

**The Economic Benefits of Increasing Educational Attainment of Public Schools
in Delaware***

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March 12, 2020

* This report is funded under contract to Arnold & Porter Kaye Scholer LLP and the ACLU Foundation of Delaware, Inc. in regard to Delaware Public Schools Litigation, No. 2018-0029-JTL.

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1 Introduction

Evidence on the economic and social benefits of obtaining more education is compelling. Benefits accrue to the students directly, as well as to taxpayers and to society as a whole. Additional years of effective schooling and college are especially beneficial for disadvantaged students – those living in neighborhoods of concentrated poverty, those who are English language learners, and those whose home environments are unstable or impoverished. Education can offer these students an opportunity to improve their future economic circumstances in adulthood.¹

Students’ educational outcomes are also affected by the quality of their local schooling options. Students who have access to high quality schooling can progress further in their education and can accumulate more academic skills; they are able to build a foundation for a better economic future. By contrast, students in low quality schools (or in schools that do not compensate for external disadvantages) are less likely to graduate from high school with the education needed to pursue careers or to complete college; their future economic well-being is significantly undermined.²

Public funding of education is therefore viewed as an investment in future generations and in improved economic conditions for all population groups. Using economic analysis, it is possible to appraise this investment to estimate the “social rate of return” from public funding of schools. Looked at from the other direction, it is possible to calculate the economic consequences when public funds are not invested to a sufficient amount.

This Report calculates the economic burden for Delaware when public school students receive an inadequate education. Inadequacy can be measured in various ways, either by looking at resources/inputs or outcomes. Here we focus on educational outcomes. Specifically, inadequate education is designated as non-completion of high school and in terms of college/career readiness. For prior generations, high school completion was an important indicator of future economic well-being. For current generations, failure to complete high school creates an almost insuperable barrier to economic advancement (Binder and Bound, 2019; Coile and Duggan,

¹Specific relationships are discussed in detail below. As examples of the extensive literature on the impacts of education on behaviors and economic well-being, see: Belfield and Levin (2007); Oreopoulos and Salvanes (2011); Barrow and Malamud (2015); Woessmann (2016). A recent review by Nobel Laureate in Economics Professor James Heckman and co-authors concludes: “There are substantial benefits from graduating high school that are especially strong for the less able, many of whom currently do not graduate. This suggests strong gains from programs promoting high school graduation” (Heckman et al., 2018).

²This literature is also extensive. For example, see Chaudhary (2009); Cellini et al. (2010); Roy (2011); Jackson et al. (2016); Knight (2017); Hyman (2017); Baker (2019).

2019). Importantly, we consider a broader definition of inadequate education to include some high school graduates. Many high school students are neither ready for work or for college; these individuals will also struggle to be economically independent. A school system where many students do not graduate from high school – and where many graduates are ill-prepared for work or college – is, in a fundamental sense, failing to provide an adequate education, regardless of the nominal high school graduation rate.

The economic burden of inadequate education across Delaware is calculated in five stages. To begin, we describe education levels for current cohorts of public school children in Delaware. Next, we describe our economic modelling approach. For our main analysis we calculate the economic loss for Delaware students who are inadequately educated. This student group includes high school dropouts and those graduates who – as defined by the Delaware Department of Education – are not college-ready or are not career-ready.³ To derive aggregate estimates of the burden to the state, we calculate the economic loss resulting from the gap between the percentage of low income students, students with disabilities and English language learners who graduate from high school without being college and/or career ready and the percentage of all students who graduate from high school without being college and/or career ready. We calculate this burden from three perspectives: private – the burden to the individual student; fiscal – the consequences for Delaware taxpayers; and social – the general economic impacts across all citizens in Delaware. We use evidence from peer-reviewed research along with data specific to Delaware. We then summarize the total economic burdens and perform sensitivity testing. Finally, we describe the challenges disadvantaged students face and identify interventions that might increase the rate of students completing high school; we evaluate whether these interventions are efficient investments when compared against the benefits of increased attainment.

Our analysis is for a single age cohort of 12th graders in Delaware public schools who should be graduating in 2020. Each year brings a new cohort of 12th grade students, so these economic burdens are annual burdens from inadequate education. As reported below, these annual burdens are substantial. They represent a significant lost opportunity for the state of Delaware. Importantly, the sizes of these burdens are strong evidence as to the social inefficiency of the public school system.

³I have used the term “dropout” throughout this report as a shorthand for those students who do not graduate from high school. It does not have the same meaning assigned that term by the Delaware Department of Education (see <https://www.doe.k12.de.us/domain/467>). Also, cohort graduation rates can be measured after 4, 5 or 6 years; the 4-year rate is applied here. The difference in rates is minor; but the four-year graduates correspond most directly to high school graduates as per the economic data (Heckman and Mosso, 2014; Heckman et al., 2018).

2 Educational Outcomes in Delaware

2.1 High School Graduation

Students who do not graduate from high school have not received an adequate education. Annually, each grade cohort is approximately 10,000 students. The breakdown of graduation rates by gender and race for the 2017-18 cohort is shown in Table 1.

Table 1: Four-Year Adjusted Cohort Graduation Rate

	All		Female		Male	
	Students	Grad. rate %	Students	Grad. rate %	Students	Grad. rate %
All	10,290	86.7	5,020	89.6	5,270	84.0
Low income	2,740	78.9	1,320	82.5	1,420	73.6
English learners	460	75.4	230	81.0	230	69.9

Sources: Delaware Department of Education Reports 2018 (www.doe.k12.de.us); [GraduationSummary-Report.2017-18.pdf](#); [DropoutSummary-Report.2017-18.pdf](#); and data.delaware.gov/Education/Student-Graduation/t7e6-zcnn.

Notes: 2017-18 public school 12th grade cohort, rounded to 10.

The overall graduation rate in Delaware is 87%. This adjusted cohort graduation rate for Delaware is slightly above the national rate of 85%.⁴ (Most states report graduation rates between 82-88%).⁵

The graduation rate varies considerably across student characteristics: male students have significantly lower graduation rates, as do students who come from low income families or who are English language learners. (The Delaware Department of Education dropout rate for disabled students is lower, annually at 2.6%).⁶ In total, the 2017-18 public school cohort included 1,370 students who did not complete high school.⁷

⁴U.S. Department of Education, Office of Elementary and Secondary Education, Consolidated State Performance Report, 2015–16. See *Digest of Education Statistics*, 2017, nces.ed.gov/d17, Table 219.46.

⁵There is growing evidence that the high school graduation rate has reached a plateau (or has even declined) such that current generations may not be as highly educated as prior generations (Heckman and LaFontaine, 2010).

⁶There are also significant differences by race, with rates for African American and Hispanic students at least ten percentage points below those of white students.

⁷Alternative metrics can be used to evaluate the educational performance of Delaware’s public school system. Achievement measures may indicate student performance. Delaware administers assessment tests from 3rd grade on. These tests yield a substantial amount of information on student-level and school-level academic performance. I understand that the significance of the results shown on those tests is the subject of another expert report in this case, so it will not be addressed here.

2.2 Defining Inadequate Education

For this analysis, inadequate education is identified in two ways. The most basic identification is “failure to complete high school”. As shown below, dropping out of high school is associated with a substantial impairment of social and economic well-being on average. Moreover, high school dropouts cannot attend college: thus, opportunities for further education – as well as many training programs – are closed off (Rumberger, 2011). High school dropouts have very few chances in adulthood to increase their human capital. Therefore, at minimum 13% of each cohort is inadequately educated.

However, we also identify many high school graduates as being inadequately educated. There are a number of indicators that high school graduation is not sufficient. First, there is the evidence on test scores of Delaware students. Many students in each tested grade are not considered proficient; the “not-proficiency” rate is far greater than the high school dropout rate. Second, the high school graduation rate includes students who receive a GED.⁸ There is copious evidence that GED-receipt is not equivalent to a high school diploma: GED-recipients have labor market trajectories that most closely resemble those of dropouts (Heckman et al., 2012). Third, very few graduates have sufficient education or training to be considered career-ready; they need more skills and these skills may be difficult to obtain. Finally, many graduates who enroll at community college are classified as remedial and must take sequences of developmental education prior to taking any college credits (Duchini, 2017; Saw, 2019). This remediation is in effect equivalent to repeating high school, with the extra cost of fees to the student (Bailey et al., 2010).

The Delaware Department of Education recognizes that many high school graduates are neither college ready or career ready.⁹ According to the Delaware Department of Education, this is a sizeable fraction of all high school graduates. The rate of “graduate readiness” for each annual cohort of high school graduates is shown in Figure 1.¹⁰ Only 59% of all high school graduates are designated as college or career ready. Therefore, we estimate inadequate education at 49% of the student population: 13% do not graduate high school and an additional 36% are neither college or career ready.¹¹

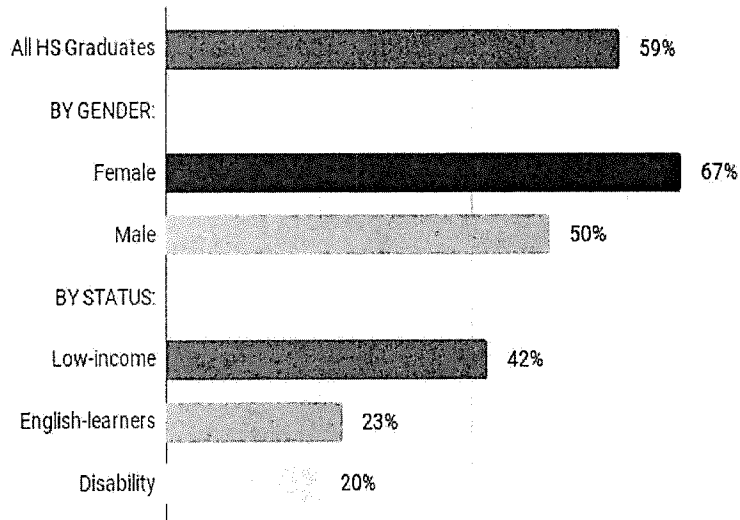
⁸See *Digest of Education Statistics*, nces.ed.gov/d18, 2018, Table 104.85.

⁹Career readiness is determined by successful completion of academic or technical coursework and mastery of that skill, industry recognized credentials or completion of a work-based learning program. See *Delaware School Success Framework Reference Guide*, Delaware Department of Education, SD0010040.

¹⁰These are 2019 figures from the state Report Card at <https://reportcard.doe.k12.de.us/>.

¹¹The categories of high school graduate and “neither college/career ready” do not overlap exactly. Some of those who are not career-ready may attend college, for example. In the economic model below, high

Figure 1 College and/or Career Readiness



The readiness rate varies significantly by gender and race (not shown).¹² For this analysis, we highlight the rates for low-income students (at 42%), for English-learners (at 23%), and for disabled students (at 20%). Even as students in these groups graduate from high school, the majority are not adequately prepared for their economic future.

Across each cohort of Delaware public school students, many leave school with education levels that are below what is needed for future economic success. This is obviously the case for high school dropouts, but it is also the case for a sizeable fraction of high school graduates. Therefore, we report economic consequences for high school dropouts and for students who are high school graduates but who do not (and most likely cannot) complete a college-level program or are not career ready. We do not assume that all students will graduate or meet readiness thresholds; instead, we compare rates across student groups.

school graduates and the “some college” group are allocated to the “not college/career ready group” according to the rates by race and gender.

¹²The readiness rate for African American students is 46% and for Hispanic students it is 50%. Below, we calibrate our economic model to account for gender and race differences in lifetime outcomes.

3 Economic Model of Inadequate Education

3.1 Life Course Trajectories

To calculate the full consequences of inadequate education we create an economic model over the life course. This economic model has been widely applied using national data and for states and population subgroups (Belfield and Levin, 2007; Cohen and Piquero, 2009; Trostel, 2010; Heckman and Mosso, 2014; Vining and Weimer, 2019). The model accounts for all the monetary flows attributable to educational status over an individual’s working life. For example, college graduates earn more than high school dropouts, but they are also less likely to be incarcerated and to be in poor health. Social scientists have investigated many life course differences by education; we include only those differences for which there is reliable evidence of an association between education and adult outcomes.

To ascertain the total losses from inadequate education we compare three life trajectories. The first is for a high school dropout (“HSD”). The second is for a high school graduate who does not progress to college (“HSG”).¹³ The third trajectory is for a high school graduate (“HSC”) who probabilistically progresses on to college (that is, he or she goes to college at the prevailing college-going rate). Completing high school affords students the option to attend college; the HSC status accounts for this option value.¹⁴ We compare economic consequences across these three life trajectories. Almost certainly, the HSD group are inadequately educated; given the low rates of career and college-readiness, the HSG group has received inadequate education.

3.2 Economic Perspectives

We examine these life-course trajectories through three perspectives: private (student); fiscal (Delaware taxpayer); and social (Delaware citizen). We focus on the social and fiscal perspectives for each life-course. For the social analysis, we model lifetime profiles of gross earnings and

¹³The HSG group is assumed to attempt no further education or training program. High school graduates may attempt or complete a technical certificate or short-term training program. However, the returns to these credentials is low and earnings are closest to those of high school graduates without such credentials (Belfield and Bailey, 2018). (If a high school graduate attempts or completes a vocational certificate or degree, they are classed as “some college” in most datasets; in this case, the HSC comparison is more valid.)

¹⁴For this model “HSC” students progress on to college and complete college at the same rate as students in the lowest socioeconomic status tercile. This yields a weighted estimate of high school graduate (0.66), some college (0.19) and BA degree completion (0.15). Rates are based on attendance rates from NELS1988 and completion rates from the BPS1996-2000 (Belfield and Levin, 2007).

social effects on health, crime, and welfare, as well as productivity gains (net of college costs). For the fiscal analysis, we separate out tax and expenditure earnings effects from those affecting the private individual. As the largest proportion of taxes are paid to the federal government, the main fiscal benefit of having a more highly educated population is accrued nationally, not directly in Delaware. However, federal tax effects are important because most of these tax dollars flow directly back to the state.¹⁵

The Benefit Map given below itemizes the domains in which education has been found to affect life course outcomes and which perspective these benefits are assigned to. We note that a significant set of benefits from improved education are experienced within schools. These benefits are important but are outside the economic model applied here.

Benefit Map of Gains when Students have Higher Attainment

Student gains: Employment; earnings; pension/benefits*; job security*; work satisfaction*; job conditions*

Taxpayer gains: Lower spending on crime, welfare, social programs; higher spending on education; lower tax burdens

School gains:* Improved school climate; increased school efficiency

Social gains: Productivity spillovers; economic growth*; inward investment*; community revitalization*; reduced inequality*

** Denotes not included in economic analysis.*

To populate the model, we use Delaware-specific data (or national data); we draw on the most recent social science research on education gradients with respect to earnings, health, crime, and other social consequences. These gradients are then mapped to attainment levels in Delaware. Four attainment levels are used: high school dropout; high school graduate; person with some college; and person with a BA degree or above. Gradients are estimated separately by gender and race (four categories) and then pooled to reflect the demography of Delaware.

Throughout, all money amounts are expressed in present values at 12th grade using a 3.5% discount rate (Moore et al., 2013). All prices are adjusted to account for the cost-of-living

¹⁵Federal expenditures in Delaware amount to 23% of state GDP (www.nasbo.org, *State Expenditure Report*, Table 1). Therefore, it is appropriate for fiscal estimates to include federal as well as state/local tax consequences.

in Delaware (relative to national cost-of-living, not within-state); and all money amounts are reported in 2019 dollars.

3.3 Delaware Student Cohorts

In the future, these students will enter the adult labor force. (Educational attainment across the adult population of Delaware is shown in Appendix Table 1). Of the 650,000 adults in Delaware, 31% have a bachelor's degree or higher and another 29% have attended some college or obtained an associate degree. Also, 31% are educated to high school level but 10% have not completed high school competency by age 25. Hence, although some dropouts do eventually obtain a high school diploma, most do not.

As for other metrics, educational attainment of working adults is significantly lower for African American adults: less than one-quarter are educated to bachelor's degree level.

Based on current patterns of student and adult attainment, we predict the terminal education of each new cohort of Delaware 12th graders. (These attainment levels are given by race and gender in Appendix Table 2).

Based on changing demographics (and evidence on college readiness and completion), we estimate a high school dropout rate that is close to the national average, as well as a bachelor's degree completion rate that is stable in the near future. There are 10,000 students in each cohort. Thus, each cohort in Delaware includes approximately 1,400 high school dropouts (13%) and at least another 3,000 who have not attended or have had very limited access to college. There are significant differences by race, with the Hispanic and African American dropout rates significantly higher than the white dropout rate, and by sex (with the dropout rate for males far in excess of that for females). The expected distribution of people in each group is modelled by race and gender from Table 1 and Appendix Tables A1 and A2. We derive overall estimates of life course profiles weighted by the demographic characteristics of the Delaware high school population.

Our analysis is for a single age cohort of 12th graders in Delaware public schools who should be graduating in 2019 (the "class" of 2019). We report estimates at both the individual and cohort level. We do not assume that all students will be able to graduate from high school or will be career or college ready: some face personal and economic challenges that will preclude this. Rather, we look at the benefits for incremental proportions of students who should – given

an adequate K-12 education – be able to graduate from high school and start on a career or are prepared for college.

4 Economic Analysis

4.1 Earnings

More education — either in high school or college – causes individuals to have higher incomes. Increased education (typically but not exclusively measured in years of schooling) is associated with: higher earnings per hour; more personal and employer-funded benefits (e.g. health insurance); increased labor force participation and employment; greater job security; and better working conditions (e.g. more flexible schedules). Overwhelming evidence establishes that these associations are substantively large and robust. All studies adjust for the possibility that underlying personal characteristics affect both education and earnings. Given the range of empirical methods applied, the sizes of the effects, and the robustness of the results, it is very likely that education causes higher earnings.¹⁶

Table 2: **Earnings Gains by Education Level**

	HS Dropout	HS Graduate	HS+ College
Lifetime gross earnings	\$316,530	\$621,210	\$791,220
Gain over HS dropout		\$304,680	\$474,690

Source: Current Population Survey (CPS), 2009-2018; Delaware sample all persons aged 18-64 (employed or not).

Notes: Gross earnings before tax. No adjustments are made for labor market participation (annual and lifetime), GED receipt, or incarceration rates. Labor market activity begins at age 18 (conditional on not being in college) and lasts until age 65. Model includes health and pension benefits incidence as per Delaware sub-sample of CPS; alpha factor of 10%; productivity growth rate 1.5%. Present values at age 18; discount rate 3%. Figures rounded to nearest \$10.

We calculate lifetime earnings by education level using gross earnings data taken directly from the Delaware resident sub-sample of the Current Population Survey 2009-2018. This yields a sample of over 50,000 individuals across Delaware over this time period. Gross earnings, i.e.

¹⁶A sampling of this evidence is: Carneiro et al. (2011); Oreopoulos and Petronijevic (2013); Autor (2014); Stephens and Yang (2014); Barrow and Malamud (2015); Webber (2014); Altonji et al. (2014); Turner (2016); Gelbach (2016); Guvenen et al. (2017); Heckman et al. (2018); van Huellen and Qin (2019).

including tax payments and employer contributions, are grouped by education level and age. We use eight age bands starting at 18 up to age 64. For each age band, average gross earnings are derived and these are then used to create a smoothed, annualized lifetime earnings profile for each education level. From these groupings we can derive a lifetime full earnings profile for each education level. With this large sample size, we are able to estimate earnings separately by sex and race. These estimates are then aggregated based on the future demographics of the population in Delaware.

Lifetime earnings levels and differentials are reported in Table 2. (The Table Notes provide full further details on how gross earnings are calculated). Over the lifetime a high school dropout in Delaware will earn a present value of \$316,530. By comparison, a high school graduate will earn \$621,210 or \$791,220 if he or she progresses on to college at the average rate for Delaware graduates.

Clearly, these levels yield substantial differences for persons with more education. Specifically, high school graduates are predicted to earn \$304,680 more than dropouts (i.e. more than double). For graduates who attend college, the differential rises to almost one-half million dollars at \$474,690.

4.2 Taxes

Additional earnings for more educated persons directly translate into additional federal and state/local tax contributions. These tax effects are both a fiscal and social effect of education.

We estimate tax payments using three methods and apply the average across the results. First, tax payments are derived directly from the Delaware resident sub-sample of the Current Population Survey (as per Table 2). These respondents reported both federal and state/local taxes paid per year (net of credits and including the taxable value of health and pension benefits). These annual tax amounts are then used to create a lifetime profile of taxes paid using age-bands. Second, we enter the national sample of earnings values, disaggregated by race and sex, into TAXSIM, the National Bureau of Economic Research tax calculator.¹⁷ TAXSIM gives the amount of federal and state tax paid. These TAXSIM rates are checked against the state tax code. Delaware has no state or local sales taxes. The state income tax rate in Delaware is seven brackets from 0% to 6.6% (with personal exemptions and standard deductions of \$3,350).

¹⁷TAXSIM version 32 incorporates all federal and state tax changes as of July 2019, see <https://users.nber.org/taxsim/taxsim32/>.

Delaware collects property taxes (equivalent to 68% of state income tax revenues), selective sales taxes (43%), and corporate taxes (34%). Thus, we add those on proportionately to the state income tax payments made by Delaware residents.¹⁸ The third method is a short-cut based on Saez and Zucman (2019). Looking across all federal, state, and local taxes paid by citizens, Saez and Zucman (2019) determine that the U.S. effectively has a flat tax code with an average tax rate of 25-30%. Thus, we estimate total tax payments as 25% of gross earnings.

Table 3: Tax Contributions by Education Level

	HS Dropout	HS Graduate	HS+ College
Federal tax	\$49,730	\$97,530	\$137,850
Gain over HS dropout		\$47,800	\$88,120
State/local tax	\$43,770	\$70,320	\$87,410
Gain over HS dropout		\$26,550	\$43,640

Source: CPS, 2009-2018; Delaware sub-sample aged 18-64.
Notes: Earnings profiles as per Table 2. Average from:
 (1) reported tax payments from CPS; (2) predicted taxes from TAXSIM at <http://users.nber.org/~taxsim/taxsim32/>;
 (3) rate of 25% of earnings (Saez and Zucman, 2019).

Differences in tax payments between high school dropouts and graduates are given in Table 3 (averaged across the three methods). There are significantly larger contributions by graduates to both the federal and state/local tax systems. Relative to a high school dropout, each high school graduate contributes \$47,800-\$88,120 more in federal taxes and \$26,550-\$43,640 more in state/local taxes.

4.3 Health

Individuals with more education – high school and college – are significantly healthier. The effects of education are found for many health conditions (e.g., hypertension, diabetes) and health behaviors (e.g., exercise and smoking). More educated persons are also better able to manage their health (e.g., through improved nutrition). Thus, more educated persons have significantly higher overall health status and gains in longevity. Notably, health disparities by education level have been growing over recent decades. Also, recent studies have linked health improvements directly to education reforms that raised school quality. The impact of education

¹⁸Data from: Federation of Tax Administrators (www.taxadmin.org, Table 15, 2019 update); Tax Policy Center (www.taxpolicycenter.org/statistics/state-and-local-general-revenue-capita, retrieved October 26, 2019).

on health is substantively large and is identifiable for many health conditions and behaviors and across demographic groups. Although there is confounding between education, income and health status, all studies attempt to control for this confounding. Overall, there is consensus of a strong independent effect of education on health status.¹⁹

Annually, Delaware spends \$2.1 billion (federal and state) on Medicaid. This is approximately 20% of the total state budget (of which 60% is funded through federal sources). This spending amounts to almost \$10,000 per Medicaid enrollee per year, with a monthly enrollment of 230,000 persons.²⁰ Increases in education levels are expected to translate into reductions in Medicaid enrollments; this should reduce government expenditures.

We use three methods to estimate changes in government expenditure attributable to differences in education. We apply the average of these three methods. Method (1) uses the Medicaid/Medicare enrollment rates by education level from the American Community Survey. These rates are then multiplied by the average expenditure per enrollee (over the period of enrollment). Method (2) adapts estimates of educational impacts on health care calculated at the national level by Muennig et al. (2010). These estimates include Medicaid and Medicare and Social Security Disability payments for those aged under 65, to which we add in direct state medical spending. Method (3) adapts estimates from Krueger et al. (2015). Together, these methods yield an estimate of the fiscal consequences of poor health attributable to low education.

In addition, we derive the social value of additional health that is attributable to education. This social estimate captures how citizens value their health overall, regardless of how much health care they receive. This value is separate from – in addition to – the expenditures on health. Separately, this valuation is almost certainly greater than the expenditures on health treatments.

We apply evidence from two studies to derive the social value of health. Using MEPS and NHIS data from 1997-2002 Muennig et al. (2010) calculate the remaining quality-adjusted life years (QALYs) of persons aged 18. For high school dropouts, these QALYs amount to 37.8 and

¹⁹Evidence for an education–health gradient includes: Cutler and Lleras-Muney (2010); Hummer and Hernandez (2013); Krueger et al. (2015); Zaiacova and Lawrence (2018); Krueger et al. (2019); Hao and Cowan (2019); Montez et al. (2019); Chiu et al. (2019). For evidence on gradients for population subgroups, see Kimbro et al. (2008); Savelyev and Tan (2019). Evidence on the growing steepness of the gradient is reported by Adler and Stewart (2010); Hayward et al. (2015). On school quality and health status, see Garcia and Berliner (2018).

²⁰Calculations based on data for 2017-18 from: www.kff.org/medicaid/; www.nasbo.org, Tables 28-29; www.statehealthfacts.org/.

for high school graduates they are 40.2. In effect, a high school graduate reaps an additional 2.4 years of life in full health. Assuming that each QALY is conservatively worth \$100,000 (Cutler and Lleras-Muney, 2010; Neumann et al., 2014), the undiscounted gain from being a high school graduate is therefore \$240,000. Using estimates from Schoeni et al. (2011) yields a more conservative estimate of annual differences in health-related quality of life across persons with different education levels. Relative to a high school dropout, Schoeni et al. (2011) find that a high school graduate experiences 0.03 extra QALYs each year and a person with a college degree experiences 0.062 QALYs more. Given the value of a QALY at \$100,000, additional education is worth \$3,000 and \$6,200 each year respectively.

Table 4: **Health Valuations by Education Level**

	HS Dropout	HS Graduate	HS+ College
Federal spending	\$39,280	\$22,980	\$15,730
Benefit over HS dropout		\$16,300	\$23,550
State/local spending	\$26,770	\$15,860	\$10,840
Benefit over HS dropout		\$10,910	\$15,930
Social health gain over HS dropout		\$16,490	\$24,680

Sources: KFF.org, MEPS, Muennig et al. (2010); Schoeni et al. (2011); Krueger et al. (2015). Medicaid spending from www.macpac.gov/wp-content/uploads/2015/12/MACStats-Medicaid-CHIP-Data-Book-December-2017.pdf, retrieved November 12 2019.

Table 4 shows the economic value of improved health status with education. Federal spending on health is higher for dropouts by \$16,300-\$23,550; and state/local spending is higher by \$10,910-\$15,930. The total fiscal consequences of low education –mediated through low health status– is the sum of these amounts. In addition, there is a social effect of ill health caused by low education: expressed relative to a dropout, each high school graduate experiences improved health status that is valued at \$16,490-\$24,680.

4.4 Crime

Educational attainment is strongly correlated with crime patterns. Persons with more education are less likely to engage in delinquent behaviors and criminal acts –both as youth and as adults. Consequently, they are less likely to become involved in the criminal justice system. The education–crime gradient is composed of a direct behavioral effect on criminal propensities and

an indirect effect in that the “opportunity cost” of crime is higher for persons with higher incomes. The association is significant and economically meaningful over time: probation, prison sentences, and parole may cause social scarring as well as recidivism. Adjusting for incomes, the effect of education on crime is almost certainly causal.²¹

The association between education and crime is illustrated by the composition of the prison population. Only 5% of the U.S. prison population has ever attended college: 64% of the U.S. prison population has high school education; 30% are high school dropouts (Carson and Sabol., 2012; Rampey et al., 2016).

Increased education should reduce the need for spending on the criminal justice system and corrections. Each year Delaware spends a substantial amount on both systems. Annual General Fund spending on the Delaware Department of Corrections is \$308 million; spending per incarcerated person is over \$48,000, with a prison population of 6,400 and an additional 15,000 on probation and parole.²² Reducing crime should therefore lead to significant savings.

The fiscal crime burden from inadequate education is averaged from two methods. For both methods, we adjust for the relative crime rate in Delaware. (Information on patterns of crime in Delaware relative to the national average is shown in Appendix Table A3.)

The first method is based on patterns of offending. We calculate the lifetime crime burden imposed by non-offenders, general offenders and chronic offenders.²³ These national estimates are adjusted to match the crime rate, incarceration rate, and criminal justice system spending in Delaware relative to the national average and then related to the relative proportions of each offender category by education level. These estimates are then extrapolated to create a lifetime profile.

The second method is based on patterns of incarceration. Individuals with low attainment are much more likely to be incarcerated. As noted above, the U.S. prison population has very

²¹For evidence on the education–crime gradient, see Lochner and Moretti (2004); Gilpin and Pennig (2015); Cook and Kang (2016); Amin et al. (2016); Cano-Urbina and Lochner (2019); Cruz and Lopez (2019). Researchers have been able to exploit differences in sentencing rates, compulsory schooling laws, and age cut-offs to causally identify the association between education and crime. Cook and Kang (2016) state that “it is reasonable to conclude that high school dropout enhances the likelihood of committing serious crime” (p.35); for adult crime, they conclude that “almost all of the increase in crime is associated with the increased dropout rate” (p.49).

²²<https://doc.delaware.gov/assets/DOC2018AnnualReport.pdf>.

²³Non-offenders (about 80% of the population) impose no crime burden. General offenders (about 15% of the population) commit about half of all crimes. Chronic offenders (the remaining 5% of the population) commit the remaining half of all crimes. Several studies have calculated the lifetime economic consequences of being either an offender or a chronic offender (Cohen and Piquero, 2009; DeLisi et al., 2010; McCollister et al., 2012).

low education levels. We assign the fiscal burden of crime according to these proportions. For both methods, we divide this fiscal burden into state and federal responsibilities.

Table 5: **Crime Burdens by Education Level**

	HS Drop-out	HS Graduate	HS+ College
Federal spending	\$10,490	\$3,160	\$2,460
Benefit over HS dropout		\$7,330	\$8,030
State/local spending	\$41,960	\$12,630	\$9,830
Benefit over HS dropout		\$29,330	\$32,130
Social crime costs	\$91,790	\$27,630	\$21,500
Benefit over HS dropout		\$64,160	\$70,290

Sources: KFF.org, MEPS, Muennig et al. (2010); Krueger et al. (2015); DeLisi et al. (2010); Anderson (2011). Spending on corrections and criminal justice system from Bureau of Justice Expenditure and Employment Extracts, 2014.

Increased education should also alleviate the social burdens of crime, i.e. the losses to crime victims. These social burdens are far greater than –and are in addition to– direct spending on the criminal justice system (McCollister et al., 2012). We apply the estimates of social burdens from Anderson (2011), again weighted to account for crime and incarceration patterns in Delaware.

Table 5 shows the lifetime crime burdens associated with completing high school versus dropping out. Each high school dropout imposes a burden to the federal criminal justice system of \$10,490 and to the state/local criminal justice system of \$41,960. (These amounts are per person but males impose a very large proportion of the total burden). By contrast, high school graduates impose far lower burdens at \$3,160 and \$12,630 respectively. HS+ college graduates impose even lower burdens. The fiscal savings from lower crime are therefore substantial.

Importantly, the largest burden is imposed on society (the victims of crime). Over their lifetime, each high school dropout imposes a social crime burden of \$91,790; by contrast, each high school graduate imposes a social burden of \$27,630 or \$21,500. Therefore, the social burden (over and above the fiscal burden) of inadequate education is \$64,160 or \$70,290.

4.5 Other Costs and Benefits

There are several other important consequences of inadequate education. These include: productivity spillovers; tax distortions; welfare expenditures; and additional spending on high

school and college (as a “saving” when education is low quality). The economic magnitudes for each domain by education level are reported in Table 6.

First, there are productivity spillovers from having a more highly educated local workforce. For example, firms are more likely to invest in those localities and workers can learn from each other. As the proportion of graduates in the population increases, so do average earnings (Abel et al., 2012). Conservatively, productivity spillovers are valued at 6% of total earnings (the average from estimates in Iranzo and Peri (2009); Monaco and Yamarik (2015)). This proportion is applied to the earnings benefits from Table 2 above. As shown in Table 6, these productivity spillovers result in gains of \$18,280 up to \$28,480.

Second, increased education improves the efficiency of the tax system. Tax collection causes an economic distortion, referred to as the Marginal Excess Tax Burden (METB) or Marginal Cost of Funds (MCF). For example, income taxes reduce labor effort and raise the prices of goods and services. As education reduces government spending (e.g. on health services), the METB falls. Estimates of the METB vary significantly, with estimates up to 100% of every dollar of government spending government. Conservatively, we apply an METB rate of 13% across all changes in government spending (Allgood and Snow, 1998; Ghavari, 2006). This METB affects all fiscal money streams.

Table 6 shows these two economic growth effects: productivity spillovers and METB benefits. From a social perspective, productivity spillovers are important. Each Delaware graduate generates additional spillovers worth \$18,280-\$28,480 over the lifetime. METB effects are also important. High school dropouts impose a larger METB of between \$8,720 and \$7,920.

Third, there are differences in welfare receipt by education level (MacFarland et al., 2016; FNS, 2015; Ganong and Liebman, 2018). For many welfare programs, the link between education and receipt is direct: high-income persons are ineligible for welfare programs. Currently, Delaware spends \$4.5 billion annually on welfare (state/local spending only); supplemental federal funding is contingent on maintenance-of-effort funding agreements. Thus, increasing education should reduce welfare spending.

Education-welfare gradients are strong but vary across programs. For simplicity, we apply gradients based on relative rates of receipt across all programs by education level from the BLS (2018): specifically, 38% of high school dropouts receive welfare payments; the rates for high school graduates, those with some college, and college graduates are 34%, 22%, and

7% respectively. We apply these rates to receipt of all welfare payments in Delaware regardless of funding source.²⁴

Table 6: Other Economic Benefits by Education Level

	HS Drop-out	HS Graduate	HS+ College
Productivity spillovers (social) Gain over HS dropout	\$18,990	\$37,270	\$47,470
		\$18,280	\$28,480
Marginal Excess Tax Burden (all taxes) Benefit over HS dropout	\$17,420	\$8,700	\$9,500
		\$8,720	\$7,920
Welfare spending (federal) Benefit over HS dropout	\$9,610	\$7,630	\$5,850
		\$1,980	\$3,760
Welfare spending (state/local) Benefit over HS dropout	\$5,890	\$4,670	\$3,580
		\$1,220	\$2,300
Education (federal) cost over HS dropout		\$760	\$4,960
Education (state/local) cost over HS dropout		\$6,840	\$19,840
Education (social) cost over HS dropout		\$7,600	\$59,620

Sources: Productivity: Iranzo and Peri (2009); Monaco and Yamarik (2015). METB: Table 3, Allgood and Snow (1998); Ghavari (2006). Welfare: FNS (2015), www.bls.gov/opub/mlr/2018/article/program-participation-and-spending-patterns-of-families-receiving-means-tested-assistance.htm, retrieved November 4 2019.

Table 6 shows the estimated amount of welfare payments received by high school status. There are modest savings to both levels of government for each new high school graduate. Whereas dropouts receive \$9,610 in federal payments, graduates draw on welfare to a lower extent, yielding a present value saving of \$1,980-\$3,760. At the state/local level, savings are small but not trivial: compared to a dropout, there are savings of \$1,220-\$2,300.²⁵

In addition, there is a broader social burden of having high welfare rolls. Direct welfare payments are considered as transfers between willing taxpayers and recipients, so they are not part of the social burden. However, the administrative cost of welfare receipt is a social burden. Assuming this cost at 15% of welfare payments, this social burden is estimated at \$640-\$1,120 per high school dropout.

Inadequate education does convey one ‘negative’ benefit: students who drop out of school

²⁴Based on Grogger (2004), we assume that individuals can only spend ten years on welfare before becoming ineligible.

²⁵The savings are low because welfare receipt is often time-limited and is often allocated to households rather than individuals.

and do not go to college receive smaller public subsidies for their education (net of tuition payments). These educational costs are calculated based on the pathways of the students.²⁶ College costs are divided into tuition/fees paid by students and public subsidies; they are split according to state/local and federal responsibilities in Delaware's public universities.

High school dropouts yield 'savings' of \$760 to the federal government and \$6,840 to the state/local government (as shown in Table 6 above). For the expected high school graduates who progress on to college, dropouts 'save' \$4,960 and \$19,840 to state/local and federal governments respectively (not all graduates attend college). The extra social expenditure is \$59,620 for expected high school graduates (most of this amount is paid by the college enrollees in tuition and fees). Because dropouts do not attend college, these amounts must be subtracted from the total burden of inadequate education.

5 Summary Results: High School Dropouts

5.1 Social Burden of Inadequate Education: HS Dropouts

The social dollar burden from low student attainment includes all the effects on workers, on health status, on crime, on welfare and other economic spillovers. This total social burden is reported in Table 7 below. For clarity, it is expressed as the gains that Delaware would obtain per new high school graduate.

The total social gain for Delaware per marginal high school graduate is \$469,250. If this graduate progresses on to college at the expected rate for public school students in Delaware, then the total social gain rises to \$627,280. If inadequate education includes persons who completed high school but do not attend college, then the social gains are \$158,040 per individual (the difference between the gain for the HSC and HSG categories).

Most of these social gains derive from extra earnings. In addition, there are substantial gains conveyed by improved health status and by reduced criminal activity. These latter two gains are important because Delaware citizens are the primary beneficiaries (rather than the

²⁶Each high school dropout is assumed to receive one half year less of high school (even as most dropouts are enrolled in some educational or youth opportunities program up to age 18 and these programs are often more expensive than high school). The cost of public schooling is from the *Annual Survey of School System Finances*, U.S. Census Bureau. Each person with some college is assumed to have two years of college at a two-year institution and each college graduate is assumed to have five years of college at a four-year institution.

Table 7: **Social Gains from HS Graduation**

	Social Gains over HS Dropout	
	HS Graduate	HS+ College
Earnings	\$304,675	\$474,690
Health	\$43,710	\$64,150
Crime	\$100,820	\$110,450
Welfare	\$640	\$1,210
Productivity Gains	\$18,280	\$28,480
METB	\$8,720	\$7,920
Education Costs	-\$7,600	-\$59,620
Total Social Gain over HS Dropout	\$469,250	\$627,280

Sources: Tables 2-6. *Notes:* Present value at age 18, discount rate 3.5%. 2019 dollars.

student *per se*). Finally, there are important gains to general productivity and through reductions in tax distortions; costs for college offset these gains, but the offset is far below the total gain.

Overall, these are large social consequences for Delaware when students fail to complete high school.

5.2 Fiscal Burden of Inadequate Education: HS Dropouts

The fiscal burden from low attainment in Delaware includes all the government expenditures and losses in tax revenue. When students are educated to complete high school, there are significant fiscal gains. These are reported in Table 8.

The total fiscal gain for Delaware taxpayers from each marginal high school graduate is \$136,450. This gain includes both federal and state/local tax savings; these two sets of savings each comprise approximately half of the total savings (at \$73,650 and \$62,800 respectively). For the high school graduates who do progress on to college, the total fiscal gain is \$195,780. If inadequate education includes high school graduates, then the fiscal gains amount to \$59,330.

As for the social gains from education, most of the fiscal gains are derived from higher earnings (and therefore higher income tax payments). However, the reductions in government spending on health care and the criminal justice system are also significant.

Table 8: Fiscal Gains from HS Graduation

	Federal Gain over HS Dropout		State/Local Gain over HS Dropout	
	HS Graduate	HS+ College	HS Graduate	HS+ College
Tax Contributions	\$47,800	\$88,120	\$26,550	\$43,640
Health	\$16,300	\$23,540	\$10,920	\$15,930
Crime	\$7,330	\$8,030	\$29,330	\$32,130
Welfare	\$1,980	\$3,760	\$1,220	\$2,300
METB	\$1,000	\$1,180	\$1,620	\$1,190
Education	-\$760	-\$4,200	-\$6,840	-\$19,840
Gain (per agency) over HS Dropout	\$73,650	\$120,430	\$62,800	\$75,350
Total Fiscal Gain over HS Dropout			\$136,450	\$195,780

Sources: Tables 3-6. Notes: Present value at age 18, discount rate 3.5%. 2019 dollars.

Based on these results, it would be efficient for Delaware taxpayers to invest additional funds to enhance student attainment. These enhancements would likely yield considerable savings to the taxpayer.

5.3 Aggregate Results: HS Dropouts

Here we place the results per students into an aggregate context. We are not assuming that all students will be able to graduate. The figures reported here are illustrative of the magnitude of the annual burdens to the state and to Delaware taxpayers from inadequate education.

Given the cohort sizes for public schools in Delaware, the per student social gains from adequate education would translate into an aggregate social gain of between \$0.65-\$0.87 billion. These lump sum amounts are annuities, in the sense that each year there is a cohort of students with similar life course trajectories and pathways. For comparison, the entire Gross Domestic Product of the state is \$61 billion. Therefore, the economic gains represent 1.1-1.4% of state GDP. If we include the high school graduates who are inadequately educated, this percentage rises to at least 3%.²⁷

From the fiscal perspective, the gains from increased education are also substantial. Per new high school graduate, the expected taxpayer gains are between \$136,450 and \$195,780. Across an entire cohort of students, this translates into a fiscal gain of \$0.19-\$0.27 billion. By

²⁷The exact percentage depends on the proportion of high school graduates who are classed as inadequately educated.

Table 9: Aggregate Gains from HS Graduation

	Aggregate Gains over HS Dropouts	
	HS Graduate	HS+ College
Total Social Gain per HS Dropout	\$469,245	\$627,280
Social Gain per Age Cohort (billions)	\$0.65	\$0.87
Delaware GDP (billions)	\$61	\$61
Social Gain as % of Delaware GDP	1.1%	1.4%
Total Fiscal Gain per HS Dropout	\$136,450	\$195,780
Fiscal Gain per Age Cohort (billions)	\$0.19	\$0.27
Delaware General Fund (billions)	\$4.1	\$4.1
Fiscal Gain as % of Delaware State General Fund	4.6%	6.6%

Sources: Tables 1, 7, 8; General Fund: www.nasbo.org, *State Expenditure Report*, Table 1; state GDP: www.bea.gov/data/gdp/gdp-state, retrieved November 12, 2019.
Notes: By assumption, fiscal and social gain assume zero rate of high school failure. Present value at age 18, discount rate 3.5%. 2019 dollars.

comparison, the Delaware General Fund (excluding federal sources of government expenditure) is \$4.1 billion annually. Therefore, if all students received adequate education to high school level, the economic effect would be comparable to an increase in revenue equivalent to 4.6-6.6% of the state budget. Again, this amount does not include the high school graduates who have not received an adequate education.

6 Summary Results: Graduates Not College/Career Ready

6.1 Calculation of Burdens by Education Level

As identified above, less than two-thirds of high school graduates are either career or college ready according to the Delaware Department of Education. These graduates are in a better economic position than high school dropouts but they are far from being adequately prepared to succeed in the labor market or to gain postsecondary credentials that may help them. In this Section, we derive the economic burden when graduates leave Delaware public schools and they are neither career or college-ready. The comparison is relative to students who meet one of these thresholds (for brevity we refer to these high school graduates as *ready* students).

We apply the same calculation methods and data as for the high school dropouts and for each of the social and fiscal domains (e.g. earnings, taxes). For each domain, we apply the lifetime consequences by race and gender for each education level. The respective social and

fiscal lifetime streams are reported in Appendix Table A4. Each lifetime stream is weighted to account for the proportion of graduates who are designated as career/college ready. As shown in Figure 1, the state-wide rate is 59% but we account for the significant differences by race and gender in the model.

These burdens are for high school graduates. They are therefore *an addition to burdens arising from high school dropout*. To obtain the full measure of the economic consequences of inadequate education it is necessary to add these two burdens together.

6.2 Social Burden of Inadequate Education: HS Graduates

The social dollar burden when graduates are not ready includes all the effects on workers, on health status, on crime, on welfare and other economic spillovers. This total social burden is reported in Table 10 below. It is the difference in economic consequences for the average graduate who is ready relative to the average graduate who is not ready.

Table 10: Social Gains from College/Career Readiness

	Gain per Career/College Ready HS Graduate
Earnings	\$485,240
Health	\$23,880
Crime	\$27,550
Welfare	\$1,670
Productivity Gains	\$29,110
METB	\$550
Education Costs	-\$140,800
Total Social Gain over HS Graduate Not Career/College Ready	\$427,200

Sources: Tables 2-6; Appendix Table A4. *Notes:* Present value at age 18, discount rate 3.5%. 2019 dollars.

The total social gap for Delaware for ready high school graduates is \$427,200. If the state invests in sufficient high quality education to ensure a high school graduate becomes ready, this amount is the expected social gain. Even based on conservative estimates, this dollar amount is very large. (Most of these social gains derive from extra earnings. The biggest cost is for education; by definition, almost all these graduates attend college).

6.3 Fiscal Burden of Inadequate Education: HS Graduates

The fiscal burden in Delaware when graduates are not ready includes all the government expenditures and losses in tax revenue. For each ready student, there are on average large fiscal gains. These are reported in Table 11.

Table 11: Fiscal Gains from College/Career Readiness

	Gain per Career/College Ready HS Graduate	
	Federal	State/Local
Tax Contributions	\$112,430	\$47,920
Health	\$21,480	\$21,480
Crime	\$3,150	\$12,590
Welfare	\$5,170	\$3,170
METB	\$1,280	\$1,840
Education	-\$19,960	-\$44,200
Gain over HS Graduate Not College/Career Ready	\$123,550	\$42,800
Total Fiscal Gain		\$166,350

Sources: Tables 3-6 and Appendix Table A4. *Notes:* Present value at age 18, discount rate 3.5%. 2019 dollars.

The total fiscal gain for Delaware taxpayers on average per ready high school graduate is \$166,350. This gain includes both federal and state/local tax savings. Federal gains are very large at \$123,550; and the state/local gains are not trivial at \$43,800 per student. (The distinction arises because the federal government collects more taxes on earnings but pays less for college education).

This evidence shows that it would be efficient for Delaware taxpayers to invest additional funds to enhance student attainment to ensure students are ready. These enhancements would likely yield considerable savings to the taxpayer.

6.4 Aggregate Results: HS Graduates

Similarly, it is important to place these results per students in an aggregate context. We are not assuming that all graduates will be career/college ready. Nevertheless, it is possible to calculate the aggregate size of these annual burdens for groups of students. (Again, this aggregate amount is separate from the burdens from high school dropouts).

Table 12: Aggregate Gains from College/Career Readiness

	Aggregate Gains over HS Graduate Not Career/College Ready			
	Low-income	English Learners	Disabled	Disadvantaged
Social Gain per Age Cohort (billions)	\$0.50	\$0.11	\$0.33	\$0.72
Social Gain as % of Delaware GDP	0.81%	0.18%	0.54%	1.17%
Fiscal Gain per Age Cohort (billions)	\$0.19	\$0.04	\$0.13	\$0.28
Fiscal Gain as % of Delaware GDP	4.71%	1.03%	3.12%	6.79%

Sources: Tables 1, 9, 10; General Fund: www.nasbo.org, *State Expenditure Report*, Table 1; state GDP: www.bea.gov/data/gdp/gdp-state, retrieved November 12, 2019. *Notes:* Disadvantaged group is the combination of low-income, English learner and disabled students, adjusting for overlap. By assumption, fiscal and social gain assume parity of readiness to state-wide average of 59%. Delaware GDP at \$61 billion; Delaware State General Fund at \$4.1 billion. Present value at age 18, discount rate 3.5%. 2019 dollars.

The economic burden depends on how many students might be expected to be career or college ready. There are many scenarios; we report a set of plausible scenarios in Table 12.²⁸

First, we assume that the rate for low income students reaches the rate for the general student population. That is, low income students are ready at a rate of 59% instead of 42%. This translates into 1,150 new ready high school graduates. The social gain per cohort is \$0.5 billion, which is 0.8% of state GDP (at \$61 billion). The fiscal gain is \$0.19 billion, equivalent to 4.7% of the state General Fund (at \$4.1 billion).

Second, we assume that the rate for English learners reaches the rate for the general student population. That is, English learners are ready at a rate of 59% instead of 23%. This increase would yield 250 new ready graduates. The social gains would be \$0.11 billion (0.2% of state GDP). The fiscal gains would be \$0.04 billion (1% of the state General Fund).

Third, we assume that the rate for students with disabilities reaches the rate for the general student population. That is, students with disabilities are ready at a rate of 59% instead of 20%. This increase would yield 770 new ready high school graduates, with social gains of \$0.33 billion and fiscal gains of \$0.13 billion.

Importantly, the state should ensure that all students in these three groups reach the

²⁸Again, the lump sum amounts are reported as annuities: each year there is a cohort of students with similar life course trajectories and pathways.

average for the general population. Adjusting for the overlap between these groups, we report the economic burden when this collected group of disadvantaged students is not educated to be ready for career or college.²⁹ Collectively, if all student groups had rates of career or college readiness that were at parity, there would be 1,670 new ready graduates. This would yield social gains to Delaware of \$0.72 billion, equal to 1.2% of state GDP each year. Also, the state would alleviate \$0.28 billion in fiscal burden, equal to 6.8% of the state General Fund. In bringing students in these three groups up to parity with the state-wide population, there would be significant gains for Delaware residents.

Notably, these scenarios are conservative in an important respect. As of 2019, only 59% are defined as college or career ready by the Delaware Department of Education. It might be expected that this percentage figure should be higher (especially given the returns to college). If we assume that all students are brought up to a rate of 75% career or college ready, the economic gains are significant.³⁰

7 Sensitivity Testing

The above estimates are based on the most recent research evidence and data available for Delaware. However, they may be subject to measurement error and uncertainty. Therefore, we consider sensitivities in regard to our baseline estimates of the fiscal and social burdens. As the estimates are already economically large, we test for over-estimation.

First, some sensitivity testing is already built into the model. For each domain, we applied the average from a set of estimates. Also, the baseline estimates are conservative assumptions (e.g. in under-adjusting for employment probabilities).

Second, some important benefits of education have been omitted from our baseline calculations (see the benefits map above). These include benefits during high school, such as the cost of grade repetition by high school dropouts; benefits for juveniles, such as lower rates of teenage pregnancy and juvenile crime; and any other benefits accrued before age 18. Other omissions relate to family effects (e.g., single motherhood) and broader social consequences such as the effects on a community of “mass incarceration”. Importantly, the cost of remedial education, either during youth, whilst in college (for high school graduates who are not ready for college),

²⁹ Approximately half of all English learners are low income. To be conservative, we assume a 50% overlap across all three groups.

³⁰ Aggregated over 1,480 new ready graduates, the social gain would be \$0.59 billion and the fiscal gain would be \$0.23 billion.

and during adulthood is not included. Strictly, all these expenditures are part of the burden of inadequate education.

Third, the lifetime profiles are calculated based on the assumption that the benefits of education are constant across generations. In fact, it is likely that the returns to education – especially in the labor market and health – will be greater for future generations (Autor, 2014).³¹

We can compare these estimates to other studies that have performed similar calculations. Adjusting for cost-of-living, demographics, and economic conditions, our results are strongly in line with results from other studies (Belfield and Levin, 2007; Trostel, 2010; Oreopoulos and Petronijevic, 2013; Rumberger et al., 2017). For example, Trostel (2010) reports fiscal gains of approximately \$200,000 per community college graduate relative to a high school graduate. Directly, our estimates are very close to recent estimates by Vining and Weimer (2019). These authors use a similar approach to ours to calculate national values for the economic value of a new high school graduation. (The method is very similar to ours but the assumptions about the components of the returns to high school differ). Vining and Weimer (2019) calculate that the economic value per additional high school graduate is \$228,000-\$332,000 (2019 dollars, present value). Macro-level (aggregate) analyses have also been undertaken to identify the benefits of education; these too find substantial economic impacts from increased education levels.³²

Overall, the social and fiscal burdens of inadequate education are likely to exceed the estimates reported in Tables 7-12.

³¹In theory the returns to education might fall if more educated workers enter the labor market. However, evidence does not support this argument: jobs are not a set of fixed tasks; more educated persons can perform most jobs more productively. Instead, most evidence shows ‘skill-biased technological change’, i.e. firms change how they use workers as those workers accumulate more skills. Consequently, educated workers earn more as they utilize more of their skills and as the labor force becomes more educated.

³²For a review of this literature see Hulten and Ramey (2019). One example is illustrative of the potential magnitudes. Hanushek et al. (2017) investigate how ‘knowledge capital’ — proxied by NAEP scores in 8th grade in math — determines state per capita GDP growth. Looking over the past four decades of changes across state economies, and adjusting for migration patterns and educational attainment, the authors find a “clear and significant relationship between growth [in real per capita GDP per state] and knowledge capital... a one-standard deviation increase in NAEP scores... is associated with a 1.43-percentage-point-faster annual growth of state GDP per capita over the past four decades” (p.463). That is an enormous difference in economic growth.

8 Educational Reforms for High School Dropouts in Delaware

8.1 Challenges Faced by Disadvantaged Children

Many children face educational challenges that impede their ability to enroll in and succeed at school. These challenges relate to family circumstances, environmental conditions, and basic financial constraints (Parcel et al., 2010).

Children's home circumstances and resources may undermine their educational development (Crosnoe and Cavanagh, 2010). In families with limited resources, there are typically fewer/weaker parent-child interactions related to language and literacy and fewer attributes of a school-like home (such as a desk or learning materials). Children in low-income families receive poorer nutrition and have less access to health insurance; they therefore have worse health status (Almond et al., 2018). Disadvantaged children experience out-of-school time which is less educative (e.g. with fewer after-school activities or visits to museums). As well, parent-school interactions may affect educational progress: low-income parents are less likely to be involved in their children's school or track their educational progress. Finally, low-income children have fewer educational resources available in the community. These children reside in neighborhoods with higher crime rates and fewer educational resources (such as libraries).

Disadvantaged students face significant personal barriers to learning. Schools may be able to reduce these barriers through effective policies and investments. In fact, for many children, these personal disadvantages are compounded by the quality of the schools they attend. A full description of resource differences across Delaware's schools is beyond the scope of this report. However, low-income students typically attend schools with *fewer* resources for learning; this is manifest in, for example, the quality of teaching, the age of the facilities, and the availability of supports (libraries, health counseling, and mentoring, as well as the availability of advanced courses in school). These school quality differences heighten the need for investments to provide adequate education for all students.

8.2 Educational Interventions

There are many reasons why some children's education - especially those children from disadvantaged families attending low quality public schools - will be sub-optimal and inadequate.

Moreover, given the powerful economic benefits of education - particularly for these children - there is a strong case for school-based investments in interventions to promote education.

Many educational interventions have been proposed to address both mechanisms (e.g. absence) and outcomes (high school non-completion). Some of these interventions have been evaluated and found to have either proven or promising evidence in their favor. A list of some of these interventions – based on evaluative review from the What Works Clearinghouse (WWC) – is given in Appendix Table A5.³³ The primary set of interventions are those with strong supporting evidence that they affect the K-12 path to graduation; also listed is a set of interventions that influence behavior (and that have positive or potentially positive impacts). In addition, the Washington State Institute for Public Policy has identified a series of effective educational interventions; these are listed in Appendix Table A5.

Overall, there are many, various ways in which schools might increase student attainment if they were provided with the necessary funding.

8.3 Benefit-Cost Ratios for Educational Interventions

To determine efficiency, we can compare the cost of educational interventions to the benefits in terms of economic outcomes. Fundamentally, the benefits per additional high school graduate are at least \$136,450; it is economically rational to spend up to that amount per extra high school graduate. More emphatically, the social benefits are at least \$469,250; up to that amount is what would be economically rational for the state of Delaware to spend per extra graduate. If educational interventions are effective at increasing attainment, they are highly likely to pass a benefit-cost test.

Table 13 reports economic evaluation for the interventions identified by the WWC. The first three columns show the estimated cost per student, effectiveness, and cost per high school graduate. Based on the fiscal and social benefits per graduate, columns 4 and 5 show the fiscal and social benefit-cost ratios. The goal of Table 13 is not to prioritize one intervention over other interventions. Instead, as illustrated by the benefit-cost ratios, for almost all cases the benefits far exceed the costs for each intervention.

A similar exercise has been undertaken by the Washington State Institute for Public Policy (WSIPP). For a broader class of educational interventions, and applying a separate set of

³³<https://ies.ed.gov/ncee/wwc/FWW/>, retrieved November 6 2019. Grade levels per intervention are indicated.

Table 13: Interventions to Increase High School Graduation

Reform	Cost per student	Extra graduates per 100 students	Cost per HSG	Fiscal benefit-cost ratio	Social benefit-cost ratio
10% increase in teacher salaries (K-12)	\$10,420	5	\$208,400	0.65	2.25
Chicago Child-Parent Center Program	\$8,760	11	\$79,640	1.71	5.89
High Scope Perry Pre-School Program	\$18,310	19	\$96,370	1.42	4.87
Talent Development High Schools	\$1,780	1	\$178,000	0.77	2.64
Class size reduction (K-3)	\$16,280	11	\$148,000	0.92	3.17
Expansion of Head Start	\$8,330	4	\$208,250	0.66	2.25
First Things First	\$6,960	16	\$43,500	3.14	10.79
ALAS	\$3,650	5	\$73,000	1.87	6.43
Twelve Together	\$4,610	5	\$92,200	1.48	5.09
Career Academies	\$4,180	11	\$38,000	3.59	12.35
Check & Connect	\$5,840	17	\$34,350	3.97	13.66
Talent Search	\$3,980	9	\$44,220	3.09	10.61

Sources: Adapted from Belfield and Levin (2012). 2019 dollars to nearest \$10. Discount rate of 3.5%. Adjusted to Delaware cost of education using Taylor-Fowler cost index (2007). *Notes:* Cost per student assumes funding for the education program is entirely state sourced. Cost per high school graduate is column (1)*100 divided by column (2). For columns (4)/(5) benefit/cost ratios are calculated as the ratios of the fiscal/social benefits per expected high school graduate (Tables 7-8 above) divided by the costs per high school graduate in column (3).

benefit and cost estimates, WSIPP derives a set of benefit-cost ratios. These ratios are reported in Appendix Table A6 (for interventions where the benefits exceed the costs). Conforming to the results in Table 13, WSIPP finds many interventions that easily pass a benefit-cost test.³⁴

9 Conclusions

Increased attainment by high school students in Delaware would yield significant economic benefits. This finding holds for the individual student, for the Delaware taxpayer and for the state. For each group, the economic magnitudes are substantial.

Per high school dropout, the social burden is conservatively estimated at \$469,250 and the fiscal burden is \$195,780. This burden applies to 13% of each student cohort. Per high

³⁴These interventions are expressed as present values at the start of each intervention and so cannot be directly compared or related to the economic burdens for Delaware as reported above. Nevertheless, with relatively low costs it is likely that many such interventions would pass a formal benefit-cost test for Delaware.

school graduate who is not career or college ready, the social burden is \$427,200 and the fiscal burden is \$166,350. This burden applies to 36% of each student cohort. With a combination of reductions in the high school dropout rate (from 13%) and an increase in readiness (from 59%), the social and fiscal gains would be measured in billions annually; they would be valued at up to 3% of state GDP and over 10% of the state General Fund.

These burdens reflect the fundamental fact that education levels strongly determine economic well-being. Moreover, the returns to education appear to be growing over recent decades. Behavior is becoming more strongly determined by one's education; and the burdens of inadequate education (such as health care costs) are increasingly more rapidly.

By failing to make sufficient investments in effective educational interventions Delaware is trading off short-run budget "savings" for much larger long-run economic burdens. Approximately, these long-run economic burdens are almost as much as the entire spending per child during their years in K-12 schooling. In economic terms, this lack of investment in public education is (by definition) inefficient.

Importantly, there are interventions which have been found to improve educational outcomes, including high school graduation. Investments in resource-intensive interventions to enhance educational outcomes, particularly for disadvantaged student groups, clearly pass a benefit-cost test.

References

- Abel, J. R., Dey, I., and Gabe, T. M. (2012). Productivity and the density of human capital. *Journal of Regional Science*, 52:562–586.
- Adler, N. E. and Stewart, J. (2010). Health disparities across the lifespan: Meaning, methods, and mechanisms. *Annals of the New York Academy of Sciences*, 1186:5–23.
- Allgood, S. and Snow, A. (1998). The marginal cost of raising tax revenue and redistributing income. *Journal of Political Economy*, 106:1246–1273.
- Almond, D., Currie, J., and Duque, V. (2018). Childhood circumstances and adult outcomes: Act II. *Journal of Economic Literature*, 56(4):1360–1446.
- Altonji, J. G., Kahn, L. B., and Speer, J. D. (2014). Trends in earnings differentials across college majors and the changing task composition of jobs. *American Economic Review*, 104(5):387–393.
- Amin, V., Flores, C. A., Flores-Lagunes, A., and Parisian, D. J. (2016). The effect of degree attainment on arrests: Evidence from a randomized social experiment. *Economics of Education Review*, 54:259–273.
- Anderson, D. A. (2011). The cost of crime. *Foundations and Trends in Microeconomics*, 7:209–265.
- Autor, D. H. (2014). Skills, education, and the rise of earnings inequality among the “other 99 percent”. *Science*, 344:843–851.
- Bailey, T., Jeong, D. W., and Cho, S.-W. (2010). Referral, enrollment and completion in developmental education sequences in community colleges. *Economics of Education Review*, 29:255–270.
- Baker, B. (2019). *Educational Inequality and School Finance: Why Money Matters for America’s Students*. Harvard University Press, Cambridge, MA.
- Barrow, L. and Malamud, O. (2015). Is college a worthwhile investment? *Annual Review of Economics*, 7:519–555.
- Belfield, C. and Bailey, T. (2018). *The labor market value of higher education: Now and in the future*. *Handbook of Theory and Research* (Ed. Paulson and Perna)., Springer Press: New York, NY.

- Belfield, C. R. and Levin, H. M. (2007). *The Price We Pay: The Economic and Social Costs of Inadequate Education*. Brookings Institution, Washington, DC.
- Binder, A. J. and Bound, J. (2019). The declining labor market prospects of less-educated men. 33(2):163–190. WP25577.
- Cano-Urbina, J. and Lochner, L. (2019). The effect of education and school quality on female crime. *Journal of Human Capital*, 13(2):188–235.
- Carneiro, P., Heckman, J. J., and Vytlacil, E. J. (2011). Estimating marginal returns to education. *American Economic Review*, 101(6):2754–2781.
- Carson, E. A. and Sabol, W. J. (2012). Prisoners in 2011. US Department of Justice, Bureau of Justice Statistics, NCJ239808.
- Cellini, S. R., Ferreira, F., and Rothstein, J. (2010). The value of school facility investments: Evidence from a dynamic regression discontinuity design. *Quarterly Journal of Economics*, 125(1):215–261.
- Chaudhary, L. (2009). Education inputs, student performance and school finance reform in Michigan. *Economics of Education Review*, 28(1):90–98.
- Chiu, C.-T., Hayward, M. D., Chan, A., and Matchar, D. B. (2019). Educational differences in the compression of disability incidence in the United States. *SSM Population Health*, 7.
- Cohen, M. and Piquero, A. (2009). New evidence on the monetary value of saving a high risk youth. *Journal of Quantitative Criminology*, 25(1):25–49.
- Coile, C. C. and Duggan, M. G. (2019). When labor’s lost: Health, family life, incarceration, and education in a time of declining economic opportunity for low-skilled men. *Journal of Economic Perspectives*, 33(2):191–210.
- Cook, P. J. and Kang, S. (2016). Birthdays, schooling, and crime: Regression-discontinuity analysis of school performance, delinquency, dropout, and crime initiation. *American Economic Journal: Applied Economics*, 8(1):33–57.
- Crosnoe, R. and Cavanagh, S. E. (2010). Families With Children and Adolescents: A Review, Critique, and Future Agenda. *Journal of Marriage and Family*, 72(3):594–611.
- Cruz, I. and Lopez, G. (2019). Policing, schooling and human capital accumulation. *Journal of Economic Behavior and Organization*, 159:572–597.

- Cutler, D. and Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of Health Economics*, 29:1–28.
- DeLisi, M., Kosloski, A., Sween, M., Hachmeister, E., Moore, M., and Drury, A. (2010). Murder by numbers; monetary costs imposed by a sample of homicide offenders. *Journal of Forensic Psychiatry and Psychology*, 21:501–513.
- Duchini, E. (2017). Is college remedial education a worthy investment? New evidence from a sharp regression discontinuity design. *Economics of Education Review*, 60:36–53.
- FNS (2015). Supplemental nutrition assistance program. state activity report. fiscal year 2014. Report, www.fns.usda.gov/sites/default/files/FY14.
- Ganong, P. and Liebman, J. B. (2018). The decline, rebound, and further rise in SNAP enrollment: Disentangling business cycle fluctuations and policy changes. *American Economic Journal - Economic Policy*, 10(4):153–176.
- Garcia, A. M. and Berliner, D. C. (2018). A critical review of the literature on the relationship between school quality and health inequalities. *Review of Education*, 6:40–66.
- Gelbach, J. (2016). When do covariates matter? and which ones, and how much? *Journal of Labor Economics*, 34(2):509–543.
- Ghavari, F. (2006). On the marginal cost of public funds and the optimal provision of public goods. *Journal of Public Economics*, 90(6-7):1251–1262.
- Gilpin, G. and Pennig, L. (2015). Compulsory schooling laws and school crime. *Applied Economics*, 47:4056–4073.
- Grogger, J. (2004). Welfare transitions in the 1990s: The economy, welfare policy, and the etc. *Journal of Policy Analysis and Management*, 23:671–695.
- Guvenen, F., Kaplan, G., Song, J., and Weidner, J. (2017). Lifetime incomes in the United States over six decades. *NBER Working Paper No. 23371*.
- Hanushek, E. A., Ruhose, J., and Woessmann, L. (2017). Knowledge capital and aggregate income differences: Development accounting for us states. *American Economic Journal: Macroeconomics*, 9:184–224.
- Hao, Z. and Cowan, B. W. (2019). The effects of graduation requirements on risky health behaviors of high school students. *American Journal of Health Economics*, 5(1):97–125.

- Hayward, M. D., Hummer, R. A., and Sasson, I. (2015). Trends and group differences in the association between educational attainment and US adult mortality: Implications for understanding education's causal influence. *Social Science and Medicine*, 127(SI):8–18.
- Heckman, J. J., Humphries, J. E., LaFontaine, P. A., and Rodriguez, P. L. (2012). Taking the easy way out: How the GED testing program induces students to drop out. *Journal of Labor Economics*, 30(3):495–520.
- Heckman, J. J., Humphries, J. E., and Veramendi, G. (2018). The nonmarket benefits of education and ability. *Journal of Human Capital*, 12:282–304.
- Heckman, J. J. and LaFontaine, P. A. (2010). The American high school graduation rate: Trends and levels. *Review of Economics and Statistics*, 92:244–262.
- Heckman, J. J. and Mosso, S. (2014). The economics of human development and social mobility. *Annual Review of Economics*, 6(1):689–733.
- Hulten, C. and Ramey, V. A. (2019). *Education, Skills and Technical Change*. University of Chicago Press, Chicago, IL.
- Hummer, R. A. and Hernandez, E. M. (2013). The effect of educational attainment on adult mortality in the united states. *Population Bulletin*, 68(1).
- Hyman, J. (2017). Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment. *American Economic Journal– Economic Policy*, 9(4):256–280.
- Iranzo, S. and Peri, G. (2009). Schooling externalities, technology, and productivity: Theory and evidence from U.S. states. *Review of Economics and Statistics*, 91(4):420–431.
- Jackson, C. K., Johnson, R. C., and Persico, C. (2016). The effects of school spending on educational and economic outcomes: Evidence from school finance reforms. *Quarterly Journal of Economics*, 131(1):157–218.
- Kimbro, R. T., Bzostek, S., Goldman, N., and Rodriguez, G. (2008). Race, ethnicity, and the education gradient in health. *Health Affairs*, 27:361–374.
- Knight, D. S. (2017). Are High-Poverty School Districts Disproportionately Impacted by State Funding Cuts? School Finance Equity Following the Great Recession. *Journal of Education Finance*, 43(2):169–194.
- Krueger, P. M., Dehry, I. A., and Chang, V. W. (2019). The Economic Value of Education for Longer Lives and Reduced Disability. *Milbank Quarterly*, 97(1):48–73.

- Krueger, P. M., Trau, M. K., Hummer, R. A., and Chang, V. W. (2015). Mortality attributable to low levels of education in the United States. *PLoS One*, 10(7):0131809.
- Lochner, L. and Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American Economic Review*, 94(1):155–189.
- MacFarland, J., Stark, P., and Cui, J. (2016). Trends in high school dropouts and completion rates for the United States: 2013. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- McCollister, K. E., French, M. T., and Fang, H. (2012). The cost of crime to society: New crime-specific estimates for policy and program evaluation. *Drug and Alcohol Dependence*, 108(1-2):98–109.
- Monaco, K. and Yamarik, S. (2015). Are there human capital externalities in U.S. states? Evidence from the Current Population Survey. *Economics Bulletin*, 35(4):2345–2362.
- Montez, J. K., Zajacova, A., Hayward, M. D., Woolf, S. H., Chapman, D., and Beckfield, J. (2019). Educational disparities in adult mortality across US states: How do they differ, and have they changed since the mid-1980s? *Demography*, 56(2):621–644.
- Moore, M. A., Boardman, A. E., and Vining, A. R. (2013). More appropriate discounting: the rate of social time preference and the value of the social discount rate. *Journal of Benefit-Cost Analysis*, 4:325–346.
- Muennig, P., Fiscella, K., Tancredi, D., and Franks, P. (2010). The Relative Health Burden of Selected Social and Behavioral Risk Factors in the United States: Implications for Policy. *American Journal of Public Health*, 100(9):1758–1764.
- Neumann, P. J., Cohen, J. T., and Weinstein, M. C. (2014). Updating Cost-Effectiveness - The Curious Resilience of the \$50,000-per-QALY Threshold. *New England Journal of Medicine*, 371(9):796–797.
- Oreopoulos, P. and Petronijevic, U. (2013). Making College Worth It: A Review of the Returns to Higher Education. *Future of Children*, 23(1):41–65.
- Oreopoulos, P. and Salvanes, K. G. (2011). Priceless: The Nonpecuniary Benefits of Schooling. *Journal of Economic Perspectives*, 25(1):159–184.
- Parcel, T. L., Dufur, M. J., and Zito, R. C. (2010). Capital at home and at school: A review and synthesis. *Journal of Marriage and Family*, 72:828–846.

- Rampey, B. D., Keiper, S., Mohadjer, L., Krenzke, T., Li, J., Thornton, N., and Hogan, J. (2016). Highlights from the U.S. PIAAC Survey of Incarcerated Adults: Their skills, work experience, education, and training. NCES 2016-040. U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Roy, J. (2011). Impact of school finance reform on resource equalization and academic performance: Evidence from Michigan. *Education Finance and Policy*, 6(2):137–167.
- Rumberger, R., Addis, H., Allensworth, E., Balfanz, R., Bruch, J., Dillon, E., Duardo, D., Dynarski, M., Furgeson, J., Jayanthi, M., Newman-Gonchar, R., Place, K., and Tuttle, C. (2017). Preventing drop-out in secondary schools. Washington, DC: Institute of Education Sciences, U.S. Department of Education.
- Rumberger, R. W. (2011). *Dropping Out: Why Students Drop Out of High School and What Can Be Done About It*. Harvard Education Press, Cambridge, MA.
- Saez, E. and Zucman, G. (2019). *The Triumph of Injustice*. W. W. Norton Company, New York, NY.
- Savelyev, P. A. and Tan, K. T. K. (2019). Socioemotional skills, education, and health-related outcomes of high-ability individuals. *American Journal of Health Economics*, 5(2):250–280.
- Saw, G. K. (2019). Remedial Enrollment During the 1st Year of College, Institutional Transfer, and Degree Attainment. *Journal of Higher Education*, 90(2):298–321.
- Schoeni, R. F., Dow, W. H., Miller, W. D., and Pamuk, E. R. (2011). The economic value of improving the health of disadvantaged americans. *American Journal of Preventive Medicine*, 40:S67–72.
- Stephens, M. J. and Yang, D. Y. (2014). Compulsory education and the benefits of schooling. *American Economic Review*, 104:1777–1792.
- Trostel, P. A. (2010). The fiscal impacts of college attainment. *Research in Higher Education*, 51(2):220–247.
- Turner, L. J. (2016). The returns to higher education for marginal students: Evidence from Colorado welfare recipients. *Economics of Education Review*, 51.
- van Huellen, S. and Qin, D. (2019). Compulsory schooling and returns to education: A re-examination. *Econometrics*, 7(3).

- Vining, A. R. and Weimer, D. L. (2019). The value of high school graduation in the united states: Per-person shadow price estimates for use in cost-benefit analysis. *Administrative Sciences*, 9(81):1–15.
- Webber, D. A. (2014). The lifetime earnings premia of different majors: Correcting for selection based on cognitive, noncognitive, and unobserved factors. *Labour Economics*, 28:14–23.
- Woessmann, L. (2016). The economic case for education. *Education Economics*, 24(1):3–32.
- Zaiacova, A. and Lawrence, E. M. (2018). The relationship between education and health: Reducing disparities through a contextual approach. *Annual Review of Public Health*, 39:273–289.

Appendix

Table A1. Attainment: Delaware Adult Population
(Ages 25+)

	Total		White		African American		Hispanic		Other	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Female:										
HSD: <9th grade	10,920	3	6,980	3	3,570	5	1,070	5	340	2
HSD: 9th-12th grade	21,490	6	11,630	5	5,720	8	1,920	9	850	5
HSG (incl. GED)	104,580	31	69,800	30	22,870	32	7,060	33	5,110	30
Some college	67,930	20	46,530	20	12,860	18	4,280	20	3,920	23
Associate's degree	30,870	9	20,940	9	6,430	9	1,710	8	1,530	9
Bachelor's degree	61,810	18	44,200	19	12,150	17	3,210	15	3,060	18
Grad./prof. degree	45,030	13	32,570	14	7,860	11	2,140	10	2,210	13
Total	342,630	100	232,660	100	71,470	100	21,390	100	17,030	100
Male:										
HSD: <9th grade	12,490	4	8,460	4	2,940	5	1,150	5	470	3
HSD: 9th-12th grade	24,740	8	14,800	7	5,890	10	2,290	10	1,260	8
HSG (incl. GED)	98,560	32	65,550	31	20,020	34	7,800	34	4,870	31
Some college	58,030	19	38,060	18	10,600	18	4,360	19	2,990	19
Associate's degree	20,160	7	14,800	7	4,710	8	1,830	8	1,260	8
Bachelor's degree	55,670	18	40,180	19	8,240	14	3,210	14	2,830	18
Grad./Prof. degree	39,260	13	29,600	14	6,480	11	2,290	10	2,040	13
Total	308,910	100	211,460	100	58,890	100	22,930	100	15,720	100

Source: U.S. Census Bureau, 2018 5-Year American Community Survey.

Notes: High school graduate includes GED. Numbers rounded to 10.

Table A2. Predicted Attainment for Public School Cohorts (2019-)
(Percentages)

	HS Dropout	HS Graduate	Some College	BA Plus
Female:				
White	7	25	31	37
African American	16	36	25	23
Hispanic/Latino	16	41	20	23
Other	8	30	27	35
Male:				
White	10	31	28	31
African American	22	41	19	19
Hispanic/Latino	22	38	22	18
Other	10	36	25	29
Total	13	33	25	28

Sources: Table 1 and Appendix Table A1.

Table A3. Crime in Delaware and U.S.

	Delaware		U.S.
	Total Arrests	Rate per 100,000	Rate per 100,000
Violent crime	4,097	420	390
Murder/manslaughter	48	10	10
Forcible rape	338	40	40
Robbery	866	90	100
Aggravated assault	2,845	290	250
Property crime	22,481	2320	2360
Burglary	3,158	330	430
Larceny-theft	17,847	1850	1690
Motor vehicle theft	1,476	150	240

Source: FBI Uniform Crime Report, 2018 data, Table 4. Retrieved October 26 2019.

Notes: Annual arrest numbers and rates per 100,000 persons.

Table A4. Life-time Profiles by Education Level, Race and Gender

	Female				Male			
	White	African American	Hispanic	Other race group	White	African American	Hispanic	Other race group
Gross earnings								
HS dropout	\$206,770	\$202,590	\$209,720	\$228,890	\$546,250	\$291,160	\$552,880	\$422,680
HS graduate	\$470,100	\$412,660	\$410,230	\$432,140	\$939,530	\$582,750	\$801,960	\$709,860
Some college	\$582,110	\$551,820	\$553,570	\$542,830	\$1,059,450	\$751,020	\$931,600	\$848,460
BA+	\$1,046,330	\$1,014,630	\$919,840	\$1,022,310	\$1,870,950	\$1,305,250	\$1,577,610	\$1,753,520
State tax payments								
HS dropout	\$45,106	\$32,122	\$29,497	\$43,514	\$72,149	\$37,314	\$50,088	\$61,405
HS graduate	\$69,310	\$48,448	\$45,109	\$53,307	\$98,594	\$61,273	\$71,198	\$69,288
Some college	\$91,028	\$63,062	\$65,304	\$80,057	\$120,482	\$83,816	\$94,113	\$90,839
BA+	\$126,784	\$104,461	\$86,871	\$96,564	\$174,926	\$131,754	\$137,214	\$147,144
Federal tax payments								
HS dropout	\$41,242	\$37,448	\$29,777	\$39,717	\$69,088	\$48,120	\$59,279	\$73,424
HS graduate	\$82,638	\$71,167	\$64,042	\$92,159	\$133,802	\$97,148	\$111,033	\$100,239
Some college	\$123,086	\$105,090	\$98,005	\$113,848	\$175,566	\$129,575	\$145,684	\$175,739
BA+	\$226,665	\$222,046	\$203,700	\$223,920	\$318,599	\$244,028	\$292,261	\$318,205
Fiscal crime burdens								
HS dropout	\$11,290	\$11,290	\$11,290	\$11,290	\$120,400	\$147,536	\$135,440	\$135,440
HS graduate	\$4,368	\$4,368	\$4,368	\$4,368	\$38,144	\$42,176	\$42,176	\$41,168
Some college	\$2,554	\$2,554	\$2,554	\$2,554	\$23,104	\$23,104	\$21,088	\$21,088
BA+	\$1,092	\$1,092	\$1,092	\$1,092	\$9,032	\$9,032	\$9,032	\$9,032
Fiscal health burdens								
HS dropout	\$104,832	\$109,025	\$109,025	\$104,832	\$86,112	\$72,684	\$72,684	\$69,888
HS graduate	\$56,160	\$57,283	\$57,283	\$57,283	\$54,288	\$47,736	\$47,736	\$47,736
Some college	\$18,720	\$18,720	\$18,720	\$18,720	\$17,018	\$17,018	\$17,018	\$17,018
BA+	\$7,488	\$7,488	\$7,488	\$7,488	\$7,131	\$7,131	\$7,131	\$7,131
Welfare burdens								
HS dropout	\$17,556	\$26,334	\$26,334	\$17,556	\$10,534	\$15,800	\$15,800	\$10,534
HS graduate	\$15,708	\$22,176	\$22,176	\$15,708	\$9,425	\$13,306	\$13,306	\$9,425
Some college	\$10,164	\$12,936	\$12,936	\$10,164	\$6,098	\$7,762	\$7,762	\$6,098
BA+	\$3,234	\$6,468	\$6,468	\$3,234	\$1,940	\$3,881	\$3,881	\$1,940

Notes: Author calculations; see text for explanations and sources.

Table A5. Educational Interventions with Proven or Positive Effects

K-12 Path to Graduation:	Behavior:
Dual Enrollment Programs 9-12	Caring School Community (CSC) K-6
Accelerated Middle Schools 6-8	First Step to Success K-3
Check & Connect 9-12	Coping Power 4-5
ACT/SAT Test Preparation and Coaching Programs 10-12	Social Skills Training PK
Green Dot Public Schools 9-12	Positive Action K-6
Summer Counseling 12-PS	Too Good for Drugs and Violence (TGFD V) 9-12
Financial Incentives for Teen Parents to Stay in School 11-12	Fast Track: Elementary School K
Career Academies 9-12	Early Risers K-2
Achievement for Latinos through Academic Success (ALAS) 7-9	Functional Behavioral Assessment-based Interventions K-12
High School Redirection 9-12	The Incredible Years PK-2
Talent Search 11-12	Too Good for Drugs (TGFD) 3-6
Job Corps 11-12	Lessons in Character 4-5
National Guard Youth ChalleNGe Program 11-12	Too Good For Violence (TGFV) 3
Twelve Together 8	Facing History and Ourselves 8
	Building Decision Skills 12
	Connect with Kids

Source: Institute of Education Sciences, What Works Clearinghouse, retrieved October 26 2019, <https://ies.ed.gov/ncee/wwc/FWW>.

Table A6. Benefit-Cost Ratios: K-12 Interventions

Program name	Total Benefits	Costs	Benefit-Cost Ratio
Consultant teachers: Content-focused coaching	\$10,720	\$60	178.7
Tutoring: By peers	\$15,690	\$110	142.6
Professional development: Data use for instruction	\$14,300	\$110	130.0
Growth mindset interventions	\$3,690	\$40	92.3
Professional development: Induction/mentoring	\$5,680	\$80	71.0
Summer book programs: Multi-year intervention	\$15,290	\$220	69.5
Teacher performance pay programs	\$2,430	\$40	60.8
Consultant teachers: Online coaching	\$12,740	\$200	63.7
Literacy instruction: English language learners	\$10,980	\$300	36.6
Consultant teachers: Literacy Collaborative	\$26,640	\$750	35.5
Double-dose classes	\$16,730	\$490	34.1
Teacher professional development: Targeted	\$8,540	\$270	31.6
Consultant teachers: Coaching	\$6,570	\$260	25.3
Summer book programs: One-year intervention	\$1,960	\$80	24.5
Tutoring (non-certificated adults)	\$9,170	\$550	16.7
Tutoring (adults for English language learners)	\$15,580	\$1,450	10.7
Tutoring (certificated teachers)	\$15,140	\$1,440	10.5
Becoming a Man (BAM) with high-dosage tutoring	\$37,450	\$4,510	8.3
Computer-assisted instruction (struggling readers)	\$4,500	\$550	8.2
Reducing class size by 1 student in grade K	\$1,640	\$210	7.8
Summer book programs: One-year intervention	\$910	\$120	7.6
Project Lead The Way (PLTW)	\$13,870	\$1,790	7.7
Teacher professional development: Online, targeted	\$2,190	\$300	7.3
Out-of-school-time tutoring by adults	\$6,310	\$940	6.7
Tutoring: By adults, one-on-one, structured	\$14,640	\$2,350	6.2
Reducing class size by 1 student, grade 1	\$1,070	\$210	5.1
Parents as tutors with teacher oversight	\$4,150	\$810	5.1
Summer learning programs: Academically focused	\$5,820	\$1,160	5.0
Second Step	\$560	\$120	4.7
State/district early childhood education	\$33,460	\$7,220	4.6
First Step to Success	\$1,960	\$600	3.3
Reducing class size by 1 student, grade 2	\$630	\$210	3.0
Tutoring (adults, one-on-one, non-structured)	\$3,890	\$1,460	2.7
Reducing class size by 1 student, grade 3	\$490	\$210	2.3
Head Start	\$19,360	\$8,900	2.2
Becoming a Man (BAM)	\$4,350	\$2,010	2.2
Reducing class size by 1 student, grades 4-6	\$380	\$190	2.0
Reducing class size by 1 student, grades 9-12	\$330	\$170	1.9
Reducing class size by 1 student, grades 7-8	\$320	\$170	1.9
Tutoring: Supplemental educational services	\$2,690	\$1,680	1.6
Per-pupil expenditures: +10% grades K-12	\$11,420	\$11,000	1.0

Source: Washington State Institute for Public Policy, wsipp.wa.gov, retrieved November 15 2019. *Notes:* Only interventions with benefits greater than costs reported. Interventions are reported in present values from start of each intervention (discount rate 3.5%); 2019\$ rounded to \$10. Amounts are adjusted to Delaware dollars using Taylor-Fowler Education Wage Index (2006) at <https://nces.ed.gov/pubs2006/2006321.pdf>.

**The Economic Benefits of Increasing Educational Attainment of Public Schools in
Delaware**

Report finalised: March 12, 2020

A handwritten signature in black ink, appearing to read 'CRB' with a stylized flourish at the end.

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