The Economic Impact of Specialized Training and Internship Programs for High School Students: The Case for Alabama and the Alabama Data Scholars Program

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Executive Summary

Question for the paper:
- What is the overall economic impact of QuantHub's *Alabama Data Scholars* program?
- How can we measure wage increases for students who have engaged in the *Alabama Data Scholars* program?
- What are the benefits of Alabama Data Scholars taking jobs with one of the participating in-state corporations?
- How can the benefits be amplified by expanding the program to engage with more students?

Results of Research
- Expected future starting salary of participants after college graduation is $85,956 compared to forecast average Alabama salary of $47,826;
- Higher wages and greater labor-market engagement can create lifetime earnings advantages for participants of more than $2.3 million dollars;
- Substantial gains to employment and employability can translate into local and state fiscal impacts of between $600,000 and $800,000 per participant over their lifetime.
- Higher wages will increase tax revenue for the state of Alabama. Given Alabama's current tax code and brackets, we estimate that the lifetime fiscal benefit for the state of Alabama is between $39,626 and $46,390 per participant.
- Expected fiscal return on investment (ROI) for the state on the Alabama Data Scholars Program of between 7.53 and 8.82 times the investment made and between 6.5 and 9.5 times for a more robust version of the program.

1. What is QuantHub?

The State of Alabama has contracted with QuantHub, a data-focused digital learning program, for student and teacher licenses to be used in high schools across Alabama. Employing an adaptive "micro-learning" strategy, QuantHub's educational application provides high school students with age and curriculum-appropriate opportunities to learn, test, and reinforce their skills in data analytics, data sciences, and mathematics. In as little as five minutes per day, QuantHub's hands-on daily lessons and activities teach students new data skills and how to apply those skills in problem solving.

These vital data analysis and mathematical competencies are tested on the ACT and SAT. They are also some of the skills that top employers rank among the most valuable in their workforce. In fact, Forbes listed digital literacy and data literacy as the top two most in-demand skills for the next ten years.[3]

With a new grant from Innovate Alabama, in 2024 QuantHub, through the *Alabama Data Scholars* program (ADS), will be placing 25 students with corporations to complete 80 contact-hour internships[4] during the summer after their Junior or Senior years of high school. This placement process, which includes flexible scheduling and accommodations for both on-site and hybrid engagement, will ensure stratification for geography and representation from rural/underserved communities to provide access to advancement and enrichment opportunities.

2. Innovate Alabama and QuantHub: Economic Impact of Internship Program

Students engaging in high school internship programs have clearer career goals and more confidence upon entering the workforce.[5] Internships provide students with professional connections and real-world experience. They open opportunities for letters of recommendation that can be used for employment and college applications.[6] Further benefits of student internships include:

- Opportunity to implement classroom concepts in real work settings
- Professional growth and success
- Earnings boosts in first job
- Quicker job offers
- Acquisition of professional skills

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[3] https://www.forbes.com/sites/bernardmarr/2022/08/22/the-top-10-most-in-demand-skills-for-the-next-10-years/?sh=27019ee217be
[4] QuantHub is not just placing students in opportunities and expecting an outcome. Rather, QuantHub provides an intentional curriculum and enrichment program, integrating work and learning within a cohort experience
[5] Ricket, A. L., Yahn, J., & Bentley, E. (2023). Rural Community and Career Connected Learning: Impacts of High School Internships Prioritizing People and Place. *Journal of Research in Rural Education*, *39*(3).
[6] https://www.jraeducationalconsulting.com/blog/summer-internships-for-high-school-and-college-students

- Development of high-quality personal and work habits
- Increased confidence level
- Strong networking connections[7]

Supplementary STEM education for traditionally underrepresented students is a proven solution to shortfalls in secondary education. A program aimed at addressing the higher educational needs of at-risk high school students whose parents did not attend college resulted in those who took advanced mathematics courses enrolling in college at a rate of 75%, as compared to 44% of students who took mid-level math classes.[8] A study on university-run summer STEM programs for high school students through the National Science Foundation showed that participation in summer programs led to students being 1.8 times more likely to aspire to STEM careers.[9] While neither of these programs did precisely what QuantHub aims to accomplish, their successes demonstrate the efficacy of supplementary STEM education in both improving educational outcomes and increasing enthusiasm for in-demand career paths.

QuantHub's provision of internships for 25 students from diverse backgrounds and typically underrepresented populations provides two tangible benefits for participants: 1) an increase in the math and data skills associated with higher college enrollment and promising career goals, and 2) the technical and interpersonal skills associated with higher quality and higher paying jobs in data analytics and artificial intelligence.

2.1. Lifetime Earnings and Fiscal Impact

To our knowledge, there are few programs in the market that replicate QuantHub's innovative fusion of gamified data science education, cutting-edge AI technology, and enriching high school internship opportunities. As such, no research measuring the utility of precisely this type of educational intervention exists. The programs cited above point to the broadly positive effects of tech education and internships for high school and college students, but a clearer picture of the value of QuantHub's ADS project emerges via a mathematical projection of the program's long term economic impact. This projection demonstrates how investment in ADS today will benefit both students and Alabama's economy for years to come.

QuantHub tracks student engagement with its online learning resources. A student who meets standards, then independently works ahead, voluntarily engaging with more challenging material, is marked in QuantHub's system as "Inspired." As QuantHub implementation is expanded and its programming is updated and optimized, the number of Inspired students will increase. We argue that these Inspired students prove QuantHub's ability to spark a passion for data science in young learners. This newly-developed passion for data analytics and AI will result in many of QuantHub's alumni, especially the top performers selected for ADS, pursuing careers as data analysts, data scientists, and data engineers. Many of the students targeted for ADS participation are from historically underserved groups. The data science education provided by QuantHub will be a gateway to a once-inaccessible future, in some of the most

[7] Galbraith, D., & Mondal, S. (2020). The Potential Power of Internships and the Impact on Career Preparation. *Research in Higher Education Journal*, *38*.

[8] Choy, S. P., Horn, L. J., Nuñez, A. M., & Chen, X. (2000). Transition to college: What helps at-risk students and students whose parents did not attend college. *New directions for institutional research*, *2000*(107), 45-63.

[9] https://onlinelibrary.wiley.com/doi/epdf/10.1002/sce.21332

lucrative and in-demand careers available. QuantHub's proven ability to not only educate, but to motivate students to pursue data science is the basis of the following projection.

The earnings differential per participant is calculated using earnings data from the Bureau of Labor Statistics, labor force participation data from the US Census and the Federal Reserve Bank, and other labor market data from Alabama.[10] We project the earnings for QuantHub participants by assuming that this engagement will increase the likelihood of these participants graduating college and securing jobs in data analytics and artificial intelligence related fields.

We show 17 years of calculations for the difference in earnings and labor force participation rate between professionals in data-related fields and the average worker in Alabama in Table 1. The current average annual starting salary in Alabama is approximately $37,798[11] . The average starting salary for a person holding a data-related occupation (data analysts, data scientists, and data engineers) is approximately $67,932. Adjusting for annual wage inflation in Alabama,[12] in six years, the average starting salary for a 22-year old who has successfully enrolled in the Alabama Data Scholars program will be $85,956 compared to starting salary of $47,826 for their counterparts. We anticipate that when the Alabama Scholars Program participants finish college, their earnings differential over the average employee from Alabama will be more than $38,000. This earnings differential increases over time as data professionals further develop their specialized skills. An ADS student who began a career in data analytics upon graduating college could expect, by their mid 40s, to earn an average yearly income of $161,580, compared to an overall average income of $88,096. Assuming a best-case scenario with consistent employment and retirement at age 71, a QuantHub-trained data scientist could expect to out earn the average worker by over $2.3 million in their lifetime.

When we discount these differences and sum them over the expected lifetime of these participants to estimate the lifetime earnings advantage for the QuantHub program, the students will have a lifetime earnings impact[13] of between $792,521[14] and $927,807[15] per participant.

Higher wages will increase tax revenue for the state of Alabama. Given Alabama's current tax code and brackets, we estimate that the lifetime fiscal benefit for the state of Alabama is between $39,626 and $46,390 per participant.[16] We show the discounted lifetime earnings benefit and fiscal benefit of the QuantHub program in Table 2.

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[10] https://www.mtu.edu/engineering/outreach/welcome/salary/; https://www.bls.gov/mwe/; https://fred.stlouisfed.org/series/LES1252881500Q; https://www.atlantafed.org/chcs/wage-growth-tracker#Tab1'; https://www.dol.gov/agencies/wb/data/latest-annual-data/labor-force-participation-rates; https://www2.labor.alabama.gov/workforcedev/Alabama%20and%20Regional%20Data/Alabama/Education%20and%20Training%20Outlook.pdf;
[11] This is based on the weighted average of starting salaries by educational attainment. See https://finance.yahoo.com/news/entry-level-salary-every-state-140043966.html for salaries and https://wfalabama.org/assets/2020/12/Status-of-Women-in-AL-2020_WEB_READY_PAGES_11302020.pdf for educational attainment.
[12] https://www.bls.gov/regions/southeast/news-release/countyemploymentandwages_alabama.htm
[13] The impact is calculated as the present value of the difference between the 'but for' earnings of these participants and the earnings of each participant under the program.
[14] Under the assumption that 70% of the interns end up with jobs as data analysts, 20% take on jobs relating to data scientists, and 10% find jobs as data engineers,
[15] Under the assumption that 60% of the interns become data analysists, 25% become data scientists, and 15% become data engineers.
[16] https://www.revenue.alabama.gov/tax-types/individual-income-tax/

Considering that the state of Alabama is spending $131,500 on this program ($5,260 per participant for 25 participants) and the expected life-time fiscal impact is between $39,626 and $46,390, the fiscal return on investment (ROI) for this grant is between 7.53 and 8.82. That is, the state of Alabama can expect to receive between 7.5 and 9 times the return on the money spent through. We expect that the state would receive between 6.5 and 9.5 times the return on a more robust version of this program; long run fiscal returns to the state are an expected outcome of this program.

Table 1 Earnings Differentials for Alabama Data Scholars Participant Relative to Average Person from Alabama (Age 22 – 38)

AGE	A Labor Force Participation: Averages All Persons	B Earnings: Average Earnings Across Education	C Labor Force Participation: Educated Persons	D Earnings: Educated Person in Data-related occupations	(D - B) Delta	(C*D) - (A*B) Predicted Delta Given Labor Force Participation
22	0.6925	$47,826.53	0.6925	$85,956.41	$38,129.88	$26,404.94
23	0.6925	$49,739.59	0.6925	$89,394.67	$39,655.08	$27,461.14
24	0.6925	$53,465.08	0.6925	$96,036.69	$42,571.61	$29,480.84
25	0.6925	$56,934.97	0.6925	$102,211.85	$45,276.88	$31,354.24
26	0.814	$60,060.70	0.814	$107,761.95	$47,701.26	$38,828.82
27	0.814	$63,358.03	0.814	$113,613.43	$50,255.40	$40,907.89
28	0.814	$66,202.81	0.814	$118,646.50	$52,443.70	$42,689.17
29	0.814	$68,513.28	0.814	$122,716.08	$54,202.79	$44,121.07
30	0.814	$70,219.27	0.814	$125,698.08	$55,478.81	$45,159.75
31	0.814	$71,265.53	0.814	$127,495.56	$56,230.03	$45,771.24
32	0.814	$72,327.39	0.814	$129,318.75	$56,991.36	$46,390.97
33	0.814	$74,858.85	0.814	$133,844.90	$58,986.06	$48,014.65
34	0.814	$76,917.47	0.814	$137,525.64	$60,608.17	$49,335.05
35	0.814	$77,971.23	0.814	$140,207.39	$62,236.15	$50,660.23
36	0.8235	$79,039.44	0.8235	$142,941.43	$63,901.99	$52,623.29
37	0.8235	$80,122.28	0.8235	$145,728.79	$65,606.51	$54,026.96
38	0.8235	$81,219.96	0.8235	$148,570.50	$67,350.55	$55,463.17
39	0.8235	$82,235.21	0.8235	$150,501.92	$68,266.71	$56,217.64
40	0.8235	$83,263.15	0.8235	$152,458.44	$69,195.30	$56,982.33
41	0.8235	$84,208.18	0.8235	$154,240.68	$70,032.50	$57,671.76
42	0.8235	$85,163.95	0.8235	$156,043.76	$70,879.81	$58,369.52
43	0.8235	$86,130.56	0.8235	$157,867.91	$71,737.35	$59,075.71
44	0.8235	$87,108.14	0.8235	$159,713.38	$72,605.25	$59,790.42
45	0.8235	$88,096.82	0.8235	$161,580.43	$73,483.62	$60,513.76
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71	0.2695	$71,865.26	0.2695	$134,485.18	$62,619.92	16876.0678
TOTAL		$3,957,126.65		$7,316,270.12	$3,359,143.47	$2,364,935.22

Source: Author's calculations based on Bureau of Labor Statistics and US Census data on wages, earnings, and labor force participation.

Table 2 Estimated Lifetime Wage Benefit for Participants: **Alabama Data Scholars**

Total Impact	Number of Participants	Estimated Lifetime Wage Benefit per participant: Low	Estimated Lifetime Wage Benefit per participant: High	Total Impact: Low	Total Impact: High
Total Impact	25	$792,521	$927,807	$19,813,025	$23,195,175
Total Impact	Number of Participants	Estimated Lifetime State Fiscal Benefit per participant: Low	Estimated Lifetime State Fiscal Benefit per participant: High	Total Impact: Low	Total Impact: High
Total Impact	25	$39,626	$46,390	$990,650	$1,159,750

Although no high school educational initiative can force students to choose the career that they will pursue for the remainder of their lives, QuantHub aims to significantly increase the number of students who pursue data science by providing them with the beginnings of both an education in hard data analysis and an introduction to the real work experiences of date science professionals.

For the preliminary rollout of the ADS, which will serve 25 students, the total estimated impact on lifetime wage benefits is between $19 million and $23 million.

These projections do not account for students not selected for the internship, but nevertheless inspired to pursue data science by QuantHub's program. Also outside the bounds of this analysis are those who gain data analysis skills but put them to use in fields outside of the data sciences. It should be noted that education in data science has increasing potential applications beyond the traditional bounds of data professions. Entrepreneurial projects driven by a passion for AI, interdisciplinary academic research, increased college attendance, and increased confidence that can be leveraged in salary negotiations in any field are just a few of the potential additional benefits of this program that are more difficult to project. The specific benefits of shepherding students toward careers in data science through ADS should be considered on top of the overall economic value of education funding in general, which is supported by abundant research.[17] QuantHub's program will not only benefit the top 25 students who earn the ADS experience, but all of the students statewide who receive a cutting-edge data science education in high school.

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[17] Galbraith, D., & Mondal, S. (2020). The Potential Power of Internships and the Impact on Career Preparation. *Research in Higher Education Journal*, *38.*; Ricket, A. L., Yahn, J., & Bentley, E. (2023). Rural Community and Career Connected Learning: Impacts of High School Internships Prioritizing People and Place. *Journal of Research in Rural Education*, *39*(3).

2.2. Business Development and Education: A Nexus

An expansion of the ADS will contribute to the development of a well-educated working age population that appeals to employers and motivates the establishment of new business ventures in Alabama. The state is currently ranked 43rd in the country with respect to its educational attainment; only 28.8% of Alabama's population holds a bachelor's degree or higher. One of the best strategies for growing an economy is to educate its population.

Figure 1 Educational Attainment and Per Capita Personal Income (2023)

Educational Attainment and Per Capita Personal Income: By State (2022)

$$y = 23000 + 130000\,x$$
$$R^2 = 0.72$$
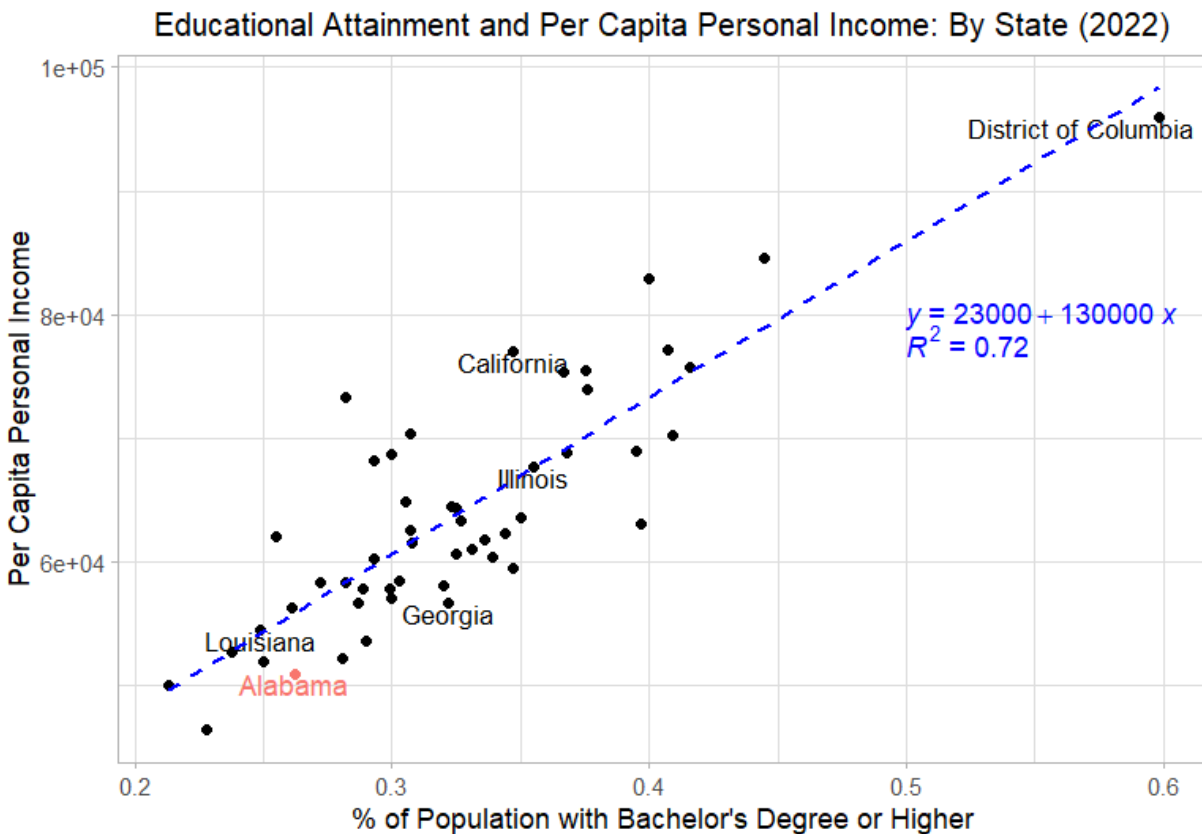
Source: Graph produced by author, data: Bureau of Labor Statistics, US Census Bureau, Bureau of Economic Analysis

Figure 1 shows the correlation (and corresponding line of best fit) between the percentage of each state's population with a bachelor's degree or higher and the state's per-capita-personal income.[18] The highly significant relationship between educational attainment and personal success stresses the importance of creating a highly-educated workforce to generate economic momentum within a state (and within municipalities within those states).

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[18] Personal income by state is one of the predominant economic metrics used to measure and compare the economic wellbeing of persons living in each state: https://www.bea.gov/data/income-saving/personal-income-by-state

Research on the nexus between education, the educated workforce, and business development has revealed the following:

- A more highly educated population and workforce is positively correlated with higher median earnings[19]
- A more highly educated population and workforce is positively correlated with higher per capita earnings[20]
- A better educated workforce is a more productive workforce[21]
- A talented workforce acts as a catalyst for attracting more capital for states and cities[22]
- A well-educated workforce attracts more business to the local economy, and creates opportunities for industrial diversification in rural Alabama counties[23]
- Programs linking businesses and the workforce increase innovation within a community and generate local economic growth[24]
- Higher educated students in Alabama were more likely to remain in Alabama if there were more, better paying jobs in Alabama[25]

Building a better-educated workforce through ADS and an expansion of QuantHub's licenses could increase Alabama's median household and per capita income, and promote new business innovation while providing momentum for growing Alabama's tax base by attracting new businesses. More businesses and better paying jobs could, in turn, decrease out-migration of educated workers.

2.3. Additional Benefits for Alabama

State spending on educational programs can have far-reaching economic implications. This report has shown that the expenditures associated with educational development, like the QuantHub program, have the potential to generate increases in economic output, employment, and government tax revenues. There are three distinct but interdependent impacts: a direct impact, an indirect impact, and an induced impact. First, there is a direct effect: the quantity of tax revenue and number of jobs directly linked to the initial expenditures. Second, there is an indirect impact: the revenue generated by either upstream or downstream firms that provide resources or services to the primary firm. Lastly, there is an induced effect that results from the employees, vendors, and upstream and downstream firms spending their wages.

The economic impact of QuantHub operating their data services for hundreds of schools and tens of thousands of students and teachers across Alabama is best understood based on this

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[19] Berger, N., & Fisher, P. (2013). A well-educated workforce is key to state prosperity. *Economic Policy Institute*, *22*(1), 1-14.
[20] See this research, Figure 1.
[21] See footnote 19
[22] Florida, R., & Mellander, C. (2015). *Talent, cities, and competitiveness* (pp. 34-53). Oxford University Press: Oxford, UK.
[23] Douglass, J., Edelstein, R., & Hoareau, C. (2011). A global talent magnet: How a San Francisco/Bay Area global higher education hub could advance California's comparative advantage in attracting international talent and further build US economic competitiveness.; https://escholarship.org/uc/item/3bm3s5m9
[24] Leon, N. (2008). Attract and connect: The 22@ Barcelona innovation district and the internationalization of Barcelona business. *Innovation: Management policy and practice*, *10*(2/3), 235-246.
[25] https://www.ache.edu/wp-content/Publications/Retain_AI_Rpt.pdf

tripartite construction. In one scenario, QuantHub invests an additional $131,500[26] to engage with local businesses to hire students for internships across the state. Some of that $131,500 is spent by QuantHub to hire a consulting group in Birmingham, AL to run a workshop to train 25 high school students in interviewing skills. This is a direct impact, creating wages for the consulting group. The consulting group books a conference room at a local hotel and has the event catered by a local restaurant. These are indirect impacts, as QuantHub's investment results, indirectly, in patronage of two local businesses. The wages from the employees at QuantHub, the consulting group, the hotel, and the caterer create additional economic activity throughout the community as all of these people spend more in the course of everyday life. This broad injection of resources into the community is an induced impact. This cascade effect distributes the original dollars spent on the program throughout the economy as it is continuously reinvested in local wages and businesses.

Table 3 Economic Impact of QuantHub Internship Program

Program	Number of Student Internships	Direct Spending	Direct Impact: Jobs	Total Jobs	Indirect & Induced Jobs	Total Output Created ($)	Total Wages Created[27] (Direct, Indirect, and Induced)
QuantHub Internship Program (2023)	25	$131,500	1.32	2.48	1.16	$235,424.35	$142,311.45

Source: Author's calculations using RIMS II multipliers and identify industry as belonging to Professional, Scientific, and Professional Services.

The economic impact of the first phase of ADS is modest. 2024's preliminary iteration of the program supports 1.32 direct jobs and creates an additional 1.16 full-time jobs within Alabama's economy. The total output generated is $235,424 and the total wages are $142,311. An expansion of this program to 2,500 ADS participants, however, will have a robust impact on the Birmingham metropolitan area and Alabama.

3. Conclusion

The QuantHub Internship Program provides direct and indirect benefits for Alabama's students and economy. The program could serve as a model for how educators and businesses can collaborate to create value for their communities. The benefits of the expansion of this program include:

- More than $3.3 million in lifetime nominal wage growth per participant;
- More than $770,000 in discounted lifetime wage benefits per participant;

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[26] This is the value of the grant provided to QuantHub by the state of Alabama.

[27] This number reflects the wages earned by persons directly and ancillarily supporting the QuantHub internship program and does not reflect the impact that the program has on the wages of QuantHub internship participants. Expected wage increases for QuantHub internship participants is discussed in Section 2.1.

- More than $39,000 in additional lifetime state tax revenue per participant.
- More than 7.5 times return on investment in state funds spent on the program.