest.

Discussion

Our findings uniquely fill a gap in the literature on service-learning pedagogy as a means to teach undergraduate students knowledge about and acceptance of individuals with ASD. The results support and build upon previous research on service-learning and its effects on perception of individuals with disabilities and families from diverse backgrounds (Able et al., 2014). Revisiting the research questions addressed in the present study, our findings suggest that the service-learning pedagogy increased students' knowledge relative to ASD (RQ1) and perceptions of ASD (RQ2), thus supporting the idea that gaining hands-on experience in partnership with community providers may enhance student learning. The service-learning experience may have contributed to increased student confidence because students were able to apply their knowledge and skills in real-world settings. This may be beneficial both to students themselves as they continue in their education and move into careers where they will inevitably encounter individuals with ASD, and to individuals with ASD, who will likely experience a stronger sense of acceptance and inclusion from students who participated in the service-learning course. Furthermore, the students who participated in the service-learning experience may be more likely to include individuals with ASD in decision making and solution generation.

Our findings additionally support service-learning as a means to educate students specifically about ASD and as a means to increase students' confidence in their ability to share this knowledge about ASD with others in the community. Specific quantitative and qualitative findings from our survey of the students are further described.

Table 4: Main Themes Development From Responses to Case Study Questions

<i>Theme</i>	<i>Definition</i>	<i>Pretest Quotes</i>	<i>Posttest Quotes</i>
Increased involvement of Rob	Relating to students' comments to have Rob be part of working out solutions to prevent future frustrations	Maybe I could speak to the group about not moving the furniture when they congregate in the lounge. Put up a sign asking students to not move the furniture.	I would attempt to facilitate a relationship between Rob and the other students so he could express his concerns to them himself next time Discuss both with Rob and the group the other side's perspective and help reach a compromise.
Decreased separation of Rob	Comments about pulling Rob out of the group situation to study alone	If available, I would have Rob check out an individual study room. It would be helpful to create a schedule of times when Rob can use the lounge by himself and make the agreement that whoever uses the lounge will put furniture back in place before they leave.	Perhaps some students could talk to the RA about having a dorm-wide meeting that discusses respecting the preferences of students with special needs.
Increased awareness of sensory processing	Comments about Rob's distress being caused by differences in sensory processing	It's because of the noise and movements of the people there.	With a diagnosis of autism, Rob has problems with sensory processing. It is likely that the increased auditory stimuli are overwhelming to Rob.
Educating others about Rob	Comments about helping other students understand Rob and ASD	Ask them to stop moving furniture as much and talk a little quieter.	Tell the group about autism and Rob, talk to Rob and the group about schedules and Rob's routines.

Quantitative

Results from the survey indicated that students in both cohorts increased their knowledge and awareness of ASD following participation in the course. This is particularly important as ASD has increased in prevalence and, as a result, students will likely be in contact with individuals with ASD in their education, careers, and social lives. Therefore, these students' increased abilities to understand, accept, and include individuals with ASD may benefit society as a whole.

Students in the course also reported increased confidence in their ability to recognize and interact with individuals with ASD and, perhaps equally important, to explain ASD to others in the community. These acquired skills could be very beneficial in the workplace. Students who participated in the course may be able to educate co-workers about an individual with ASD and suggest supports and resources to assist the individual with ASD, leading to a more productive working environment.

Qualitative

The results from the qualitative case study analysis similarly suggest that students learned about the importance of inclusion of individuals with ASD, in addition to learning about symptoms associated with ASD. As noted in the results, there were some discrepancies in students' reports of experiences with other students with ASD at the university (i.e., in Cohort 1, the number of students reporting that they had experiences increased from pretest to posttest, and in Cohort 2, the number of students reporting experiences decreased). Perhaps as a result of gaining knowledge and awareness of ASD, students in Cohort 1 began to recognize more similarities among their peers to the student in the case study. On the other hand, as a result of gaining knowledge and awareness of ASD, students in Cohort 2 found that those peers who they thought were similar to the student in the case study prior to starting the course, actually were not. Alternatively, these differences may have been random variation across groups.

The course content included an overview of sensory processing. As a result, students indicated an increased understanding of sensory processing difficulties for individuals with ASD. More students used this terminology in their posttest case study

responses, which reflects that they learned that actual neurological processes may underlie Rob's discomfort with noise and change.

The importance of inclusion of individuals with ASD in society as a whole was the focus of the course and many of the writing assignments. The most noteworthy theme in the case study analysis was that of increased inclusion of Rob in the solutions generated to reduce his frustration. Both cohorts suggested (more at the posttest than at the pretest) that Rob himself should be included in finding a reasonable solution. These results suggest that the students gained an understanding of the importance of including individuals with ASD in decision making and solution generation and that they were able to apply that knowledge to the case study with Rob. This concept is further reflected by the students' decrease in responses that suggested Rob study alone.

In concordance with including Rob in the solution, students' recognition of the importance of educating others about Rob is a relevant finding. With the exception of one student who suggested that the group who was bothering Rob may be disruptive on purpose, most students recognized that the group is likely unaware of Rob's differences and his ASD diagnosis. With a focus on community inclusion and acceptance, the students appear to have learned from the course that awareness of ASD, and ensuring that the community and other students are aware of ASD, are important steps. Furthermore, it appears that, following the completion of the class, students were confident in their own ability to educate others about ASD, which could have a tremendous impact in their future careers and contributions to society.

In sum, students who participated in the ASD service-learning course reported increased knowledge about underlying sensory processing differences in individuals with ASD, awareness of the importance of including individuals with ASD in making decisions about what might work best for them, and understanding of the importance of educating others about ASD in order for individuals with ASD to be fully included in the community. These findings contribute to our understanding about the importance of ASD education and training with undergraduate students.

Limitations

This research study has a few limitations. Most data were student reported and were collected in a classroom setting. Although students were told that their answers would not affect their grade, some of the answers they provided may have been influenced by awareness that their professors would be reading them. This is especially relevant to the open-ended questions following the case study. Although the data included two cohorts of students, the sample size was small and all students attended the same university, which limits the generalizability of the data. Results of this study would be strengthened by collecting data from students who did not enroll in the course to serve as a comparison group to the two cohorts of students in the course. Moreover, the majority of students in the course indicated prior interest or experience with ASD and related disabilities before enrolling, so their pretest answers may reflect that knowledge.

Recommendations for Future Research

Future research to better understand service-learning and its impact on undergraduate students' knowledge, acceptance, and awareness of ASD is needed. Studies could include a focus on in-depth analyses of students' and community partners' lived experiences as participants in the course and their service-learning experiences. Future individualized interviews or focus groups conducted with students and community partners may help provide this information.

Furthermore, findings from this study can aid in the development of an assessment tool for community members to capture understanding, acceptance, and attitudes toward individuals with ASD. More and more individuals with ASD are participating in the community, so a means to assess community perceptions may be warranted.

In turn, these assessments could provide information on ways to better include individuals with ASD and develop future training for community members.

Longitudinal and follow-up studies should be conducted with students as an effort to determine whether changes in attitude and acceptance persist long term. It would be interesting to follow up on where students find careers in the future and how they interact with people with ASD. This follow-up information may additionally include surveys given to future employers to assess whether employers also perceive that students who completed this course are inclusive of individuals with ASD and other developmental disabilities.

Conclusion

Service-learning pedagogy has potential to improve student knowledge and perception related to individuals with ASD. Especially for aspiring educators and therapists, having experience working with and interacting with individuals with ASD in a service-learning course could ease perceived challenges reportedly faced by new teachers and therapists working with young children with ASD (Chung et al., 2015) and increase positive perceptions of students with ASD by all teachers (Park & Chitiyo, 2011). This is particularly relevant for aspiring physicians, who have also reported less competency in working with individuals with ASD (Golnik et al., 2009). Physicians will undoubtedly continue to encounter individuals with ASD in their practice, and participation in the service-learning course appears to better prepare them to work with these individuals. All in all, our findings suggest that service-learning is a viable and effective approach to increasing undergraduate students' knowledge and perception of ASD and individuals with ASD.



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