Proceedings of the Interdisciplinary STEM Teaching and Learning Conference

Volume 1 Article 6

5-2017

The Correlation between Extracurricular STEM Activities and Students with Disabilities

Karin Fisher
Georgia Southern University, kfisher@georgiasouthern.edu

The Correlation between Extracurricular STEM Activities and Students with Disabilities

Abstract
Students with disabilities perform below their non-disabled peers in science (National Science Foundation, 2015). The purpose of the exploratory research was to determine if informal science learning activities offered in Florida districts make a difference on the performance of students with disabilities (SWD) on the 2015 8th grade Florida science assessment using quasi-experimental research methods. After determining a statistically significant difference does exist on the difference between students with and without disabilities on the 8th Grade Florida Science Assessment, the researcher determined if STEM personnel track the number of students with disabilities who participate in STEM activities. The number and types of STEM activities were collected by district. Lastly, the researcher determined there was a small correlation between SWD performance on the Science assessment and the number of STEM activities offered in each district.

Keywords
extracurricular, STEM, disabilities, correlation, science

The Correlation between Extracurricular STEM activities and Student with Disabilities Performance on a Standardized Science Assessment

Karin Fisher, Georgia Southern University

Abstract: Students with disabilities perform below their non-disabled peers in science (National Science Foundation, 2015). The purpose of the exploratory research was to determine if informal science learning activities offered in Florida districts make a difference on the performance of students with disabilities (SWD) on the 2015 8th grade Florida science assessment using quasi-experimental research methods. After determining a statistically significant difference does exist on the difference between students with and without disabilities on the 8th Grade Florida Science Assessment, the researcher determined if STEM personnel track the number of students with disabilities who participate in STEM activities. The number and types of STEM activities were collected by district. Lastly, the researcher determined there was a small correlation between SWD performance on the Science assessment and the number of STEM activities offered in each district.

Keywords: extracurricular, STEM, disabilities, correlation, science

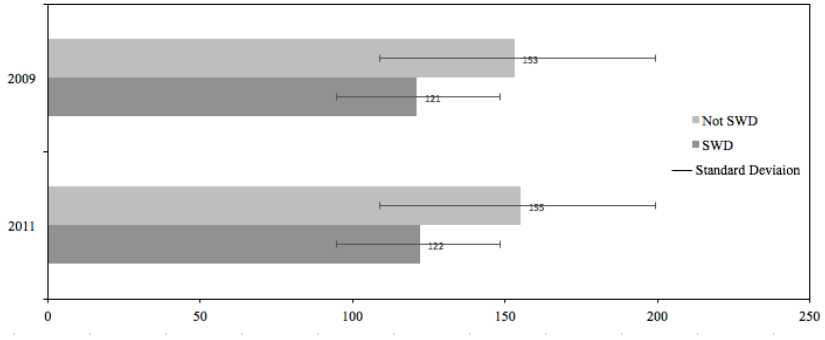
Correlation between Extracurricular STEM activities and Student with Disabilities Performance on a Standardized Science Assessment

A robust and diverse science, technology, engineering and mathematics (STEM) workforce is critical to our nation's competitiveness because individuals with STEM knowledge, skills, and abilities drive the innovation that will lead to new products, industries, and economic growth (BHED/Act Policy Brief, 2014; National Academies of Sciences, Engineering, and Medicine, 2016; National Science Board, 2016). Even with the clear need for more diverse STEM workers, only 5% of students with disabilities (SWD) enter the STEM workforce (Leddy, 2010). One reason SWD do not enter the STEM workforce is because they struggle in science (Basham & Marino, 2013). Students with disabilities (SWD) have historically and consistently struggled in science (National Center for Education Statistics, 2011). This trend becomes increasingly clear in middle school where the decision is often made to pursue advanced science and engineering courses (Hartung, Porfeli, & Vondracek, 2008).

On the 2011 National Assessment of Educational Progress (NAEP)

in 8th grade science in all states, a significant difference on the scaled scores of SWD (M = 122, SD = 38) and students without disabilities (M = 155, SD = 32); p = 0.00 was evident. On the 2009 NAEP 8th grade science assessment, there was a significant difference on the scaled scores of students with disabilities (M = 121, SD = 39) and students without disabilities (M=153, SD = 33); p = 0.00 (National Center for Education Statistics [NCES], 2011). See Figure 1 for an overview of 8th grade NAEP science scores where the discrepancy can be easily seen. As a result, educators and policymakers continue to search for programs to close the science achievement gap between SWD and their non-disabled peers.

Figure 1. NAEP Science 8 Grade Scores.



Many general education STEM teachers are unprepared to meet the needs of SWD (Stefanich, 2007). Montgomery and Mirenda (2014) stated teachers of students in inclusive classrooms report they lack the knowledge, skills, and confidence to make instructional adaptations for SWD. Furthermore, the adaptations made were not consistent, systemic, or as frequent as needed (Montgomery & Mirenda, 2014) In 2012, Marino and Hayes stated science teachers lack instructional diversity and have inadequate knowledge of effective pedagogical practices for teaching SWD. As a result, there is a need to research different pedagogical approaches for educating SWD to become scientifically literate citizens. Different pedagogical approaches include teaching science literacy through extracurricular STEM activities.

The purpose of this project is to address the science literacy discrepancy between students with and without disabilities in the 8th grade by determining if STEM activities make an impact on standardized science scores. Should there

DOI: 10.20429/stem.2017.010106

be a correlation between STEM activities and SWD science scores, then an argument can be made to provide access to more STEM activities to all students, especially SWD. Implications from this research will be discussed.

Purpose and Research Questions

Researchers suggest that participation in out of school science learning experiences has a positive influence on participants' attitudes about science both short term and longitudinally (Antink-Meyer, Bartos, Lederman, & Lederman, 2014; Bhattacharyya, Mead, & Nathaniel, 2011; Bischoff, Castendyk, Gallagher, Schamloffel, & Labroo, 2008; Fields, 2009; Luehmann, 2009). Furthermore, students who participated in extracurricular activities have better academic and social outcomes than students who do not participate (Durlak, Weissberg, & Pachan, 2010). However, SWD are underrepresented in extracurricular activities and struggle with middle school science (Brigman, Webb, & Campbell, 2007; Marino, Gotch, Israel, Vasquez, Basham, & Becht, 2014; U. S. Government Accountability Office, 2013). Therefore, additional research is needed to determine the effect on SWD participation in extracurricular activities and learning outcomes in science (Shields, King, Corbett, & Imms, 2014).

The purpose of the current study was to determine if there were differences between students with and without disabilities on the 2015 8th Grade Florida Science Assessment, the types of STEM activities offered in Florida school districts, and the percentage and type of SWD who participate in STEM activities in each district. Furthermore, the researcher examined the relationship between the number of STEM activities in a district and SWD achievement on the 2015 8th Grade Florida Science Assessment. The findings from this investigation should assist researchers, administrators and teachers in understanding the relationship between extracurricular activities and SWD performance in science. Findings should add to the general knowledge and understanding of extracurricular activities and their impact on SWD.

The research design for this study was guided by the following questions:

- RQ1: Is there a statistically significant difference between the perfor mance of students with and without disabilities on the 2015 8th Grade Florida Science assessment?
    - Hypothesis – There will be a statistically significant difference
- RQ2: What percentage of SWD do school personnel report as partici pating in after-school STEM activities?

- Hypothesis – Most school personnel do not report SWD par ticipation

- RQ3: What federal category of SWD (e.g., specific learning disability) do school personnel report as having the highest level of participation during after-school STEM activities?
  - Hypothesis – SLD will be the highest reported category.
- RQ4: What is the relationship between the number of STEM activities in a district and SWD achievement on the 2015 8th Grade Florida Statewide Science Assessment?
  - There will be a small correlation between the number of STEM activities and SWD performance on the science assessment.

The researcher used an exploratory, quasi-experimental single survey design for this study. The researcher created the survey with input from the state STEM director. The survey was then distributed to the STEM or science director in each of the 67 Florida districts. The district directors were instructed to forward the survey to STEM personnel in their districts. The participants in the survey are described in Table 1. These participants were selected, as they would have the most knowledge about the number and types of STEM activities offered in their schools.

Table 1. Position stated by study participants.

Position	Response	Percentage
STEM Teacher	124	47%
Non-STEM Teacher (e.g., special educator, gifted)	46	17%
District STEM Administrator	24	9%
Instructional Coach	7	3%
Specialists	7	3%
School STEM Administrator	5	2%
Other (did not state position)	50	19%
Total	263	

As a part of the survey, school personnel were asked to name the types of STEM activities offered in each district. Table 2 lists the top activities offered in Florida public school districts.

DOI: 10.20429/stem.2017.010106

Table 2. Types of Activities Offered in the Respondent's School or District.

Answer	Responses	Percentage of Respondents
Science Fair	188	79
FIRST Robotics	78	33
Common STEM Planning time	48	20
Thematic STEM assignments	57	24
Modeling and Simulation Club	24	10
SECME	80	33
Science Olympiad	69	29
Other	96	40
Total	230	

Summary of the Results

Research Question 1.

The first research question asked the following: Is there a statistically significant difference between the performance of students with and without disabilities on the 2015 8th Grade Florida Science Assessment? Hypothesis 1 stated there would be a statistically significant difference between students with and without disabilities on the 8th Grade Science Assessment. The null hypothesis was rejected based on the independent samples t test analysis, there was a statistically significant difference between the variables.

Table 3. *T*-test for Independent Means

	Levene's Test		*t*-test for Equality of Means						
					S		M	S	95% CI
	I	ig.	*t*	*f*	ig.	D	ED	L	U
	.	.	2		.	1	.	1	1
V	061	805	0.665	32	000	7.61	852	5.925	9.296

Note. EV = equal variances assumed, Sig. = significance, MD = mean differences, SED = standard error difference, CI = confidence interval of the difference, L = lower, U = upper

The question was answered with student performance data accessed from the FLDOE website using an independent samples t test (Table 3). The researcher tested assumptions for normality, homogeneity of variance, and independence on each variable prior to running the analysis. Because the

assumption of normality was not met in the first analysis on all 2015 8th Grade students, the researcher examined a boxplot and performed a Grubb's test. Consequently, the researcher determined outliers were causing the abnormal distribution. As a result, the researcher removed the outliers, which were more than two standard deviations from the mean. The resulting analysis revealed the assumption of normality was met when outliers were removed on the results of the Florida Science Assessment for all 8th grade students. The assumption of normality was met for SWD and an analysis of the districts with outlying science scores was performed.

The assumption of homogeneity was met as indicated by an insignificant Levene's test. Because there was no random assignment, the assumption of independence was not met. Violation of the independence assumption created potential for an increased probability of a Type I or Type II error. Based on G*power version 3.1.9.2 (Faul, Erdfelder, Buchner, & Lang, 2009) analysis, the suggested sample size was 26 districts for each group for an independent samples t test using two different samples. The resulting analysis determined the mean scores between SWD and all 8th grade Students on the 8th Grade Florida Science Assessment was statistically significant with a large effect size. The results provided evidence that SWD score lower than students without disabilities on the 2015 8th Grade Florida Science Assessment.

Research Question 2.

The second research question asked the following: What percentage of students with disabilities do school personnel report as participating in after-school STEM activities? Hypothesis 2 stated school personnel will report a small percentage of SWD participating in after-school STEM activities. The null hypothesis was rejected based on the descriptive statistics used to analyze the responses from 230 school STEM personnel who answered the question. Of the 230 respondents, 173 or 75% reported their district does not track the number of SWD in their STEM clubs and 47 or 20% stated 0-20% of SWD participate in STEM activities. See Table 4 for more information on the categories of SWD reported.

DOI: 10.20429/stem.2017.010106

Table 4. The Percentage of SWD School Personnel Report as Participating in STEM Activities.

Answer	Response	Percentage
We do not track the number of SWD	173	75
0-20%	47	20
21-40%	5	2
41-60%	4	2
Greater than 60%	1	0
Total	230	

Research Question 3.

The third research question asked the following: What disability category do school personnel report as having the highest level of participation during after-school STEM activities? Hypothesis 3 stated the disability category having the highest level of participation during after-school STEM activities was students with learning disabilities. Students with learning disabilities are defined as students who exhibit "one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations" (IDEA, 2004; 20 U.S.C. §1401 [30]). The null hypothesis was rejected based on the descriptive statistics used to analyze the responses from the 75 respondents who answered the survey question. Of the 75 responses, 42 or 56% selected LD. It should be noted that only 75 of the 230 respondents answered this question on the survey. Implications of the low response rate are discussed in the results.

Research Question 4.

The last research question asked the following: What is the relationship between the number of STEM activities in a district and students with disabilities' achievement on the 8th Grade Florida Statewide Science Assessment? Hypothesis 4 stated there will be a small correlation between the number of STEM activities offered and SWD achievement on the 2015 8th Grade Science assessment. The null hypothesis of a zero correlation, however, was not rejected based on the analysis of a Pearson Correlation Coefficient because the observed

power was .189, which indicates a Type I error may be possible. Thus the researcher could not reject the null hypothesis that the correlation is zero at the .05 level of significance. There was a small positive correlation (Table 5) between the number of STEM activities districts offered and SWD 2015 8th Grade Florida Science Assessment scores. The number of STEM activities offered in a district explained 8% of the variation in the 2015 8th Grade Florida Science Assessment scores. Specifically, the number of STEM activities offered in a district explained 8% of the variance in the test scores. Alternatively, the number of STEM activities in the students' school district did not explain 92% of the variance in scores of SWD.

Table 5. Pearson's Correlation Coefficient.

			Activities	SWD mean score
	activities	Pearson's Correlation	1	.235
		Sig. (2-tailed)		.189
		N	33	33
	SWD Mean Score	Pearson's Correlation	.235	1
		Sig. (2-tailed)	.189	
		N	33	33

Research question 4 was answered by the researcher with student performance data accessed from the Florida Department of Education (FLDOE) website and the results of an electronic questionnaire distributed to school STEM personnel. Assumptions for variables, outliers, linearity, and normality were tested by the researcher on each variable prior to running the analysis. Assumptions for variables were met. Assumptions of normality was met for STEM activities but not the 8th Grade Science Florida Assessment mean scores of SWD based on the Shapiro-Wilk's test. Even though the assumption of normality was violated for the mean science scores, a Pearson's Correlation Coefficient was calculated because the test is somewhat robust to deviations from normality (Laerd Statistics, 2016). The Pearson Correlation Coefficient (r = 0.235) is interpreted as a small effect size (Cohen, 1988).

DOI: 10.20429/stem.2017.010106

Discussion of the Results

Interpretation of the Findings

Analysis of RQ1 added to the research that there is a statistically significant difference between students with and without disabilities on the 8th grade Florida Science Assessment. The results align with what is found in the literature with the history of performance on standardized science assessments between students with and without disabilities in both Florida and the nation. The current study adds to the field of research that SWD continue to struggle in science in the state of Florida. Furthermore, outliers were present in the data from smaller school districts, indicating students from smaller districts perform worse than their peers from larger districts on the Florida Science assessment.

Analysis of RQ2, resulted in data that explains the paucity of information on the number of SWD who participate in STEM activities. Until school and district personnel track the number of SWD who participate in STEM activities, researchers will not be able to determine if STEM activities benefit them, specifically when correlated with student outcomes on standardized assessments. School and district personnel should track the number of SWD who participate in STEM activities. Without the data, research on the effectiveness of such activities will not be robust.

For research question 3, the researcher determined the type of SWD represented in STEM activities. According to the U.S. Department of Education (2014), 35% of all children and youth receiving special education services were categorized as having SLD in 2012-2013. Given most students served under the Individuals with Disabilities Education Act (IDEA) have learning disabilities, students with LD as expected represented the disability category having the highest level of participation in afterschool STEM activities. Additionally, researchers at NCES (2016) reported 66.2% of students with LD spent 80% or more of their time in inclusion classrooms in the fall of 2011, the latest figures reported. Students with LD were more likely to spend most of their time in inclusion classrooms than any other disability category. Specifically, more than 80% of students with LD receive their science instruction in the general education setting (Aud et al., 2012). As a result, the fact that district and school personnel in this study reported students with LD represent the most SWD who participate in STEM activities lends strength to the robustness of the survey as it follows the national trend for students with disabilities and inclusion.

However, only 75 of the 489 respondents (15%) who began the survey answered the question. The lack of response on this question impacted the validity of the survey. Consequently, the results are not robust and should be interpreted with caution. Further analysis needs to be conducted to determine why so many respondents skipped this question.

For RQ4, the researcher found the number of STEM activities in a district and the outcomes of SWD on the 8th Grade 2015 Florida Science assessment did have a small correlation ($r = 0.235$) between the two variables. It is concerning that power was not met and thus rejecting the null hypothesis of no correlation at the .05 significance level cannot be accomplished. The observed power was .189, which indicated a Type I error may be possible, but was not likely. Thus the null hypothesis that the correlation is zero could not be rejected at the .05 level of significance. In other words, failure to reject the null hypothesis, because there is no correlation between the performance of SWD on the 8th Grade Florida Science Assessment and the number of STEM activities offered in a district implies further analysis and research is needed. A possibility exists of a correlation between the two variables, despite the evidence from a single sample (Gall, Gall, & Borg, 2012). Even if the researcher had set a higher significance level, the null hypothesis could not be rejected due to the high p value. Because the researcher selected a .05 level, there is a 1 in 5 chances occur that the researcher will reject the null hypothesis when, in fact, the statistical evidence does not justify its rejection (Gall et al., 2007). If the rejection of the null hypothesis is unwarranted, it is called a Type I error (Cowles & Davis, 1982). Because none of the samples were randomly drawn or assigned, the use of tests of statistical significance is questionable. Furthermore, inferences cannot be made as a result of the current quasi experimental, exploratory research. As a result, replications of the current study should be completed to attain additional information and assurance that the observed results are real. Cohen (1990) suggested future replication of the variables in the same and different settings will provide a more informed judgment of the research.

Limitations

As with any study, limitations arise that affect the outcomes of the research. The study was limited to student performance data from the districts for the year 2015. Additionally, the data was self-reported to the state by school personnel. Some of the data used in this study were collected using a researcher

DOI: 10.20429/stem.2017.010106

created survey instrument. Findings are based on the assumptions that the participants responded honestly and interpreted the instrument as intended. Additionally, results could be biased by the personality traits of school personnel who responded to the questionnaire compared to the traits of personnel who deleted the questionnaire without answering or forwarding it. Lastly, the results could be biased by the personalities of respondents who did not complete or skipped questions on the questionnaire.

After-school programs in each district and even each school varies and there is no district or state measurement of the number or types of after-school programs offered. As a result, the researcher utilized an electronic survey to ask school personnel about the types of STEM activities offered in their school district. Even after receiving feedback from experts in the field and piloting a survey on STEM activities, the answers varied widely depending on the title of the respondent and whether he or she represented a school or district. As a result, these differences may have been a factor in this study with regards to the number of activities offered in a district as well as the reliability of consistency in responses from the survey. Having a reliability of consistency in responses of less than 80% is another limitation as the reliability of the survey was weak. More research should be conducted on the psychometrics of the survey and the variability of participant responses. Lastly, researcher bias is presumable due to the fact that the researcher holds prior beliefs regarding the influence of STEM activities on SWD due to her experience as a FIRST robotics coach. The study was limited to interpretations made by the author; other plausible explanations may exist.

Recommendations

Additional research is needed on STEM activities and their impact on SWD performance on standardized science assessments because of the discrepancy in student scores. However, there is a dearth in the scientific research on the impacts of STEM activities and SWD. As a result of the outcomes of the current study, the researcher suggests STEM activities may be beneficial to students with disabilities performance in science. Based on the findings, the researcher recommends district personnel track the number and disability category of SWD who participate in extracurricular STEM activities. These data are needed to conduct more robust research in the area of informal STEM learning and SWD.

It is recommended the current research be replicated in other states. The size and resources of the different school districts should be considered. It is also recommended more targeted research be conducted within a single district to determine if a correlation exists between different schools in a district. A single district study could possibly control for more variables like teacher preparation, teacher quality, student demographics, etc.

Implications

For Practice

Given the current climate of science education, SWD will continue to fall even further behind if educators do not identify activities that help SWD become successful in science. If activities cannot be offered during the school day, science educators have the potential to offer exciting, competition based extracurricular STEM activities that take place after school. Researchers have studied the effects of extracurricular activities on students with promising results (Mahoney, Levine, & Hinga, 2010; Vandell, Reisner & Pierce, 2007). However, very few studies have focused on the effects of extracurricular activities on SWD (Fisher, 2016). Given this paucity in research, a need exists to identify if STEM activities make a difference on the outcomes of SWD on standardized science assessments.

For Research

The relationship between STEM programs and SWD are rarely researched. To address persistent issues and assist in providing helpful skills and tools to educators working with SWD, it is recommended that current interventions and best practices focus on including more SWD in STEM activities. Oftentimes researchers analyze interventions for SWD; however, as addressed in research question two, many school personnel do not track or report the number of SWD who participate in STEM activities. Therefore, it is difficult to effectively research SWD and STEM activities as an intervention. The researcher recommended, for large national studies, that scientists collect data on SWD who participate in STEM activities. Once this data is gathered, researchers will be able to look more closely at trends and issues of SWD and informal science learning. Finally, previous researchers discuss the positive attributes associated with participating in extracurricular activities (Durlak et al.,

DOI: 10.20429/stem.2017.010106

2010; Fredricks & Eccles, 2008). To include SWD in research on extracurricular activities, unique data collection methods must be used to ensure SWD needs are represented in the literature.

Conclusion

Students with disabilities perform below their non-disabled peers in science (National Center for Educational Statistics [NCES], 2011; National Educational Longitudinal Study [NELS], 1998; National Science Foundation [NSF], 2013). The achievement gap is a problem because the nation's competitiveness depends on individuals with science, technology, engineering, and mathematics (STEM) knowledge, skills, and abilities to drive innovation that will lead to new products and economic growth (Business-Higher Education Forum [BHEF]/Act Policy Brief, 2014; National Academies of Sciences, Engineering, and Medicine, 2016; National Science Board, 2015). If Florida is to continue to grow and prosper, all students, including students with disabilities must be prepared for the economy they will inherit. The purpose of the current study was to determine if informal science learning activities offered in Florida school districts make a difference on students with disabilities (SWD) performance on the 8th Grade Florida science assessment.

The researcher found many extracurricular STEM activities are being offered in the state of Florida. Furthermore, many districts do not track or know the number of types of students with disabilities who do participate in the activities offered. The researcher attempted to correlate the number of STEM activities offered in each district to the results of the 8th Grade Science assessment of students with disabilities in each district. The results were there was a small correlation of those scores and the number of STEM activities offered. Because this was an exploratory study, more research is needed to address the limitations of the study to see if extracurricular STEM activities can impact science scores of students with disabilities.

References

Antink-Meyer, A., Bartos, S., Lederman, J. S., & Lederman, N. G. (2016). Using science camps to develop understandings about scientific inquiry – Tai wanese students in a U.S. summer science camp. International *Journal of Science and Mathematics Education*, 14(1), 29-53.

Aud, S., Hussar, W., Johnson, F., Kena, G., Roth, E., Manning, E., . . . Zhang, J. (2012). *The condition of education 2012 (NCES 2012-045)*. Washing ton, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch

Basham, J. D., & Marino, M. T. (2013). Understanding STEM education and sup porting students through Universal Design for Learning. *Teaching Exceptional Children*. 45(4), 8-15.

Bhattacharyya, S., Mead, T. P., & Nathaniel, R. (2011). The influence of science summer camp on African-American high school students' career choices. *School Science and Mathematics*, 111(7), 345-353.

Bischoff, P. J., Castendyk, D., Gallagher, H., Schaumloffel, J., & Labroo, S. (2008). A science summer camp as an effective way to recruit high school students to major in the physical sciences and science education. *International Journal of Environmental & Science Education*, 3(3), 131-141.

Brigman, G. A., Webb, L. D., & Campbell, C. (2007). Building skills for school success: Improving the academic and social competence of students. *Professional School Counseling*, 10(3), 279-288.

Business-Higher Education Forum (2014). *Building the talent pipeline: Policy recommendations for the condition of STEM 2013*. BHED/ACT Policy Brief. Retrieved from http://www.bhef.com/sites/default/files/BHEF_2014_ACT_0.pdf

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences (2nd ed.)*. New York: Academic Press.

Cohen, J. (1990). *Things I learned so far. American Psychologist*, 45(12), 1304-1312.

Cowles, M., & Davis, C. (1982). On the origins of the .05 level of statistical signif icance. *American Psychologist*, 37(5), 553-558.

Durlak, J. A., Weissberg, P., & Pachan, M. (2010). Meta-analysis of after-school programs that seek to promote personal and social skills in children and

DOI: 10.20429/stem.2017.010106

adolescents. *American Journal of Community Psychology*, 46, 294-309.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power anal yses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149-1160.

Fields, D. A. (2009). What do students gain from a week at science camps? Youth perceptions and the design of an immersive, research-oriented astronomy camp. *International Journal of Science Education*, 21(2), 151-171.

Fisher, K. (2016). *The relationship between extracurricular STEM activities and performance on the Florida science assessment*. Electronic Thesis and Dissertations, 5076, retrieved from http://stars.library.ucf.edu/etd/5076 Florida Department of Education (2015). Student enrollment. Retrieved from https://edstats.fldoe.org/SASWebReportStudio/gotoReportSection.do?sectionNumber=1

Fredricks, J. A., & Eccles, J. S. (2008). Participation in extracurricular activities in the middle school years: Are there developmental benefits for African American and European American youth? *Journal of Youth & Adolescence*, 37(9), 1029-1043. doi:10.1007/s10964-008-9309-4

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research*. Boston, MA: Pearson.

Hartung, P. J., Porfeli, E. J., & Vondracek, F. W. (2008). Career adaptability in childhood. *The Career Development Quarterly*, 57, 63–74. *Independent School District No. 12, Centennial, v. Minnesota Depart ment of Education, A08-1600 MN* (2010).

Israel, M., Maynard, K., & Williamson, P. (2013). Promoting literacy-embedded, authentic STEM instruction for students with disabilities and other struggling learners. *Teaching Exceptional Children*, 45(4), 18-25.

Israel, M., Wang, S., & Marino, M. T. (2015). A multilevel analysis of diverse learners playing life science video games: Interactions between game content, learning disability status, reading proficiency, and gender. *Journal of Research in Science Teaching*, 1-22. doi: 10.1002/tea.21273.

Laerd Statistics (2016). *Pearson's product-moment correlation using SPSS sta tistics*. Retrieved from https://statistics.laerd.com/spss-tutori als/pearsons-product-moment-correlation-using-spss-statistics.php

Leddy, M. H. (2010). Technology to advance high school and undergraduate students with disabilities in science, technology, engineering,

and mathematics. *Journal of Special Education Technology*, 25(3), 3-8.

Luehmann, A. L. (2009). Students' perspectives of a science enrichment pro gramme: Out-of-school inquiry as access. *International Journal of Sci ence Education*, 31(13), 1831-1855.

Mahoney, J. L., Levine, M. D., & Hinga, B. (2010). The development of af ter-school program educators through university-community partner ships. *Applied Developmental Science*, 14(2), 89-105.

Marino, M. T., Coyne, M., & Dunn, M. (2010). The effect of technology-based altered readability levels on struggling reader's science comprehension. *Journal of computers in Mathematics and Science Teaching*, 94(1), 5-16.

Marino, M. T., Gotch, C. M., Israel, M., Vasquez III, E., Basham, J. D., & Becht, K. (2014). *Learning Disability Quarterly*, 37(2), 87-99.

Marino, M. T., & Hayes, M. T. (2012). Promoting inclusive education, civic scien tific literacy, and global citizenship with video games. *Cultural Studies of Science Education* 7(4). 945-954.

Montgomery, A. & Mirenda, P. (2014). Teachers' self-efficacy, sentiments, atti tudes, and concerns about the inclusion of students with developmental disabilities. *Exceptional Education International*, 24(1), 18-32.

National Academies of Science, Engineering, and Medicine. (2016). B*arriers and opportunities for 2-year and 4-year STEM degrees: Systemic change to support diverse student pathways*. Washington, DC: The National Academies Press.

National Center for Education Statistics. (2016). N*ational Educational Longitudi nal Study*, 1988.

National Center for Education Statistics. (2011). *NAEP science assessment data, 2000*. Retrieved from http://nces.ed.gov

National Research Council. (2011). *Learning science through computer games and simulations* [Report]. Retrieved from http://www.nap.edu/catalog.php?record_id=13078

National Science Board (2016). *Science and engineering indicators*. Arlington, VA: National Science Foundation (NSB-2016-1).

National Science Foundation, National Center for Science and Engineering Sta tistics (2015). *Women, minorities, and persons with disabili ties in science and engineering*. Special Report NSF 15-311. Arlington, VA. Retrieved from https://www.nsf.gov/statistics/2015/nsf15311/

DOI: 10.20429/stem.2017.010106

Seifert, K., & Espin, C. (2012). Improving reading of science text for secondary students with learning disabilities: Effects of text reading, vocabulary learning, and combined approaches to instruction. *Learning Disability Quarterly*, 35(4), 236-247.

Shields, N., King, M., Corbett, M., & Imms, C. (2104). Is participation among children with intellectual disabilities in outside school activities similar to their typically developing peers? A systematic review. D*evelopmental Neurorehabilitiation*, 17(1), 64-71. doi:10.2109/17518423.836256

Stefanich, G. P. (2007). *Inclusive science strategies. Dubuque, IA*: Kendall-Hunt Publishing Company.

U.S. Department of Education, National Center for Education Statistics, Com mon Core of Data (CCD), "Public Elementary/Secondary School Uni verse Survey", 2013-14. Retrieved from http://nces.ed.gov/programs/ stateprofiles/sresult.asp?mode=short&s1=12

U.S. Government Accounting Office. (2010). *Students with disabilities: More in formation and guidance could improve opportunities in physical education and athletics*. (GAO Publication No. 10-519). Washington, D.C.: U.S. Government Printing Office.

Vandell, D., Reisner, E., & Pierce, K. (2007). *Outcomes linked to high-quality afterschool programs: Longitudinal findings from the study of promis ing afterschool program*s. Washington, DC: Policy Studies Associates.

Villanueava, M. G., & Hand, B. (2011). Science for all: Engaging students with special needs in and about science. *Learning Disabilities Research & Practice*, 26, 233-240.

Zimmerman, D. W. (1997). A note of interpretation of the paired-samples t-test. *Journal of Educational and Behavioral Statistics*, 22, 349-360.