

AWARD NUMBER: W81XWH-19-1-0825

TITLE: Examining the Efficacy of the TEACCH School Transition to Employment and Post-Secondary Education Program

PRINCIPAL INVESTIGATOR: Dr. Laura Klinger, PhD

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14. ABSTRACT The purpose of this project is to conduct a RCT trial examining the efficacy of the TEACCH School Transition to Employment and Postsecondary Education (T-STEP) Program. 60 Community college students (18-21 years of age) with autism spectrum disorder will participate in either the T-STEP Program or manualized counseling services (career, academic, self-counseling) with both proximal (executive function, social communication, and emotion regulation) and distal (employment, postsecondary education success) outcomes measured. The long-term impact of this intervention is to promote a more positive quality of life for young adults with high functioning ASD including increased postsecondary education completion, employment, self-determination, and decreased difficulties with coping and depression. Due to the COVID-19 epidemic preventing in person interactions, we have adapted the protocol to conduct online interventions. This adapted protocol has received approval from all regulatory bodies and the adapted intervention and RCT trial will begin in the second year of funding.					
15. SUBJECT TERMS Autism, transition-aged, community college, executive function, emotion regulation, professional social skills					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Unclassified	18. NUMBER OF PAGES 32	19a. NAME OF RESPONSIBLE PERSON USAMRMC
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1. **INTRODUCTION:** *Narrative that briefly (one paragraph) describes the subject, purpose and scope of the research.*

The purpose of this study is to test whether the targeted intervention provided by the comprehensive T-STEP (course, counseling, internship) is more effective at supporting the transition to adulthood than counseling services alone (i.e., academic, career, and self-advocacy counseling). Using an alternative treatment randomized-control trial design, transition-aged (16-21-year-old) individuals with ASD will be enrolled. Young adults will be randomly assigned to receive either the comprehensive T-STEP Program (T-STEP course, internship, counseling) or only counseling services at two community college sites. Across three academic years, 120 young adults will be enrolled, 60 in the Comprehensive T-STEP Group (T-STEP) and 60 in the Counseling Only group.

2. **KEYWORDS:** *Provide a brief list of keywords (limit to 20 words).*

Autism, transition-aged, community college, executive function, emotion regulation, professional social skills

3. **ACCOMPLISHMENTS:** *The PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction.*

What were the major goals of the project?

List the major goals of the project as stated in the approved SOW. If the application listed milestones/target dates for important activities or phases of the project, identify these dates and show actual completion dates or the percentage of completion.

Training Specific Major Tasks:

- **Task 1: Learn clinical trial design and evaluation for individuals with Autism Spectrum Disorder**
 - Milestone: Submit grant proposal for Autism Research Program Clinical Translation Award (months 36-42; 100% complete)
- **Task 2: Train with experts in community-based behavioral interventions in ASD**
 - Milestone: Leading a professional seminar and community workshop on clinical interventions (months 30-36; 50% complete)
- **Task 3: Acquire skills in research team management**
 - Milestone: Supervise intervention & research staff (months 24-48; 50% complete)
- **Task 4: Build national collaborations in ASD field**
 - Milestone: Presentation of project outcome data at International Society for Autism Research Meeting (month 48; 0% complete)

Research Specific Major Tasks:

- **Task 1: Obtain IRB approval**
 - Milestone: IRB Approval (months 6; 100% complete)
 - Milestone: Obtain regulatory approval from Department of Defense Human Research Protection Office (month 9; 100% complete)

- **Task 2: Coordinate Study Staff**
 - Milestone: Research staff trained (month 15; 100% complete)
 - Milestone: Maintained trained and available independent evaluators (month 15; 100% complete)
- **Task 3: Randomized, Controlled Trial**
 - Milestone: 1st cohorts participant consented, screened, and enrolled in study (months 13-40; 33% complete)
 - Milestone: T-STEP and Counseling intervention begins (months 17-41; 33% complete)
 - Milestone: Report findings from overall studies (month 48; 0% complete)
- **Task 4: Data analysis**
 - Milestone: Report results from data analysis (month 48; 20% complete)

What was accomplished under these goals?

For this reporting period describe: 1) major activities; 2) specific objectives; 3) significant results or key outcomes, including major findings, developments, or conclusions (both positive and negative); and/or 4) other achievements. Include a discussion of stated goals not met. Description shall include pertinent data and graphs in sufficient detail to explain any significant results achieved. A succinct description of the methodology used shall be provided. As the project progresses to completion, the emphasis in reporting in this section should shift from reporting activities to reporting accomplishments.

Training Specific Major Tasks:

- **Task 1: Learn clinical trial design and evaluation for individuals with Autism Spectrum Disorder**
 - Subtask 1: Attend UNC School of Medicine North Carolina Translational and Clinical Sciences Institute (NCTraCS) professional developmental seminars
 - Activities Accomplished: Attended School of Medicine, Frank Porter Graham Child Development Professional Development Series, and Department of Psychiatry professional development mentoring meetings.
 - Subtask 2: Take 1 course per year through a collaboration between NCTraCS and UNC School of Public Health in clinical trials research
 - Activities Accomplished: Began Public Health Course in Clinical Trial Design in Fall 2021
 - Subtask 3: Submit applications to attend national RCT workshops
 - Activities Not Accomplished: Training workshops were not offered in the reporting period due to COVID-19.
 - Subtask 4: Travel to UCLA postponed to due to COVID-19
 - Activities Not Accomplished: Unable to visit UCLA due to COVID-19 travel restrictions. However, we conducted virtual meetings with UCLA faculty, Dr. Connie Kasari.
 - Subtask 5: Participate in statistical workshops
 - Activities Accomplished: Attended training on a self-determination assessment tool (Self Determination Inventory) with the University of Kansas.
 - Attended NCTraCS Biostatistics Seminars, Consortium for Advanced Research Methods, and H. W. Odum Institute Seminars.

- Subtask 6: Submit grant proposal to start collecting pilot data
 - Activities Accomplished: Submitted 7 grants: three pilot grants to University of North Carolina at Chapel Hill, a development grant to the National Institute on Disability, Independent Living, and Rehabilitation Research Disability and Rehabilitation Research Projects (DRRP) Program: Employment of Individuals with Disabilities (Development) as a multiple PI, to the National Institute of Aging R21/R33 and R01 clinical trial grant as a multiple PI, and to the Administration on Community Living Projects of National Significance: Community Collaboration for Employment as lead PI.
- **Task 2: Train with experts in community-based behavioral interventions in ASD**
 - Subtask 1: Observe clinical services at the TEACCH Autism Program by attending individual and group therapy sessions
 - Activities Accomplished: Attended TEACCH Autism Specialist trainings and weekly T-STEP clinical supervision meetings for Spring 2021 and Fall 2021 semesters.
 - Assisted with development and implementation of TEACCH T-STEP training for Singapore
 - Subtask 2: Attend T-STEP and counseling sessions in the first semester.
 - Activities Accomplished in Previous Reporting Period
 - Subtask 3: Observe RCT implementation during visit to Kasari Lab at UCLA
 - Activities Not Accomplished: Travel to UCLA will be delayed to a future date due to COVID-19.
 - Subtask 4: Receive training on implementation of assessing fidelity
 - Activities Accomplished: Met with Dr. Kara Hume to discuss assessment and training for fidelity.
- **Task 3: Acquire skills in research team management**
 - Subtask 1: Attend the UNC Blueprint for Engaged Supervision Training (BEST), UNC Human Resources 2-day workshop.
 - Activities Not Accomplished: Training was not offered during the reporting period.
 - Subtask 2: Take the NCTraCS/UNC Public Health Course: Team Leadership in Research Navigation (PUBH 767).
 - Activities Not Accomplished: Course was not offered during the reporting period.
 - Subtask 3: Co-Supervise graduate research assistant and research assistant on project related tasks
 - Activities Accomplished:
 - Receive training from Dr. Klinger in hiring of new research assistants and interview processes and training of research staff.
 - Co-supervised post-assessment research visits, data management, and regulatory document submission.
- **Task 4: Build national collaborations in ASD field**
 - Subtask 1: Meet with UCLA autism researchers during Kasari Lab visit
 - Activities Not Accomplished: Travel to UCLA postponed to due to COVID-19.
 - Subtask 2: Attend UNC Autism Research Quarterly Meetings
 - Activities Accomplished: Attended UNC Autism Research Meeting

- Subtask 3: Attend national conferences disseminating ASD-related research
 - Activities Accomplished:
 - Attended national conference (Council for Exceptional Children) and presented one presentation focused on transition and Autism Spectrum Disorder
 - Attended and presented at the International Society for Autism Research 2021 virtual conference.
 - Attended Triangle Neurodiversity Advisory Committee Summit, Stanford Neurodiversity Summit, and College Autism Summit.

Research Specific Major Tasks:

● **Task 1: Obtain IRB approval**

- Subtask 1: Prepare Regulatory Documents and Research Protocol.
 - Activities Accomplished:
 - ClinicalTrials.gov record released
 - Received approval from UNC IRB and HRPO to recruit 16- and 17-year-olds.
 - Updated ClinicalTrials.gov to include 16- and 17-year-olds in our recruitment age.

● **Task 2: Coordinate Study Staff**

- Subtask 1: Hiring and Training of Study Staff
 - Activities Accomplished:
 - Hired and trained assessment 3 new staff during this reporting period (Sara Stahl and Tabetha Marsh, research assistants; Claire Klein, graduate student).
- Subtask 2: Coordinate supervision, fidelity checks, and training of Independent Evaluators
 - Activities Accomplished:
 - Conducted weekly supervision meetings with Comprehensive T-STEP class interventionists and Counseling interventionists.
 - Finalized drafts of Counseling intervention Fidelity Forms and trained new interventionists on fidelity.

● **Task 3: Randomized, Controlled Trial**

- Subtask 1: Conduct study, report findings
 - Activities Accomplished:
 - Cohort 1: Spring 2021 semester.
 - Screening: Phone screenings occurred for 38 participants.
 - Baseline: 21 participants and their caregivers participated in baseline assessments.
 - 1 participant was ineligible due to IQ and 1 participant decided not to participate due to their schedule.
 - Enrolled: 19 participants were enrolled and completed pre-assessments.
 - 1 participant decided not to participate due to their schedule.
 - 18 participants (9 in the Comprehensive T-STEP Class and 9 in the Counseling Only) began the intervention.
 - 1 participant decided to no longer participate during Week 2 of the intervention and resources were shared regarding TEACCH clinical services.

- Completed: 17 participants completed the intervention and post-assessments
- Follow-Up: 5 participants completed Follow-Up assessments with remaining participants scheduled for the next reporting period
- Cohort 2: Fall 2021 semester.
 - Screening: Phone screenings occurred for 57 participants.
 - Baseline: 22 participants and their caregivers participated in the baseline assessments
 - 3 students were ineligible: 1 participant was ineligible due to their IQ, 1 was ineligible due to their diagnosis, 1 was ineligible due to their readiness interview
 - 4 participants decided not to participate due to their schedule or group assignment prior to pre-assessments.
 - Enrolled: 15 participants were enrolled and completed pre-assessments. (8 Comprehensive T-STEP class; 7 Counseling Only)
 - Completed: Intervention ongoing
- Total Data Collected Across Cohorts:
 - 340 pre-assessment questionnaires completed (5 questionnaires/participant; 5 questionnaires/caregiver)
 - 204 post-assessment questionnaires completed (6 questionnaires/caregiver; 6 questionnaires/participant).
 - 60 follow-up assessment questionnaires completed (5 questionnaires/caregiver; 7 questionnaires/participant)
- Community College Partner Meetings
 - Conducted meetings with Guilford Technical Community College to plan for on-campus visits and internship supervisors for second cohort.
 - Conducted internship supervisor trainings for Guilford Technical Community College staff for second cohort.
 - Conducted preliminary meetings to recruit additional community college at Johnston County Community College

What opportunities for training and professional development has the project provided?

If the project was not intended to provide training and professional development opportunities or there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe opportunities for training and professional development provided to anyone who worked on the project or anyone who was involved in the activities supported by the project. “Training” activities are those in which individuals with advanced professional skills and experience assist others in attaining greater proficiency. Training activities may include, for example, courses or one-on-one work with a mentor. “Professional development” activities result in increased knowledge or skill in one’s area of expertise and may include workshops, conferences, seminars, study groups, and individual study. Include participation in conferences, workshops, and seminars not listed under major activities.

In addition to the training program for the partnering PI described above, professional training opportunities were present for 2 graduate students and 2 postdoctoral fellows including weekly team meetings and one-on-one mentoring on clinical trials design, developmental of fidelity assessments, and behavioral coding procedures.

How were the results disseminated to communities of interest?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe how the results were disseminated to communities of interest. Include any outreach activities that were undertaken to reach members of communities who are not usually aware of these project activities, for the purpose of enhancing public understanding and increasing interest in learning and careers in science, technology, and the humanities.

We conducted an international outreach activity to the Autism Resource Center in Singapore. The ARC has a school (K-12) for 1700+ children with autism with average or higher intellectual skills. They also provide an employment services program. They are interested in creating a transition program to support students who will leave their school in the next year or who have just entered their employment services program. We conducted an 18-hour workshop (2 hours/day across 9 days) in June 2021 disseminating information regarding transition to adulthood challenge and T-STEP techniques including sharing the T-STEP manual.

What do you plan to do during the next reporting period to accomplish the goals?

If this is the final report, state “Nothing to Report.”

Describe briefly what you plan to do during the next reporting period to accomplish the goals and objectives.

Training Specific Tasks through next quarter:

1. Begin pilot data collection for employments services with TEACCH.
2. Enroll in second public health course.

Research Specific Tasks through next quarter:

1. Complete Follow-up assessments of cohort 1
2. Complete intervention sessions with cohort 2
3. Complete Post-assessment of cohort 2
4. Add a 2nd community college partner and implementation site.
5. Begin recruitment for the Spring 2022 semester/cohort 3

4. IMPACT: Describe distinctive contributions, major accomplishments, innovations, successes, or any change in practice or behavior that has come about as a result of the project relative to:

What was the impact on the development of the principal discipline(s) of the project?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe how findings, results, techniques that were developed or extended, or other products from the project made an impact or are likely to make an impact on the base of knowledge, theory, and research in the principal disciplinary field(s) of the project. Summarize using language that an intelligent lay audience can understand (Scientific American style).

Nothing to Report.

What was the impact on other disciplines?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe how the findings, results, or techniques that were developed or improved, or other products from the project made an impact or are likely to make an impact on other disciplines.

Nothing to Report.

What was the impact on technology transfer?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe ways in which the project made an impact, or is likely to make an impact, on commercial technology or public use, including:

- *transfer of results to entities in government or industry;*
- *instances where the research has led to the initiation of a start-up company; or*
- *adoption of new practices.*

Nothing to Report.

What was the impact on society beyond science and technology?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe how results from the project made an impact, or are likely to make an impact, beyond the bounds of science, engineering, and the academic world on areas such as:

- *improving public knowledge, attitudes, skills, and abilities;*
- *changing behavior, practices, decision making, policies (including regulatory policies), or social actions; or*
- *improving social, economic, civic, or environmental conditions.*

Nothing to Report.

5. CHANGES/PROBLEMS: *The PD/PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction. If not previously reported in writing, provide the following additional information or state, “Nothing to Report,” if applicable:*

Nothing to Report.

Actual or anticipated problems or delays and actions or plans to resolve them

Describe problems or delays encountered during the reporting period and actions or plans to resolve them.

During COVID-19 restrictions, with approval from DOD, we switched to a virtual intervention format. With decreased rates of COVID-19 and a return to most colleges offering in-person classes, we anticipate transitioning back to an in-person intervention. Our recruitment numbers were lower than expected during the current Fall 2021 semester with many families choosing not to enroll after the screening call as they were seeking in person services. After discussions with our consultant, Dr. Connie Kasari, we decided to follow family preferences. We anticipate having either 3 virtual and 3 in-person cohorts or 2 virtual and 4 in-person cohorts depending on changes in COVID restrictions and family preferences. Our goal is to have at least one in person program offered in Spring 2022. We will examine differences in intervention format (virtual/in-person) in data analyses.

Changes that had a significant impact on expenditures

Describe changes during the reporting period that may have had a significant impact on expenditures, for example, delays in hiring staff or favorable developments that enable meeting objectives at less cost than anticipated.

Nothing to Report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Describe significant deviations, unexpected outcomes, or changes in approved protocols for the use or care of human subjects, vertebrate animals, biohazards, and/or select agents during the reporting period. If required, were these changes approved by the applicable institution committee (or equivalent) and reported to the agency? Also specify the applicable Institutional Review Board/Institutional Animal Care and Use Committee approval dates.

Significant changes in use or care of human subjects

We submitted and received IRB and HRPO approval for lowering our recruitment age from 18-years to 16-years.

Significant changes in use of biohazards and/or select agents

Not Applicable.

6. **PRODUCTS:** *List any products resulting from the project during the reporting period. If there is nothing to report under a particular item, state “Nothing to Report.”*

- **Publications, conference papers, and presentations**

Report only the major publication(s) resulting from the work under this award.

Journal publications. *List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

Tomaszewski, B., Klinger, L., & Pugliese, C.E. (2021) Self-Determination in Autistic Transition-Aged Youth without Intellectual Disability. *Journal of Autism and Developmental Disorders*. <https://doi.org/10.1007/s10803-021-05280-6> (Published-Yes)

Books or other non-periodical, one-time publications. *Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like. Identify for each one-time publication: author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (e.g., book, thesis or dissertation); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

Klinger, L.G., & Dudley, K.M. (2020). Intervention to support transition to adulthood for individuals with autism spectrum disorder. In F. Volkmar (Ed.). *Encyclopedia of Autism Spectrum Disorder*, New York: Springer. (Published-Yes)

Tomaszewski, B., Klinger, LG., Osborne, G., & Klein, C. B. (in press). Easing the Transition to Adulthood. In D. Spain, F.M. Musich, & S.W. White, *Psychological Therapies for Adults with Autism*. New York: Oxford University Press. (Awaiting Publication-Yes)

Other publications, conference papers and presentations. *Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication as noted above. List presentations made during the last year (international, national, local societies, military meetings, etc.). Use an asterisk (*) if presentation produced a manuscript.*

International Society for Autism Research Annual Meeting 2021 Virtual Conference Presentations

- Longitudinal Employment Outcomes for Young Adults with Autism: Follow up to a High School-Based RCT K. Hume, B. Tomaszewski, S. L. Odom, J. R. Steinbrenner, L. J. Hall, L. E. Smith DaWalt, and B. Kraemer
- Community Participation in Autistic Young Adults B. Tomaszewski, L. J. Hall, J. R. Steinbrenner, L. E. Smith DaWalt, K. Hume and S. L. Odom
- Factor Structure and Construct Validity of the Transition Readiness and Employability Evaluation K. Bowman, B. Tomaszewski, C. B. Klein, S. M. Matherly, and L. G. Klinger
- Performance on the Transition Readiness and Employability Evaluation (TREE) in Transition-Age Youth with and without Autism Spectrum Disorder C. B. Klein, K. Bowman, S. M. Matherly, B. Tomaszewski, and L. G. Klinger

Alabama Autism Conference, University of Alabama. Transition to Post-Secondary Education and Employment: Supporting Positive Outcomes for Individuals with Autism Spectrum Disorder. February 26, 2021; Virtual conference.

14th Annual Autism Update, Stanford University. Autism in Adulthood: How Can We Support Positive Outcomes? March 20, 2021; Virtual conference

- **Website(s) or other Internet site(s)**

List the URL for any Internet site(s) that disseminates the results of the research activities. A short description of each site should be provided. It is not necessary to include the publications already specified above in this section.

Nothing to Report.

- **Technologies or techniques**

Identify technologies or techniques that resulted from the research activities. Describe the technologies or techniques were shared.

Nothing to Report.

- **Inventions, patent applications, and/or licenses**

Identify inventions, patent applications with date, and/or licenses that have resulted from the research. Submission of this information as part of an interim research performance progress report is not a substitute for any other invention reporting required under the terms and conditions of an award.

Nothing to Report.

- **Other Products**

Identify any other reportable outcomes that were developed under this project. Reportable outcomes are defined as a research result that is or relates to a product, scientific advance, or research tool that makes a meaningful contribution toward the understanding, prevention, diagnosis, prognosis, treatment and /or rehabilitation of a disease, injury or condition, or to improve the quality of life. Examples include:

- *data or databases;*
- *physical collections;*
- *audio or video products;*
- *software;*
- *models;*
- *educational aids or curricula;*
- *instruments or equipment;*
- *research material (e.g., Germplasm; cell lines, DNA probes, animal models);*
- *clinical interventions;*
- *new business creation; and*
- *other.*

Educational Aids:

- Training Materials
 - Developed Singapore TEACCH T-STEP Training materials for 18-hour training with Singapore
- Online Training Program
 - Adapted T-STEP intervention materials to create an online training program for employers on how to support autistic employees. Program in development with 2 of 9 modules complete.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Provide the following information for: (1) PDs/PIs; and (2) each person who has worked at least one person month per year on the project during the reporting period, regardless of the source of compensation (a person month equals approximately 160 hours of effort). If information is unchanged from a previous submission, provide the name only and indicate “no change”.

Example:

Name: *Mary Smith*

Project Role: Graduate Student
Researcher Identifier (e.g. ORCID ID): 1234567
Nearest person month worked: 5

Contribution to Project: Ms. Smith has performed work in the area of combined error-control and constrained coding.

Funding Support: The Ford Foundation (Complete only if the funding support is provided from other than this award.)

Name: Laura Klinger
Project Role: Principal Investigator
Researcher Identifier: 0000-0002-3399-9039
Nearest person month worked: 2.4

Contribution to Project: Dr. Klinger has overseen all study activities including maintaining IRB and HRPO approval and receiving ClinicalTrials.gov approval, and training of fidelity coders, and hiring and onboarding research and clinical staff. She has also met with study investigators (Kara Hume) and consultants (Connie Kasari) to finalize implementation plans and has overseen Dr. Tomaszewski's training and research activities.

Name: Brianne Tomaszewski
Project Role: Partnering Principal Investigator
Researcher Identifier: 0000-0003-0074-1442
Nearest person month worked: 6

Contribution to Project: Dr. Tomaszewski has attended trainings and statistical workshops, submitted grant proposals, provided oversight to training of assessment team, finalizing fidelity coding documents and testing of protocols, assisted with submission of IRB, HRPO and other regulatory documents, and has assisted with development of virtual assessment procedures and virtual intervention protocols.

Name: Kara Hume
Project Role: Co-Investigator
Researcher Identifier: 0000-0002-7917-792X
Nearest person month worked: 1.8

Contribution to Project: Dr. Hume has provided training and support for finalizing and reliability training of the fidelity coding.

Name: Elena Lamarche
Project Role: Research Coordinator
Researcher Identifier: 0000-0003-0600-3387
Nearest person month worked: 4.8

Contribution to Project: Ms. Lamarche has assisted in the training of research staff including organization and purchase of study materials, and maintaining IRB, HRPO protocol and other regulatory documents, including documentation at partnering institution.

Name: Karrah Bowman
Project Role Research Assistant
Researcher Identifier:
Nearest person month worked: 3.6

Contribution to Project: Ms. Bowman has assisted in the maintaining the REDCap database and becoming reliable on the behavioral observation and fidelity coding.

Name: Sara Stahl
Project Role Research Assistant
Researcher Identifier:
Nearest person month worked: 3

Contribution to Project: Ms. Stahl was onboarded and trained in administration and coding of the behavioral assessments and trained on data entry in the REDCap database.

Name: Tabetha Marsh
Project Role: Research Assistant
Researcher Identifier:
Nearest Person month worked: 4.8
Contribution to Project: Ms. Marsh was onboarded and trained in administration and coding of the behavioral assessments and trained on data entry in the REDCap database.

Name: Glenna Osborne
Project Role: Lead Comprehensive T-STEP Clinician
Researcher Identifier:
Nearest person month worked: 5.4
Contribution to Project: Ms. Osborne has trained and supported the co-clinician and led the Comprehensive T-STEP class for cohort 1 and 2.

Name: Kelsey Forrest
Project Role: Comprehensive T-STEP Clinician
Researcher Identifier:
Nearest person month worked: 1
Contribution to project: Ms. Forrest has co-led the Comprehensive T-STEP class for cohort 2.

Name: Linda Varblow
Project Role: Lead Counseling Clinician
Researcher Identifier:
Nearest person month worked: 4.8
Contribution to Project: Ms. Varblow has trained and supported the co-clinician and conducted group and individual counseling sessions for both cohorts.

Name: Halie Ellinger
Project Role: Counseling Clinician
Researcher Identifier:
Nearest person month worked: 3
Contribution to Project: Ms. Ellinger has trained and conducted group and individual counseling sessions for both cohorts.

Name: Michal Cook
Project Role: Graduate Research Assistant/Clinician
Researcher Identifier:
Nearest person month worked: 3
Contribution to the Project: Ms. Cook completed intake visits and intervention training. She trained and was the co-clinician for cohort 1 Comprehensive T-STEP class.

Name: Claire Klein
Project Role: Graduate Research Assistant
Researcher Identifier:
Nearest person month worked: 3
Contribution to Project: Ms. Klein onboarded as a first-year graduate student and has become reliable in conducting and coding behavioral assessments.

Name: Ya Cing Syu
Project Role: Graduate Research Assistant
Researcher Identifier:
Nearest person month worked: 3
Contribution to Project: Ms. Syu has trained and become reliable on behavioral and fidelity coding systems.

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

If the active support has changed for the PD/PI(s) or senior/key personnel, then describe what the change has been. Changes may occur, for example, if a previously active grant has closed and/or if a previously pending grant is now active. Annotate this information so it is clear what has changed from the previous submission. Submission of other support information is not necessary for pending changes or for changes in the level of effort for active support reported previously. The awarding agency may require prior written approval if a change in active other support significantly impacts the effort on the project that is the subject of the project report.

Nothing to Report.

What other organizations were involved as partners?

If there is nothing significant to report during this reporting period, state “Nothing to Report.”

Describe partner organizations – academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic) – that were involved with the project. Partner organizations may have provided financial or in-kind support, supplied facilities or equipment, collaborated in the research, exchanged personnel, or otherwise contributed.

Provide the following information for each partnership:

Organization Name:

Location of Organization: (if foreign location list country)

Partner’s contribution to the project (identify one or more)

- *Financial support;*
- *In-kind support (e.g., partner makes software, computers, equipment, etc., available to project staff);*
- *Facilities (e.g., project staff use the partner’s facilities for project activities);*
- *Collaboration (e.g., partner’s staff work with project staff on the project);*
- *Personnel exchanges (e.g., project staff and/or partner’s staff use each other’s facilities, work at each other’s site); and*
- *Other.*

Organization Name: Guilford Tech Community College

Location of Organization: Greensboro, North Carolina

- Intervention and assessment staff use the partner's facilities for the various activities.
- The intervention's staff uses the partner's disability services, career counseling, and academic advising resources provided on the community college campus.

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS: *For collaborative awards, independent reports are required from BOTH the Initiating Principal Investigator (PI) and the Collaborating/Partnering PI. A duplicative report is acceptable; however, tasks shall be clearly marked with the responsible PI and research site. A report shall be submitted to <https://ebrap.org/eBRAP/public/index.htm> for each unique award.*

QUAD CHARTS: *If applicable, the Quad Chart (available on <https://www.usamraa.army.mil/Pages/Resources.aspx>) should be updated and submitted with attachments.*

9. **APPENDICES:** *Attach all appendices that contain information that supplements, clarifies or supports the text. Examples include original copies of journal articles, reprints of manuscripts and abstracts, a curriculum vitae, patent applications, study questionnaires, and surveys, etc.*

W81XH1910825: Examining the Efficacy of the T-STEP



PI: Dr.'s Laura Klinger & Brianne Tomaszewski, University of North Carolina, Chapel Hill, NC

Budget: \$1,435,538.00

Topic Area: TEACCH Autism Program

Mechanism: Clinical Trial Award

Research Area(s): Autism, transition-aged

Award Status: 15 September 2019 - 14 September 2023

Study Goals:

The current study seeks to test whether the targeted intervention provided by the comprehensive T-STEP (course, counseling, internship) is more effective at supporting the transition to adulthood than counseling services alone (i.e., academic, career, and self-advocacy counseling). We hypothesize that the full T-STEP program (community college course, internship, counseling) will lead to improved short-term and long-term outcomes compared to counseling services only.

Specific Aims:

1. Examine the efficacy of the T-STEP compared to counseling only services in improving executive function, social communication, emotion regulation, and self-determination skills.
2. Examine moderators of T-STEP efficacy to identify characteristics of individuals who benefit most from the program.
3. Examine maintenance of intervention effects and more distal outcomes (grade point average, employment) at 6-months post-intervention.
4. An auxiliary meta-analysis aim to compare outcomes of a simultaneously running RCT examining the efficacy of the comprehensive T-STEP program to a waitlist control no services/services as usual condition. This auxiliary aim will allow us to re-examine Aims 1 & 2 across three treatment groups: T-STEP (120 students), counseling only (60 students), and no services/services as usual (60 students).

Key Accomplishments and Outcomes:

Publications: Tomaszewski, B., Klinger, L., & Pugliese, C.E. (2021) Self-Determination in Autistic Transition-Aged Youth without Intellectual Disability. *Journal of Autism and Developmental Disorders*. <https://doi.org/10.1007/s10803-021-05280-6>

Patents: none to date

Funding Obtained: none to date



Self-Determination in Autistic Transition-Aged Youth without Intellectual Disability

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Abstract

Self-determination refers to an individual's capacity and opportunities to act as a causal agent in their own lives to make choices, decisions, and set goals. The current study examined self- and parent-reports of the AIR Self-Determination Scale in transition-aged autistic youth (Based on stakeholder preferences, we use identity-first (autistic) or neutral language (on the autism spectrum) (Bottema-Beutel in *JAMA* 3:18–29, 2020)). Autistic youth completed depression and executive function measures, and parents rated their child's social-communication and executive function difficulties. Despite differences between youth and parent reports, both youth and their parents reported lower self-determination skills (capacity) than opportunities to practice self-determined behaviors. Both depression and executive function skills were related to self-determination capacity, highlighting potential intervention targets for transition-aged youth to facilitate increased self-determination and potentially improved adult outcomes.

Keywords Autism · Self-determination · Transition · Executive function · Adolescence · Young adult

The prevalence rate of autism has increased 150% in the first two decades of the twenty-first century, with the fastest growing subgroup including individuals without co-occurring intellectual disability (ID; Maenner et al., 2020). Within this group, comprising 2/3 of individuals on the autism spectrum, there is an expectation of positive outcomes based on relatively higher cognitive and linguistic abilities. However, longitudinal studies have not generally found more

favorable outcomes in this group (Howlin, 2003). As few as 9% of autistic adults without ID reach functional independence, only 9% remain consistently employed in full-time competitive positions compared to 90%–96% of the general U.S. population, and most remain employed in entry-level jobs (Baio et al., 2018; Christensen et al., 2016; Henninger & Taylor, 2012; Roux et al., 2015; Shattuck et al., 2012; Taylor & Mailick, 2014; Taylor & Seltzer, 2011). Compared to autistic adults with ID, autistic adults without ID are three times more likely to have no daytime activities of any kind (Taylor & Selzer, 2011). The high rates of unemployment and educational and vocational disruptions (Chan et al., 2017; Taylor & DaWalt, 2017) are associated with a per-person cost of \$50,319 per year for autistic adults without ID (Buescher et al., 2014).

Despite these poor outcomes, autistic youth without ID experience a steep decline in services that begins during high school and continues into the post-secondary time period. (Laxman et al., 2019). This loss of services is often characterized as "falling over a cliff." When asked about specific transition support needs, caregivers of autistic adults report that during high school, the curriculum focuses on academics, but not on "soft" skills that are critical for transition success, including independent living skills, self-determination, and preparedness for employment or

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post-secondary education (Anderson & Butt, 2018; Matthews et al., 2021; Snell-Rood et al., 2020). The lack of support for specific skills associated with a successful transition to adulthood has posed a significant problem for autistic youth who commonly struggle with independent living skills and self-advocacy (Gillespie-Lynch et al., 2017; Pugliese et al., 2015, 2016; Shogren & Plotner, 2012; Van Hees et al., 2015). Thus, there is a critical need to study and identify potential intervention targets for autistic youth without ID to promote successful adult outcomes.

Self-determination is one potential intervention target that has been highlighted as a significant predictor of positive outcomes in adolescence and adulthood for individuals with disabilities (Shogren & Shaw, 2017; Shogren et al., 2015) but has received less attention in autism research. Self-determination refers to a set of beliefs, knowledge, and skills (e.g. self-awareness, decision-making, goal setting) that enable someone to engage in self-directed behavior and pursue their own goals and desires in areas a person feels are important to them (Wehmeyer, 1998). Self-determination theory emphasizes the importance of providing individuals with the opportunity and support to practice self-determined behaviors in their environment (Wolman et al., 1994). Self-determination includes capacity and opportunity. Capacity refers to the knowledge, perception, and abilities that enable an individual to set desired goals, independently make choices and plans to pursue those goals, and self-awareness of goal progress. Opportunity refers to the chance to use their knowledge and abilities at home and school (Wolman et al., 1994). Much of the literature on self-determination comes from research on intellectual disabilities or learning disabilities. It suggests that higher self-determination has been linked to various positive school and adult outcomes (Wehmeyer et al., 2010). Increased self-determination is associated with higher academic achievement in high school students with disabilities (Gaumer Erickson et al., 2015; Zheng et al., 2014). Youth with disabilities and higher self-determination in high school have greater community access post-graduation, higher rates of enrollment and completion of post-secondary education, are more likely to be employed, make greater wages, have better quality social relationships, more financial supports, and advocacy, and have a higher quality of life than youth with disabilities with lower self-determination (Chao, 2018; Petcu et al., 2017; Shogren & Shaw, 2017; Shogren et al., 2015; Wehmeyer & Schwartz, 1997; Zalewska et al., 2016).

The small amount of prior research on self-determination in autistic adolescents and adults indicates that it is positively associated with quality of life (Kim, 2019; White et al., 2018). However, autistic adolescents have lower self-determination abilities than those with ID or learning disabilities (Chou et al., 2017; Kim, 2019; White et al., 2018). Studies that have combined autistic young

adults with and without ID have reported that caregivers rated autistic young adults as having lower capacity than opportunities for making self-determined decisions (Cheak-Zamora et al., 2020; Tomaszewski et al., 2020). However, in contrast to the caregiver report, Tomaszewski et al., (2020) found that adolescents and young adults reported higher capacity levels. Given the central theoretical importance of the individual's perception in self-determination theory, it is critical to consider the youth's perspective. To date, no studies have examined predictors of self-reported self-determination in transition-aged youth on the autism spectrum without ID. Identification of malleable factors is essential to enhancing self-determination and downstream positive outcomes. We explore three significant predictors that may influence the ability to engage in self-determined behavior: social communication difficulties, executive function (EF) skills, and depressive symptoms.

Increased social-communication difficulties have been associated with reduced independence in autistic adults (Eaves & Ho, 2008; Howlin et al., 2004). Two studies in autistic adolescents and young adults have reported a significant association between caregiver and educator reports of social-communication difficulties and self-determination in combined samples of individuals with and without ID (Cheak-Zamora et al., 2020; Tomaszewski et al., 2020) with more social-communication difficulties associated with lower levels of self-determination. Similarly, teacher ratings of greater student self-determination abilities were correlated with greater social skills in adolescents with disabilities, more generally (Pierson et al., 2008). Thus, it is likely that greater social-communication difficulties may negatively impact self-determination in transition-aged autistic youth.

Higher order cognitive skills to manage goal-directed behavior and problem-solving have been theoretically linked to self-determination (Wehmeyer & Garner, 2003) and may be particularly relevant in autistic youth due to well-documented EF difficulties. EF abilities, including flexibility, working memory, organization, and planning, are impaired in individuals on the autism spectrum as reported by parents and teachers (Granader et al., 2014; Hill, 2004; Kenworthy et al., 2008) and as demonstrated in controlled clinical settings (Kenworthy et al., 2005, 2008; Lai et al., 2017; Landry & Al-Taie, 2016; Pennington & Ozonoff, 1996). Impaired EF has been linked to problems in areas that impact health, well-being, and independence in autistic adolescents and adults, including poor academic achievement (Pellicano et al., 2017; St. John et al., 2018) and adaptive behavior (Gardiner & Iarocci, 2018; Pugliese et al., 2015, 2016; Wallace et al., 2016). Thus, it is likely that impaired executive function may negatively impact self-determination in transition-aged autistic youth.

It is also possible that co-occurring mental health disorders, such as depression may be associated with reduced self-determination (Capriola-Hall et al., 2021). There are high rates of co-occurring depression in adolescents and adults on the autism spectrum (Cederlund et al., 2010; Hill et al., 2004; Taylor & Gotham, 2016), with a recent meta-analysis estimating a 37% lifetime prevalence rate of depression in autistic adults (Hollocks et al., 2019). Autistic adolescents and young adults also show higher depressive symptoms than those with other developmental disabilities (Gotham et al., 2015) and students without autism (Zuckerman et al., 2018). To our knowledge, the relationship between depression and self-determination has been examined in only one study in transition-aged youth (Capriola-Hall et al., 2021). A significant, negative association ($r = -0.52$) was reported between depression and self-determination. Thus, it is likely that depression may negatively impact self-determination in transition-aged autistic youth.

The purpose of the present study is to characterize self-determination for transition-aged autistic youth without ID from both the youth and parent perspective and explore mutable factors associated with its development. Specifically, we aimed to:

- (1) Compare student and parent perceptions of self-determination skills (i.e. capacity) and opportunities to practice self-determination in the home and school environment.
- (2) Explore the associations of age, IQ, social-communication difficulties, EF, and depression with youth- and parent-report of self-determination using structural equation modeling.

Methods

IRB approval was obtained from [blinded for review] and from participating school districts and community colleges. Participants under 18 provided assent, and their parents provided consent to participate. Participants 18 or older were asked specific structured questions to ensure capacity for consent.

Participants

Participants included 237 autistic transition-aged youth aged 14–21 ($M = 18.36$, $SD = 1.64$) and a subsample of their 198 parents and caregivers who completed self-determination measures. Participants were drawn from two different clinical trials studies examining the efficacy of transition to adulthood intervention programs across two different research teams. in the eastern United States. Participants were recruited from local high school transition fairs, high

schools, community colleges, vocational rehabilitation services, and local clinics providing services to individuals on the autism spectrum. Inclusion criteria were: (1) being transition age between 14 and 21 years, (2) a diagnosis of autism, including an educational diagnosis (as documented by a high school IEP) or a vocational rehabilitation diagnosis (as documented by either a previous IEP or a psychological evaluation within the past three years), (3) average or higher intellectual skills and language skills as evidenced by completion or in the process of completing a standard high school diploma, and (4) current enrollment in high school or community college. Adolescents and young adults on the autism spectrum were predominately male (76%) and White (71%). All assessments were conducted before participation in an intervention. Participants completed questionnaires and direct assessments as part of a larger battery of assessments during the baseline visit to the intervention study.

The majority of measures were consistent across studies warranting a combination of baseline assessments to address questions regarding self-determination. However, there are some differences among sites, as noted below. A subset of participants ($n = 106$) completed the Wechsler Abbreviated Scales of Intelligence Full-Scale IQ or Brief Full-Scale IQ (WASI-II FSIQ-4 or FSIQ-2; Wechsler, 2011) to confirm an IQ score of > 80 from both sites. Participants were excluded if they received a prior diagnosis of ID.

Measures

Self-Determination

The AIR Self-Determination Scale (AIR-SDS; Wolman et al., 1994) was developed to measure school-age students' self-determination across two subdomains: Capacity and Opportunity. The Capacity domain measures the student's knowledge, abilities, and perceptions that enable youth to become self-determined. The Opportunity domain measures youth's chances to apply their knowledge and abilities related to self-determination at home and school. Items are rated on a 5-point scale from "Never" to "Always," with higher scores indicating greater self-determination. The AIR-SDS Student Form and Parent Forms were used in the current study.

The AIR-SDS student form is a 24-item scale measuring Capacity (12 items), Opportunity at School (6 items), and Opportunity at Home (6 items). The Capacity (Cronbach's $\alpha = 0.89$), Opportunities at Home (Cronbach's $\alpha = 0.86$), Opportunities at school (Cronbach's $\alpha = 0.86$), and overall self-determination items, (Cronbach's $\alpha = 0.91$) demonstrated high internal consistency in the current sample. See Table 1 for item examples.

The AIR-SDS parent form has 18 items that parallel the student form, but the Capacity scale only contains six items

Table 1 Example items for the AIR-SDS

Capacity		Opportunity	
Student			
Ability Think	I know what I need, what I like, and what I'm good at	At School Think	People at school listen to me when I talk about what I want, what I need, or what I'm good at
Ability Do	I figure out how to meet my goals. I make plans and decide what I should do	At School Do	People at school encourage me to start working on my plans right away
Ability Adjust	If my plan doesn't work, I try another one to meet my goals	At School Adjust	I have someone at school who can tell me if I am meeting my goals
Perception Think	I believe that I can set goals to get what I want	At Home Think	People at home let me know that I can set my own goals to get what I want or need
Perception Do	I like to begin working on my plans right away	At Home Do	At home, I have learned how to make plans to meet my goals and to feel good about them
Perception Adjust	I am willing to try another way if it helps me meet my goals	At Home Adjust	People at home understand when I have to change my plan to meet my goals. They offer advice and encourage me when I'm doing this
Parent			
Ability Think	My child sets his or her own goals to satisfy wants or needs. (S)he thinks about his or her own abilities when setting goals	At Home Think	At home, people let my child know that (s)he can set his or her own goals to get what (s)he wants or needs
Ability Do	My child figures out how to meet goals alone. (S)he makes plans and decides what to do independently	At Home Do	At home, my child has learned how to make plans to meet his or her own goals and to feel good about them
Ability Adjust	My child checks his or her own progress when completing his or her plan. (S)he asks others what they think of his or her progress	At Home Adjust	At home, people understand my child when (s)he has to change plans to meet his or own goals. They offer advice and encouragement

assessing their child's abilities related to self-determination. The parent form Capacity (Cronbach's $\alpha=0.85$), Opportunity at School (Cronbach's $\alpha=0.88$), Opportunity at Home (Cronbach's $\alpha=0.79$), and overall self-determination items (Cronbach's $\alpha=0.87$) demonstrated high internal consistency (see Table 1 for example items) in the current sample. The Level of Self-Determination is calculated by dividing the sum by the total possible sum and multiplying by 100, with a maximum score of 100. The self-determination level was used to compare student and parent reports directly due to the different items. This measure was collected at both sites.

Social-Communication Difficulties

Parents or caregivers completed the Social Responsiveness Scale-2nd edition School-Age or Adult Form (SRS-2; Constantino, 2012). The SRS-2 is a 65-item measure of social-communication difficulties, with higher *T*-scores indicating greater social-communication difficulties. The School-Age Form is designed for ages 4–18, and the Adult form is designed for ages 19–89 years, and there is considerable overlap between the two forms. The SRS-2 was standardized with a large representative, a sample of 1014 children and 1602 adults, and demonstrated strong internal consistency (0.94–0.96; Constantino, 2012). The total *T*-Score was used in the current sample (Cronbach's $\alpha=0.78$). The

School-Age form was used at one site, and the Adult Form was used at the second site. The SRS-2 School Report and Adult both have 65 items with slight wording changes and more appropriate items for adult contexts (i.e. separates easily from caregivers in SRS-2 School Age was replaced with enjoys and is competent with small talk (casual conversation with others)). The authors and the user manual recommend using the SRS-2 across the lifespan.

Executive Function

Parent/caregiver-report of EF was measured using the Behavior Rating Inventory of Executive Function-2nd edition (BRIEF-2; Gioia et al., 2015) or the Behavior Rating Inventory of Executive Function, Adult Form (BRIEF-A; Roth et al., 2004). The BRIEF-2 and BRIEF-A are informant report questionnaires that assess EF abilities' behavioral manifestation in school-aged children (ages 5–18; BRIEF-2) and adults (ages 18–90; BRIEF-A). The BRIEF-2 was used at one site, and the BRIEF-A was used at the second site. For both versions, items are summed to create an overall Global Executive Composite (GEC) *T*-score, with higher scores indicating more significant EF difficulties. The BRIEF-2 and BRIEF-A standardization samples included nationally representative samples of 3603 children and 1136 adults. The BRIEF-2 and BRIEF-A have demonstrated acceptable reliability and validity as an ecologically sensitive EF measure

(Gioia et al., 2015; Roth et al., 2005). The BRIEF- A (Cronbach's $\alpha = 0.96$) and BRIEF-2 (Cronbach's $\alpha = 0.90$) demonstrated excellent internal consistency in the current sample. A subset of adolescents with ASD ($n = 47$) completed the BRIEF-2 Self-Report form (Gioia et al., 2015). The Self-Report form examines EF difficulties in individuals ages 11–18. The BRIEF-2 Self-Report has demonstrated reliability and validity in clinical and non-clinical samples (Gioia et al., 2015). The GEC is on the same scale for all three BRIEF versions; thus, the GEC was used in the current analysis.

Depression

Autistic youth completed the CESD Scale (Radloff, 1977) or the (CESD-R; (Eaton et al., 2004), depending on site. The CESD and CESD-R are widely used measures of depression. Individuals rate the frequency of their depression symptoms from 0 (*not at all*) to 3 (*5–7 days/nearly every day*). Both CESD and CESD-R have demonstrated high internal consistency and validity (Eaton et al., 2004; Van Dam & Earleywine, 2011). CESD-R scores were converted to the same range as CESD overall scores across 20 questions for a range of possible scores between 0 and 60, with higher scores indicating more significant depressive symptoms as recommended by the authors (Eaton et al., 2004). Individuals with a total score of 16 or above are considered to have clinically significant depression scores (Eaton et al., 2004).

Missing Data

There was missingness across the sample from the two clinical sites. Participants completed student-reported EF ($N = 47$) from one site and a subset of participants completed IQ measures from both sites ($N = 106$). There was missingness for student-reported self-determination ($N = 230$), parent-reported self-determination ($N = 195$), social communication difficulties ($N = 224$), parent-reported EF ($N = 219$), and student-reported depression ($N = 214$). Data from self-determination, social communication difficulties, parent-reported EF, and self-reported depression were assumed to be missing at random (MAR) or that the missingness is due to the observed variables (Enders, 2003; Little & Rubin, 2020). Missing data were handled in data analysis using Multiple Imputation and Full Information Maximum Likelihood as described below.

Data Analysis Plan

To characterize and compare youth and parent self-determination, repeated-measured ANOVAs were conducted using IBM SPSS Statistics, version 28 for youth and parents. Multiple imputation was used to address missing data.

Data were imputed across 18 datasets to address the 18% of missing data from the parent reports of self-determination. Multiple imputation estimates a set of values for the missing data based on the observed data. Data is analyzed across the 18 datasets to derive a set of unbiased parameter estimates (White et al., 2011). Between-group differences and within-individual profiles of self-determination were examined for self-determination domains.

Analyses exploring predictors of self-determination were conducted in MPlus Version 8 using structural equation modeling (Muthén & Muthén, 1998–2017). The first step in structural equation modeling is to confirm the measurement model, or the factor structure, of the scale before adding in predictors. A confirmatory factor analysis was conducted to examine the factor structure of the AIR-Self-Determination Scale Student Report and Parent Report forms with robust weighted least squares estimators (WLSMV). WLSMV is recommended for categorical indicators (Brown, 2006). Several indices of model fit were examined to determine the adequacy of the measurement models: $\chi^2/df < 3.00$, CFI and TFI > 0.90 , and RMSEA and SMRM < 0.08 (Brown, 2006). Following validation of the measurement model, a structural equation model was performed to examine the extent to which age, IQ, parent-reported autism severity, parent and student-reported EF, and student-reported depression predicted self-determination. These variables were added as covariates to the final measurement models from the confirmatory factor analyses. Associations were examined among student and parent levels of self-determination to assess the concordance of student and parent forms. Full information maximum likelihood was used to address the missing data. Full information maximum likelihood is recommended rather than listwise deletion due to the production of less bias in parameters (Enders, 2010; Graham, 2009). Full information maximum likelihood uses all available information in the dataset to produce unbiased parameter estimates and standard errors (Enders, 2010).

Results

Student and Parent Self-Determination Levels

The overall repeated-measures ANOVA between parent and student reported domains of Capacity, Opportunity at Home, and Opportunity at School was statistically significant, $F(2, 419) = 86.51$, $p < 0.001$, $\eta^2 = 0.29$, indicating that youth-rated their self-determination skills differently than their parents. Students reported significantly higher self-determination capacity, more self-determination opportunities at home, and fewer self-determination opportunities at school than parents; (See Table 2).

Table 2 Self-determination descriptive statistics

Self-Determination Level	Parent Level		Student Level		t	p-value	η^2
	M(SE)	Range	M(SE)	Range			
Capacity	56.42(.96)	23–100	68.43(.86)	31–100	9.28	<.001	.16
Opportunities at Home	75.76(1.01)	40–100	79.92(.93)	27–100	3.00	.003	.02
Opportunities at School	76.81(1.19)	33–100	67.66(1.89)	20–100	9.15	<.001	.07

Note. Items are summarized across the 18 multiple imputed datasets for 237 participants

The overall repeated-measure ANOVA for student report of self-determination was statistically significant, $F(2, 236) = 72.83$, $p < 0.001$, $\eta^2 = 0.39$. Post-hoc paired sample t-tests indicated that students reported higher levels of opportunities to practice self-determined behavior at home than self-determination skills (capacity), $t(236) = 10.81$, $p < 0.001$, Cohen's $d = 0.72$, and self-determination opportunities at school, $t(236) = 10.25$, $p < 0.001$, Cohen's $d = 0.68$. Youth reported similar levels of capacity and opportunities at school, $t(236) = 0.72$, $p = 0.27$, Cohen's $d = 0.04$.

The overall repeated-measure ANOVA for parent report of self-determination was statistically significant, $F(2, 236) = 163.24$, $p < 0.001$, $\eta^2 = 0.73$. Parents reported that students had higher levels of opportunities to practice self-determined behavior at home, $t(236) = 17.43$, $p < 0.001$, Cohen's $d = 1.25$, and school, school, $t(236) = 17.75$, $p < 0.001$, Cohen's $d = 1.26$, than they had skills to engage in those behaviors (capacity). Parents reported similar levels of self-determination opportunities at home than at school, $t(236) = -0.90$, $p = 0.18$, Cohen's $d = 0.07$.

Predictors of Self-Determination

The first step of examining predictors of self-determination involved confirmatory factor analyses of the AIR-SDS Student Report and Parent Report. The hypothesized structural model of the AIR-SDS Student and Parent Reports did not fit the data well, $\chi^2/df = 1.99$, RMSEA = 0.07 (90% CI [0.06, 0.07]), CFI = 0.90, TLI = 0.89, SRMR = 0.08. Modification indices suggested an Opportunity at Home and an Opportunity at School item loaded onto the Capacity domain for student and parent reports. On both student and parent versions of the AIR-SDS, the Opportunity at Home and School scale items "[At School]...I have learned how to make plans to meet my goals and to feel good about them" also loaded onto the capacity domain. This item was also reported as loading onto both domains in the parent version of AIR-SDS in a larger sample of high school students across cognitive abilities on the autism spectrum (Tomaszewski et al., 2020). Students and parents rated this item lower on the opportunities at home domain than the other opportunities items. The measurement model fit indices demonstrated acceptable fit, $\chi^2/df = 1.56$, RMSEA = 0.05 (90% CI [0.04, 0.06]),

CFI = 0.94, TLI = 0.93, SRMR = 0.07. All item factor loadings were > 0.30 . See Table 3 for item statistics.

Age, IQ, social-communication difficulties, EF, and depression were regressed onto the latent constructs of student capacity, student opportunities at school, student opportunities at home, parent capacity, parent opportunities at school, and parent opportunities at home in a structural equation model. The model demonstrated acceptable fit, $\chi^2/df = 1.48$, RMSEA = 0.05 (90% CI [0.04, 0.05]), CFI = 0.94, TLI = 0.92, SRMR = 0.07. Lower student-reported depression ($\beta = -0.17$, $p = 0.04$) and fewer student-reported EF problems ($\beta = -0.63$, $p < 0.001$) were associated with greater student-reported capacity for self-determination (for student-report significant associations). The model was also repeated without student-reported EF due to only 47 participants completing this measure. There were no significant differences in relationships among measures in the model.

Higher IQ scores were associated with greater parent-reported capacity ($\beta = 0.28$, $p = 0.02$). Lower parent-reported social-communication difficulties were associated with greater parent-reported self-determination capacity ($\beta = -0.30$, $p = 0.001$). Fewer parent-reported EF problems were significantly associated with greater parent-reported capacity ($\beta = -0.56$, $p < 0.001$). Younger ages were significantly associated with greater parent-reported opportunities at home ($\beta = -0.18$, $p = 0.03$).

There were no significant correlations between parent and student reports of opportunities at home. There was a small, significant association between student and parent reports of capacity ($\beta = 0.20$, $p = 0.01$) and opportunities at school ($\beta = 0.17$, $p = 0.02$). Student-reported depression was significantly associated with parent-reported social communication difficulties ($\beta = 0.17$, $p = 0.03$), parent-reported EF ($\beta = 0.31$, $p < 0.001$), and student reported-EF ($\beta = 0.55$, $p < 0.001$). Parent-reported EF was significantly associated with age ($\beta = -0.16$, $p = 0.03$) and social communication difficulties ($\beta = 0.43$, $p < 0.001$).

Discussion

The purpose of the current study was to compare self-determination from perspectives of transition-aged youth with autism and their parents using the AIR Self-Determination

Table 3 Item statistics for the confirmatory factor analysis of the Air Self-Determination Scale student and parent forms

Domain	Items	Mean (SD)	Corrected item-total correlation	Standardized factor loading
Student Capacity	Do1s	3.94(.77)	.50	.61
	Do2s	3.31(.89)	.70	.77
	Do3s	3.28(.91)	.69	.77
	Do4s	3.09(.99)	.68	.80
	Do5s	3.03(1.07)	.59	.70
	Do6s	3.29(1.01)	.59	.66
	Feel1s	3.95(.87)	.41	.55
	Feel2s	3.76(.90)	.60	.69
	Feel3s	3.42(1.04)	.70	.79
	Feel4s	3.14(1.05)	.62	.75
	Feel5s	3.18(1.03)	.73	.82
	Feel6s	3.60(.92)	.53	.62
	Home3s	3.61(1.02)	.53	.45
	School3s	3.37(1.03)	.56	.44
Student Opportunity at Home	Home1s	4.10(.93)	.62	.75
	Home2s	4.10(.99)	.71	.84
	Home3s	3.61(1.02)	.52	.44
	Home4s	4.02(1.05)	.68	.77
	Home5s	4.12(1.05)	.63	.76
	Home6s	4.01(1.03)	.68	.82
Student Opportunity at School	School1s	3.42(1.04)	.57	.70
	School2s	3.35(1.20)	.72	.81
	School3s	3.38(1.04)	.55	.50
	School4s	3.50(1.28)	.73	.81
	School5s	3.36(1.32)	.66	.77
	School6s	3.38(1.16)	.72	.83
Parent-Reported Capacity	Do1p	3.72(.75)	.33	.41
	Do2p	2.96(.84)	.74	.89
	Do3p	2.65(.86)	.75	.88
	Do4p	2.56(.90)	.65	.78
	Do5p	2.54(.94)	.63	.76
	Do6p	2.59(.89)	.68	.80
	Home3p	3.35(.95)	.57	.49
Parent-Reported Opportunity at Home	School3p	3.28(.82)	.51	.50
	Home1	4.02(.692)	.54	.82
	Home2	4.08(.750)	.54	.80
	Home3p	3.35(.95)	.53	.42
	Home4	3.97(.785)	.42	.53
	Home5	4.00(.911)	.30	.81
Parent-Reported Opportunity at School	Home6	4.18(.807)	.40	.92
	School1	3.94(.85)	.60	.88
	School2	4.00(.88)	.52	.80
	School3p	3.35(.95)	.71	.42
	School4	3.66(.892)	.55	.71
	School5	3.81(.923)	.39	.83
	School6	3.77(.947)	.49	.93

Scale and examine associations among self-reported and parent-reported individual characteristics. First, we found evidence to suggest that ratings of self-determination capacity and opportunities to practice self-determined behaviors differ between autistic youth and their parents. Additionally, ratings on these domains were differentially distributed within each group, with skill level generally lagging opportunities for practice. Second, we demonstrated significant associations among social-communication challenges, EF, depression, and self-determination domains that differed depending on the reporter.

Autistic students reported higher self-determination capacity and higher levels of opportunity to practice self-determined behavior at home than their parents. Notably, students reported fewer opportunities to practice self-determined behavior at school than their parents. There was a small significant correlation between parent reports and self-reports of capacity. The lack of correlation finding is unsurprising, given that multi-informant reports typically only yield low-to-moderate levels of correspondence (i.e. r 's ranging from 0.20 to 0.60; De Los Reyes et al., 2015). This lack of concordance between parent and self-reports in transition-aged autistic youth without co-occurring ID suggests the importance of gaining information from both youth and their parents in setting goals for the transition to independence.

While some studies suggest that we should take caution in self-reports due to these discrepancies (Mazefsky et al., 2011), self-determination involves the individual's causal agency, so it is critical to incorporate perspectives of autistic transition-aged youth. Despite differences in the mean-level report of self-determination capacity and opportunities and a lack of parent-child correlation on these domains, parents and youth both reported similar patterns across the AIR-SDS such that self-determination capacity was viewed as lower than the opportunities they had to practice self-determination skills at home; and that there were more opportunities to practice self-determination at home than at school. These findings suggest that while opportunities at home and school exist for students, they may need more support in skills surrounding explicit instruction in self-determination or activities that promote self-determination, emphasizing school-based supports. To date, one intervention incorporates explicit self-determination instruction in autistic youth without co-occurring ID ages 16–25 (White et al., 2017, 2019). The STEPS program incorporates an explicit focus on self-determination through cognitive-behavioral strategies (White et al., 2017). Results showed that students with higher self-determination levels at baseline predicted increases in college adjustment intervention gains (White et al., 2019). These findings were preliminary due to small sample sizes and did not demonstrate a change in self-determination over time; thus, more research is needed to

examine self-determination interventions for transition-aged youth on the autism spectrum.

Increased levels of depression and EF difficulties were associated with student-reported capacity but not opportunity, suggesting that depression and EF may contribute to lower capacity levels. In the current sample, 35% of participants met the criterion for a clinically significant depression score. Both depression and EF have been associated with adaptive behavior or outcomes related to daily living activities in autistic adolescent youth (Kraepel et al., 2017; Pugliese et al., 2015, 2016) and independence and well-being in adulthood (Wallace et al., 2016). Given that autistic youth are at risk for increased depression and EF difficulties, focusing on mental health and building strong foundational EF skills, such as teaching self-advocacy around EF challenges, may be essential for building self-determination skills. Interestingly, greater parent-reported EF difficulties were associated with decreased self-determination levels and fewer opportunities to practice self-determined behavior at home but more opportunities at school. The opposite pattern of opportunities at home and school may indicate the difference in how supports are viewed. For example, parents may rate fewer opportunities at home for students with increased EF difficulties because they have less capacity to act upon opportunities at home. Nevertheless, they may view the school as providing increased supports for their students due to their child having increased EF difficulties. Future research would be necessary to consider school context by including teacher or instructor reports of self-determination opportunities.

For autistic youth without co-occurring ID, the item surrounding making plans for goals was not clearly distinguished from the skill of self-determination or the opportunities provided to learn these skills. It may be that there need to be both learning opportunities and more explicit instruction in how to learn to make plans for goals for parents and educators. Research on goal planning in autistic transition-aged youth has suggested that clear post-school goals are essential for a successful transition to college or employment settings (Alverson et al., 2019; Wei et al., 2016). Autistic students currently in post-secondary education settings may also benefit from clear goal planning support during their experiences to promote a successful transition from post-secondary education to employment (Van Hees et al., 2015; Vincent, 2019).

This study is not without limitations. First, due to two separate samples, there were missing data on the BRIEF Self-Report and IQ measures. While data was estimated using FIML, which produces less biased parameters than case deletion, there was a larger percentage of missingness across predictor variables. Second, this study was cross-sectional, and longitudinal research is needed to explore these relationships over time to make inferences about causality

among the variables. Third, we do not have a history of previous services received. Detailing the types and amounts of services received during transition will be critical when examining future studies' service use and intervention programs. Fourth, we combined the use of the BRIEF-A and BRIEF-2, which has not been reported on previously. There is more validation work needed to justify the combination of these measures in future studies. Finally, there were no self-reported autism severity or parent-reported depression measures to examine all reporters' perspectives on these constructs.

The current study examined self-determination in autistic youth in high school and community colleges using student and parent-reports. There was a discrepancy between students and parents, with students reporting higher capacity and fewer opportunities at school. However, overall both students and parents reported that self-determination capacity lagged behind opportunities for engaging in self-determined behavior. For students, depression was strongly related to capacity suggesting that a focus on treating depression may support increased self-determination and potentially adult outcome. For caregivers, symptom severity and cognitive abilities (IQ and executive function) were most related to self-determination. Findings highlight the importance of gaining both the parent and student perspective and suggest that depression and executive function skills may be important intervention targets for transition aged youth in facilitating increased self-determination and potentially improved adult outcomes.

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Declarations

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

References

- Alverson, C. Y., Lindstrom, L. E., & Hirano, K. A. (2019). High School to College: Transition Experiences of Young Adults With Autism. *Focus on Autism and Other Developmental Disabilities, 34*(1), 52–64. <https://doi.org/10.1177/1088357615611880>
- Anderson, C., & Butt, C. (2018). Young adults on the autism spectrum: The struggle for appropriate services. *Journal of Autism and Developmental Disorders, 48*(10), 3673–3683. <https://doi.org/10.1007/s10803-018-3673-z>
- Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., Kurzius-Spencer, M., Zahorodny, W., Robinson, C., White, T., Durkin, M. S., Imm, P., Nikolaou, L., Yeargin-Allsopp, M., Lee, L.-C., Harrington, R., Lopez, M., Fitzgerald, R. T., & Dowling, N. F. (2018). Prevalence of autism spectrum disorder among children aged 8 years—Autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *MMWR Surveillance Summaries, 67*(10), 281–291. <https://doi.org/10.15585/mmwr.ss6706a1>
- Bottema-Beutel, K., Kapp, S. K., Lester, J. N., Sasson, N. J., & Hand, B. N. (2020). Avoiding ableist language: Suggestions for autism researchers. *Autism in Adulthood, 2*(1), 1–6. <https://doi.org/10.1089/aut.2020.0014>
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. The Guilford Press.
- Buescher, A. V. S., Cidav, Z., Knapp, M., & Mandell, D. S. (2014). Costs of autism spectrum disorders in the United Kingdom and the United States. *JAMA Pediatrics, 168*(10), 937–942. <https://doi.org/10.1001/jamapediatrics.2014.210>
- Capriola-Hall, N. N., Brewaele, A. M., Golt, J., & White, S. W. (2021). Anxiety and depression reduction as distal outcomes of a college transition readiness program for adults with autism. *Journal of Autism and Developmental Disorders, 51*, 298–306. <https://doi.org/10.1007/s10803-020-04549-6>
- Cederlund, M., Hagberg, B., & Gillberg, C. (2010). Asperger syndrome in adolescent and young adult males. Interview, self - and parent assessment of social, emotional, and cognitive problems. *Research in Developmental Disabilities, 31*(2), 287–298. <https://doi.org/10.1016/j.ridd.2009.09.006>
- Chan, W., Smith, L. E., Hong, J., Greenberg, J. S., Lounds Taylor, J., & Mailick, M. R. (2017). Factors associated with sustained community employment among adults with autism and co-occurring intellectual disability. *Autism, 21*(1), 10–24. <https://doi.org/10.1177/1362361317703760>
- Chao, P.-C. (2018). Using self-determination of senior college students with disabilities to predict their quality of life one year after graduation. *European Journal of Educational Research, 7*(1), 1–8. <https://doi.org/10.12973/eu-er.7.1.1>
- Cheak-Zamora, N. C., Maurer-Batjer, A., Malow, B. A., & Coleman, A. (2020). Self-determination in young adults with autism spectrum disorder. *Autism, 24*(3), 605–616. <https://doi.org/10.1177/1362361319877329>
- Chou, Y. C., Wehmeyer, M. L., Palmer, S. B., & Lee, J. (2017). Comparisons of self-determination among students with autism, intellectual disability, and learning disabilities: A multivariate analysis. *Focus on Autism and Other Developmental Disabilities, 32*(2), 124–134. <https://doi.org/10.1177/1088357615625059>
- Christensen, D. L., Baio, J., Braun, K. V. N., Bilder, D., Charles, J., Constantino, J. N., Daniels, J., Durkin, M. S., Fitzgerald, R. T., Kurzius-Spencer, M., Lee, L.-C., Pettygrove, S., Robinson, C., Schulz, E., Wells, C., Wingate, M. S., Zahorodny, W., & Yeargin-Allsopp, M. (2016). Prevalence and characteristics of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2012. *Morbidity and Mortality Weekly Report Surveillance Summaries (Washington, D.C.: 2002), 65*(3), 1–23. <https://doi.org/10.15585/mmwr.ss6503a1>
- Constantino, J. N. (2012). *Social Responsiveness Scale* (2nd ed.). Western Psychological Services.
- De Los Reyes, A., Augenstein, T. M., Wang, M., Thomas, S. A., Drabick, D. A. G., Burgers, D. E., & Rabinowitz, J. (2015). The validity of the multi-informant approach to assessing child and

- adolescent mental health. *Psychological Bulletin*, 141(4), 858–900. <https://doi.org/10.1037/a0038498>
- Eaton, W. W., Muntaner, C., Smith, C., Tien, A., & Ybarra, M. (2004). Center for Epidemiologic Studies Depression Scale: Review and revision (CESD and CESD-R). In M. E. Maruish (Ed.), *The Use of Psychological Testing for Treatment Planning and Outcomes Assessment* (3rd ed., pp. 363–377). Lawrence Erlbaum.
- Eaves, L. C., & Ho, H. H. (2008). Young adult outcome of autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 38(4), 739–747. <https://doi.org/10.1007/s10803-007-0441-x>
- Enders, C. K. (2003). Using the expectation maximization algorithm to estimate coefficient alpha for scales with item-level missing data. *Psychological Methods*, 8(3), 322–337. <https://doi.org/10.1037/1082-989X.8.3.322>
- Enders, C. K. (2010). *Applied missing data analysis*. Guilford Press.
- Gardiner, E., & Iarocci, G. (2018). Everyday executive function predicts adaptive and internalizing behavior among children with and without autism spectrum disorder. *Autism Research*, 11(2), 284–295. <https://doi.org/10.1002/aur.1877>
- Gaumer Erickson, A. S., Noonan, P. M., Zheng, C., & Brusso, J. A. (2015). The relationship between self-determination and academic achievement for adolescents with intellectual disabilities. *Research in Developmental Disabilities*, 36, 45–54. <https://doi.org/10.1016/j.ridd.2014.09.008>
- Gillespie-Lynch, K., Kapp, S. K., Brooks, P. J., Pickens, J., & Schwartzman, B. (2017). Whose expertise is it? Evidence for autistic adults as critical autism experts. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2017.00438>
- Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2015). Behavior Rating Inventory of Executive Function, Second Edition (BRIEF 2).
- Gotham, K., Marvin, A. R., Taylor, J. L., Warren, Z., Anderson, C. M., Law, P. A., Law, J. K., & Lipkin, P. H. (2015). Characterizing the daily life, needs, and priorities of adults with autism spectrum disorder from Interactive Autism Network data. *Autism*, 19(7), 794–804. <https://doi.org/10.1177/1362361315583818>
- Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Reviews of Psychology*, 60, 549–576.
- Granader, Y., Wallace, G., Hardy, K., Yerys, B., Lawson, R., Rosenthal, M., Wills, M., Dixon, E., Pandey, J., Penna, R., Schultz, R., & Kenworthy, L. (2014). Characterizing the factor structure of parent reported executive function in autism spectrum disorders: The impact of cognitive inflexibility. *Journal of Autism and Developmental Disorders*. <https://doi.org/10.1007/s10803-014-2169-8>
- Heninger, N. A., & Taylor, J. L. (2012). Outcomes in adults with autism spectrum disorders: A historical perspective. *Autism*, 12(1971), 1–14. <https://doi.org/10.1177/1362361312441266>
- Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, 8(1), 26–32. <https://doi.org/10.1016/j.tics.2003.11.003>
- Hill, E., Berthoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders*, 34(2), 229–235. <https://doi.org/10.1023/B:JADD.0000022613.41399.14>
- Hollocks, M. J., Lerh, J. W., Magiati, I., Meiser-Stedman, R., & Brugha, T. S. (2019). Anxiety and depression in adults with autism spectrum disorder: A systematic review and meta-analysis. *Psychological Medicine*, 49(4), 559–572. <https://doi.org/10.1017/S0033291718002283>
- Howlin, P. (2003). Outcome in high-functioning adults with autism with and without early language delays: Implications for the differentiation between autism and asperger syndrome. *Journal of Autism and Developmental Disorders*, 33(1), 3–13. <https://doi.org/10.1023/A:1022270118899>
- Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry*, 45(2), 212–229. <https://doi.org/10.1111/j.1469-7610.2004.00215.x>
- John, T., Dawson, G., & Estes, A. (2018). Brief report: Executive function as a predictor of academic achievement in school-aged children with ASD. *Journal of Autism and Developmental Disorders*, 48(1), 276–283. <https://doi.org/10.1007/s10803-017-3296-9>
- Kenworthy, L. E., Black, D. O., Wallace, G. L., Ahluvalia, T., Wagner, A. E., & Sirian, L. M. (2005). Disorganization: The forgotten executive dysfunction in high-functioning autism (HFA) spectrum disorders. *Developmental Neuropsychology*, 28(3), 809–827. https://doi.org/10.1207/s15326942dn2803_4
- Kenworthy, L., Yerys, B. E., Anthony, L. G., & Wallace, G. L. (2008). Understanding executive control in autism spectrum disorders in the lab and in the real world. *Neuropsychology Review*, 18(4), 320–338. <https://doi.org/10.1007/s11065-008-9077-7>
- Kim, S. Y. (2019). The experiences of adults with autism spectrum disorder: Self-determination and quality of life. *Research in Autism Spectrum Disorders*, 60, 1–15. <https://doi.org/10.1016/j.rasd.2018.12.002>
- Kraper, C. K., Kenworthy, L., Popal, H., Martin, A., & Wallace, G. L. (2017). The Gap Between Adaptive Behavior and Intelligence in Autism Persists into Young Adulthood and is Linked to Psychiatric Co-morbidities. *Journal of Autism and Developmental Disorders*, 47(10), 3007–3017. <https://doi.org/10.1007/s10803-017-3213-2>
- Lai, C. L. E., Lau, Z., Lui, S. S. Y., Lok, E., Tam, V., Chan, Q., Cheng, K. M., Lam, S. M., & Cheung, E. F. C. (2017). Meta-analysis of neuropsychological measures of executive functioning in children and adolescents with high-functioning autism spectrum disorder. *Autism Research*, 10(5), 911–939. <https://doi.org/10.1002/aur.1723>
- Landry, O., & Al-Taie, S. (2016). A Meta-analysis of the Wisconsin Card Sort Task in Autism. *Journal of Autism and Developmental Disorders*, 46(4), 1220–1235. <https://doi.org/10.1007/s10803-015-2659-3>
- Laxman, D. J., Taylor, J. L., DaWalt, L. S., Greenberg, J. S., & Mailick, M. R. (2019). Loss in services precedes high school exit for teens with autism spectrum disorder: A longitudinal study. *Autism Research*, 12(6), 911–921. <https://doi.org/10.1002/aur.2113>
- Little, R. J. A., & Rubin, D. B. (2020). *Statistical Analysis with Missing Data*. Wiley.
- Maenner, M. J., Shaw, K. A., Baio, J., Washington, A., Patrick, M., DiRienzo, M., Christensen, D. L., Wiggins, L. D., Pettygrove, S., Andrews, J. G., Lopez, M., Hudson, A., Baroud, T., Schwenk, Y., White, T., Rosenberg, C. R., Lee, L. C., Harrington, R. A., Huston, M., et al. (2020). Prevalence of autism spectrum disorder among children aged 8 years - autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, 69(4), 1–12. <https://doi.org/10.15585/mmwr.ss6904a1>
- Matthews, N. L., Christenson, K., Kiefer, S., & Smith, C. J. (2021). A mixed-methods examination of the gap between intelligence and adaptive functioning in autistic young adults without intellectual disability. *Autism*. <https://doi.org/10.1177/13623613211018334>
- Mazefsky, C. A., Kao, J., & Oswald, D. P. (2011). Preliminary evidence suggesting caution in the use of psychiatric self-report measures with adolescents with high-functioning autism spectrum disorders. *Research in Autism Spectrum Disorders*, 5(1), 164–174. <https://doi.org/10.1016/j.rasd.2010.03.006>
- Muthén, L. K., & Muthén, B. O. (1998). *Mplus User's Guide* (8th ed.). UK: Muthén & Muthén.
- Pellicano, E., Kenny, L., Brede, J., Klaric, E., Lichwa, H., & McMillin, R. (2017). Executive function predicts school readiness in autistic

- and typical preschool children. *Cognitive Development*, 43, 1–13. <https://doi.org/10.1016/j.cogdev.2017.02.003>
- Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 37(1), 51–87. <https://doi.org/10.1111/j.1469-7610.1996.tb01380.x>
- Petcu, S. D., Van Horn, M. L., & Shogren, K. A. (2017). Self-determination and the enrollment in and completion of postsecondary education for students with disabilities. *Career Development and Transition for Exceptional Individuals*, 40(4), 225–234. <https://doi.org/10.1177/2165143416670135>
- Pierson, M. R., Carter, E. W., Lane, K. L., & Glaeser, B. C. (2008). Factors influencing the self-determination of transition-age youth with high-incidence disabilities. *Career Development for Exceptional Individuals*, 31(2), 115–125. <https://doi.org/10.1177/0885728808317659>
- Pugliese, C. E., Anthony, L. G., Strang, J. F., Dudley, K., Wallace, G. L., Naiman, D. Q., & Kenworthy, L. (2016). Longitudinal examination of adaptive behavior in autism spectrum disorders: influence of executive function. *Journal of Autism and Developmental Disorders*, 46(2), 467–477. <https://doi.org/10.1007/s10803-015-2584-5>
- Pugliese, C., Anthony, L., Strang, J., Dudley, K., Wallace, G., & Kenworthy, L. (2015). Increasing adaptive behavior skill deficits from childhood to adolescence in autism spectrum disorder: Role of executive function. *Journal of Autism and Developmental Disorders*, 45(6), 1579–1587. <https://doi.org/10.1002/aur.1474.Replication>
- Radloff, L. (1977). The CED-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385–401. <https://doi.org/10.1177/014662167700100306>
- Roth, R. M., Isquith, P. K., & Gioia, G. A. (2005). Behavior Rating Inventory of Executive Function—Adult Version (BRIEF-A). Psychological Assessment Resources
- Roth, R. M., Baribeau, J., Milovan, D. L., & O'Connor, K. (2004). Speed and accuracy on tests of executive function in obsessive-compulsive disorder. *Brain and Cognition*, 54(3), 263–265. <https://doi.org/10.1016/j.bandc.2004.02.053>
- Roux, A. M., Shattuck, P. T., Rast, J. E., Rava, J. A., & Anderson, K. A. (2015). National Autism Indicators report: transition into young adulthood. In Life Course Outcomes Research Program, A.J. Drexel Autism Institute, Drexel University.
- Shattuck, P. T., Narendorf, S. C., Cooper, B., Sterzing, P. R., Wagner, M., & Taylor, J. L. (2012). Post-secondary education and employment among youth with an autism spectrum disorder. *Pediatrics*, 129(6), 1042–1049. <https://doi.org/10.1542/peds.2011-2864>
- Shogren, K. A., & Plotner, A. J. (2012). Transition planning for students with intellectual disability, autism, or other disabilities: Data from the national longitudinal transition study-2. *Intellectual and Developmental Disabilities*, 50(1), 16–30. <https://doi.org/10.1352/1934-9556-50.1.16>
- Shogren, K. A., & Shaw, L. A. (2017). The impact of personal factors on self-determination and early adulthood outcome constructs in youth with disabilities. *Journal of Disability Policy Studies*, 27(4), 223–233. <https://doi.org/10.1177/1044207316667732>
- Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Riftenbark, G. G., & Little, T. D. (2015). Relationships between self-determination and postschool outcomes for youth with disabilities. *Journal of Special Education*, 48(4), 256–267. <https://doi.org/10.1177/0022466913489733>
- Snell-Rood, C., Ruble, L., Kleinert, H., McGrew, J. H., Adams, M., Rodgers, A., Odom, J., Wong, W. H., & Yu, Y. (2020). Stakeholder perspectives on transition planning, implementation, and outcomes for students with autism spectrum disorder. *Autism*, 24(5), 1164–1176. <https://doi.org/10.1177/1362361319894827>
- Taylor, J. L., & DaWalt, L. S. (2017). Brief report: Postsecondary work and educational disruptions for youth on the autism spectrum. *Journal of Autism and Developmental Disorders*, 47(12), 4025–4031. <https://doi.org/10.1007/s10803-017-3305-z>
- Taylor, J. L., & Gotham, K. O. (2016). Cumulative life events, traumatic experiences, and psychiatric symptomatology in transition-aged youth with autism spectrum disorder. *Journal of Neurodevelopmental Disorders*, 8(1), 28. <https://doi.org/10.1186/s11689-016-9160-y>
- Taylor, J. L., & Mailick, M. R. (2014). A longitudinal examination of 10-year change in vocational and educational activities for adults with autism spectrum disorders. *Developmental Psychology*, 50(3), 699–708. <https://doi.org/10.1037/a0034297>
- Taylor, J. L., & Seltzer, M. M. (2011). Employment and post-secondary educational activities for young adults with autism spectrum disorders during the transition to adulthood a. *Journal of Autism and Developmental Disorders*, 41(5), 566–574. <https://doi.org/10.1007/s10803-010-1070-3>
- Tomaszewski, B., Kraemer, B., Steinbrenner, J. R., Smith DaWalt, L., Hall, L. J., Hume, K., & Odom, S. (2020). Student, educator, and parent perspectives of self-determination in high school students with autism spectrum disorder. *Autism Research*, 13(12), 2164–2176. <https://doi.org/10.1002/aur.2337>
- Van Dam, N. T., & Earleywine, M. (2011). Validation of the Center for Epidemiologic Studies Depression Scale-Revised (CESD-R): Pragmatic depression assessment in the general population. *Psychiatry Research*, 186(1), 128–132. <https://doi.org/10.1016/j.psychres.2010.08.018>
- Van Hees, V., Moysen, T., & Roeyers, H. (2015). Higher education experiences of students with autism spectrum disorder: Challenges, benefits and support needs. *Journal of Autism and Developmental Disorders*, 45(6), 1673–1688. <https://doi.org/10.1007/s10803-014-2324-2>
- Vincent, J. (2019). It's the fear of the unknown: Transition from higher education for young autistic adults. *Autism*, 23(6), 1575–1585. <https://doi.org/10.1177/1362361318822498>
- Wallace, G. L., Yerys, B. E., Peng, C., Dlugi, E., Anthony, L. G., & Kenworthy, L. (2016). Assessment and treatment of executive function impairments in autism spectrum disorder: An update. *International Review of Research in Developmental Disabilities*, 51, 85–122. <https://doi.org/10.1016/bs.irrdd.2016.07.004>
- Wechsler, D. (2011). *Wechsler abbreviated scale of intelligence* (2nd ed., WASI-II). Pearson.
- Wehmeyer, M. L. (1998). Self-determination and individuals with significant disabilities: examining meanings and misinterpretations. *Journal of the Association for Persons with Severe Handicaps*. <https://doi.org/10.2511/rpsd.23.1.5>
- Wehmeyer, M. L., & Garner, N. W. (2003). The impact of personal characteristics of people with intellectual and developmental disability on self-determination and autonomous functioning. *Journal of Applied Research in Intellectual Disabilities*, 16(4), 255–265. <https://doi.org/10.1046/j.1468-3148.2003.00161.x>
- Wehmeyer, M., & Schwartz, M. (1997). Self-determination and positive adult outcomes: A follow-up study of youth with mental retardation or learning disabilities. *Exceptional Children*, 63(2), 245–255. <https://doi.org/10.1177/001440299706300207>
- Wehmeyer, M. L., Shogren, K. A., Zager, D., Smith, T. E. C., Shogren, K. A., Zager, D., Smith, T. E. C., & Simpson, R. (2010). Research-based principles and practices for educating and social interactions. *Education & Training in Autism & Developmental Disabilities*, 45(4), 475–486.
- Wei, X., Wagner, M., Hudson, L., Yu, J. W., & Javitz, H. (2016). The effect of transition planning participation and goal-setting on college enrollment among youth with autism spectrum disorders. *Remedial and Special Education*, 37(1), 3–14. <https://doi.org/10.1177/0741932515581495>

- White, I. R., Royston, P., & Wood, A. M. (2011). Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in Medicine*, 30(4), 377–399. <https://doi.org/10.1002/sim.4067>
- White, K., Flanagan, T. D., & Nadig, A. (2018). Examining the relationship between self-determination and quality of life in young adults with autism spectrum disorder. *Journal of Developmental and Physical Disabilities*, 30(6), 735–754. <https://doi.org/10.1007/s10882-018-9616-y>
- White, S. W., Elias, R., Capriola-Hall, N. N., Smith, I. C., Conner, C. M., Asselin, S. B., Howlin, P., Getzel, E. E., & Mazefsky, C. A. (2017). Development of a college transition and support program for students with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 47(10), 3072–3078. <https://doi.org/10.1007/s10803-017-3236-8>
- White, S. W., Smith, I. C., Miyazaki, Y., Conner, C. M., Elias, R., & Capriola-Hall, N. N. (2019). Improving transition to adulthood for students with autism: A randomized controlled trial of STEPS. *Journal of Clinical Child and Adolescent Psychology*. <https://doi.org/10.1080/15374416.2019.1669157>
- Wolman, J. M., Campeau, P. L., DuBois, P. A., Mithaug, D. E., & Stolarkski, V. S. (1994). *American Institutes for Research: Self-Determination Scale and User Guide*. American Institute for Research.
- Zalewska, A., Migliore, A., & Butterworth, J. (2016). Self-determination, social skills, job search, and transportation: Is there a relationship with employment of young adults with autism? *Journal of Vocational Rehabilitation*, 45(3), 225–239. <https://doi.org/10.3233/JVR-160825>
- Zheng, C., Gaumer Erickson, A., Kingston, N. M., & Noonan, P. M. (2014). The relationship among self-determination, self-concept, and academic achievement for students with learning disabilities. *Journal of Learning Disabilities*, 47(5), 462–474. <https://doi.org/10.1177/0022219412469688>
- Zuckerman, H., Pan, Z., Park, C., Brietzke, E., Musial, N., Shariq, A. S., Iacobucci, M., Yim, S. J., Lui, L. M. W., Rong, C., & McIntyre, R. S. (2018). Recognition and treatment of cognitive dysfunction in major depressive disorder. *Frontiers in Psychiatry*. <https://doi.org/10.3389/fpsyt.2018.00655>

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