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Effects of an employer-based intervention on employment outcomes for youth with significant support needs due to autism

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Abstract

The purpose of this study was to develop and investigate an employer-based 9-month intervention for high school youth with autism spectrum disorder to learn job skills and acquire employment. The intervention modified a program titled Project SEARCH and incorporated the use of applied behavior analysis to develop Project SEARCH plus Autism Spectrum Disorder Supports. A randomized clinical trial compared the implementation of Project SEARCH plus Autism Spectrum Disorder Supports with high school special education services as usual. Participants were 49 high-school-aged individuals between the ages of 18 and 21 years diagnosed with an autism spectrum disorder and eligible for supported employment. Students also had to demonstrate independent self-care. At 3 months post-graduation, 90% of the treatment group acquired competitive, part-time employment earning US$9.53–US$10.66 per hour. Furthermore, 87% of those individuals maintained employment at 12 months post-graduation. The control group's employment outcomes were 6% acquiring employment by 3 months post-graduation and 12% acquiring employment by 12 months post-graduation. The positive employment outcomes generated by the treatment group provide evidence that youth with autism spectrum disorder can gain and maintain competitive employment. Additionally, there is evidence that they are able to advance within that time toward more weekly hours worked, while they also displayed increasing independence in the work setting.

Keywords

applied behavior analysis, autism, autism spectrum disorder, employment, positive behavior support, Project SEARCH, transition to adulthood

For most individuals with autism spectrum disorder (ASD), graduation from high school represents a time of worry with few future options and a lack of hope for college or post high school employment (Wehman et al., 2014a). Adolescents with autism aging out of high school are unemployed and underemployed at higher rates than other similar disability groups (Howlin et al., 2013; Newman et al., 2011; Roux et al., 2013; Schall et al., 2014; Shattuck et al., 2011). Unfortunately, for the most part, they remain unemployed, underemployed, or chronically change low-wage jobs through adulthood (Cimera and Cowan, 2009; Cimera et al., 2012; Henninger and Taylor, 2013; Schall et al., 2014; Shattuck et al., 2011, 2012). Furthermore, families, individuals with ASD, health care professionals, and educators are unclear about their future with limited employment options on the horizon (Holwerda et al., 2012; Schall et al., 2013, 2014; Shogren and Plotner, 2012; Watson et al., 2013; Wehman et al., 2014a).

While this situation is likely to grow in intensity due to the increasing prevalence of ASD, few intervention studies have addressed this tremendous treatment need (Buescher et al., 2014; Hansen et al., 2015). Recent reviews of the literature have found weak evidence for vocational interventions that demonstrate employment outcomes (Nicholas et al., 2015; Taylor et al., 2012). To date, there has been a

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collection of single subject to small quasi-experimental and experimental studies that research the efficacy of discrete interventions designed to strengthen adaptive or weaken maladaptive behaviors associated with ASD for high-school-aged students and young adults (e.g. Dogoe et al., 2011; Gentry et al., 2010, 2012; Hillier et al., 2007; Lattimore et al., 2006; Mechling and Seid, 2011; Smith et al., 2014; Southall and Gast, 2011). None of these, however, specifically provide for a replicable, high-quality, evidence-based approach that directly culminates in competitive employment. Thus, more high-quality studies are required to meet the needs of youth with ASD who seek employment upon graduation from high school. This should result in the development of a model that can be implemented for youth and young adults with ASD that leads directly to a "real job."

Therefore, it was the purpose of this study to design and implement an intervention over a 5-year period for four annual cohorts of individuals with significant impact of ASD that would lead to competitive employment. More specifically, this study sought to provide a transition to employment intervention for individuals with ASD who did not access the general education curriculum because of significant cognitive, academic, and behavioral challenges. This study was designed using a randomized clinical trial (RCT). This RCT had two aims to address this research gap. First, the research team modified an existing high-school-to-work, employer-based intervention for individuals with developmental disabilities. This approach was modeled after Project SEARCH to meet the extensive social communication and behavioral needs of high school youth with significant ASD who sought competitive, community-based employment upon graduation. This article presents the extension of a previously published preliminary result paper that explored the impact of this intervention with youth with ASD. This article includes additional subjects and one additional data point. In so doing, this article extends findings from the previous paper by documenting the effects of the intervention on employment retention (Daston et al., 2012; Wehman et al., 2013, 2014b). Second, the research team subjected this modified intervention, Project SEARCH plus Autism Spectrum Disorder Supports (PS-ASD), to randomized experimental conditions to assess the effect of this model on employment outcomes for youth with ASD. The research questions guiding this study were as follows.

1. What supports are necessary for youth with ASD to acquire community-based competitive employment?
2. What supports are necessary for youth with ASD to maintain community-based competitive employment?
3. What is the effect of PS-ASD on employment outcomes for youth with ASD?
4. What is the effect of PS-ASD on work independence for youth with ASD?
5. What is the effect of PS-ASD on employment retention for youth with ASD?

Preliminary results from this study were previously reported (Wehman et al., 2014b). This study extends the previous findings by the inclusion of additional participants and the extension of data collected from 3 months post intervention to 1 year post intervention. By adding the additional data point, we are able to report the effect of PS-ASD on participants' employment retention up to 12 months after graduation. Findings related to employment retention are important to review as individuals with ASD are noted to display chronic unemployment after short employment experiences (Wehman et al., 2014a).

Methods

This RCT was a collaborative effort between the university, the state vocational rehabilitation (VR) agency, a local community rehabilitation provider (CRP), and a public local education agency (LEA). The university staff supervised the implementation of the research, collected and maintained all data, and provided overall leadership in the implementation of this research. VR participated in recruitment and provided funding through its regular funding streams (separate from grant funding) for supported employment for all participants. The CRP provided trained job coaches for implementation of internship supports. Finally, the LEA assisted in recruitment and provided educational staff for the implementation of the model in the treatment condition (also separate from grant funding). This study was approved for implementation by two institutional review boards: one from the university where the study took place and one from VR. In addition, the study was approved by the local school division's office of research prior to the initiation of any study activities. The study is registered at clinicaltrials.gov Identifier: NCT02360332.

Participants and settings

Between August 2009 and September 2012, 54 individuals with an ASD diagnosis between the ages of 18 and 21 years were enrolled into the "PS-ASD" model (treatment condition) or high school as usual (control condition). These individuals were recruited in each year across 4 years to create four cohorts recruited independently of each other. Those individuals accepted into the study received the treatment or control condition for 1 school year following entry into the study. Data were collected between August 2009 and July 2014.

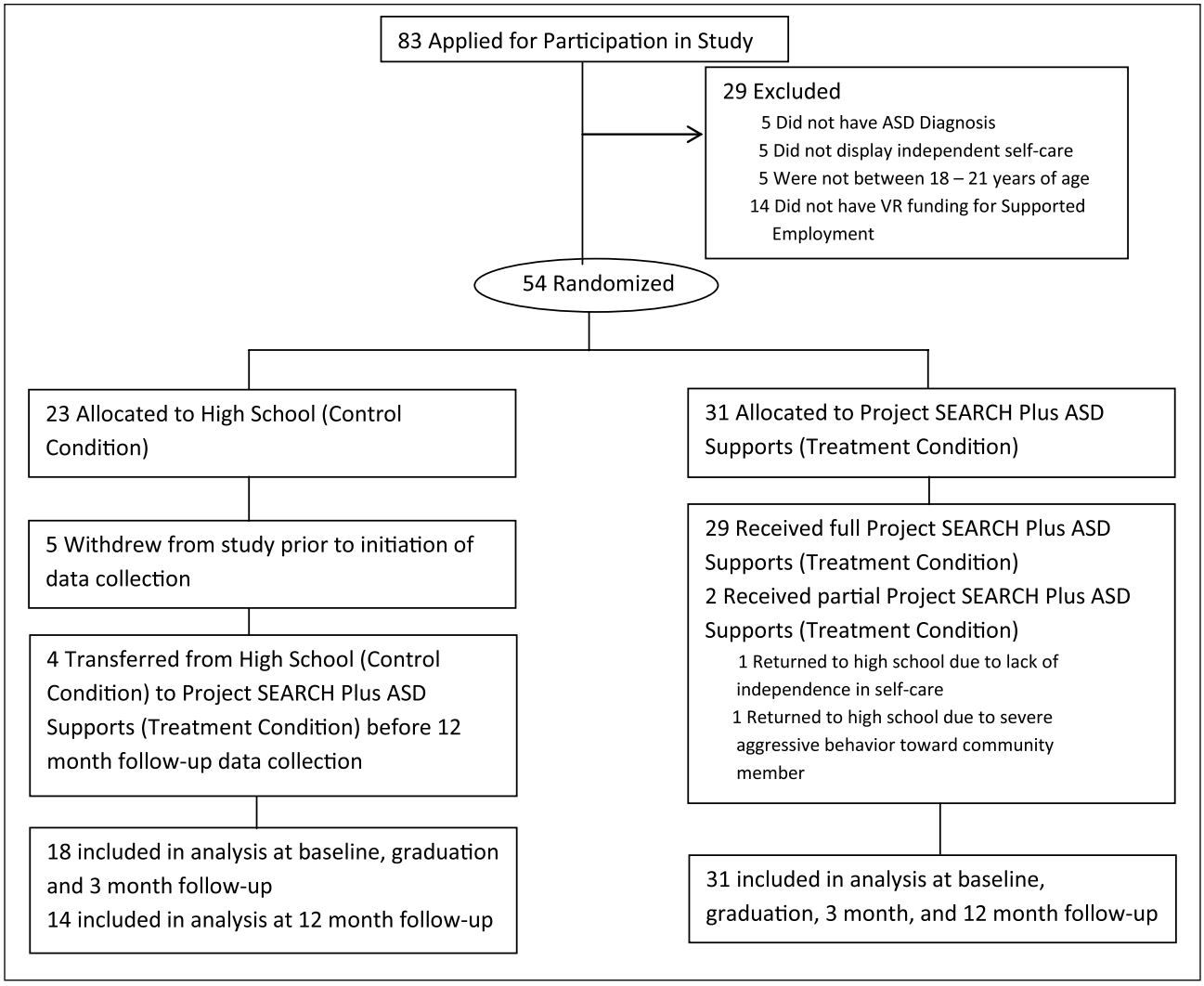

Figure 1. Flow of participants through the study.

The inclusion criteria were as follows: (1) being a student in the local public school where the research was being conducted, (2) having an ASD medical diagnosis and/or educational eligibility, (3) being between the ages of 18–21 years, (4) displaying independent self-care, (5) being able to provide consent or assent, (6) having funding for supported employment through VR, and (7) having continued eligibility for public school educational services in the coming school year. The ASD diagnosis was accepted from a previous medical diagnosis by a qualified health care provider and/or the identification of autism as a primary or secondary disability category on the individual's Individualized Education Plan (IEP). Figure 1 shows the flow of participants through the study.

All students in the control condition attended high school for the full school year in which they participated in the study. Five of the control group participants dropped from the study prior to data collection. This resulted in a total of 49 students. All students in the treatment condition attended PS-ASD in place of attending high school. Our treatment and control groups were discrete. We did not employ a wait list control group method. Nevertheless, some participants who were randomized into the control condition elected to reapply to the program in the following year in the hope that they might be randomized into the treatment condition. Of the five individuals who reapplied following a year in the control condition, four were randomized into the treatment condition and one was randomized into the control condition at the second application.

Procedure

Potential participants were contacted and provided study information through three different means including informational flyers with an application attached, informational letters from the school district personnel, and an in-person informational meeting each of the 4 years in which

participants were recruited between 2009 and 2012. Interested individuals then submitted an application that was completed either by themselves, a family member on their behalf, or a teacher with permission from a family member. They were also interviewed in-person to assess their match for the study and confirm their meeting the inclusion criteria. All individuals who applied completed consent or assent at their interview. In cases where students were not able to fully participate in the interview due to a lack of communication abilities, team members followed up with an observation of the student in their classroom. Due to the data collection procedures related to the Support Intensity Scale (SIS) interview, it was not possible to complete a blind review of the outcomes. Specifically, interviewers had to contact interview respondents to set up data collection. Those interview respondents had to be familiar with the individual and have supported them regularly. Thus, data collectors had to know which team members to include in the interview resulting in revealing the location where supports were provided.

Intervention conditions

PS-ASD. The treatment condition for this RCT was a full school year (September through June) of intervention in a program called "PS-ASD" (Wehman et al., 2013, 2014b). Project SEARCH is an intensive 9-month job training program where youth with developmental disabilities in their last year of high school are embedded in a large community business such as a hospital, government complex, or banking center (Daston et al., 2012). Students with developmental disabilities who participate in this model rotate through three 10–12 week internships within the business where they log approximately 720 h of internship time learning marketable skills while receiving supported employment. They also get 180 h of classroom time at the business for a total of approximately 900 h embedded in the business setting. In addition to these important training components, Project SEARCH requires collaboration between multiple community partners to support students in attaining employment upon completion of the program. Collaborations include students with developmental disabilities and their family, a LEA, a local CRP, the state VR, and a host business.

For this study, the Project SEARCH model was modified by adding additional supports for individuals with ASD. The Project SEARCH model includes a loose set of guidelines for the curriculum. In order to modify the program to meet the needs of youth with ASD, we increased the structure and intensity of the learning experiences by ensuring the use of applied behavior analytic (ABA) techniques, in addition to increasing the specific social communication skills needed for success at work. The ABA techniques used included the use of scored task analyses for teaching multistep tasks, structured repeated trials for discrete tasks, behavioral rehearsal for specific social skills, visual and self-directed prompting procedures for transitioning, self-management procedures for behavioral challenges, and reinforcement for appropriate behavior. We also found it necessary to assist individuals with ASD to understand common work statements in behavioral terms. For example, we behaviorally defined, then taught youth to demonstrate behaviors associated with the phrases "act professional," "take the high road," and specific workplace values such as integrity, compassion, and trust. Additionally, we collected regular data and adjusted instructional and behavioral plans based upon the regular review and analysis of data. Finally, when a student displayed problem behavior, we completed functional behavior assessment and implemented behavior intervention plans to address the challenging behavior (Wehman et al., 2013). Finally, we frequently used customized employment as a method to analyze workplace tasks and identify those tasks most suited to the strengths of the interns with ASD (Wehman et al., in press). Table 1 shows how the methods used were adjusted and the skills addressed were increased to meet the needs of youth with ASD.

These supports resulted in the implementation of a successful array of educational strategies designed for the PS-ASD model.

In addition to educational supports in the classroom portion of this model, participants also received supported employment during the internship portion of the model. Supported employment uses a four-phase process to assist job seekers with significant disabilities in achieving stability in competitive community-based employment. Those four steps are as follows: (1) job seeker profile, (2) job development, (3) job site training, and (4) long-term supports (Schall et al., 2015; Wehman et al., 2012). Supported employment is a highly individualized approach that meets the needs of the job seeker based upon an ongoing data collection and on-site observation process. Supported employment also allows for long-term follow-along services in the fourth phase of the model. This is a particularly important aspect of the model for youth with ASD who have significant support needs. The four phases of supported employment are described below.

1. Job seeker profile: the individual with disabilities works with a job coach to complete various community-based assessments and determines their personal job goal. The goal is specific to the type of work, work conditions, and amount of time worked per week.
2. Job development: during this phase of supported employment, the individual with disabilities works with the job coach to apply for employment and complete interviews. This phase of supported employment continues until the individual secures or ceases their search for employment.

Table 1. Critical components of PS-ASD employment intervention.

Activity	Project SEARCH guidelines for skills and tasks	PS-ASD methods used	Team leader
Getting to and from the program via regular transportation (bus, car, etc.). Time varies based upon location	Preparing for day at work Reading bus schedule Occupying time Scheduling personal transportation	Task analysis Prompting Visual schedules Modeling	VR case managers, family, intern
Classroom orientation and preparation for the day, approximately 1.5 h daily	Accepting correction from supervisor Greeting co-workers Solving work-related problems Calming self when frustrated Reviewing workplace-specific expectations and social skills Identifying job skill strengths and needs Practicing behavioral self-monitoring Practicing specific job skills Communicating with customers Developing a resume Attending a job interview	Task analysis Structured repeated trials Behavioral rehearsal Group instruction Modeling (live) Video modeling Differential reinforcement of alternative behaviors Functional communication training Prompting Social narratives Social skill training Redirection Technology-aided instruction Visual supports	Teachers and instructional assistants
Structured internship rotations in business, approximately 4 h daily	Completing specific job tasks Transitioning between tasks Solving work-related problems Accepting supervisor and co-worker feedback Regulating and monitoring personal behavior Interacting with customers, co-workers, and supervisors Requesting assistance Following workplace procedures and rules Following personal work schedule Maintaining professional dress and demeanor Navigating the workplace campus safely and efficiently Managing work materials and equipment safely and efficiently Reporting work issues to supervisors	Antecedent-based job and task structure Differential reinforcement of alternative behaviors Extinction Functional behavior assessment Functional communication training Modeling Naturalistic instruction Peer-mediated instruction (by co-workers and supervisors) Prompting Positive reinforcement Redirection Scripting Self-management Social narratives Social skills training Task analysis Technology-aided instruction and intervention Time delay Video modeling Visual supports	Job coaches (CRP)
Business development, training, and marketing, 4–8 h weekly	Providing general disability awareness to business employees Providing specific disability awareness regarding particular intern needs to specific internship departments Marketing interns to new departments Marketing interns for open jobs in the business Training co-workers to be internship mentors Meeting with departments to develop internship sites and tasks Coordinating with business to meet business needs	Adult learning and teaching strategies Visual schedules and supports Marketing material distribution Sales strategies highlighting intern assets Differential reinforcement of supportive staff behavior Ecological inventory Task and environmental structuring	Job coaches (CRP)

PS-ASD: Project SEARCH plus Autism Spectrum Disorder Support; VR: vocational rehabilitation; CRP: community rehabilitation provider.

3. Job site training: the job coach works closely with the individual to learn the job skills, perform the job to the employer's satisfaction, and demonstrate all expected job behaviors and social skills. The

individual remains in this phase of supported employment until the employee is able to be independent in their job for 80% or more of their work hours per week.
4. Long-term supports: individuals enter this phase of supported employment when they consistently receive on-the-job support by their job coach 20% or less of their work hours per week.

Due to the significant support needs that these youth presented, they all qualified for supported employment services. As such, the goal of competitive community-based employment included the provision of long-term supports during their employment (Wehman et al., 2013).

Treatment condition staffing. Staff members from PS-ASD sites received additional training and consultation in the needs of transition-aged youth with ASD. Specifically, they received additional training and coaching in the implementation of the supports described in Table 1. Furthermore, most Project SEARCH sites for those with developmental disabilities have a staffing ratio of approximately three interns to one staff member. In this replication, it was necessary to increase that staffing ratio to two/two-and-a-half interns to one staff member.

High school condition. Students assigned to the control condition continued in their regular high school special education program as determined by their IEPs. Typically, such plans include an array of related services including special education, one-on-one instruction, and behavior management from a paraprofessional assistant, speech and language therapy, occupational therapy, social skills training, and limited vocational training. Students in the control group also had access to VR services like those in the treatment group.

Hypothesis

The hypothesis guiding the design of data collection procedures in this study was individuals who participate in PS-ASD will demonstrate (1) a higher rate of employment, (2) earn higher wages, (3) work more hours weekly, and (4) demonstrate higher independence at work than those in a typical high school program.

Measures

Enrollment into study. In addition to providing basic information regarding the applicant's needs, the application also provided demographic information for the research team. Demographic data collected from each participant's application included age, gender, race, medical diagnosis, IEP disability category, behavioral health needs (including the use of any psychotropic medications), and prior unpaid and paid employment experiences. We did not collect intelligence quotient (IQ) scores from participants due to the fact that IQ testing is no longer required for continued eligibility in special education services.

The SIS. The SIS is a standardized interview that measures support intensity in terms of type of support needed (e.g. none, monitoring, verbal/gestural prompting, partial physical assistance, and full physical support), frequency (e.g. none or less than monthly to hourly or more frequently), and daily support time (e.g. none to 4 h or more daily) in six subscales (home living, community living, lifelong living, employment, health and safety, and social; Thompson et al., 2004a). It results in the identification of a Support Needs Index (SNI) score. The final SNI indicates whether the individual requires limited support (SNI 1-60), intermittent support (SNI 61-84), extensive support (SNI 85-116), or pervasive support (SNI 117 and above). There are two optional scales that are not included in the calculation of the SNI. They are the Supplemental Protection and Advocacy Scale and the Exceptional Medical and Behavioral Support Needs Scale. These were also administered in this study. Reliability has been established for internal consistency (each factor exceeds 0.94), test–retest reliability (corrected r for each factor ranged from 0.74 to 0.94), and inter-rater reliability (inter-interviewer ratings ranged from 0.74 to 0.96; Thompson et al., 2004b, 2008). Validity has also been established for content, criterion, and construct validity (six-factor structure; Bossaert et al., 2009; Kuppens et al., 2010; Thompson et al., 2004b; Weiss et al., 2009).

The SIS was used to assess individual support needs by each participant across the six subscales included in the final SNI score. Data collectors were trained in the administration of the SIS, and inter-rater reliability checks were completed on 20% of data collected in each group. Inter-rater reliability for this study was calculated at a mean of 93.1% with a range of 89%–98% agreement.

In addition to using the SNI for comparison of baseline support intensity between the treatment and control group, the research team also repeated administration of the Employment Activities Subscale at all other data collection times to measure the intensity of needed employment supports. As with the SNI, higher standard subscale scores indicate higher support needs on the SIS Employment Activities subscale. For the subscale, scores range from 1 to 20.

Outcome interview. In order to assess the outcomes that each participant in both groups achieved, the research team completed a phone interview with each participant, their family, or their job coach. That interview included three questions. They were as follows: (1) Are you currently employed? (2) If you are currently employed, how much money do you make per hour? and (3) If you are

currently employed, approximately how many hours do you work weekly? When completing this interview, the respondent selected was the person who had the verbal ability and knowledge of the individual's employment status, work schedule, and hourly wage.

Data collection

Data were collected at four different times throughout the study. Baseline data from the application and the SIS were completed at the time of application through October of the intervention year. The outcome interview and Employment Activities Subscale of the SIS were completed at graduation, 3-month follow-up, and 12-month follow-up.

Data analysis

Chi-square and independent *t*-tests were used to examine group and cohort demographic data. Generalized estimating equations (GEE) using PROC GENMOD was used to analyze repeated dichotomous employment status (employed vs unemployed) outcome data to determine group differences across all four time points (SAS™ 9.4, 2013). Mixed repeated measures using PROC Mix procedure (SAS™ 9.4, 2013) was used to assess the differences between the control and treatment groups on hours worked and wages. The primary predictor variable was the interaction between time and group. Subjects were nested inside groups in order to reduce error. Mixed model contrasts were performed to compare treatment at each time point. Significance level was set at $p < 0.05$. All data were included in this analysis since PROC GENMOD and PROC Mix procedures allow for missing data. This model also adjusts for the difference in sample size; therefore, the difference in the treatment and control group size was accounted for in the results reported below.

Results

Age by group was significantly different, with the mean treatment age of 20.23 years (standard deviation (SD) = 1.13) and control age of 19.33 years (SD = 1.42). There were no associations between age and any of the outcome variables; hence, age was not included in further analyses. No other group differences in demographic data were found (see Table 2).

Participants in both groups were mainly male and represented both Caucasian and African American races in relatively equal distributions. Most individuals were diagnosed with autism versus PDD-NOS (pervasive developmental disorder, not otherwise specified) or Asperger's disorder. Additionally, most participants in both groups required significant support related to their social communication and patterns of behavior. Finally, most participants had approximately one prior internship experience while in the public school setting. This internship was short and few hours per week. Most participants did not have prior paid work experience. While we did not collect family income, we did analyze family status (raised in two-parent home, one-parent home, foster/other relative home) and parents' occupational status. There were no differences related to family status or parent occupational status between the treatment and control groups. Approximately 54% of participants were living in two-parent households although there was a fair representation of single-parent households, especially in the treatment group. Most parents reported working in a technician or associate professional occupation (includes science, engineering, and computer associates and technicians; life science and health technicians and assistants; teacher aides; finance and sales associate professionals; business service agents; and administrative assistants) or lower level profession (54.9%), while 45.1% reported being a small-business owner or working as a corporate manager, senior official, or professional such as a scientist, mathematician, architect, teacher, legal professional, or health professional. Of the 11 parents who reported not working outside the home, 4 represented single-parent families where the family relied upon public assistance in the form of disability or welfare income. Three out of four of those families were assigned to the treatment condition. These data indicate that there was a range of family conditions from below poverty to wealthy with the majority of individuals reporting occupations in the lower middle class to middle class range.

In addition to demographics, we collected baseline information through a review of the individual IEPs and completion of the entire SIS interview to identify support needs of the participants. There were no significant differences between the treatment or control group on any of these variables. In both groups, all 49 participants were in the process of completing a "Special Diploma" upon graduation. According to the Virginia Department of Education,

> The Special Diploma is available to students with disabilities who complete the requirements of their IEP and who do not meet the requirements for other diplomas such as the Modified Standard Diploma or Standard Diploma. The Modified Standard Diploma is intended for certain students at the secondary level who have a disability and are unlikely to meet the credit requirements for a Standard Diploma. (S Hollins, 15 December 2014, personal communication)

This is an indication that all participants in the study had significant disability-related cognitive impairments such that they were not able to achieve at or near grade level school work. Additionally, based upon review of the IEPs, the majority of participants were completing academic work below the 3rd grade level. The mean SNI scores were 81.87 (6.51) for the treatment group and 80.47 (5.6) for the control group. These means indicate

Table 2. Demographic characteristics by group.

Characteristics	Treatment, *n* (%)	Control, *n* (%)	*p*-value
Group size	31 (63.2)	18 (36.7)	
Age (years)			0.05
18	5 (16.1)	10 (55.5)	
19	8 (25.8)	2 (11.1)	
20	5 (16.1)	2 (11.1)	
21	13 (41.9)	4 (22.2)	
Gender			0.22
Male	24 (77.4)	11 (61.1)	
Female	7 (22.5)	7 (38.8)	
Race/ethnicity			0.42
African American	12 (38.7)	10 (55.5)	
Caucasian	18 (58.1)	7 (38.8)	
Asian	1 (3.2)	1 (5.5)	
Medical diagnosis			0.57
Autism	22 (70.9)	13 (72.2)	
PDD-NOS	6 (19.4)	3 (33.3)	
Asperger's disorder	3 (9.7)	1 (5.5)	
Characteristics (*n*)	0 (0)	1 (5.5)	
Diagnosis			
Psychotropic medication			0.32
Yes	11 (35.5)	9 (50.0)	
No	20 (64.5)	9 (50.0)	
General support needs to related social communication and repetitive/restricted behavior			0.61
Requiring support	8 (25.8)	6 (33.3)	
Requiring significant support	15 (48.3)	8 (53.3)	
Requiring very significant support	8 (25.8)	2 (13.3)	
Missing	0	2 (13.3)	
Prior work and internship experiences			
Mean prior unpaid internships	1.52	1.11	0.27
Number of participants with prior paid part-time employment	8 (25.8)	6 (33.3)	0.37
Family status			0.13
Two-parent household	17 (54.8)	6 (33.3)	
Single-parent household	12 (38.7)	2 (11.1)	
Raised by grandparent/other relative/foster parent	2 (6.4)	3 (16.6)	
Missing	0	7 (38.8)	
Parents' occupation[a]			0.53
Does not work outside home	8 (18.1)	3 (11.5)	
Temporary/part time/itinerate work	1 (2.2)	3 (11.5)	
General laborer	1 (2.2)	0	
Service or sales worker	1 (2.2)	0	
Clerk	3 (16.6)	1 (3.8)	
Technician or associate professional	9 (20.4)	2 (7.7)	
Craft or trade worker	1 (2.2)	0	
Small-business owner	3 (16.6)	2 (7.7)	
Corporate manager/senior official	7 (15.9)	3 (11.5)	
Professional	7 (15.7)	2 (7.7)	
Missing	3 (16.6)	10 (38.4)	

PDD-NOS: pervasive developmental disorder, not otherwise specified.
[a]Does not equal participant *n* due to some households where both parents worked outside the home.

that these participants' support needs ranged from intermittent to extensive.

Finally, there were significant differences between the treatment and control groups related to the SIS Exceptional

Table 3. Baseline Support Needs Index and Exceptional Behavioral and Medical Support Needs Score.

Measured baseline	Treatment, mean (*SD*)	Control, mean (*SD*)	*p*-value
Support Needs Index	81.87 (6.51)	80.47 (5.6)	0.765
SIS Exceptional Behavioral Needs Score	1.36 (1.36)	0.77 (0.99)	0.054
SIS Exceptional Medical Needs Score	0.45 (0.57)	0.14 (0.47)	0.017*

*$p < 0.05$.

Table 4. Employment outcomes by group and time.

Outcome by group	Baseline	Graduation	3-month follow-up	12-month follow-up
% Employed (*SD*)				
Treatment	0 (0)	74 (0.45)**	90 (0.30)**	87 (0.34)**
Control	0 (0)	6 (0.24)	6 (0.24)	12 (0.33)

*$p < 0.05$; **$p < 0.001$.

Medical Support Needs supplemental scale. Specifically, the treatment group had significantly more medical support needs than the control group. These medical needs included the presence of seizure management, diabetes, therapy services needed, and frequent breaks due to physical exhaustion. These conditions occurred at a higher frequency and intensity in the treatment group than the control group (Tables 3 and 4).

Behaviors endorsed as needing support for both groups included injury or assault to others, property destruction, stealing, self-injury, inappropriate behavior (touching self and exposing self), tantrums, and wandering.

Analysis of employment outcomes

Overall, the treatment group acquired community-based employment at a much higher rate than the control group. The treatment group achieved community-based employment at 74.2% at graduation, 90.3% at 3-month follow-up, and the majority of these individuals maintained employment at 1 year post-graduation with 87.1 % employment at 12-month follow-up. In fact, the mean length of employment for all individuals to date is now a mean of 40.16 months post-graduation. Additionally, the mean number of long-term support hours provided is approximately 1 h weekly ($M = 0.91$, $SD = 0.43$, $min. = 0.34$, $max. = 1.75$). As described earlier, these long-term support hours are typically offered to those with significant disabilities who qualify for supported employment. These services included consultation with the employer regarding work station design and work task assignment, behavioral problem solving, increasing productivity, and addressing workplace-specific challenges. Only one participant lost his or her employment between graduation and 3-month follow-up. Beyond the time frame for this study, two individuals in the treatment group ceased employment, while one additional individual gained employment since the 12-month follow-up resulting in an employment retention rate of 83.8% over approximately 3 years. Meanwhile, the control group achieved community-based employment at 5.9% at graduation and 3-month follow-up and 11.1% at 12-month follow-up. The GEE model of employment status (employed vs unemployed) was significant and indicated that the treatment group was significantly more likely to be employed than the control group ($x^2(1) = 27.49$, $p < 0.0001$). The best model fit consisted of only group differences.

Analysis of wages earned

The mixed repeated measures model was significant ($x^2 = 12.17$, $p = 0.0005$) for wages indicated that interaction of group × time were significant ($F(3,138) = 31.92$, $p < 0.0001$) as well as the main effects of group ($F(1,47) = 96.40$, $p < 0.0001$) and time ($F(3,138) = 41.91$, $p < 0.0001$). The mean (with *SDs* in parentheses) wage for the treatment group (including those who were unemployed) at graduation, 3-month, and 12-month follow-up was US$7.01 (4.21), US$8.61 (2.88), and US$8.46 (3.32), respectively. In comparison, the control group had mean wages of US$0.53 (2.24), US$0.53 (2.24), US$0.60 (2.42) at graduation, 3-month, and 12-month follow-up, respectively. Excluding those who were unemployed, wages earned by those employed in the treatment group ranged from US$9.53 to US$10.66 per hour. Those who were employed in the control group earned an hourly wage from US$9.67 to US$10.00 per hour. There were large differences in standardized effect sizes (*d*) between the treatment and control groups at each time: 2.00 (graduation), 3.16 (3 months), and 2.74 (12 months), respectively. Significant within- and between-group wage comparisons are given in Table 5.

Due to the fact that the wages of those employed were relatively similar in both groups, this finding appears to be related to the significant differences between the groups'

Table 5. Within- and between-group comparisons for wages, hours worked, and SIS.

Baseline	Graduation	3-month follow-up	12-month follow-up	*t* (*SE*)
Wages: within-group significant comparisons				
Treatment	Treatment			12.40 (0.5653)**
Treatment		Treatment		15.22 (0.5653)**
Treatment			Treatment	14.96 (0.5653)**
Wages: between-group significant comparisons				
	Treatment vs control			8.05 (0.8054)**
		Treatment vs control		9.66 (0.8311)**
Hours worked: within-group significant comparison				
Treatment	Treatment			10.76 (1.4169)**
Treatment		Treatment		13.60 (1.4169)**
Treatment			Treatment	14.05 (1.4169)**
	Treatment		Treatment	3.29 (1.4169)*
Hours worked: between-group significant comparisons				
	Treatment vs control			6.99 (2.0003)**
		Treatment vs control		9.01 (2.0003)**
			Treatment vs control	8.59 (2.0305)**
SIS: within-group significant comparison				
Treatment		Treatment		4.82 (0.2209)**
Treatment			Treatment	8.76 (0.2209)**
	Treatment		Treatment	6.86 (0.2209)**
		Treatment	Treatment	3.94 (0.2209)*
SIS: between-group significant comparisons				
			Treatment vs Control	5.23 (0.3512)**

SIS: Support Intensity Scale; *SE*: standard error.
*$p < 0.05$; **$p < 0.001$.

employment outcomes. When all participants who were unemployed were taken out of the analyses, this left 8 participants in the control group and 23 participants in the treatment group, and the model was not significant ($p = 0.191$).

Analysis of hours worked

The model for hours worked was significant ($x^2 = 7.79$, $p = 0.0053$) and indicated that hours per week rose significantly over time for the within-group effects ($F(3,140) = 37.76$, $p < 0.0001$), between groups ($F(1,140) = 77.99$, $p < 0.0001$), and group × time interaction effect ($F(3,140) = 325.88$, $p < 0.0001$). For treatment participants who were employed, the mean (with *SDs* in parentheses) hours worked weekly were 15.24 (9.32) at graduation, 19.27 (7.62) at 3-month follow-up, and 19.90 (9.00) at 12-month follow-up. In comparison, those in the control group worked an average of 1.25 (5.30), 1.25 (5.30), 2.50 (7.07) at graduation, 3 months, and 12 months, respectively. Additionally, the treatment group worked significantly more hours at the 12-month follow-up compared to the hours worked at graduation ($t = -3.29$, $p = 0.027$) with a large standardized effect size (d) of 2.17. Thus, the hours worked by those employed at graduation in the treatment group rose significantly by 12-month follow-up, while the hours worked for the control group did not change during the same period of time. The range of hours worked for employed treatment participants was 0–30 h per week at graduation and 0–40 h at 3 months and 12 months. In contrast, the hours worked for employed control group participants ranged from 0 to 22.5 h weekly at graduation and 3-month follow-up, and 12-month follow-up. Yet again, the significant between-group findings seem to repeat the extreme employment outcome differences. See Table 5 for significant within- and between-group comparisons for hours worked. When all participants who were unemployed were taken out of the analyses, this left 8 participants in the control group and 23 participants in the treatment group, and the model was not significant ($p = 0.362$).

Analysis of support intensity needs in employment activities

Secondary analysis consisted of examining SIS Employment Activity Subscale standard scores for each group (treatment and control) within groups and across groups. The model was significant ($x^2 = 32.73$, $p < 0.0001$) and indicated that the main effects of group ($F(1, 48) = 7.56$,

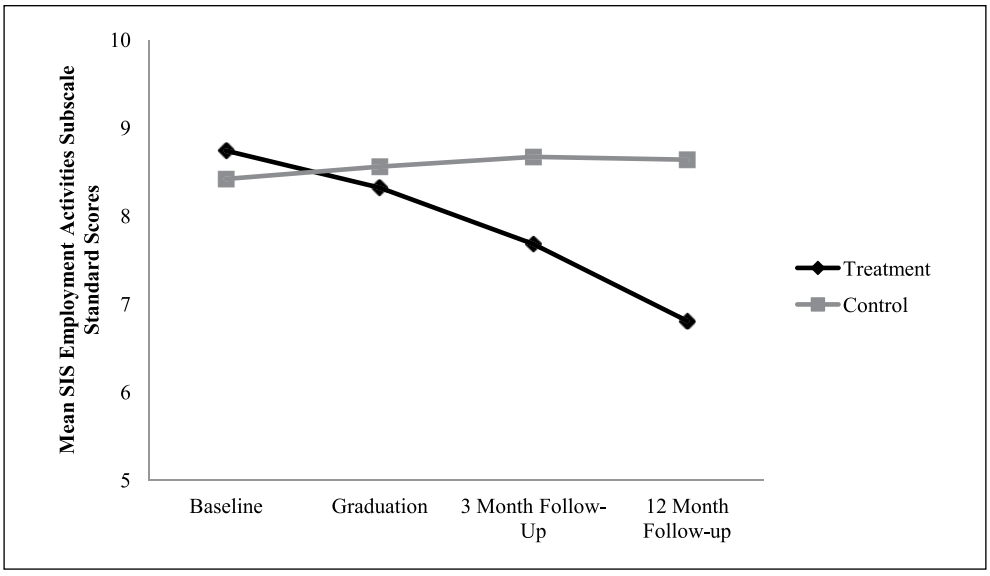

Figure 2. SIS Employment Activities Subscale by group and time.

$p=0.0084$) and time ($F(3,137)=7.55$, $p<0.0001$) along with the interaction effects of group × time ($F(3,137)=12.08$, $p<0.0001$) were significant. The within-group analysis consisted of the within-group analysis for the treatment and a separate within-group analysis for the control group. These within-group comparisons indicated that there were no significant differences between the scores within the control group from baseline through the 12-month follow-up; however, there were significant differences within the treatment group scores between baseline and 3-month follow-up, baseline and 12-month follow-up, graduation and 12-month follow-up, and 3-month and 12-month follow-ups. Between-group comparisons (treatment vs control) indicated that 12-month treatment group follow-up was significantly different from the control group at all four time periods (i.e. baseline, graduation, 3-month, and 12-month follow-ups). See Table 5 for all significant within- and group-SIS comparisons. When all participants who were unemployed were taken out of the analyses, this left 8 participants in the control group and 23 participants in the treatment group, and the model was not significant ($p=1.00$). This may indicate that employment experience provides therapeutic effects related to increased independence.

The respective means for each time from baseline to 12-month follow-up on the SIS Employment Activity Subscale for the control and treatment groups are presented in Figure 2. In sum, the control group employment support intensity needs did not change over the course of the 21 months of observation, while the treatment group employment support intensity needs decreased significantly during that same period of time.

The differences over time in the treatment group were noted in each of the three ways in which support intensity is defined. For example, individuals who required partial physical assistance at least once a day for up to 2 h daily to complete tasks such as "completing work-related tasks with acceptable speed" frequently moved to no support needed for this same item. This same change was observed across the social communication indicators where participants moved from requiring verbal/gestural prompting daily for 30 min to 2 h to interact with co-workers and supervisors to no support needed.

Discussion

The purpose of this article was to demonstrate a replicable employer-based 9-month intervention that can reliably lead to competitive employment for youth with significant impact as a result of their ASD diagnosis. Additionally, this study explored employment retention up to 12 months post-graduation from high school by following up on previously published preliminary findings (Wehman et al., 2014). This project was partially based on a program called Project SEARCH (Daston et al., 2012) and subsequently modified for youth with ASD to become PS-ASD (Wehman et al., 2012, 2014b). To our knowledge, this is the first study that utilized a RCT experimental design and provided a 12-month follow-up as a primary endpoint.

This program yielded high employment outcomes for the students in the treatment condition with 87% competitively employed compared to 12% of those in the high school condition. The students in the sample were comparable on most variables with one exception. The treatment group was more medically challenged than the control group. The principle intervention technique that was used when the students were in the work settings for the 720 field hours was supported employment with intensive

application of applied behavior analysis (Nicholas et al., 2015; Wehman et al., 2012). Essentially, the use of a highly trained autism employment specialist who provided applied behavioral analysis for skill development and behavior management were key aspects of the clinical intervention.

Additionally, the implementation of internships seemed to be an essential ingredient in the outcomes observed. Specifically, youth with ASD frequently demonstrate excellent work ethic with known tasks, yet their unusual presentation and difficulty with social communication limit their apparent employability to an uninformed employer (Smith et al., 2014). For example, the individuals in the treatment condition interviewed for their subsequent employment. The employers admitted that despite interview coaching, many of their interviews were, at best, unusual. In response to an interviewer's question to describe what he liked about the place of business, after considering the question, one treatment group participant responded with one word, "Lunch!" Thus, this participant's tendency to take the interviewer's question literally might have otherwise disqualified him for his eventual position. Yet, because the employer had the opportunity to observe this participant in three different internships, the participant demonstrated his work ethic and the value he added to the employer, despite his communication and behavioral challenges. That individual and the majority of his peers continue to be employed as much at 5 years post-graduation. In fact, to date, approximately 80% of those who were employed upon graduation have retained their employment while receiving increased wages and hours worked weekly (Schall et al., 2015).

Finally, during the course of three intensive internship positions, the participants received a number of instructional benefits from the experience. These benefits included the opportunity for repeated practice at work and social skills in the environment in which they would be used. These intensive internships essentially acted as the vocational training equivalent of intensive early intervention. In place of repeatedly practicing preschool skills, as 3- to 6-year-old children with ASD might be in an intensive early intervention program, these youth practiced essential work skills multiple times daily. For example, they greeted peers and co-workers, accepted workplace correction, interacted with customers, and solved work-related problems multiple times daily. This model of embedded, intensive internship experience allowed these youth the opportunity to practice these skills in a real environment, thus increasing opportunities to master and become fluent in these essential work skills. They also learned to tolerate uncomfortable work experiences while having higher levels of support from educators and job coaches (Schall et al., 2015).

Employed participants experienced a decrease in the intensity of supports provided by trained staff as indicated by the SIS. It is likely that this particular intervention provided a level of skill practice that is not available to young adults with significant impact from their ASD. In fact, many of the individuals included in this study were previously denied services due to the severity of their impairment (Lawer et al., 2009). The type of intensity and repeated practice that individuals with significant impact from their ASD require to master skills is ill suited to the VR services model which attempts to provide targeted intensive services initially with rapid drops in service delivery after initial mastery. Yet, these individuals required a higher intensity to learn job skills as well as social interaction skills. This intervention offered intensity of services, while the individual was eligible for both educational and VR services. It is highly likely that this overlap in service delivery provided the opportunity for increased intensity to occur.

We also believe strongly that the commitment of the senior management of the hospital setting where the program took place was critical. The students were in internships in over 40 different hospital departments ranging from coronary care, obstetrics and gynecology, neonatal care, facilities management, and ambulatory surgery, to name a few. Senior nurse managers and hospital administrators in these departments were very open to learning how to include these students in the work of their units while extracting their full potential for success. It is very difficult to imagine a meaningful employer-based intervention program like the one described without serious commitment from business management and key personnel.

There are several very positive outcomes of this multi-year study. First, the fact that so many students were offered employment within a 90-day period was a testimony to the efficacy of an internship model where individuals with ASD could learn skills and become acculturated into the business setting. As Roux et al. (2013) and Shattuck et al. (2012) have noted, these students typically experience high rates of unemployment. The students in the control group who did not access the 9-month, employer-based intervention had significantly lower employment rates. Students in the control group remained unemployed and their support needs did not change during the same period of time. Second, the majority of individuals in the treatment condition maintained employment up to 12 months post intervention and beyond. (To date, the majority of this cohort remains employed with a mean length of employment at 52.16 months since graduation). In other words, once they were employed and continued to receive limited ongoing supported employment from employment specialists, they were maintained by the company in employment. Additionally, their success in employment is evidenced by the increasing hours awarded over time. In fact, the move from 16 to over 22 h weekly by 12 months suggests the possibility of advancing value to

the employer. Finally, possibly the most exciting part of these findings is that each year students became increasingly independent at work. They required less help and less support. It is important to realize this is a group that for the most part presented with significant impact from ASD, with few reading past the 3rd grade level. Yet throughout the study, the treatment participants demonstrated increased independence as measured by the SIS, unlike those in the control group. Future research should investigate this finding further. Specifically, it is possible that community-based competitive employment acts as a therapeutic agent in other areas such as communication, social interaction, and overall health (Garcia-Villamisar and Hughes, 2007).

Limitations

There were several limitations to this study. First, the total of 49 is limited. We are in the process now of a larger replication which will triple these numbers. However, given that there were four annual cohorts, each recruited individually, and the results are consistent throughout, we feel an encouraging level of confidence that this intervention holds significant promise. Second, the intervention requires a higher degree of detailing in the manual. We are currently undertaking that project. However, the components we have identified and the techniques undertaken year after year were highly consistent and monitored by external consultants resulting in excellent evaluations for fidelity of implementation. Third, we would have preferred to have had a higher retention rate among our control group. However, as each year went by and these students were not employed or enrolled in a comparable program, it became more difficult to have them engage in the data collection process. There is a large difference in employment outcomes that appears to drive the large difference in hours worked and wages earned. It is possible that significant differences in wages earned and hours worked should be interpreted with caution as a result. We did not verify the diagnosis of ASD and accepted previously identified diagnoses. This may limit the findings as well. The differences noted over time in the level of support intensity required at work likely were impacted by the employment outcomes as well. Yet, the point of the intervention is to provide intensive practice in vocational skills in an employment environment. Thus, this finding is attributable to the intervention itself. This study required an intensive amount of intervention with overlapping services provided by both the educational and VR systems. This study did not explore the cost or acceptability of that cost on local systems of service. Future research should consider the cost of this intervention as well as considering whether or not this level of intensity is required to achieve these outcomes. Finally, the last limitation is that this study took place at only one setting: a 410-bed community hospital. It is possible that this hospital was so predisposed to employ persons with ASD that they decided to hire all of these participants and maintain them despite their challenges as workers. We do not believe this is true but are replicating this study currently across several other businesses with persons with significant ASD to assess if this is a true limitation. We do not think a hospital would hire this many people with ASD unless they were genuinely productive and adding value.

Conclusion

In summary, this study is the first which examines an experimentally controlled intervention that directly leads to competitive employment for youth with significant impact from their ASD. The study is based on the use of applied behavior analysis implemented by highly skilled employment specialists who engaged in supported employment practices. The intervention was done in close collaboration with the business personnel, educational staff, and community rehabilitation services providers. Employment outcomes were excellent and follow-up data highly promising as was the concomitant independence in the work behavior of students in the treatment group.

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