Diversity in Information Systems: Increasing Opportunities in STEM for Capable Students with Developmental and Intellectual Disabilities

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Abstract

The demand for graduates in STEM continues to expand in industry. To address the demand, not enough focus is on programs for students with disabilities having knowledge in STEM. This paper describes a post-secondary program at a school of computer science and information systems that is contributing marketability in STEM for moderately impaired but intellectually nimble students with developmental and intellectual disabilities. The findings of this paper denote contributions of academic identity, content learning of information systems technology and limited norms of sociability from the program, as a foundation for opportunities in STEM for the students. The results of this study can encourage other schools of computer science and information systems in pursuing special education programs in STEM for this niche population of students.

Keywords: college inclusion programs, disabilities, individualized education programs (IEP), information systems, post-secondary students with developmental and intellectual disabilities (IDD), special education programs in STEM, technology

1. BACKGROUND OF PAPER

A concern of industry is the continuing inadequacy in the availability of college graduates in science, technology, engineering and mathematics (STEM). A post-secondary education is considered critical for the bulk of industrial occupations in STEM (Takahashi et.al., 2017). The growth in the number of STEM students is not enough to facilitate however the growth in industrial innovation in new products involving skills in STEM (United States Equal Opportunity Commission, 2014). The United States Department of Commerce estimates growth of 20% by 2018 in the number of industrial occupations in STEM (Wilkie, 2014). The United States Equal Employment Commission estimates the number of opportunities in STEM to be higher than the number of post-secondary practitioners with skills in STEM (United States Equal Opportunity Commission, 2014), or 1.4 million positions to be in STEM but merely a .5 million graduates in STEM students to fill them in 2020 (Lohr, 2016). The incentive of an annual

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average of $81,000 in salary (Thompson, 2017) is not enough to fill them. The growth in positions in the sector of STEM is increasing more than in other industrial sectors (Hewlett et. al., 2008), highlighting the importance of the availability of STEM students. The inadequacy in the availability of STEM students is concomitant with a considered inadequacy in the diversity of STEM students (United States Equal Opportunity Commission, 2014) that if addressed by colleges can alleviate the concern.

The inadequacy is considered due in part to the limited number of females and minorities, and individuals with disabilities, in programs of STEM (Bellman, Burgstahler, & Ladner, 2014). A particular group of interest to the authors is capable individuals with developmental and intellectual disabilities (IDD), a group of millennials desiring to be in college inclusion programs in STEM (Skibell, 2015, Boccella, 2016, & Kuehl, 2016) but not considered eligible (Ladner & Burgstahler, 2015), as capabilities of the higher-functioning of this group may not be discerned enough due to the impairments (Kim & Aquino, 2017). For example, determined students with autism spectrum disorders (ASD) are considered frequently to have higher skills in STEM more than students without the disorders (The Economist, 2016).

Higher-functioning students with developmental and intellectual disabilities at mid-spectrum with chromosomal disorders (e.g., Down Syndrome) frequently finish post-secondary programs in STEM so that they can be hired in industrial positions (Uditsky & Hughson, 2012), especially in small-sized technology firms (Silberman, 2015), such as in the Silicon Valley; and autistic students with less impairments have longer longevity in the positions. Such students can furnish independent insights in innovations of STEM and in new products (Mone, 2017) that may be lacking to those without disabilities (Ladner & Burgstahler, 2015, & Lazar et.al., 2017). There are in the country currently 250+ post-secondary programs for students with developmental and intellectual disabilities with a diversity of models (Canright, 2014) including STEM, and more programs are expected in 2017 – 2020 (Diament, 2015). These programs can address the concern of industry for skilled STEM students (Bellman, Burgstahler, & Ladner, 2014). Accordingly, this paper presents a model at the Seidenberg School of Computer Science and Information Systems of Pace University, as a foundational program for increased availability and diversity of skilled students in STEM.

2. INTRODUCTION TO PROGRAM

"Everyone desires the opportunity to reach their full potential" (Hublar, 2016)
The post-secondary model at the Seidenberg School of Pace University is devised as a certificate non-credit non-degree program in STEM for moderately impaired students with disabilities having individualized education plans (IEP) from middle / high schools. Though the students are moderately impaired with disabilities, they are free from disruptions and largely intellectually nimble and interested in learning STEM and non-STEM skills (Corrigan, 2016). The program is modeled on requirements from the Higher Education Act (HEA) of 2008: Programs for Students with Intellectual Disabilities in Higher Education Title VII – Part D-2 Excerpts (Grigal, Hart, & Weir, 2012) and on the Think College Standards, Quality Indicators, and Benchmarks for Inclusive Higher Education Initiative (Grigal et.al., 2012) for students with disabilities. The students are matched to the program based on capability and desire, as discerned by a non-profit AHRC New York City organization, a disability organization partner of the school, and by the school. The students with developmental and intellectual disabilities are included in the school with students without disabilities in a fully inclusive setting.

The program is devised as a coherent experience in exploring and in learning STEM that can help in identifying industrial opportunities in STEM (i.e. technology) for the students with disabilities. Following a course in *University 101*, the focus of the program is on courses in technology, which includes:

- *Computer Information Systems;*
- *Computer Programming*;
- *Creating with the Interactive Web*;
- *Information Technologies*;
- *Intermediate Microsoft Tools*;
- *Introduction to Computing Technology*;
- *Introduction to Information Technologies*;
- *Introduction to Programming*;
- *Java Programming*;
- *Multimedia User Interface Design*;
- *Problem Solving Using Lego Robotics*;
- *Social Media*;
- *Social Media Networking Technology*; and
- *Web Design for Non-Profit Organizations*.

From person-centered plans (Mount, 2000), and desired outcomes from the plans, the program can engage further interests and skills of the students in non-STEM courses, examples of which

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are *Communication and Popular Culture*, *Contemporary History* and *Psychology of Women*, often involving the students with disabilities on projects in STEM and non-STEM with the students without disabilities, on self-directed teams.

The full program scope is 14 courses in STEM, as above, and 9 courses in non-STEM study, as exampled, of which the students with disabilities are in an average of 12 chosen courses, mostly in STEM, since 2013.

However, the curricular is expanded by extra-curricular experiences in STEM, such as the following:

- *Big Data Boot Camps*
  (e.g., Data Analytics Labs and Data Modeling Competitions);
- *Career Networking Nights*
  (e.g., Preparing for the Google Interview);
- *Computer Science Tech Talks*
  (e.g., Google Brain Team: Deep Learning with Python);
- *Computing Nerd Night Fights*
  (e.g., Hacker-Rank Nights);
- *Conservatory STEM Summers*;
- *Cybersecurity Hackathon Innovation Labs*;
- *Entrepreneurship Lab Mobile App Pitches*
  (e.g., My Everyday Pace);
- *Gaming in the Cloud Fest Programs;* and
- *Learn from a Legacy of Technology Leaders & Innovators - Speaker Spotlight Series*
  (e.g., Women in Technology).

The extra-curricular experiences furnish internship opportunities in the school for the students, as the Confucius Institute, as a foundation for occupational positions in technology.

The students with disabilities are further included in extra-curricular experiences in non-STEM recreation and sociality, such as the *Confucius Institute*, in the university, or 173 extra-curricular experiences in non-STEM (40) and STEM (133), since 2013.

There are an average of 2-3 students in the program in a semester, or a cumulative of 13 students with developmental and intellectual disabilities, a national norm number for post-secondary programs for such students (Grigal & Hart, 2010), during an average but flexible 3 years, since 2013.

The post-secondary program is not altered in expectations for the students with disabilities (Valls, & Kyriakides, 2013). However, they are assisted by companion mentor students without disabilities (Topping & Ehly, 1998, & Getzel, 2014) in their curricular experiences of identity and learning, with the concurrence of faculty, and in their extra-curricular experiences of sociality; and they are shadowed by the mentor peer students in the school and university. They are assisted by assistive resources (Gassner, 2016), such as apps on i-pads, communication devices, content displays and mobile scribes, furnished mostly by the non-profit organization, and by social networking services, such as MyPace, Snap Chat and Twitter. They are helped if they need other services (Barnhill, 2016), such as re-scheduling testing times. Literature indicates that students with disabilities can complete post-secondary programs, connecting experiences to industrial opportunities as real outcomes of the programs, if they have mentoring and other resources and services (Baer et. al., 2003, Hoffman, 2016, & Diament, 2017). Not clear, even given the resources and the services of the non-profit organization and the Seidenberg School of Pace University in this paper, is the contribution depth of the post-secondary program in STEM for the students with developmental and intellectual disabilities.

3. FOCUS OF PAPER

The focus of this paper is to evaluate the contribution depth of the post-secondary program of the Seidenberg School on the students with disabilities. The evaluation is of factors of *academic identity* (Singer-Freeman, Bastone, & Skrivanek, 2014) – Is the program favorably or non-favorably impacting the identity of the students as bona fide members of the school?; *content learning* (Thoms & Eryilmaz, 2015) – Is the program favorably or non-favorably impacting the learning of technology by the students?; and *norms of sociability* (Ehiyazaryan-White, 2012) – Is the program favorably or unfavorably impacting sociality skills of the students?, as an effective foundation for marketable skills in STEM. The factors are found in the literature and were investigated in preliminary analyses of the authors (Greene & Lawler, 2017; Lawler, 2016; and Lawler, 2013). The evaluation is apt as, despite the number of offered programs, limited numbers of eligible students with developmental and intellectual disabilities are effectively engaged in post-secondary programs (Kolodner, 2016) and even post-secondary professions (Schwarz, 2006, &

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Smith & Lowrey, 2017), such as STEM. The literature is moreover scant on inclusion interventions for moderately impaired but intellectually nimble STEM students with developmental and intellectual disabilities. The results of this study can be helpful to instructors in information systems in learning practices for pursuing diversity of an enthusiastic niche population of STEM students.

4. METHODOLOGY OF STUDY

The methodology of this study consisted of different focus groups of the 13 students with disabilities, in the program in STEM in the Seidenberg School of Computer Science and Information Systems of Pace University, since 2013. The perceptions of the students with disabilities were evaluated by a checklist instrument on the contribution depth of impact of the 23 courses (14 STEM and 9 non-STEM) of the program as applicable, on the aforementioned factors of academic identity and content learning and on factor items, as defined fully in Tables 1 and 2 in the Appendix. The perceptions of the students with disabilities were evaluated further on the contribution of impact of the cumulative experiences in extra-curricular as applicable, on the aforementioned factor of norms of sociality and on factor items, also detailed fully in Table 3. The perceptions of the dimensions of the impact of the courses and of the experiences in identity, learning and sociality items were evaluated on a Likert-like scaling of 5 – very high impact, 4 – high impact, 3 – intermediate impact, 2 – low impact and 1 – very low impact, with an option of 0, on the students. The evaluations were consistent with the methodology engaged on the preliminary analyses of the program (Greene & Lawler, 2017; Lawler, 2016; and Lawler, 2013), in the community context of construct, content and face validity for this population of students with developmental and intellectual disabilities at the university.

The resultant quantitative data was interpreted from the Mat Lab 7.10.0 Statistics Toolbox (Evans, 2014) by the second author; and the resultant qualitative information was interpreted, in consultation with the instructors and the mentors in the program and with the students, by the third and first authors of this study.

5. ANALYSIS OF DATA AND DISCUSSION OF RESULTS

The analysis of the data on the post-secondary program is disclosing contributions of favorably high impact of academic identity (means=4.50/ 5.00) and content learning (3.92) but limited sociality (2.24). The courses in STEM are favorably impacting identity (4.49), content learning of technology (3.97) but limited norms of sociality (2.48); and the extra-curricular experiences in STEM are concurrently impacting identity, content learning of technology and norms of sociality, in the perceptions of the students with disabilities. The courses and the extra-curricular experiences in non-STEM study are concurrently impacting the factors favorably.

(Tables 1-3 detail the results of the study.)

Academic Identity

The administrative aspects of the program are enabling the academic identity of the students with disabilities. The students are easily engaging the course facilities and labs (4.42/ 5.00) of the Seidenberg School, easily enrolling in its systems (4.51), and easily navigating the library and research resources (4.49) of the university, as non-official students. They are accepted as equal course members by instructors and by students without disabilities (4.56). This is inspiring confidence skills for them to be members of the school like STEM students without disabilities. The development of an academic identity encourages expectations of a career identity in STEM.

Content Learning of STEM

From initial literacy (2.84/5.00 [STEM]), the courses in the program are enabling content learning in hard skills (3.97) in intermediate information systems subjects. The inclusion on projects is facilitating increased interest in STEM. Most of the projects are enabling increased learning in coding - computational methods for computational thinking - in technology, by involving the students with disabilities in individual contributor tasks and in cooperative group-learning (Gregory & Chapman, 2013) on mutual problem-solving tasks (3.81) This is impacting positively soft skills (3.69), such as perseverance, presentation, problem-solving, thinking and time management, impacting the increasing interest in STEM (Cox, Cekic, & Adams, 2010), as the students perform tasks on the teams. The students with disabilities are helped in increasing interactions on the tasks by non-technical and technical tools (Satriale, 2016) on the tasks (4.75); and they are helped without issue to the instructors or to the students without disabilities (4.38). Other prerequisites, such as Universal Design Learning (Thoma et.al., 2016) and Universal Design for Learner Support (Tobin, 2016), are helping in the program, as instructors, educated in the prerequisites, improve interactions with the students with disabilities. The learning of intermediate skills in STEM (i.e. technology), even if not for skills as an engineering or coding wizard, and of liberal arts orientation skills, is a foundation for individualized plans for employment (IPE) that may be developed for the students by the non-profit organization. The foundation for marketable skills for industrial positions is highly motivating for these students.

Norms of Sociality

The experiences offered by the program are facilitating limited sociality of the students with disabilities. The experiences are indicating involvement in extra-curricular events, in memberships or non-memberships (3.46/5.00), notably in hackathons in technology, and in seminars (2.77 [STEM]), in the school or in the university. The experiences are further indicating holistic learning beyond sociality from peer students without disabilities (Schwarz, 2006, & Khan, 2015). The recognition for their roles are however not as pronounced in the school (1.31) or in the university (1.00), as their roles are limited by a focus on content learning. The socialization skills will be eventually marketable nevertheless especially if integrated with the skills in STEM.

Overall, the perceptions of the post-secondary program in the Seidenberg School are essentially indicating generally high satisfaction. The students with developmental and intellectual disabilities are learning practical skills beyond STEM for societal success (Alwell & Cobb, 2007) – 6 of the 13 are already in semi-professional positions through the non-profit organization and the school. With their skills, they are even learning to be self-advocates for themselves.

(Tables 2b and 2c document the content learning correlations and frequency distribution results of this study.)

6. IMPLICATIONS FOR PRACTICE

"Everyone should have the opportunity to go to college.' (Hublar, 2016)

The program in the Seidenberg School is enabling a college experience from both curricular and extra-curricular facets. Most of the students are engaging in a diversity of opportunities (Causton-Theoharis, Ashby, & DeClouette, 2009) in the discipline of STEM. The opportunities are facilitating outcomes of possibilities (Grigal & Hart, 2010) in STEM. In this process, the students with disabilities are formulating a portfolio of increased marketability of skills in STEM, focusing on technology. The implication is that a post-secondary program in STEM for higher-functioning students with developmental and intellectual disabilities is a feasible proposition for a school of information systems.

The program is existing from funding from the non-profit organization. The program is functioning from the internal resources of the university, such as the Department of Internal Technology, Health Services and the Office of Disability Services, that do not insist on more resources for the norm of a small number of students (Grigal & Hart, 2010). The program is functioning however largely from the mentor students and from the network of proactive professors who, with the political sponsorship of the Dean of the SEidenberg School and the Dean for Students of the university, are important in maintaining the program (Cerf & Johnson, 2016) with high finishing rates. The initiation of a post-secondary program for atypical students with disabilities is frequently an issue for schools in STEM or non-STEM not familiar with inclusion practices for this niche population of students (Causton-Theoharis, Ashby, & DeClouette, 2009). The implication for requirements for a school of information systems is that a post-secondary program in STEM for students with developmental and intellectual disabilities is an incremental proposition that requires the inventive integration of resources and services of a university.

The practices of the Seidenberg School are illustrative of other post-secondary Think College practices. Eligible students with disabilities do not have enough industrial opportunities if they are not included in a post-secondary program (Diament, 2016), even though industries have positions for them if the students have the required skills. The program in STEM is offering meaningful possibilities in technology to higher-functioning motivated students with disabilities at Pace University, moving beyond considered deficits of the impairments to the actual capabilities of the students (Gay, 2013) – can we afford to have other coding - such students become discouraged or intimidated without such programs? These programs posit a new positive reality for schools of information systems and for the students themselves. The final implication for practices is that special education programs in STEM are an important proposition for schools of

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information systems, in sourcing a neglected niche population of students with developmental and intellectual disabilities interested in learning skills in STEM, in order to address the demands of industries.

7. LIMITATIONS AND OPPORTUNITIES

The paper is constrained by perceptions of a limited number of students at one school of information systems focusing on technology. The paper is constrained further by its current dimension of heterogeneity that is limited to the needs of students with developmental and intellectual disabilities from one non-profit organization. However, this paper may be improved as diverse students with other disabilities (Brand & Valent, 2013) are included in the post-secondary program at the school, and intersections of the disabilities with other diversity, such as ethnic, gender, racial, religious and sexual, are as feasible included in the program, introducing an improved and inclusive intervention measurement study. Measurement of students with disabilities interested in non-STEM subjects, and more measurement of sociality, may be further improvement in a new paper. Nevertheless, this study, in the interim, may energize other schools of information systems in pursuing programs in STEM for this population of students.

8. CONCLUSION OF PAPER

This paper describes a post-secondary program for the diversity of students with developmental and intellectual disabilities in a school of computer science and information systems at a metropolitan university. The essence of the program is in engaging higher-functioning interested students with the disabilities in curricular and extra-curricular experiences of STEM inclusively like other students without disabilities. The goal of the program is in helping in proficiency in industrial possibilities for these students with disabilities.

The perceptions of the program are indicating that the academic identity and the content learning of marketable skills in technology, and the limited norms of sociality, are factors of the program furnishing satisfaction of the students. The importance of mentor peer students and networks of proactive professors sensitive to the students with disabilities is indicated by the authors. The importance of involvement of a non-profit organization, as a post-secondary source of the students with disabilities pre-evaluated to have potential to succeed in technology, is further indicated in this paper. The importance of the internal organizational services of the university is noted in this study. The post-secondary program of this study is a proposition that may be integrated in schools of information systems seamlessly with the institutional services of the university.

In summary, this paper presents an outreach proposition that can motivate other schools of information systems to pursue inclusiveness programs in STEM for this population of students – a compelling imperative beyond any moral necessity.

9. REFERENCES

Alwell, M., & Cobb, B. (2007). Teaching Social / Communicative Interventions to Youth with Disabilities. National Secondary Transition Technical Assistance Center, Charlotte, North Carolina.

Baer, R.M., et.al. (2003). A collaborative follow-up study on transition service utilization and post-school outcomes. *Career Development for Exceptional Individuals*, 26, 7-25.

Barnhill, G.P. (2016). Supporting students with Asperger syndrome on college campuses: Current practices. *Focus on Autism and Other Developmental Disabilities*, 31(1), 3-15.

Bellman, S., Burgstahler, & Ladner, R. (2014). Work-based learning experiences help students with disabilities transition to careers: A case study of University of Washington projects. *Work*, 1051(9815), 399-405.

Boccella, K. (2016, November 11). College-bound students with autism learn to navigate campus life. *Disability Scoop*, 1-3.

Brand, B., & Valent, A. (2013). Improving college and career readiness for students with disabilities. *College & Career Readiness & Success Center at American Institutes for Research*, March, 4,26.

Causton-Theoharis, Ashby, C., & DeClouette, N. (2009). Relentless optimism: Inclusive postsecondary opportunities for students with significant disabilities. *Journal of Postsecondary Education and Disabilities*, 22, 8-105.

ISSN: 2473-3857
v3 n4306

Canright, B. (2014, September 3). I want to go to college. *Apostrophe*, 1-3.

Cerf, V.G., & Johnson, M. (2016). Enrollments explode! But diversity students are leaving. *Communications of the ACM*, 59(4), 7.

Corrigan, K. (2016, May 11). New program for adults with autism matches potential with skills. *Disability Scoop*, 1-2.

Cox, M.F., Cekic, O., & Adams, S.G. (2010). Developing leadership skills of undergraduate engineering students: Perspectives from engineering faculty. *Journal of STEM Education*, 11(3), 22-33.

Diament, M. (2015, September 21). Post-secondary programs see signs of success. *Disability Scoop*, 1-2.

Diament, M. (2016, May 3). Vocational rehabilitation often leads to low-paying jobs for those with autism. *Disability Scoop*, 1-2.

Diament, M. (2017, March 14). Bucking trend, 9 in 10 with autism land jobs after training. *Disability Scoop*, 1-3.

Ehiyazaryan-White, E. (2012). The dialogic potential of eportfolios: Formative feedback and communities of learning within a personal environment. *International Journal of ePortfolio*, 2(2), 173-185.

Evans, A.N. (2014). Using Basic Statistics in the Behavioral and Social Sciences. Sage Publications, Inc., 5th Edition, Thousand Oaks, California.

Gassner, D. (2016). The changing times and tools of assistive technology: One man's story of college success. *Autism Spectrum News*, Winter, 9,24.

Gay, G. (2013). Teaching to and through cultural diversity. *Curriculum Inquiry*, 43(1), 48-70.

Getzel, E.E. (2014). Fostering self-determination in higher education: Identifying evidence-based practices. *Journal of Postsecondary Education & Disability*, 27(4), 381-386.

Greene, M., & Lawler, J. (2017). Enabling college inclusion in a special education STEM program for students with developmental and intellectual disabilities. *Faculty Network Journal*, New York University, April.

Gregory, G.H., & Chapman, C. (2013). Differentiated Instructional Strategies. Corwin, Thousand Oaks, California, 131.

Grigal, M., & Hart, D. (2010). What's the point? A reflection about the purpose and outcomes of college for students with intellectual disabilities. *Think College Insight Brief*, September, 1-4.

Grigal, M., Hart, D., & Weir, C. (2012). Framing the future: A standards-based conceptual framework for research and practice in inclusive higher education. *Think College Insight Brief*, 10, 1-4.

Hewlett, S.A., et.al. (2008). The Athena factor: Reversing the brain drain in science, engineering, and technology. *Harvard Business Review Research Report*, June, 1.

Hoffman, J. (2016, November 19). Helping autistic students navigate life on campus: A web of academic and social support. *The New York Times*, 22.

Hublar, M. (2016). Postsecondary education and individuals with intellectual disabilities. *Proceedings of the 2016 State of the Art Postsecondary Education and Individuals with Intellectual Disabilities*, Fairfax, Virginia, December.

Kim, F., & Aquino, K.C. (2017). Disability as Diversity in Higher Education: Policies and Practices to Enhance Student Success. Routledge, New York, New York, xii.

Khan, A. (2015, October 13). Young adults on the spectrum learn ins and outs of socialization. *Disability Scoop*, 1-5.

Kolodner, M. (2016, June 10). Despite smarts, few on the spectrum college-bound. *Disability Scoop*, 1-6.

Kuehl, T.R. (2016, April 14). Man with Down syndrome attends four year college. *Apostrophe*, 1-10.

Ladner, R.E., & Burgstahler, S. (2015). Increasing the participation of individuals with disabilities. *Communications of the ACM*, 58(12), 33-36.

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v3 n4306

Lazar, J., et.al. (2017). Making the field of computing more inclusive. *Communications of the ACM*, 60(3), 50-59.

Lawler, J.P. (2013). Engagement and impact in a college inclusion pilot program for individuals with disabilities. *Proceedings of the Southeast Decision Sciences Institute (SEDSI)*, Charleston, South Carolina, February.

Lawler, J.P. (2016). Empowering college students with cognitive disabilities in a special education program integrating e-portfolio technology. *Proceedings of the Southeast Decision Sciences Institute (SEDSI)*, Williamsburg, Virginia, February.

Lazar, J., et.al. (2017). Making the field of computing more inclusive. *Communications of the ACM*, 60(3), 50-59.

Lohr, S. (2016, November 18). Udacity, an education start-up, offers technology job tryouts. *The New York Times*, 1.

Mone, G. (2017). Bias in technology: As leading companies release troubling diversity statistics, experts search for solutions. *Communications of the ACM*, 60(1), 19-20.

Mount, B. (2000). Person-Centered Planning: Finding Directions for Change Using Personal Futures Planning. Capacity Works, Amenia, New York.

Satriale, G., & Zane, T.L. (2016). Technology: The silver bullet in education for individuals with autism. *Autism Spectrum News*, Winter, 15,27.

Schwarz, P. (2006). From Disability to Possibility: The Power of Inclusive Classrooms. Heinemann, Portsmouth, New Hampshire, 40.

Silberman, S. (2015). NeuroTribes: The Legacy of Autism and the Future of Neurodiversity. Avery, New York, New York, 9-11,252.

Singer-Freeman, K., Bastone, L., & Skrivanek, L. (2014). Eportfolios reveal an emerging community of underrepresented minority scholars. *International Journal of ePortfolio*, 4(1), 85-94.

Skibell, A. (2015, December 1). More on the spectrum training for technology jobs. *Disability Scoop*, 1-5.

Smith, S.J., & Lowrey, K.A. (2017). Applying the universal design for learning framework for individuals with intellectual disabilities: The future must be now. *Intellectual & Developmental Disabilities*, 55(1), 48-51.

Takahashi, K., Roberts, K.D., Brown, S.E., Park, H-J., & Stodden, R. (2017, March 22). Preparing young adults with disabilities for STEM careers: The Pacific Alliance Model. *Impact Newsletter*, 1-5.

Thoma, C.A. et.al. (2016). Education of students with intellectual and developmental disabilities. In *Critical Issues in Intellectual and Developmental Disabilities*: *Contemporary Research*, *Practice*, and *Policy*. Washington, D.C.: American Association on Intellectual and Developmental Disabilities, 40-41.

Thompson, C. (2017, February 8). The next big blue-collar job is coding. *Wired*, 3.

Thoms, B., & Eryilmaz, E. (2015). Introducing a twitter discussion board to support learning in online and blended learning environments. *Education Information Technologies*, 20, 265-283.

Tobin, T.J. (2016). How universal design for learning supports concept mastery in the flipped classroom. In B. Honeycutt (Ed.), *Flipping the College Classroom*: *Practical Advice from Faculty*. Madison, Wisconsin: Magna Publications, 86-90.

Topping, K., & Ehly, S. (1998). Peer-Assisted Learning. Lawrence Erlbaum Associates, Mahwah, New Jersey.

Uditsky, B., & Hughson, E. (2012). Inclusive postsecondary education – An evidence-based moral imperative. *Journal of Policy and Practice in Intellectual Disabilities*, 9(4), 298.

Valls, R., & Kyriakides, L. (2013). The power of interactive groups. *Cambridge Journal of Education*, 43(1), 17-33.

Wilkie, D. (2014). Challenges confront disabled who pursue STEM careers. *Society for*

 ISSN: 2473-3857
v3 n4306

Human Resource Management (SHRM), August 7, 1-3.

______ (2014). Diversity in high technology. *Employer Information Equal Employment Opportunity (EEO-1) Report: United States Equal Employment Opportunity Commission*, January 31, 3,5,35.

______ (2016, April 16). Beautiful minds, wasted: How not to squander the potential of autistic people. *The Economist*, 9,19.

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APPENDIX

Table 1: Evaluation of Post-Secondary Special Education Program – Academic Identity

	STEM and Non-STEM		**STEM**	
Academic Identity Factor	**Means**	**Standard Deviations**	**Means**	**Standard Deviations**
Student was admitted to the course without administrative difficulty.	4.51	0.77	4.56	0.76
Student was easily engaged into the course facilities and labs.	4.42	0.85	4.41	0.87
Student was easily enrolled on to the course black board and e-portfolio id systems of the university.	4.51	0.80	4.56	0.80
Student was easily involved in navigating course library, material and research resources of the school and the university.	4.49	0.70	4.41	0.76
Student was accepted as an equivalent course member by the course professor and by the students.	4.56	0.70	4.50	0.76
Overall	4.50	0.76	4.49	0.79

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Table 2: Evaluation of Post-Secondary Special Education Program – Content Learning

	STEM and Non-STEM		STEM	
Content Learning Factor	**Means**	**Standard Deviations**	**Means**	**Standard Deviations**
Student was demonstrating initial literacy skills in the course subjects by the beginning of the semester.	2.83	1.29	2.84	1.35
(F2) Student was involved with other course students on project teams.	3.84	1.11	3.81	1.18
(F3) Student was involved in course Q&A with the professor and with other students.	3.53	1.20	3.41	1.19
(F4) Student was demonstrating hard proficiency skills in the course subjects by the end of the semester.	4.12	0.73	3.97	0.69
(F5) Student was demonstrating other proficiency soft skills by the end of the semester.	3.84	0.87	3.69	0.90
(F6) Student was demonstrating a positive presence in the course in the semester.	3.91	0.95	3.78	0.94
(F7) Student was supported by non-technical resources without issue to the course, the professor and the other students.	4.81	0.45	4.75	0.51
(F8) Student was supported by technical tools without issue to the course, the professor ad the other students.	4.51	0.63	4.38	0.66

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Overall	3.92	0.90	3.97	0.87

Table 2a: Evaluation of Post-Secondary Special Education Program – Content Learning - Curricular in STEM

	STEM	
Content Learning in Courses of STEM	**Means**	**Standard Deviations**
Computer Information Systems	4.38	0.71
Computer Programming	3.13	0.88
Creating with the Interactive Web	4.17	0.51
Information Technologies	3.57	0.92
Intermediate Microsoft Tools	(-)	(-)
Introduction to Computing Technology	3.54	0.87
Introduction to Information Technology	(-)	(-)
Introduction to Programming	3.00	0.79
Java Programming	(-)	(-)
Multimedia User Interface Design	4.67	0.58
Problem Solving Using Lego Robotics	3.90	1.08
Social Media	(-)	(-)
Social Media Networking Technology	3.25	0.71
Web Design for Non-Profit Organizations	(-)	(-)

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(-) Evaluations were incomplete in inputs by the students.

Table 2b: Kendall's Tau b Non-Parametric Correlations of Factor Pair Ratings – Content Learning – Curricular in STEM (Corresponding to Table 2)

Content Learning Factor	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**
F2	0.319*						
F3	-0.119	0.045					
F4	0.362*	0.439**	0.238				
F5	0.263	0.283	-0.169	0.018			
F6	0.248	0.562**	0.322*	0.433**	0.206		
F7	-0.162	0.257	-0.204	0.080	0.218	0.184	
F8	0.220	0.294	0.078	0.290	0.180	0.383*	0.336*

*Correlations are significant at the 0.01 level (2-tailed).

**Correlations are significant at the 0.05 level (2-tailed).

Table 2c: Frequency Distributions of Ratings – Content Learning – Curricular in STEM (Corresponding to Table 2)

	Frequencies							
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Impacts								
5	3	12	8	7	5	10	25	15
4	7	8	5	17	16	6	6	14
3	12	7	13	8	7	15	1	3
2	4	4	4	0	4	1	0	0
1	4	1	2	0	0	0	0	0

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0	2	0	0	0	0	0	0	0

Table 3: Evaluation of Post-Secondary Special Education Program – Sociality

	STEM and Non-STEM		**STEM**	
Sociality Factor	**Means**	**Standard Deviations**	**Means**	**Standard Deviations**
Student was involved in memberships or non-memberships in extra-curricular clubs of recreation and socialization in the school and / or university.	3.19	1.83	3.92	1.44
Student was involved in extra-curricular non-membership events in the school and / or university.	3.46	1.75	3.46	1.39
Student was involved in extra-curricular seminars on hard and / or soft skills in the school and / or university.	2.27	1.95	2.77	2.17
Student was involved as a non-participant or participant in recreation / sports in the university.	1.27	1.80	0.92	1.66
Student was prominently recognized for her / his role in membership and/ or non-membership clubs, events, and / or seminars in the school and / or university.	1.00	1.57	1.31	1.80
Overall	2.24	1.78	2.48	1.69