

An analysis of gender differences in industry-based certification attainment rates of Texas high school graduates

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Abstract

In this statewide, multiyear study, industry-based certification attainment rates were examined by gender for Texas high school graduates. Industry-based certifications included in the study were vetted by the Texas Education Agency and reported through the Texas Academic Performance Reports for the 2019-2020, 2020-2021, and 2021-2022 school years. Inferential analyses revealed statistically significant differences in industry-based certification attainment rates for each of the three school years of data analyzed. Both boys and girls demonstrated increases in certification attainment across the years analyzed; however, the attainment rate of Texas male high school graduates increased at a faster rate than the attainment rate of Texas female high school graduates. Differences in attainment rates and associated attainment gaps between male and female graduates are presented for each of the three school years of data analyzed, as well as recommendations for future research.

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Introduction

Academic performance differences between boys and girls have been well documented in previous research (e.g., Burillo, 2012; Combs et al., 2010; Johnson, 2020). Combs et al. (2010) analyzed the extent to which gender differences were present in reading, mathematics, and both subjects of college readiness of Texas high school students. They also addressed gender differences in SAT and ACT performance for the 2005-2006 and 2006-2007 school years. The study was important in that the researchers noted that post-high school education was directly related to wage earnings and, on a broader scale, contributed to the health of the nation. Combs et al. (2010) established that girls had higher college readiness rates than boys in reading and boys had higher college readiness rates than girls in mathematics. Overall, only 31.11% of boys and girls combined were identified to be college ready in both subjects. In regard to SAT and ACT performance, Combs et al. (2010) determined that boys had higher SAT scores than girls for both years studied, but girls had slightly higher ACT scores over the same school years.

In a study conducted in Texas, the state of interest for this article, Johnson (2020) examined archival data obtained from the Texas Education Agency to determine whether differences were present in college, career, and military readiness by gender for the 2017-2018 and 2018-2019 school years. The degree to which the proportion of college, career, and military readiness differed for all students to college, career, and military readiness separately for boys and for

girls was addressed. Statistically significant differences were not evident for the 2017-2018 school year, but statistically significant differences were present for the 2018-2019 school year. Recommendations to school leaders included efforts to implement college, career, and military readiness programs that aligned with the interests of boys and girls, with effort placed on programmatic offerings designed to close gender gaps (Johnson, 2020).

In a separate study completed by Burillo (2012), demographic trends of Texas community college students seeking to earn a form of industry certification termed Marketable Skills Achievement Awards were examined. The Marketable Skills Achievement Award certificates were based on entry-level industry skills, and the study included an analysis of certification attainment by gender from 2004 to 2010. Burillo (2012) documented that the number of female students obtaining certifications increased from 1,088 in 2004 to 1,743 in 2010, whereas the number of male students obtaining certificates increased from 1,037 in 2004 to 2,223 in 2010. Although female students had a visible increase in certification attainment, attainment rates between 2004 and 2010 were not statistically significant. In contrast, attainment rates for male students during the same time period did result in a statistically significant difference (Burillo, 2012). Also identified in the research were that attainment rates of females compared to males aligned with collegiate enrollment trends in that males were outpacing females in enrollment rates. Overall recommendations included the continuation of Marketable Skills Achievement programs in community colleges, as attainment rates for both males and females were documented to have increased over the years of data analyzed in the investigation, thus providing students with evidence of skill attainment that could be of interest to future employers (Burillo, 2012).

Career and Technical Education (CTE) programs offered in the secondary grade levels, as early as Grade 7, combine curricular knowledge with technical skills for the purpose of preparing students for entry into the workforce (Texas Education Agency, n.d.). Although not as widely addressed as gender differences in academic performance in the core content areas, research investigations have been conducted on enrollment statistics in CTE programs. Fluhr et al. (2017) explored CTE course enrollment patterns. Presented in the study was that boys were 1.28 times more likely to take gender-nontraditional courses in high school than girls. However, Fluhr et al. (2017) determined that females were overrepresented in certain fields, such as Health Sciences and Human Services (traditionally female dominated fields), whereas males comprised the majority of STEM, Manufacturing, and Construction (traditionally male dominated fields). Interestingly, in the same study, Fluhr et al. (2017) also identified that wage earnings could be better predicted by the career field chosen rather than by gender.

Leu and Arbeit (2020) also investigated demographic trends in fields of study within high school CTE programs. The data analyzed in the research were obtained from two larger national studies that included more than 20,000 high school participants. Leu and Arbeit (2020) noted that male students had a larger proportion of enrollment in CTE programs than female students. A cross-section analysis of enrollment revealed that male students were overrepresented in Agriculture, Architecture, Manufacturing, and STEM pathways, whereas female students were overrepresented in Arts, Health, Hospitality, and Human Services, findings that aligned with previous research (Fluhr et al., 2017).

In a study of North Carolina high schools, Casto and Williams III (2020) acknowledged that STEM fields had historically been represented by White males, an observation that aligned

with research completed by Fluhr et al. (2017). To evaluate this finding, Casto and Williams III (2020) compared gender enrollment statistics in STEM high schools to gender enrollment statistics in the STEM high schools' parent school district. Gender in STEM high school enrollment was generally proportional to the gender composition of the school district where the STEM high school was located. Unique observations were reported in two high schools, where the proportion of boys enrolled in the STEM high school was larger than the enrollment of girls. In contrast, one STEM high school was comprised of a majority of female students (Casto & Williams III, 2020). The findings of Casto and Williams III (2020) were similar to Fluhr et al.'s (2017) findings, in that although previous researchers may have documented that male students dominated CTE and STEM enrollment historically, evolving trends indicate that enrollment based on gender is becoming more equalized and traditional enrollment patterns are not as clearly evident.

Yoon and Strobel (2017) further addressed high school enrollment rates in STEM graduation pathways in Texas. Identified were that enrollment rates in Algebra 1, Geometry, and Biology consisted of a higher proportion of boys than girls. Because each course was required for graduation, the researchers suggested that girls had obtained the course credits while in middle school or through credit by exam. Yoon and Strobel (2017) also acknowledged that more female students were enrolled in advanced Biology courses, whereas more male students were enrolled in advanced physics, a trend that was also reflected in collegiate degree enrollment statistics. Because enrollment trends also included increasing enrollment rates by girls in advanced mathematics courses, such as AP Calculus AB and AP Statistics, it was suggested that enrollment statistics could be indicative of narrowing gender gaps in postsecondary STEM majors that have traditionally been dominated by male students. This conclusion was commensurate with the suggestions of Fluhr et al. (2017) and Casto and Williams III (2020).

Jiang (2017) examined gender differences in STEM fields and presented findings similar to Fluhr et al. (2017) and Leu and Arbeit (2020) that women obtained more than one half of the bachelor's degrees earned in biology, chemistry, and mathematics, but were substantially underrepresented in computer science, engineering, and physics. Jiang (2017) also cited the potential existence of certain norms and values that favored males as a contributing factor for lower female representation in otherwise male dominated career fields. Suggested as a contributing factor to the low representation of women in computer science, engineering, and physics was a lack of female role models within industry settings, in addition to a lack of exposure to course offerings prior to college enrollment. Jiang (2017) explained that a connection existed between states that required additional mathematics and science courses for high school graduation and increased enrollment in STEM programs at the collegiate level, a dynamic that paralleled the conclusions presented by Yoon and Strobel (2017).

Giani (2022) conducted a research investigation about industry-based certifications and concluded that the earning of such certifications had a positive relationship with wage earnings and did not deter students from postsecondary education. However, noted in the research was that industry-based certification offerings varied widely across Texas public high schools. Similar to the observation of designated courses required for high school graduation by previous researchers (i.e., Jiang, 2017; Yoon & Strobel, 2017), Giani (2022) identified that Texas included industry-based certifications in the state accountability system, thus contributing to a wide selection of offerings and ultimately leading to enhanced levels of

attainment. Decisions made at the local level were cited as the major contributing factor in obtaining industry-based certifications because the role schools play in promoting the attainment of such credentials was suggested to have a greater influence on attainment than any demographic factor (Giani, 2022). Further presented was that the acquisition of industry-based certifications by Texas high school graduates increased statewide from 2.7% in 2017 to 9.9% in 2019. Giani (2022) concluded that earning an industry-based certification contributed to as much as a 10% increase in first-year wage earnings when compared to individuals who did not earn an industry-based certification, regardless of ethnicity/race, gender, or economic status.

Researchers (e.g., Combs et al., 2010) have established that education is directly related to wage earnings, thus contributing to the economic health of the nation. Although significant differences in college, career, and military readiness have been marginal, researchers (e.g., Leu & Arbeit, 2020) have presented evidence that enrollment in CTE programs was more prevalent among male students than among female students. Cross-section analysis of CTE programs has further revealed that female students were overrepresented in programs such as Health, Hospitality, and Human Services, while male students were overrepresented in Architecture, Manufacturing, and STEM fields (Leu & Arbeit, 2020). Disparities in enrollment by gender in CTE programs align with research studies conducted on gender makeup in career settings, where male students were identified to earn degrees in science and engineering at higher rates than female students (Jiang, 2017). Because supplying skilled labor to the American workforce has a direct relationship to the economic welfare of the country, it is imperative that educational institutions make instructional decisions that promote the attainment of skills demanded by industry for all students, regardless of gender. However, after an extensive and intensive search of the existing research literature, no published studies could be located about industry-based certification attainment by gender in Texas public schools. Therefore, this research study will add to the literature on industry-based certification attainment by gender.

Statement of the Problem

The United States has continued to fall behind competing countries in postsecondary achievement despite the implementation of policies at the state and federal levels designed to increase student performance (Davis et al., 2013). Student success in academic settings is a critical component required to supply the workforce with skilled labor. Holman et al. (2017) noted that well-planned CTE programs can prepare high school students for successful careers following high school, thus meeting the needs of the individual and industry.

The skills determined by industry leaders to be in the highest demand are critical thinking, reasoning, and complex problem solving (Li, 2022, 4.1). Students who gain a deeper understanding of content develop the ability to apply critical thinking skills and knowledge to a broader context of problems (Conley, 2008). Bühler et al. (2022) identified that skills and content knowledge essential to the workforce can be developed in a technology-rich learning environment. To meet the growing needs of industry, AlMalki and Durugbo (2023) suggested that industry, government, and education work in collaboration to develop aligned learning opportunities for students. One such example of alignment between the three entities is the integration of industry-based certifications in the teaching-learning environment. Industry-based certifications are a form of microcredential offered to Texas public school students. Attainment of industry-based certifications can provide prospective employers with evidence

that students have gained specific skill sets demanded by the industry. Analysis of attainment rates is critical to making informed implementation decisions at the campus level. Potential disproportionality in attainment rates by gender is of particular interest because such information can be used to adjust course offerings, promote career fields, and make industry-based certifications available in the K-12 setting.

Purpose and Significance of the Study

The purpose of this study was to ascertain the extent to which gender differences existed in attainment rates of industry-based certifications. This analysis included a comparison of industry-based certifications earned by boys to the industry-based certifications earned by girls across multiple school years. Data sets included in the study were made available by the Texas Education Agency through the Texas Academic Performance Report and are from the 2019-2020, 2020-2021, and 2021-2022 school years. Included within the study was also a presentation of trends by gender across the same school years. Differences and trends are presented to the reader as a tool that can be used for programmatic justification and decision-making purposes.

Performance differences by gender have been of ongoing interest to researchers. Because the State of Texas implements a formal public school accountability system used to rate public school districts and each campus within the districts, components of the accountability system (e.g., STAAR results and college, career, and military readiness indicators) are available in a data format that can be used for statistical analysis. Academic performance in the core content areas (e.g., college readiness in reading and mathematics) has been of particular interest to researchers (e.g., Combs et al., 2010). However, a smaller body of research has been completed on the subcomponents of career readiness. Limited studies exclusive to industry-based certifications were located during this research. Specifically, Burillo (2012) analyzed demographic trends among community college students who earned a form of industry-based certification called Marketable Skills Achievement Awards. Additionally, in a policy update published by the University of Texas, Giani (2022) explored the fields of study associated with industry-based certification attainment across the State of Texas. However, no research studies exclusive to industry-based certification attainment by gender in Texas public schools could be located. Therefore, findings from this research investigation will add to an under studied component of the Texas Public School Accountability System.

Research Questions

The following research questions were addressed in this study: (a) What is the difference between high school boys and high school girls in the Texas Education Agency approved industry-based certification attainment rates of Texas high school graduates?; and (b) What trend is present in the Texas Education Agency approved industry-based certification attainment rates for high school boys and high school girls? The first research question was answered for the 2019-2020, 2020-2021, and 2021-2022 school years included in the study, whereas the second research question included all three years.

Method

Research Design

This study was a quantitative analysis of differences that existed in industry-based certification attainment by gender. The research design was a causal-comparative, non-experimental analysis (Johnson & Christensen, 2020) of the relationship between industry-based certification attainment by boys and girls. However, because historical data were analyzed, specific cause-effect relationships could not be determined, and generalizations could not be made (Johnson & Christensen, 2020). The independent variable in this study was the gender of the high school graduates, and the dependent variables were industry-based certifications earned. The data analyzed in this study were archival data made available by the Texas Education Agency.

Participants and Instrumentation

Students who graduated from comprehensive Texas public high schools during the 2018-2019, 2019-2020, and 2020-2021 school years and who earned an industry-based certification recognized by the Texas Education Agency were the participants in this study. Data made publicly available through the Texas Academic Performance Reports for the 2019-2020, 2020-2021, and 2021-2022 school years served as the basis for statistical analyses. The Texas Education Agency (2022) includes industry-based certifications in the Texas Academic Performance Report one year after they are earned, representing a one-year lag in publication (e.g., industry-based certifications publicized in the 2021-2022 Texas Academic Performance Report were from the 2020-2021 graduating class).

Industry-based certification attainment rates for male high school graduates and female high school graduates were the specific variables that were analyzed. Attainment rates have been reported in the Texas Academic Performance Report and were calculated by dividing the number of graduates who earned an approved industry-based certification in a specific school year by the number of annual graduates for that same school year (Texas Education Agency, 2022).

Data Analysis

The underlying assumptions of dependent samples *t*-tests were checked prior to conducting inferential statistical analyses. It is noted that not all assumptions were met; however, Field (2018) maintains that the parametric dependent samples *t*-test is inherently robust to accommodate violations of the underlying assumptions. As such, the parametric dependent samples *t*-test was the statistical procedure chosen to analyze differences in industry-based certification attainment rates by gender.

To ascertain whether statistically significant differences in industry-based certification attainment rates were present by gender, data from the 2018-2019, 2019-2020, and 2020-2021 school years were analyzed. Industry-based certification attainment rates are reported in connection with student demographic characteristics; therefore, they are reported separately for boys and for girls. Accordingly, differences in industry-based certification attainment rates will be presented in the pairing of male Texas high school graduates and female Texas high school graduates.

Results

Results for Industry-Based Certification Attainment Rates by Gender

Regarding the 2018-2019 school year for the comparison of male and female Texas high school graduates, the difference was statistically significant, $t(1799) = 5.86, p < .001$. The effect size was less than small, Cohen's $d = 0.14$ (Cohen, 1988). Industry-based certification attainment rates were statistically significantly higher for male Texas high school graduates, 1.68% higher than they were for female Texas high school graduates.

Statistical analyses for the 2019-2020 school year revealed a statistically significant difference in industry-based certification attainment rates between male Texas high school graduates and female Texas high school graduates, $t(1822) = 9.09, p < .001$. The effect size was small, Cohen's $d = 0.21$ (Cohen, 1988). Male Texas high school graduates had a statistically significantly higher industry-based certification attainment rate, 2.92% higher, than female Texas high school graduates.

In reference to the 2020-2021 school year, a statistically significant difference was present for industry-based certification attainment rates between male Texas high school graduates and female Texas high school graduates, $t(1845) = 8.86, p < .001$, Cohen's $d = 0.21$, a small effect size (Cohen, 1988). Male Texas high school graduates had a statistically significantly higher industry-based certification attainment rate, 3.32% higher, than female Texas high school graduates. Descriptive statistics for industry-based certification attainment rates for male and female Texas high school graduates for the three school years are presented in Table 1.

Table 1. Descriptive statistics for Texas high school graduates who earned an industry-based certification

School Year and Comparison	<i>n</i> of schools	<i>M</i> %	<i>SD</i> %
2018-2019			
Male	1,800	9.46	15.38
Female	1,800	7.78	13.43
2019-2020			
Male	1,823	12.85	18.18
Female	1,823	9.93	15.60
2020-2021			
Male	1,846	19.71	23.07
Female	1,846	16.39	21.16

Note. The *n* in the table above denotes the number of high schools included in the study.

Discussion

This statewide, multiyear research study included analyses of industry-based certification attainment rates between male and female Texas high school graduates. The data analyzed in the study were collected by the Texas Education Agency and made publicly available through the 2019-2020, 2020-2021, and 2021-2022 Texas Academic Performance Reports. The independent variable for each analysis was gender, and the dependent variable was industry-based certifications earned. Individuals included in the study were graduates of comprehensive Texas public high schools who earned an industry-based certification during the 2018-2019, 2019-2020, or 2020-2021 school years.

For each of the three school years studied, male graduates had higher industry-based certification attainment rates than female students. In 2018-2019, the attainment rate for male Texas high school graduates was 9.46%, whereas the attainment rate for female Texas high school graduates was 7.78%. Although the difference in attainment rates for this school year was only 1.68%, the difference was statistically significant. Statistically significant differences were also present for the 2019-2020 and 2020-2021 school years. In 2019-2020, male graduates had a 12.85% industry-based certification attainment rate, whereas the rate for female graduates was 9.93%. For the 2020-2021 school year, male Texas high school graduates had a 19.71% industry-based certification attainment rate, while the attainment rate for female Texas high school graduates was 16.39%.

As previously noted, male Texas high school graduates had higher industry-based certification attainment rates than female graduates across the three school years of data analyzed. Of particular interest, as presented in Figure 1, was that the margin of difference in attainment rates between male and female graduates became larger across the years studied. The gap in attainment rates was 1.68% in 2018-2019 (with male students having the higher rate of attainment) and increased to a 3.32% difference in 2020-2021. With respect to each of the three school years of data analyzed, it is also important to note that industry-based certification attainment rates increased for both boys and girls. This trend is also presented in Figure 1.

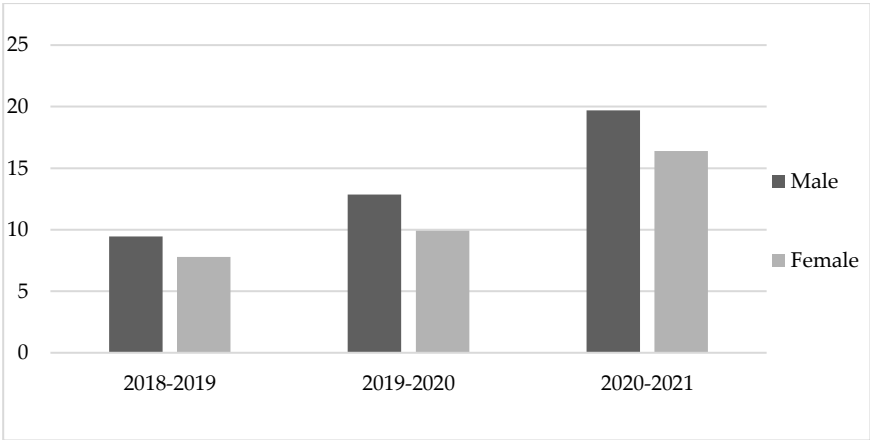


Figure 1. Descriptive statistics for Texas high school graduates who earned an industry-based certification

Results from the current study reflect that male Texas high school graduates earned industry-based certifications at a higher rate than female Texas high school graduates across the 2018-2019, 2019-2020, and 2020-2021 school years. This finding is congruent with research conducted by Burillo (2012), where boys had a higher rate of attainment of Marketable Skills Achievement Award certificates than girls. The results of the current study also align with observations presented by previous researchers (e.g., Casto & Williams III, 2020; Fluhr et al., 2017; Leu & Arbeit, 2020), where boys had higher enrollment rates in CTE and STEM related courses than girls. A final point of alignment is observed in the increase in industry-based certification attainment by both male and female graduates across the three years of data analyzed. This observation is commensurate with that of Giani (2022), who determined that industry-based certification attainment increased for all Texas high school graduates from 2017 to 2019.

Implications for Policy and for Practice

Multiple implications for policy and practice arise from the current research study. With respect to policy, foremost, Texas high school officials in the public K-12 setting must ensure robust course offerings are in place that provide students the opportunity to earn industry-based certifications. These courses must be sequenced as specified by the Texas Education Agency so that students gain the requisite knowledge to be well prepared for assessments associated with industry-based certification attainment. Similarly, campus and district program managers must monitor student enrollment within CTE programs to identify the gender ratio present in associated courses. Attention must be distributed to programs that are characterized by enrollment statistics that favor one gender over another – particularly programs comprised of a majority of boys. In such situations, program directors should implement educational opportunities designed to inform members of the opposite gender of the benefits of program enrollment, including the employment opportunities associated with gaining industry-based certifications.

From the financial aspect, campus and district administrators should monitor enrollment and completion statistics to ensure funds are maximized by supporting the continuation of programs that combine substantial enrollment with substantial program completion. Further, program directors must maintain awareness of evolving career fields and associated programmatic offerings to ensure students are competitively prepared to interview for entry-level career opportunities. Finally, legislative officials must ensure instructional mechanisms and funding systems are available that provide campus and district level staff the opportunity to offer robust career preparation programs.

The findings from this study were that participation in industry-based programs is dominated by male high school students. With jobs no longer being necessarily gender based and opportunities to earn an equitable income should exist for all, industry-based programs must be offered equally to male and female students. School leadership must be attuned to the current gender disparities and ensure all industry-based programs being offered are equitably and appropriately set up for female and male students. An additional role of school leadership is to ensure the counseling department shares industry-based certification opportunities equally to both genders. Our role as school leaders is to provide the most appropriate education to all students of both genders by providing coursework options that help them meet their high school goals as well as their post high-school goals.

Recommendations for Future Research

Multiple research opportunities exist as an extension of the current research investigation. As presented in previous research (e.g., Casto & Williams III, 2020; Fluhr et al., 2017; Leu & Arbeit, 2020), boys enroll in Career and Technical Education and STEM related courses at higher rates than female students. Therefore, the identification of Career and Technical Education and STEM programs offered in Texas public high schools, with specific analysis of the gender composition of students enrolled in those programs, would provide valuable insight for programmatic decision making. A second potential for research would be the analysis of the metrics met by girls who graduated with the Texas Education Agency designation of College, Career, or Military Ready. A final research area would be to extend the current analysis beyond three school years. A larger sample of school years would provide an opportunity to further analyze trends in industry-based certification attainment. Although statistically

significant differences were revealed in this article with respect to industry-based certification attainment rates between male and female Texas high school graduates, the margin of difference was relatively small – however, the gap in attainment rate grew across the three school years studied. Analysis of additional school years will reveal if this trend continues or if gaps in attainment begin to close, similar to the dynamics presented by Casto and Williams III (2020) and Fluhr et al. (2017).

Conclusion

This statewide, multiyear study included analyses of industry-based certification attainment rates between male Texas high school graduates and female Texas high school graduates for the 2018-2019, 2019-2020, and 2020-2021 school years. Statistically significant differences were present in attainment rates for each of the three years of data analyzed, with male students earning certifications at a higher rate than female students. The number of industry-based certifications increased annually from 2018-2019 through 2020-2021. Male Texas high school graduates had a 10.25% increase in certification attainment across the three-year time period, whereas female students had an 8.61% increase. Attainment rate differences were relatively small; however, because male Texas high school graduates earned certifications at a higher rate than female graduates, the gap in attainment widened from 1.68% in 2018-2019 to 3.32% in 2020-2021.

Declarations

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References

- AlMalki, H. A., & Durugbo, C. M. (2023). Evaluating critical institutional factors of Industry 4.0 for education reform. *Technological Forecasting & Social Change*, 188(2023), 1-13. <https://doi.org/10.1016/j.techfore.2023.122327>

- Bühler, M. M., Jelinek, T., & Nübel, K. (2022). Training and preparing tomorrow's workforce for the fourth industrial revolution. *Education Sciences*, 12(782), 1-28. <https://doi.org/10.3390/educsci12110782>
- Burillo, M. (2012). *Marketable skills achievement awards certificate completer trends by ethnicity and gender at Texas community colleges* (Unpublished doctoral dissertation). Sam Houston State University, Huntsville, TX.
- Casto, A. R. & Williams III, J. A. (2020). Seeking proportionality in the North Carolina STEM pipeline. *The High School Journal*, 103(2), 77-98. <https://www.jstor.org/stable/26986615>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
- Combs, J. P., Slate, J. R., Moore, G. W., Bustamante, R. M., Onwuegbuzie, A. J., & Edmonson, S. L. (2010). Gender differences in college preparedness: A statewide study. *Urban Review*, 42, 441-457. <https://doi.org/10.1007/s11256-009-0138-x>
- Conley, D. T. (2008). Rethinking college-readiness. *New England Journal of Higher Education*, 22(5), 24-26. <https://files.eric.ed.gov/fulltext/EJ794245.pdf>
- Davis, C. M., Slate, J. R., Moore, G. W., & Barnes, W. (2013). College readiness and Black student performance: Disaffirmed equity. *The Online Journal of New Horizons in Education*, 3(4), 23-44.
- Field, A. (2018). *Discovering statistics using SPSS* (5th ed.). Sage.
- Fluhr, S. A., Choi, N., Herd, A., Woo, H., & Alagaraja, M. (2017). Gender, career and technical education (CTE) nontraditional coursetaking, and wage gap. *The High School Journal*, 100(3), 166-182. <https://www.jstor.org/stable/90024210>
- Giani, M. (2022). Certified skills: Who earns industry-based certifications in high school, and how do they shape students' postsecondary education and employment outcomes? *The University of Texas at Austin: Texas Education*, 1-7. Retrieved 19 January, 2024 from <https://texaserc.utexas.edu/wp-content/uploads/2022/04/141-UTA148-Brief-Certifications-4.6.22-REV.pdf>
- Holman, A. G., Kupczynski, L., Mundy, M-A., & Williams, R. H. (2017). CTE students' perceptions of preparedness for post-secondary opportunities. *The CTE Journal*, 5(2), 8-23.
- Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin*, 143(1), 1-35. <http://dx.doi.org/10.1037/bul0000052>
- Johnson, R. B., & Christensen, L. (2020). *Educational research: Quantitative, qualitative, and mixed methods approaches* (7th ed.). Sage.
- Johnson, T. (2020). *Comparison of proportion of Texas campus college, career, and military readiness of all students to the proportion of Texas campus college, career, and military readiness by ethnicity/race, gender, and economic status: A Texas statewide study* (Unpublished doctoral dissertation). Sam Houston State University, Huntsville, TX.
- Leu, K. B., & Arbeit, C. A. (2020). Differences in high school CTE coursetaking by gender and race/ethnicity. *Career and Technical Education Research*, 45(1), 33-61. <https://doi.org/10.5328/cter45.1.33>
- Li, L. (2022). Reskilling and upskilling the future-ready workforce for industry 4.0 and beyond. *Information Systems Frontier: A Journal of Research and Innovation*, 1-16. <https://doi.org/10.1007/s10796-022-10308-y>

- Texas Education Agency. (2022). *2021-22 Texas academic performance report (TAPR) glossary*. Retrieved 3 February, 2024 from <https://rptsvr1.tea.texas.gov/perfreport/tapr/2022/glossary.pdf>
- Texas Education Agency. (n.d.). *Career and technical education*. <https://tea.texas.gov/academics/college-career-and-military-prep/career-and-technical-education>
- Yoon, S. Y., & Strobel, J. (2017). Trends in Texas high school student enrollment in mathematics, science, and CTE-STEM courses. *Journal of STEM Education*, 4(9), 1-23. <https://doi.org/10.1186/s40594-017-0063-6>