The Current State of Knowledge Regarding STEM Career Pathways for Students with Autism: A Systematic Literature Review

Brett Ranon Nachman[1]
Hyejung Kim[2]
Cong Liu[2]
Mack Ottens[2]
Kelley Cook[2]
Ginger Cates[2]

Abstract

Autism is the fourth-largest disability category in the US, and autistic high school students' expectations for college education in a wide variety of fields have been ever-growing. This paper focuses on the pursuit of STEM-related education for students with autism and the unique needs of these students and techniques to improve outcomes. Although the potential to diversify the current STEM workforce is evident, college enrollment trends and STEM employment rates do not reflect the increasing interests and needs of autistic individuals. This systematic literature review aimed to understand the current knowledge about autistic students' pathways from high school to STEM employment and examined associated educational practices promising to improve their STEM career outcomes. After reviewing 5,620 articles, our search yielded seven eligible articles. Findings demonstrate the prevalence of articles landing in autism journals and possessing limited demographic diversity, as well as the featured programs improving autistic students' developmental skills while participating in STEM programming. Additionally, autistic students are increasingly pursuing STEM programs in postsecondary education. Implications point to the necessity of elevating representation among diverse autistic individuals in scholarly research, offering further guidance to autistic students in following STEM career pathways, and expanding opportunities for them to enroll in STEM fields in postsecondary education institutions.

Keywords: autism, STEM, career pathways, systematic literature review

The call has been sounded for diversifying STEM professions through enhancing college education among underrepresented communities, including disabled individuals and individuals with autism[1] (Benish, 2018). STEM exists as one of many industrial pathways that autistic individuals may pursue. While the need to train professionals to enter STEM fields is rising (Aslam et al., 2018; Korte et al., 2019; Makarova et al., 2016), these industries propagate discriminatory practices toward various communities, including autistic people, who could support the shortage (Johnson & Joshi, 2014). As almost all STEM employment necessitates having some higher education experience (Fayer et al., 2017), elevating both autistic individuals' expertise and credentials in these fields is crucial to building the STEM workforce.

Since STEM fields do not necessarily honor or account for autistic individuals' differences in executive functioning and social communication, their ability to thrive in STEM fields becomes compromised (Fleury

[1] We use both identify-first and person-first language to honor the variety of perspectives that members of the autism community use in describing their experiences, particularly given recent empirical evidence suggesting that the majority of autistic adults (87%) prefer identity-first language as opposed to the more professionally accepted person-first language (Taboas et al., 2023).

[1] *University of Arkansas;* [2] *Binghamton University*

et al., 2014). For example, the academic performance of students with autism may vary based on aspects of their cognitive profiles, including auditory, visual, and detail-focused processing, executive functioning, and memory skills, among other characteristics (Fleury et al., 2014). Yet minimal research exists that examines autistic individuals' STEM pathways, including postsecondary pursuits and career development, from high school to eventual STEM employment (for exceptions, see Hedley et al., 2017; Kouo et al., 2021). Although we recognize that autistic students' expectations for a college education may include a variety of fields, this paper focuses on STEM-related fields. Thus, the goal of this systematic literature review was to update current knowledge related to STEM pathways for autistic students. This review aimed to answer the following research questions:

1. What are the publication trends of the studies that document STEM career pathways for autistic students?
2. How do K-12 autism programs with STEM activities strengthen autistic students' developmental skills?
3. What are autistic students' STEM pathways and experiences within postsecondary education?

Autistic Students and STEM

Over recent years, there has been a concurrent rise in autistic students enrolling in college (White et al., 2016) and an interest in them pursuing STEM fields, more so than their non-autistic counterparts (Chen & Weko, 2009). Yet major structural challenges exist for autistic students in their college and career aspirations; not only are there discrepancies in the rates of high school students with autism who expect to enroll in college (52%) versus the number who actually enroll (36%; data from the National Longitudinal Transition Study-2; Kim & Baker, 2021) but also STEM industries can be restrictive toward autistic people, especially women with autism (Griffiths et al., 2022).

Despite systemic barriers, autistic people possess many characteristics that show their potential in STEM fields, and some programs have emerged to leverage these skills. Students with autism spectrum disorder (ASD) often build rule-based systems to follow, which is regarded as a critical aspect in fostering their STEM learning environment (Baron-Cohen, 2009; Baron-Cohen et al., 2007). Rule-based systems—known as systemization—encompass techniques employed to identify the relationship among inputs, operations, and outputs, all of which are key STEM skills (Baron-Cohen et al., 2007). Thus, scholars have developed STEM activities and interventions to improve STEM skills exclusively for autistic students and support their success in STEM-related careers. For instance, the Inventing, Designing, and Engineering for All Students (IDEAS) Maker Program, an after-school activity aimed to promote ASD students' interests in technology and science, addresses the academic and executive functioning skills of those individuals (Martin et al., 2019, 2020). Research indicates that many students with ASD find interest in using technology to learn, and robots served as an effective tool for addressing social experiences (e.g., collaborating with peers, interacting with robots and adults; Dautenhahn & Werry 2004; Diehl et al., 2014; Feil-Seifer & Matarić, 2009; Scassellati, 2007). Autistic students also exhibit spatial-visual strengths when engaged in STEM-related activities (Kennedy & Banks, 2011; Mottron & Belleville, 1993) and are more likely to participate in STEM courses and majors compared to their non-autistic, disabled peers (Chen & Weko, 2009; Wei et al., 2013).

What remains absent from much existent literature, though, is understanding how autistic students' STEM proclivities, and the educational programs aimed to support their entrance into these fields, translate to sustaining careers. Equally as unclear, what are autistic students' STEM-based experiences in postsecondary education? Through determining how foundational experiences in STEM can shape the trajectories of students with autism, we can more clearly pinpoint how to elevate their participation in the STEM workforce.

Methodology

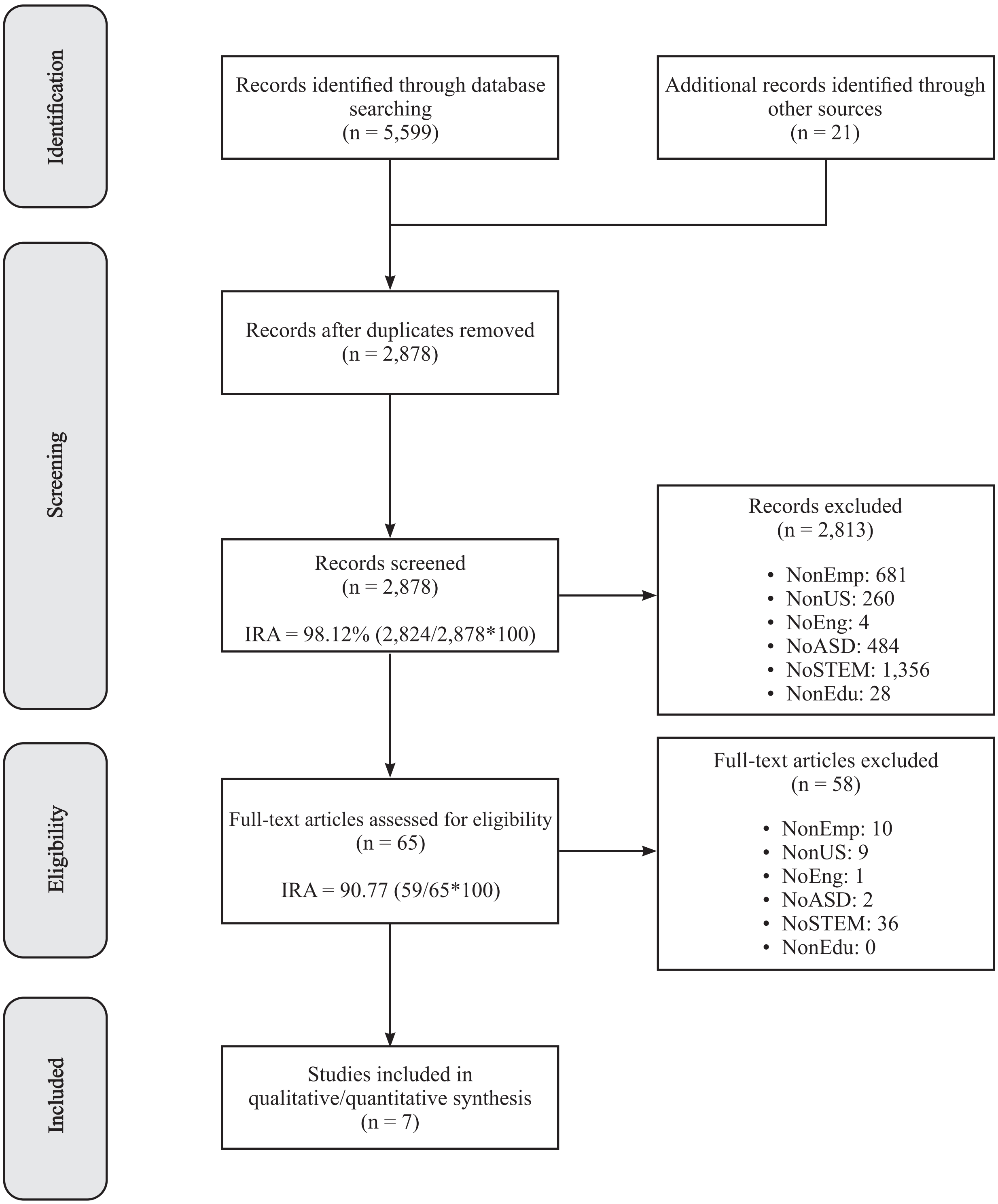
To locate eligible studies focused on autism and STEM employment pathways, we employed the PRISMA systematic literature review framework which increased the transparency of the search process (Page et al., 2021). The framework has been used in various disciplines to improve the current understanding of educational status, as well as social contexts for individuals with autism (e.g., Abelha et al., 2020; Allely, 2019). As shown in Figure 1, we used extensive search terms and pinpointed 5,620 articles through multiple databases. Finally, we identified and reviewed seven empirical studies documenting STEM career pathways and activities that help improve STEM career skills for autistic students.

Data Sources

In the initial phase of our literature search, Authors 2-4 used academic databases, namely ERIC, Education Source, and PsycInfo. ERIC, funded by

Figure 1

Systematic Literature Review Process



the government, and Education Source, a private database were used to gather a wide array of educational literature, including those focused on educating individuals with autism. Complementing these, PsycInfo offered a broad range of mental health-related articles, further broadening our search pool. To ensure a thorough coverage of relevant studies, we also included Google Scholar, which provides a unique mechanism to identify literature.

As the purpose of this review is to update the existing knowledge regarding STEM pathways for autistic students, we confined our search to three key terms: *STEM, autism,* and *employment*. We tend to focus primarily on STEM career options for students with ASD, but we excluded studies that merely examined the employment of individuals with disabilities but not autism. As a result, we restricted our search to STEM (science, technology, engineer*, math*), employment (employ*, job, career, profession, work), and autism (autis*, Asperger; see Table 1). After removing duplicates, initial screening was completed by reviewing Research Information Systems (RIS) files, such as authors, year of publication, journal outlet, title, and abstract.

Using the PRISMA framework and other reviews' guidelines (e.g., Gelbar et al., 2014), we have created inclusion criteria to ensure studies were: (a) empirical and providing scholarly evidence; (b) conducted in the United States, embracing unique national contexts; (c) written in English; (d) exclusively focusing on autism; (e) featuring multiple participants; (f) illustrating STEM career pathways; and (g) affording educational implications. The established criteria were important because they ensured that only articles relating to STEM career pathways for students with ASD were included, but studies that used STEM-related advancements, such as technology designed to support overall learning or in other subjects or non-STEM related fields, were excluded. Further, the criteria aimed to identify educational implications from studies to build upon future efforts to assist STEM career pathways for students with ASD. Collectively these criteria attended to the nuances associated with geography, autism, field/discipline, in concert with the studies' rigor.

Using the screening form with the seven inclusion criteria, Authors 1 and 2 provided initial training. We used 10 articles as a sample for training purposes, and all authors agreed with each other in terms of inclusion determination. From there we formed two dyads (Authors 3 & 6; Authors 4 & 5) to perform independent screening and met weekly to check agreement. Each dyad reviewed approximately 1,500 articles so that every piece was screened by at least two people. Cases of disagreement were resolved during our weekly whole group meetings. Later, we used the number of inclusion disagreements to calculate our inter-rater agreement rate (IRA; Chaturvedi et al., 2015). The IRA was calculated by dividing the number of agreements by the total number of codes and then multiply-

Table 1

Database Search Results

		employ*	job	career	profession	work
STEM	autis*	27	7	10	1	49
	Asperger	2	1	0	0	0
science	autis*	890	269	101	257	1883
	Asperger	39	11	4	19	97
technolog*	autis*	389	137	59	50	578
	Asperger	16	5	3	4	24
engineer*	autis*	88	21	13	16	175
	Asperger	5	2	0	3	10
math*	autis*	95	33	17	16	163
	Asperger	3	1	0	1	5

Note. *We used an asterisk on some keywords to widen our search For instance, 'autis*' allowed us to yield articles featuring both 'autism' and 'autistic.'

ing them by 100. Our IRA for this screening exceeded 98% (see Figure 1). This value is in keeping with prior research (Chaturvedi et al., 2015).

Next, we verified eligibility by reading full-text articles independently with the same inclusion criteria. We reused the screening form with the seven criteria to conduct the eligibility check. For instance, some studies did not indicate their geographic location (our inclusion criteria specified studies from the United States only) and, ultimately, did not meet the criterion after reading the full manuscript. The final number, reached by consensus, was used to calculate eligibility and check IRA, which then was over 90% (see Figure 1). This process effectively excluded articles that were not STEM career-related, such as math/science/vocational skill intervention or studies or other intervention studies that used technology as their intervention (e.g., Delisio et al., 2018; Lindsay et al., 2019). For example, studies examining computer applications or technology as a tool were excluded if they failed to examine STEM careers or educational implications related to STEM fields. Throughout the search process, the terms "profession" and "work" tended to yield many irrelevant articles, such as studies on professionals' perspectives. Overall, our research team finalized seven studies that met the inclusion criteria and were published between 2012 and 2021.

Analysis

Authors 1 and 2 developed a codebook based on our research questions (See Appendix).

We created a coding sheet consisting of 646 sentences from the selected articles' results and discussion sections. Next the first four authors, in teams of two dyads, used grounded theory coding techniques to review the articles (Saldaña, 2015). During the first round of coding, we mostly used open coding, in vivo coding, and attribute coding, breaking apart each sentence of the article's results and discussion sections into distinct excerpts that could potentially be coded. Once the first analysis was complete, we used thematic analysis to synthesize our findings (Mays et al., 2005). We were encouraged by the strong consistency of dyads applying similar codes, as well as the frequency in which both pairs did not code certain passages. Our final IRA was 75.9% (490/646*100), which exceeded our threshold for coding consensus (Stemler, 2004).

Positionality

Our research team approaches this line of work with connectivity to the communities featured in this scholarship. Author 1 brings perspective as an autistic and STEM researcher. As a family member of an autistic individual, Author 2 primarily focuses on investigating college access for autistic students. Meanwhile, Author 3 lends perspective as a researcher focused on how autistic students progress in STEM-related activities. Author 4 is a doctoral student studying the engagement outcomes of students with disabilities in higher education. Author 5 has served as a clinical social worker for the past nearly 15 years, working with families of neurodivergent and autistic youth. Finally, Author 6 is a higher education professional dedicated to supporting students with visible and/or invisible disabilities. Altogether our experiences informed an attentiveness to capturing the diversity and richness of autistic experiences in STEM and taking strengths-based approaches to our data analysis.

Delimitations

Our delimitations entailed establishing boundaries on what constituted an applicable study for inclusion. Among those criteria, we aimed to not expand too far beyond the scope of STEM and thus avoided yielding articles that focused on architecture, illustrative of the 'A' in STEAM, sometimes an extension of STEM. In the same spirit, we excluded articles that focused on neurodiversity or other disabilities more broadly, as opposed to autism in particular. Through also removing articles that were not concentrated on STEM careers, we ensured that professional possibilities remained in the forefront.

Results

From the initial search, combined with a hand search and Google Scholar search using extensive search terms, of the 5,620 articles reviewed, only seven articles were identified that met the inclusion criteria. We provide the methodological details associated with the studies in the summary table (see Table 2). Findings help address our systematic literature review's intent to uncover studies' publication trends, how K-12 STEM programs build autistic students' developmental skills, and the pathways and experiences of college students with autism.

Publication and Sample Characteristics

Studies suggest that research focusing on STEM education and career pathways for autistic students is novel, often only published in the past decade. Of particular note, four of the seven articles were published in *Journal of Autism and Developmental Disorders*, an interdisciplinary autism journal (Chen et al., 2021; Kaboski et al., 2015; Wei et al., 2013, 2014). Methodologically, four articles were qualitative in nature

Table 2

Summary Table

Author (Year)	Methods	Setting	Autistic Participant Characteristics				Main Findings
			Participants	Age/ Grade	Male (%)	Race	
Chen et al. (2021)	Focus group	Northeastern US middle schools	9 Teachers; 26 Students; 13 Parents	Grades 6-8	82.4	Hispanic 19%; White 28.6%; Black/AA 19%; Asian 23.8%; Other .1%	This study explored the students' experiences and students', teachers', and parents' perceived outcomes of the IDEAS Maker Club over two years. Five common themes were identified: (1) positive student experience and engagement, (2) skills acquisition, (3) development of interest in STEM and related careers, (4) social relationships and community, and (5) safe spaces that supported self-determination.
Dunn et al. (2015)	Field notes, observations	Utah university computer lab	8 Students	9-19	100	Caucasian 87.5%; Asian 12.5%	This study explored engagement and learning in the iSTAR program, a strength-based technology extracurricular program facilitating career exploration for autistic students. Two themes emerged that promoted engagement: (1) youth-centered learning and (2) opportunities to demonstrate skills (competence, collaboration, and challenges). The program supported STEM career exploration and learning for the students as well as encouraged interactions amongst each other and with the adults.
Gobbo et al. (2018)	Interviews	Liberal arts college	12 College-level STEM faculty	N/A	N/A	N/A	This study explored STEM college faculty experiences and effective strategies when teaching autistic students. Teaching strategies identified included: (1) careful grouping, (2) clarity of instruction, (3) individualization, (4) variety of assessment/multiple modalities, and (5) structured lessons. Additional aspects identified to improve college STEM learning for autistic students were: teaching (i.e., individualizing teaching for the learners), reframing neurodiversity as a strength, providing support services, and focusing on preparing students for employment.

Author (Year)	Methods	Setting	Autistic Participant Characteristics				Main Findings
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Kaboski et al. (2015)	Pretest-posttest	Summer robotics camp	8 Students	12-17	100	N/A	This study examined the effects of a summer robotics camp on social anxiety and social/vocational skills for autistic teenager students and their typically developing peers. The program provided robotic facts as well as career skills. Findings show that both groups of students experienced reduced self-reported social anxiety and increased understanding of robotics while the intervention did not significantly increase social skills.
Wei et al. (2013)	Secondary analysis of survey	US	660 Students/ Parents	23.18 (M)	84.2	Hispanic 8.97%; Black 20.81%; White 65.32%; Other 4.90%	Using the National Longitudinal Transition Study-2 (NLTS2), this study found that although autistic young adults were less likely to attend college (about 32%) compared with students from other disability groups, autistic students were more likely to pursue STEM majors (about 34%) than any other disability group. To be specific, autistic college students were more likely to major in science or computer science. The disproportionality was further complicated by gender, income, and mental functioning skills.
Wei et al. (2014)	Secondary analysis of survey	US	190 Students/ Parents	21-25	85	White 81.15%; People of Color 18.85%	Using NLTS2 survey data, this study found that 81% of autistic college students enrolled in a 2-year community college. Among them, autistic STEM majors were more likely to persist (about 81%) than their peers in non-STEM fields. About 32% of those students in community college transferred to a 4-year university, which is greater than non-STEM majors. The persistence was significantly higher for STEM majors with ASD. Male and racially minoritized students with ASD were more likely to persist in STEM major.
Wright et al. (2012)	Focus group	University	6 Grandparents	8-17	100	N/A	This study examined the perspectives of grandparents of autistic grandchildren regarding their social interactions in the context of a shared technology experience: the SketchUp workshops. Grandparents reported that their grandchildren learned technological skills and increased social interactions with peers and family. Two themes emerged: reframed expectations about their grandchildren's future educational and employment opportunities, and improving communication skills through shared interests.

(Chen et al., 2021; Dunn et al., 2015; Gobbo et al., 2018; Wright et al., 2012), and other studies drew on secondary analysis of national surveys (Wei et al., 2013, 2014) or pre-post tests (Kaboski et al., 2015).

Within this review, we identified several characteristics of autistic students who participated in STEM activities. Coinciding with expectations and autism population prevalence, all but the Gobbo et al. (2018) study included more than 80% male participants (this study only included college faculty). Gender varied across the articles identified, but merely three studies included female autistic students (Chen et al., 2021; Wei et al., 2013, 2014). Four studies reported their participants' race; most participants were white. Articles rarely provided details regarding manifestations of autism characteristics and individuals' co-occurring disabilities.

In terms of the programs delineated in the reviewed articles, four articles pertained to autism programs for K-12 autistic students (IDEAS Maker Club in Chen et al. [2021]; iSTAR program in Dunn et al. [2015]; a summer robotics program in Kaboski et al. [2015]; and SketchUp workshops in Wright et al. [2012]), while another three documented the experiences of college students and faculty (Gobbo et al., 2018; Wei et al., 2013, 2014). Of the three articles on autistic college students, two secondary analyses of the national survey illustrated their characteristics (Wei et al., 2012, 2014) and one qualitative study provided perspectives of college-level STEM faculty (Gobbo et al., 2018). Only one article investigated community college students, who overwhelmingly attend these institutions (Wei et al., 2014).

Improving STEM Career Skills: K-12 Extracurricular Activities

Notably, all seven studies share one important characteristic of autistic students: they recognize the diversity of students' strengths and how they can be leveraged in STEM fields, as opposed to highlighting students' deficits. Through participating in STEM programs, autistic students engage in activities that support the creation, maintenance, and improvement of developmental skills that aid their life success (e.g., Chen et al., 2021; Dunn et al., 2015; Kaboski et al, 2015; Wright et al., 2012). Autistic individuals' interest in STEM, for one, propels them forward in those fields (e.g., Chen et al., 2021; Kaboski et al., 2014). Through programmatic engagement, students obtain direct experience in translating new skills into action.

Several studies illuminate takeaways of STEM participation. Within a week-long summer robotics camp, for example, teenagers attain robotic knowledge and vocational skills that are required to be a scientist (Kaboski et al., 2014). Dunn et al. (2015) also found that participation in an online educational program resulted in positive youth development. Within the IDEAS Maker Club, autistic middle schoolers create their own products, like printed 3D items, and improved self-determination and executive functioning (Chen et al., 2021). For SketchUp workshop participants, grandparents engage with their autistic grandchildren in activities that foster spatial-design and social communication skills (Wright et al., 2012). Altogether the studies demonstrate distinct STEM programming that immersed students in hands-on activities that prepared them for STEM careers through developing relevant STEM skills (e.g., Wright et al., 2012), problem-solving capabilities (e.g., Chen et al., 2021; Gobbo et al., 2018), self-esteem (e.g., Dunn et al., 2015), and social skills (e.g., Kaboski et al., 2015).

This review identified several different practices that may support STEM pathways for students with autism, potentially informing K-12 educators to better ensure success for autistic students interested in STEM. For example, technology elevated autistic students' engagement in classroom activities, and interest-driven activities provided career and social opportunities. The programs commonly aimed to provide STEM career exploration opportunities through strength-based and interest-driven content. STEM program participants were recruited based on their STEM interests, with shared interests facilitating genuine peer interactions, regardless of their autism identities (Kaboski et al., 2015). Possessing this connection lent to shaping an enjoyable and positive environment where the participants could interact with and use technology while concurrently reducing social anxiety (Chen et al., 2021; Dunn et al., 2015; Kaboski et al., 2015; Wright et al., 2012). To ensure that the programs also imbued career interests, the iSTAR program was equipped with various instructional strategies including scaffolded guidance, prompt, modeling, task analysis, positive reinforcement, and preference within a community (Dunn et al., 2015). Clearly, K-12 programming that embraces experimentation with STEM learning and intentionality in honoring distinct communities' needs can foster STEM pursuits.

STEM Pathways in College

In tandem with K-12 education, postsecondary education represents a space where autistic students may become familiar with and end up pursuing STEM careers. Findings from these studies indicate the potential of the college experience in further fostering autistic students' pathways into fields reflective of their strengths and interests. The data alone tells a multitude of possibilities. Wei and colleagues (2013), in their review of data from the National Longitudinal Transition Study 2 (NLTS-2), note higher proportions of autistic college students majoring in STEM compared to counterparts with other disabilities (34.31% vs. 14.67-20.87%). The study also suggests that being focused and capable of creating a rule-based system can contribute to autistic students majoring in science and computer science, even more so than other disabled individuals. Drawing on the same data, Wei and colleagues (2014) determined greater persistence among autistic community college students in STEM majors versus non-STEM majors.

The studies produced by Wei and colleagues (2013, 2014), for all their utility in exploring the promise of autistic college students' participation in STEM programs, do not unravel the "why" behind the apparent thriving of autistic students in these disciplines. Meanwhile, the study by Gobbo and colleagues (2018) offers perspective into the teaching methods that facilitate favorable experiences. They center on how concentration, persistency, computer proficiency, attending to details, and abiding by rules are beneficial, particularly in solving STEM-related problems. The study also provides a glimpse into the ways in which autistic students bring their strengths into their STEM classes (e.g., following directions, demonstrating deep interest, exhibiting diligence). Through interviewing STEM college faculty and their pedagogical approaches that support autistic college students, the authors pinpoint several effective methods, including delivering clear instruction via structured lesson plans and varying assessments' modality types (e.g., notes, videos, lectures). These techniques also possess transferability, showing broader application of how to engage all students, not just autistic learners, in these fields (Gobbo et al., 2018).

What these studies fail to uncover is autistic college students' direct experiences in STEM, indeed a contrast to the aforementioned research focused on younger autistic students. Yet this work collectively indicates the opportunities associated with autistic learners in higher education—specifically STEM fields—even if scholarship has yet to fully delve into what happens within these institutions to support their trajectories.

Discussion

As the number of eligible articles for this review shows, the investigation of STEM career pathways for autistic students is in its nascent stage. As autism was first recognized in 1990 by federal special education law (Public Law 110-476), the short history of acknowledging autism in our education system explains the sparse knowledge around STEM career pathways that often requires postsecondary education (National Science Board, 2021). Still, the seven articles provide a glimpse into the untapped potential STEM workers on the autism spectrum.

Exploring Autistic Students' Multifaceted Skills and Identities

Only a decade has passed since scholars started discussing STEM career pathways for students with autism, with the earliest articles we identified published in 2012 (Wei et al., 2012; Wright et al., 2012). Given that more than half of the studies were published in the *Journal of Autism and Developmental Disorders*, a known, multidisciplinary outlet, expanding scholarly pipelines into education-specific journals will help make connections across students' transitions. Establishing STEM career pathways requires early engagement and exposure to diverse opportunities including both formal and informal activities. However, so far, the investigation of STEM career opportunities is only limited to extracurricular STEM programs for K-12 students, mostly using qualitative inquiry. The studies provided ways in which participants and their families perceived STEM program participation ramifications. From there, only one pre-post test study measured how a summer robotics program increased vocational skills (e.g., Kaboski et al., 2014). Overall, the publication trends show sparse evidence about how pre-college programs boost STEM career interests and skills.

Even within the limited set of studies, disparities were noted at the intersection of race, gender, and socioeconomic status, which lead to further inequity in education opportunities and employment. Although students with autism were more likely to major in STEM compared to other disability categories, only about 44% of the students attended college eight years after graduating from high school (vs. 60% in overall students with disabilities; Newman et al., 2011). Further, race and household characteristics significantly predict college enrollment for students with autism (Kim et al., 2021). Although the underrepresentation of students with disabilities, students of color, and/or female students in the STEM workforce is a persistent disparity issue in our education system (e.g., Beede et al., 2011), participants in the extracurricular programs we reviewed were primarily white and male. Hence, embracing the multiple axes of diversity in future research would enhance the equal distribution of STEM resources.

Leveraging Autistic Students' STEM Strengths

The reviewed studies suggest a potential to diversify the current STEM workforce by looking at the autistic participants' strengths related to a STEM career. While only seven studies specifically address the STEM workforce pathways, all studies acknowledge their autistic participants' STEM preferences, interests, and strengths. Some characteristics of autism that are traditionally considered *needs* were described as *strengths*, which opens another conversation on considering inherent traits that suit the STEM field. Particularly, authors framed restricted and repetitive behaviors, one of the diagnostic features of autism, as focused interests (Wright et al., 2012), attention to detail (Gobbo et al., 2018), or systemized thinking (Wei et al., 2014). According to Baron-Cohen and colleagues (2007), systemizing is "the drive to analyze and/or build a system based on identifying input-operation-output rules" (p. 125), and the innate talent in those skills makes autistic individuals great candidates for STEM workers. The studies recommend that to develop further STEM skills, individuals' inherent traits should be encouraged rather than normalized. However, autism embraces a broad spectrum of neurodevelopmental conditions; as a result, not all identified strengths represent the entire population. Thus, providing developmental profiles of participants would enhance the replicability and interpretation of the results, especially for educational programs.

Notably, extracurricular STEM programs depicted in the reviewed studies reported that their activities improved skills that are not necessarily STEM-related, such as self-determination. Many other excluded studies on STEM activities document that their autistic participants gained increased self-esteem and problem-solving skills, and they are more engaged academically after participating in the program (e.g., Ohrberg [2013], which was excluded from our review due to its publication in an Australian journal). Although the studies did not specifically address STEM career skills, those skillsets are closely related to improving employability. Further investigation into the mechanisms behind students' skill sets and STEM career readiness would enhance current understandings around STEM career pathways for autistic students.

Mapping Autistic Students' STEM Pipelines

Clearly, autistic students value pursuing STEM for their academic majors in college and perhaps their outcomes in career pathways, further underscored by data that show autistic community college students majoring in STEM possess high transfer rates to four-year institutions (Wei et al., 2014). Higher education represents an important stepping stone for autistic students interested in STEM careers. Ensuring students with autism have what they need to be successful in their endeavors is crucial.

Increasingly students with wide-ranging disabilities are enrolling in higher education each year, with rates hovering around 19% of all college students (National Center for Education Statistics, 2018), a number that is likely far from accurate due to underreporting. These data points fail to emphasize the prevalence of disability at higher education institutions, especially in community colleges, yet their needs and strengths are often overlooked (Nachman & Wilke, 2022). Within the autism community in particular, their potential in enrolling and thriving in STEM fields (Wei et al., 2013, 2014, 2017) illustrates promising research that could unveil autistic students' postsecondary education experiences, as opposed to just recording general enrollment rates. In so doing, such scholarship would counteract the current minimal exploration of autistic students in higher education (Evans et al., 2017).

This discrepancy highlights an important and undeniable fact: disclosure rates among autistic college students are low. According to Newman et al. (2011), only 62.7% of autistic college students disclosed their disability to their educational institution. While the literature we reviewed did not explicitly interrogate the role of disclosure, the eligible participants from the Wei and colleagues (2013, 2014) studies derived from the NLTS2, which relied on students who received special education plans in their high school experiences. That so many disabled college students fail to disclose their disabilities to their institution (Zilvinskis, 2020), because they are not required to do so, only further complicates the issue. Evans and colleagues (2017) state, "as with autistic people, many people with other disabilities make conscious decisions based on the environment as to whether it is physically and socially safe to disclose their disability status" (p. 147). Disclosure, representing a deeply personal and unique choice, falls on the individual student (Nachman, 2023), though the responsibility in cultivating a rich environment in STEM stems, in large part, from schools, colleges, and other social structures that specifically welcome autistic engagement, a sentiment echoed throughout the studies highlighted in the studies we reviewed (e.g., Dunn et al., 2015; Gobbo et al., 2018). Further disclosure works to destigmatize autism and will hopefully elevate perspectives in future studies from further marginalized communities, whose voices are often absent from scholarship (e.g., Malone et al., 2022).

Implications for Practice and Research

Although our search yielded few articles, we envision many opportunities for what (and how) scholars should explore inquiries related to the intersections of autism, STEM, and education. In tandem, we offer ideas behind how practitioners can concurrently create viable and smooth opportunities for autistic students interested in these fields.

Elevating Autistic Representation

We recognize how the programs and studies we examined consistently demonstrated a lack of gender, racial, and socioeconomic diversity. Rubenstein and Furnier (2021), among other scholars, have echoed the importance of collecting and describing participants' demographic info that honor autistic individuals' minoritized identities. While reporting this information is necessary, of course, the autism programs themselves must be made more accessible to minoritized individuals in how disability services educators recruit and engage with the autistic community themselves and have their perspectives heard (Malone et al., 2022). Indeed, students of color are often diagnosed with autism at later ages and less frequently than their white counterparts (Mandell et al., 2009), notably because of inequities in health care, as Malone and colleagues (2022) lament. Racial disparities must be more intentionally interrogated and, in turn, interrupted, to demonstrate a more accurate and representative picture of the autism community.

Providing Guidance for Future Career Development

Due to the high rates of underemployment among autistic individuals (Taylor & Seltzer, 2011), autism programs possess an additional level of responsibility in offering professional guidance regarding the possibilities of charting a STEM-centered career. While the programs featured within studies in our review clearly engaged students in activities to build disciplinary-specific skillsets, where additional attention must be placed is in strategies to help autistic people gain, maintain, and excel in industry roles, not just formal autism programs, but also in STEM courses more broadly (Müller et al., 2003). Furthermore, STEM employability does not only include STEM-related skills, but also consists of generalizable skill sets, such as teamwork, self-motivation, verbal communication, problem-solving, and proactivity (McGunagle & Zizka, 2020). Indeed, programmatic takeaways suggest a need for disability services educators to more saliently embed STEM career development at the core of their efforts.

Expanding Opportunities for Autistic People to Pursue STEM in Higher Education

As the studies by Wei and colleagues (2013, 2014, 2017) indicate, higher education institutions can draw on autistic students to bolster enrollment and, ultimately, thrive. Yet autistic students' success in these disciplines once in college is only as good as the infrastructure to carry them to their envisioned objectives, whether in mastering skills, attaining internships, landing a competitive position, or even obtaining a credential. Foundationally, before autistic students arrive in college, they must possess the self-advocacy skills to adeptly navigate the postsecondary education environment and the people they interact with (Nachman, 2022). Consequently, high school personnel and autistic students' families must instill these values and provide room for growth during this STEM pathway. Similarly, the onus falls on higher education stakeholders, such as faculty, researchers, and disability services practitioners, to increase their understanding of how disability and STEM intersect while embracing disability as a sociocultural concept (Thurston et al., 2017). Where more attention must be placed is in how these college personnel address the nuances that mark distinct members of the autism community, including the strengths, challenges, and characteristics threaded within (e.g., Elias & White, 2018; Gelbar et al., 2014). In this way, STEM programs can design undergraduate research opportunities that more adeptly meet their needs and strengths (Thurston et al., 2017).

Further, disability service practitioners in higher education can eliminate barriers to support for autistic students by more intentionally learning about the community, engaging with these students in genuine conversation, and seeking out training that highlights the unique needs of autistic students within the college context (Kim, 2022). Disability service practitioners hold a vital role in working toward an equitable campus environment, requiring collaboration across departments and disciplines. Through more frequent and intentional connections with campus partners, disability services staff may be more adept in linking students with mental health, career, and financial services, among other supports that will support students' quality experiences and success. Evans et al. (2017) note how, in concert with campus staff working more collaboratively, faculty and administrators must also contribute to this shared campus community in their efforts to build acceptance. For example, in fostering relationships with local STEM employers and identifying those who host disability hiring programs, faculty and administrations can make a vested effort in connecting their disabled—and autistic—learners with potential workplaces where they can obtain jobs during and beyond college.

Conclusion

As the limited number of articles included in our systematic review reflects, scholarly investigation of STEM pathways for autistic students is emergent. With more autistic individuals enrolling in postsecondary education (White et al., 2016), in concert with more than 3.4 million STEM field jobs going unfilled (National Science Board, 2019), supporting autistic people in locating and navigating these STEM pathways rises as a priority. Given autistic students' strong interests in STEM majors (nearly one-third gravitated toward STEM majors in the Wei et al. [2013] study), their underemployment in these fields (fewer than 4%, according to Newman et al. [2011]) demonstrates a disconnect. Our systematic review underscores the necessity to not only build a more salient research agenda on autistic people pursuing STEM employment with richer datasets, featuring more diverse participants (including factors like gender and race), but also to explore and acknowledge autistic students' authentic perspectives. Furthermore, our inquiry revealed the necessity behind educational programming that could offer clear trajectories into STEM industries. Our study provides foundational knowledge that will prompt researchers and practitioners alike to reconsider the current narratives on autism, STEM education, and employment, and more proactively address the opportunities associated with autistic people entering these careers in the future.

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About the Authors

Brett Ranon Nachman has a Ph.D. in Educational Leadership and Policy Analysis from the University of Wisconsin-Madison. He is an Assistant Professor of Adult and Lifelong Learning at the University of Arkansas. Brett's work focuses on autistic college student experiences and success in higher education. Contact Brett at brettranonnachman@gmail.com.

Hyejung Kim is an assistant professor in the special education program at Binghamton University. She taught elementary school in South Korea for five years and earned her Ph.D. from the University of Wisconsin-Madison. Her primary research focuses on the intersectionality of autism and other sites of vulnerability, especially during the transition from high school to college. She can be reached at hyejungk@binghamton.edu.

Cong Liu received her Master of Educational Studies from and is a fourth-year doctoral student at Binghamton University. She works as a research assistant in the Department of Social Work at Binghamton University. Her research interests include early childhood education and youth education in STEM. She can be reached at: cliu92@binghamton.edu.

Kelley Cook received her Master of Social Work from Simmons University and PhD from Binghamton University. She is an Assistant Professor in the Department of Social Work with Binghamton University. Her research interests include youth mental health and suicide prevention for particularly LGBTQ people. She can be reached at: kcook5@binghamton.edu.

Mack Ottens received his B.S. in Management from Keuka College and his M.S. in Student Affairs Administration and MPA from Binghamton University. He is a doctoral candidate in Community Research & Action at Binghamton University. His research focuses on Crip Time and supporting disabled college students. Contact: mottens1@binghamton.edu.

Ginger Cates received her BA in psychology from Binghamton University and an MA in developmental psychology from Cornell University. She is currently obtaining an MS in Student Affairs Administration at Binghamton University. Her research interest is young adults' transition from high school to college. She can be reached at gcates@binghamton.edu.

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Appendix

Codebook

Checklist
- Unit of analysis: sentence
- Highlight & Code
- Only look at results & discussion
- Focus on narratives rather than tables and figures
- Do not code the same instances or examples repeatedly if already coded in the results section

- **Demographic:** any sentence that describes demographic characteristics of autistic individuals (e.g., race/ethnicity, gender, household income, parent education, co-occurring conditions)
- **Developmental skills:** any sentence that provides information about developmental skills that are critical for pursuing STEM careers (e.g., conversational & social skills, behavior profiles, cognitive ability, executive function, self-determination, self-advocacy, creativity, soft skills)
- **STEM career engagement:** any sentence that describes STEM career interests
- **K-12:** any sentence that explains their activities within K-12 environments (e.g., inclusion, AP courses, extracurricular activities, special education services)
- **PSED:** any sentence that illustrates activities at postsecondary education settings (e.g., major, courses, teaching strategies, accommodations, retention, graduation)
- **Job:** any sentence that provides information about career-related environments or job settings (e.g., disability disclosure, accommodation, perspectives toward autistic workers, working conditions)
- **(Not included in IRA calculation) Tone:** any sentence that shows authorial tone (i.e., strength-based, deficit-based)