

Addressing Substitute Teacher Shortages in Harrisonburg City Public Schools



Prepared for: Harrisonburg City Public Schools
Human Resources

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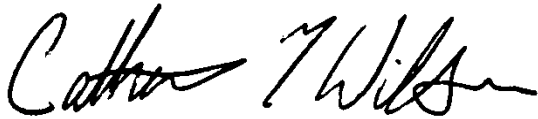
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Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

Honor Statement

On my honor as a student, I have neither given nor received unauthorized aid on this assignment.

A handwritten signature in black ink, appearing to read "Catherine Wilson". The signature is fluid and cursive, with the first name "Catherine" written in a more compact, stylized script and the last name "Wilson" written in a more legible, though still cursive, style.

Acknowledgements

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Executive Summary

Harrisonburg City Public Schools (HCPS), a public, K-12 school division in Harrisonburg, Virginia, has faced a substitute teacher shortage for several years. As of now, the average daily fill rate for substitute jobs in HCPS has decreased over 4 percentage points annually from 96% in SY16-17 to 69% in SY22-23. Many substitute teachers work fewer than 20 days out of the 180-day school year, and the majority of those substitutes work less than 10 days. Additionally, the number of unfilled positions has increased in the past several years while the number of filled jobs has decreased. The school division is currently on track to have a fill rate of less than 50% in the next 5 years.

One major cause of the issue stems from the Covid-19 pandemic-exacerbated teacher and substitute teacher shortages. Additionally, because the school division has recruited students from local colleges and universities to substitute, many new substitutes have limited schedules and cannot substitute for many days out of a given week. Substitutes who are being recruited and hired are likely not able to effectively address the shortage. Finally, because substitute teaching is a part-time position, substitutes may treat it as an additional source of income aside from another job, which occupies their time and does not allow them to substitute many days. Since there are multiple causes of this shortage, attempts to address one have been unsuccessful, and it is likely the shortage will either remain stagnant or get worse over time.

The current substitute teacher supply does not keep up with demand, and this leaves classrooms without adequate coverage, which negatively affects students' learning as well as can lead to faculty and staff burnout. The division has attempted to address this issue in the past several years by increasing substitute teacher pay, lowering requirements to be a substitute, and adding permanent substitute teachers in elementary schools, but the problem has not been resolved.

Some empirical evidence has shown that pay incentives and teacher mentorship programs have positive effects on teacher retention, which may translate into an incentive to work more days as a substitute. Additionally, some school divisions are implementing "permanent substitutes," who would be full-time employees assigned to a specific school and substitute daily at that location. HCPS currently has a few permanent substitutes in place in elementary schools.

I propose three alternatives to address the substitute teacher shortage:

1. An attendance bonus based on days worked,
2. Adding new substitutes to the existing new teacher mentorship program, and
3. Increasing the number of permanent substitutes in the school division.

All three are compared to the status quo, and are analyzed based on the criteria of effectiveness, cost, administrative and political feasibility, and cost-effectiveness.

Ultimately, I recommend HCPS adds an attendance bonus based on days worked, as it has the greatest effectiveness of the three, is a medium-cost option, is very feasible, and has a high cost-effectiveness ratio. Implementation of this bonus will begin when the budgeting process begins in October 2023, and the bonus will officially go into effect in fall 2024.

Introduction

Harrisonburg City Public Schools (HCPS) has faced a substitute teacher shortage for a number of years, which has negatively affected students, teachers, administrators, and Central Office Staff. The amount of sick, personal, and professional leave taken by teachers has increased, and while the number of new substitutes hired and trained has trended upward in recent years, the current substitute supply does not meet demand, leaving classrooms without teachers and students without an instructor. HCPS has tried to address the situation by increasing substitute teacher pay, lowering requirements to become a substitute, adding permanent substitutes to schools, and decreasing barriers to becoming a substitute like training and paying to apply, but the problem still persists.

One may wonder why the focus on substitute teacher shortages rather than teacher shortages themselves. While the general teacher shortage is a pressing issue and is a core issue at play, HCPS has reached a critically low job fill rate that must be addressed immediately. Addressing the substitute teacher shortage, while it will not completely solve the problem, will somewhat alleviate the issue and allow administrators in the division to address teacher shortages at large and implement other policies.

This report presents several options to be used to address the substitute teacher shortage in HCPS, which will buy some time for the division to determine and address underlying issues contributing to the teacher and substitute teacher shortages.

Problem Statement

The average daily fill rate for substitute jobs in Harrisonburg City Public Schools (HCPS) has decreased over 4 percentage points annually from 96% in the 2016-2017 school year to 69% in the 2022-2023 school year to-date. Current supply does not keep up with demand, and this leaves classrooms without adequate coverage, which negatively affects students' learning as well as can lead to faculty and staff burnout.

While HCPS has tried to address this in recent years by increasing substitute wages and increasing recruiting efforts at local colleges like James Madison University and Bridgewater College, average daily fill rate continues to drop, and strategies like increasing wages are becoming less feasible, due to finances. During the past seven years, HCPS has seen the average daily fill rate decrease by about 4.4 percentage points annually. If left unaddressed, we might see the fill rate decrease to less than 50% in the next five years.

Harrisonburg City Public Schools

HCPS is a public, K-12 school division located in Harrisonburg, Virginia. It includes one early learning center, six elementary schools, two middle schools, and one high school, with the construction of a second high school in progress. The division serves about 6,500 students, of which 51.5% are Hispanic or Latino, 31.6% are white, 9.9% are Black, 2.5% are Asian/Pacific Islander, 0.1% are Native Hawaiian or other Pacific Islander, and 4.4% are two or more races (*Harrisonburg City Public Schools - U.S. News Education*, n.d.). Over 40% of students are eligible for free or reduced-price lunch (WHSV Newsroom, 2022).

HCPS is committed to having a strong workforce who is able to effectively teach students. The “Operations and Professional Support” tenet of the HCPS Strategic Plan states that

“Each student will learn in a safe, up-to-date facility with a talented, diverse, and culturally competent staff supported with adequate fiscal resources” (*Strategic Plan 2020-2026 • Departments - Harrisonburg City Public Schools*, n.d.).

The Human Resources (HR) department specifically deals with hiring and training substitute teachers, while individual schools and their assistant principals handle substitute teaching assignments and management.

Problem Background

The average daily fill rate for jobs has decreased by an average of about 4.4 percentage points each school year since SY16-17, and is currently about 69%, as seen below in Figure 1. The downward trend was more gradual from SY16-17 to SY18-19, and it has been steeper in the years following the beginning of the Covid-19 pandemic in SY19-20. This is consistent with trends in the Commonwealth, as 86 of 131 school divisions had higher turnover rates after the pandemic than before, and the number of teaching vacancies has increased over 300% since before the pandemic (Cline, 2022).

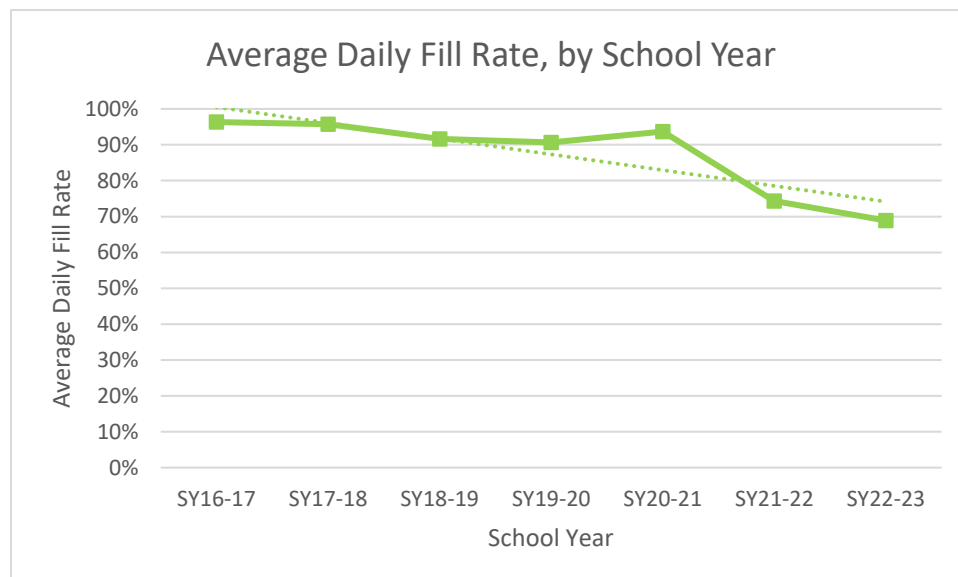


Figure 1: Average daily fill rate, by school year

Additional trends can be found within the HR data since the 2016-2017 school year and help to show the full scope of the problem HCPS is facing.

Currently, many substitute teachers do not work very many days during the school year. The most common day range that substitute teachers work has historically been between 2 and 5 days, followed by between 6 and 10 days since 2016 (Figure 2). This highlights the fact that it is presently and has historically been common for substitute teachers to work very few days out of the 180-day school year.

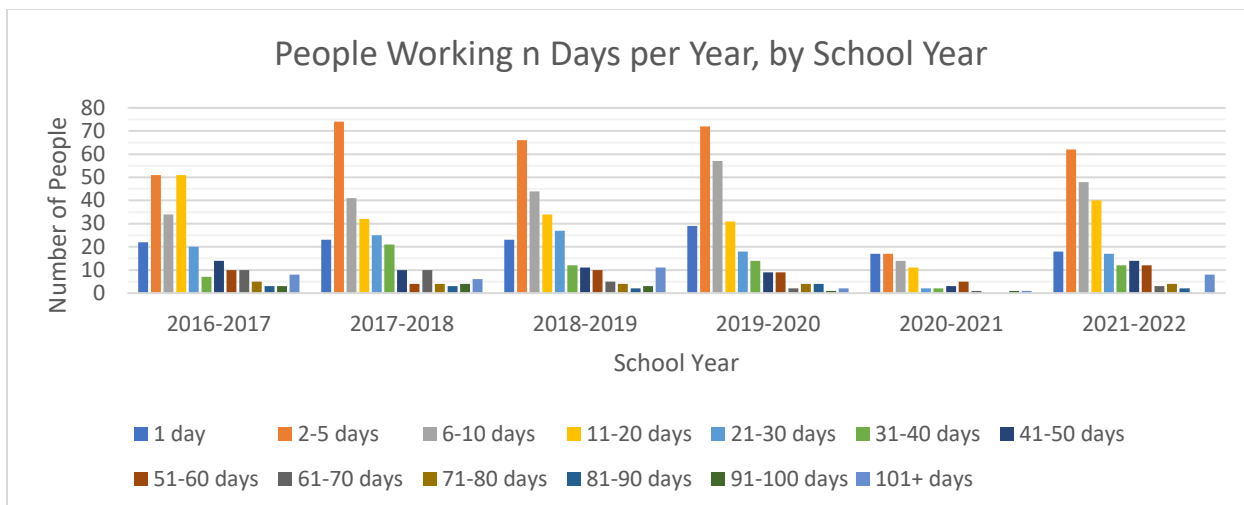


Figure 2: Number of substitute teachers who work a certain number of days per year by year since SY16-17

Additionally, the number of filled jobs has decreased while the number of filled jobs has increased, as shown below in Figure 3. Treating the 2020-2021 school year as an outlier because it was a virtual learning year, we can see that the number of filled positions has decreased from about 30 to less than 25 while the number of unfilled positions has increased from about 2 to about 20 between SY16-17 and SY22-23. This figure also highlights the spike in unfilled positions from less than 10 in SY19-20 to nearly 20 in SY21-22.

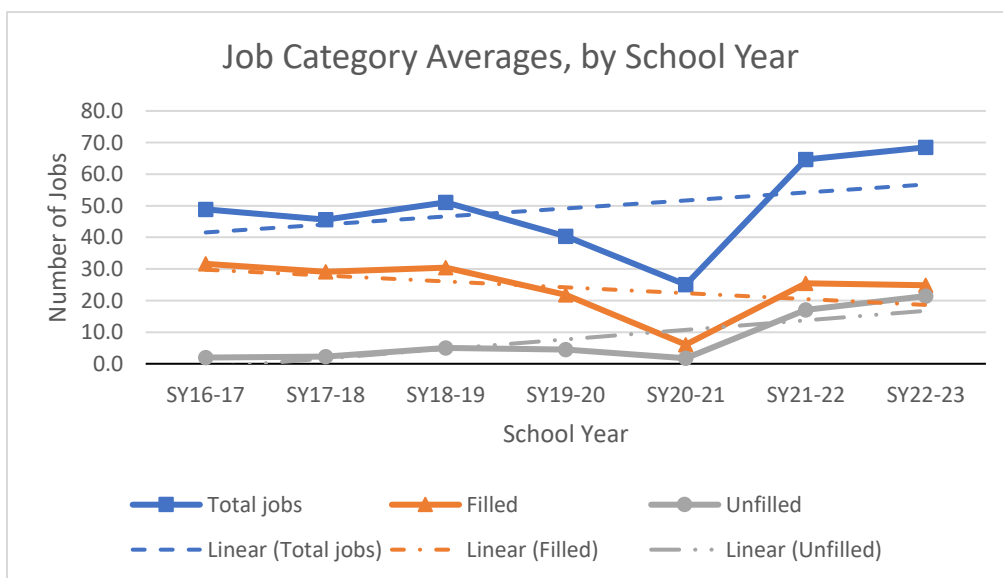


Figure 3: Average number of filled, not filled, and total jobs per day since SY16-17¹

¹ "No substitute required (NSR)" jobs, which include maintenance, cafeteria, clerical staff, etc. are excluded from the graph for clarity and visibility, but are not excluded from the number of total jobs. The number of NSR jobs has increased slightly since SY16-17.

As the problem is defined, the substitute teachers who are currently on payroll do not work enough days to cover all open positions daily, and this issue is getting worse. Some of the reasons for this include effects of the Covid-19 pandemic, college students on payroll having limited schedules, substitute teaching being a part-time job or an additional source of income, substitutes working in other school divisions or elsewhere, and the fact that people may simply not want to work at HCPS or with specific HCPS schools.

The Covid-19 pandemic affected the substitute shortage at HCPS and across the country. Teacher resignations and retirements spiked during and after the Covid-19 pandemic, which exacerbated teacher shortages, and the supply of substitute teachers could not keep up with the demand for them (Sainato, 2021). In HCPS, because fewer substitutes were hired during those years, online learning was in effect, and teaching was more taxing because of the risk of getting sick, teaching online, and learning how to teach during a pandemic. The pandemic added on to many of the existing factors that affected substitute teacher shortages, like low pay and a high-stress working environment (Heyward, 2021). Further, because substitute teaching is a part-time or on-call job, it may be that some people treat it as a part-time job or as an extra source of income in addition to another job rather than a standalone full-time job.

Additionally, HCPS has done a lot of substitute recruiting at local colleges and universities like James Madison University, Bridgewater College, and Eastern Mennonite University to bring more substitutes on board, but college students have limited schedules, and college classes frequently fall during the hours HCPS schools are in session, which prevents them from working as a substitute.

Substitute teachers who are on payroll may also be on payroll for other school divisions and choose to work elsewhere when jobs are open because of pay, workplace environment, and more. Possible competition comes from Rockingham, Shenandoah, Page, and Augusta County Public Schools, as well as Staunton City and Waynesboro Public Schools, which either border HCPS or are geographically close. Commuting to any of these locations would be approximately an hour or less, which some people might be willing to travel to take a job outside of Harrisonburg if pay is higher, workplace environment is better, or more. Additionally, people may not work because they simply do not want to work, rather than some type of situational or scheduling reason.

Previously, HCPS HR has undertaken efforts to combat this shortage including increasing pay, recruiting at local colleges, incentivizing retirees returning to substitute, adding more long-term substitutes, and adding pay incentives for teachers who cover empty classrooms. Despite these efforts, the problem persists.

One major change made about 2 to 3 years ago was decreasing the requirement to be a substitute from an associate degree or two years of college to a high school degree or GED. Other states and school districts across the US have done this, as well (Heyward, 2021). Because of this, their workforce has gotten younger in recent years, sparking some worries about teacher quality. US Secretary of Education Miguel Cardona has expressed his concern with lowering standards, saying “Our students need more now, not less ... I do not support lowering any standards for qualifications with teachers” (Olander, 2022). HR is concerned about the implications of this change as individuals who have just finished high school could feasibly teach their peers or people too close to their own age. HCPS is trying to combat this by placing

younger substitutes in elementary and middle schools, but a recent high school graduate being placed at the high school is within the realm of possibility.

Consequences of Substitute Teacher Shortages

Main consequences of the substitute teacher shortage include student learning loss, faculty and staff burnout, and exacerbating existing teacher and substitute teacher shortages.

It is estimated that teachers are absent about 5-10% of days out of the school year, which means that about 7 to 14 months of a child's learning time from kindergarten to 12th grade is spent with substitute teachers (Joseph et al., 2014; O'Connor, 2009). Because approximately 25% of jobs are not filled daily at HCPS, children are at risk to have an unqualified teacher, a teacher who does not teach that subject, or an administrator in their classroom for a significant portion of their learning career, which concerns educators, administrators, and policymakers as unqualified teachers could affect students' learning outcomes. This is especially concerning, given that the Covid-19 pandemic resulted in significant learning loss (*NAEP Long-Term Trend Assessment Results: Reading and Mathematics*, 2022; Rosenberg et al., 2021).

Further, vulnerable student populations within HCPS can be affected by a lack of substitute teachers. Over half of students are Hispanic or Latinx, and approximately 40% are English Language Learners (*Harrisonburg City Public Schools - U.S. News Education*, n.d.). Additionally, over 40% of students are eligible for free or reduced-price lunch (WHSV Newsroom, 2022). These vulnerable populations are especially at risk for negative outcomes.

Additionally, unfilled positions are currently being filled by other teachers during their planning blocks, administrators, and even by Central Office staff, which is burdensome to these individuals as they lose their break, planning block, or otherwise add another task to their day. This could lead to burnout as these individuals do extra work to cover classes and lose time to do their assigned job, and adds onto existing burnout caused by the Covid-19 pandemic and existing teacher shortages (Chang, 2009; Duncan, 2022; Liu, 2020; Pressley, 2021). Avoiding burnout is critical, as schools are already facing general teacher shortages, and burnout and attrition could exacerbate these shortages.

Evidence on Potential Solutions

Pay Incentives

Pay incentives come in many formats, such as wage increases, loan forgiveness, and bonuses. Teachers have said that a salary increase is an important factor in their decision to return to teaching, but teacher salaries are not competitive (Podolsky et al., 2019). Increases in wages have been successful in improving teacher turnover (Podolsky et al., 2019). Additionally, loan forgiveness has been successful in improving teacher retention and in keeping those teachers in-state (Feng & Sass, 2018). However, increasing pay in HCPS is not an extremely viable option, as HCPS has increased substitute teacher wages previously, and surrounding school divisions could also increase wages, which would make it difficult to compete with other divisions. Additionally, loan forgiveness is managed on the state and federal level and would be difficult for HCPS to implement a policy change. For these reasons, wage increases and loan forgiveness are not considered.

Adding a bonus or stipend has been successful in reducing turnover and increasing retention in some contexts. Adding stipends to teacher salaries in high-poverty areas has been shown to lower attrition rates.

In North Carolina, higher salaries in the form of bonuses helped reduce teacher turnover by about 17% in hard-to-staff subjects in high poverty schools (Podolsky et al., 2019). Bonuses, specifically, have shown some promise in improving retention. A 2016 study on teachers in Priority Schools in Tennessee which gave effective teachers a \$5,000 bonus—which was equivalent to an approximately 10% salary increase—increased retention rates by about 20% (Springer et al., 2016). In California, \$20,000 bonuses given to teachers who had acquired a National Board Certification are associated with teachers in high-needs schools remaining in those schools (Podolsky et al., 2019). A 2017 study found that retention bonuses of up to \$1,200 in Florida reduced the probability of exiting teaching by about 32%, which was statistically significant (Feng & Sass, 2018). A study on bonus use in the Talent Transfer Initiative in seven different states, which provided \$20,000 bonuses over two years, increased retention and transfer rates; however, attrition rates increased significantly after the program ended, suggesting bonuses are only effective as long as people continue receiving payments (Podolsky et al., 2019). While the effects on teacher retention are mixed, bonuses for acquiring board certifications help increase the proportion of teachers with those certifications (Cowan & Goldhaber, 2018). However, in that 2018 study, Cowan and Goldhaber determine that the increase in board-certified teachers was not correlated with an increase in student achievement (Cowan & Goldhaber, 2018).

Pay incentives have some positive benefits on teacher retention, which in this case may help to drive substitute teachers to work more days because they feel more valued, and these pay incentives may incentivize working HCPS more days rather than another division or another job. Since substitute teachers are part-time employees, a pay bonus will be smaller and will be based on an hourly or daily rate, rather than an annual salary.

Mentorship

Mentorship can also be a useful tool to help increase retention. Mentorship between new teachers, or in this case, substitutes, and veteran teachers or administrators can help decrease isolation, improve communication, and foster professional relationships between teachers which could lead to improved retention and a desire to work more at HCPS (Vierstraete, 2005). A small, qualitative study of 6 teachers in Canada helped to illuminate needed aspects of mentorship programs. Researchers found that all participants wanted some level of mentorship, whether formal or informal, and main tenets of a program included actively involved administrators, involvement of experienced teachers, opportunities for observation, and more (Whalen et al., 2019). Mentorship programs should be built with these in mind.

Mentorship helps to increase retention rates among teachers who participate.

A 2011 literature review of 15 different teacher mentorship and induction programs found they had positive effects on teacher retention, classroom instruction, and student achievement (Ingersoll & Strong, 2011). A 1992 study found that four years after teachers participated in a mentorship program, 96% of the 88% who were able to be located and surveyed

were still teaching (Odell & Ferraro, 1992). This program was fairly intensive, and included mentoring support on a weekly basis with veteran teachers who committed to providing support for two years (Odell & Ferraro, 1992). However, their overall attrition rate was about 4% compared to the national attrition rate of about 4.1% (Odell & Ferraro, 1992). While their attrition rate was lower, it does not show a significant decrease from the national one, and this may point to this mentoring program not being as effective as other solutions or not as effective given the time, resources, and effort put in. Additionally, this study was limited as they did not do thorough statistical analysis, so it is difficult to say if their results were statistically significant.

Current research on mentorship programs lends itself to showing that they are beneficial to teacher retention and can improve relationships between new teachers and current faculty. Teacher mentorship is a viable option for improving working conditions, integrating substitute teachers into the HCPS community, and could lend itself well to increasing the number of days worked by substitute teachers in the division.

Permanent Substitute Teachers

Permanent substitute teachers have been implemented as a means to address substitute teacher and teacher shortages in the US, as well as in HCPS. They are assigned to a specific school, report to that school daily to receive assignments, and can work in any classroom they are needed (Engle, 2019). Additionally, if there are no open positions for them on a school day, they can assist in other ways in the school, such as doing clerical tasks, assisting with lunchroom or playground supervision, and assisting in the library (Engle, 2019). In Everett Public Schools in Washington State, permanent substitutes are full-time, salaried employees with health benefits (Morton, 2022).

Nathan Roberts, a permanent substitute in Everett Public Schools, says, “Instead of trying to find a sub every single morning, or bringing in administration, I [a permanent substitute] can step in for the entire week and give those kids some consistency” (Morton, 2022).

Because they are a newer strategy than others, it is unclear what the exact effects of permanent substitute teachers are on student learning, faculty and staff burnout, and more. However, there is anecdotal evidence on their positive benefits on consistency for students and decreasing workload for faculty and staff (Morton, 2022). HCPS currently has one permanent substitute at each of the six elementary schools in the division, and they are full-time, salaried employees with benefits.

Criteria for Evaluation

All criteria will be measured on a scale of 1-5, with 1 being low, 3 being medium, and 5 being high, the exception being cost, in which 1 is high, 3 is medium, and 5 is low. In limited instances, a score of 0 is given for measures that result in a negative score.

Criteria are weighted based on their perceived importance to the problem and the school division. Effectiveness is weighted the highest, as the ability to address the problem is of utmost importance. Cost and cost-effectiveness are both included in the analysis because the bottom line for cost is important in terms of budgeting, and cost-effectiveness is important in order to try to

maximize the effectiveness per dollar spent. These criteria are weighted equally, but the weights are lower than effectiveness. Feasibility is weighted the lowest, not because it is insignificant, but because effectiveness, cost, and cost-effectiveness are more important.

Effectiveness

This criterion measures the extent to which the alternative solves the problem at hand, which is a decrease in average daily job fill rates. It will be measured as the difference between the projected average daily fill rate without the alternative and with the alternative. Total effectiveness is the sum of the effectiveness each year, and average annual effectiveness is equal to total effectiveness divided by 5 years. Average daily fill rate is calculated by dividing the number of unfilled jobs by total jobs available, multiplying this by 100, then subtracting the number from 100, and is written as a percent.² Effectiveness will be weighted 35%. Notes on effectiveness calculations can be found in Appendices A and C.

Cost

This criterion measures the cost of the alternative over the life of the program (5 years). This includes all monetary costs of alternatives and will include wages, the monetary value of non-wage benefits, cost of materials, advertising costs, and more. Cost will be measured in US dollars and is discounted annually. Cost will be weighted 25%. Notes on cost calculations can be found in Appendix B.

Feasibility

This criterion refers to the likelihood and ease of implementing an alternative. It will combine administrative and political feasibility. This will be a more qualitative criterion than the others, and it will factor in whether a current program exists, what would need to be changed, what kinds of data and activities need to be tracked and by whom, how much cross-department cooperation is needed, funding availability, the favorability of the alternative among faculty, staff and administrators. Feasibility will be given as a range between the two values for administrative and political feasibility to account for some error. Feasibility will be weighted 15%.

Cost-Effectiveness

This criterion measures the ratio of cost to effectiveness. It uses units of cost per units of effectiveness, which use the conclusions from the effectiveness and cost criteria and will be measured as dollars per 1 percentage point increase in average daily fill rate. Cost-effectiveness will be weighted 25%.

Alternatives

I offer three alternatives: adding an attendance bonus based on days worked, including new substitute teachers in the new teacher mentorship program, and increasing the number of permanent substitute teachers in the division. I also describe the current status quo if no alternative is pursued, which provides a baseline from which to compare alternatives. A fourth alternative, paying substitutes for attending professional development days, was considered;

² Fill rate = $[100 - ((\text{Unfilled jobs} / \text{Total jobs}) \times 100)]\%$ OR Fill rate = $[1 - (\text{Unfilled jobs} / \text{Total jobs})]$

however, there was little evidence on how this might affect fill rates, so it was not analyzed and pursued. More information on this alternative can be found in Appendix D.

Status Quo

The status quo is based on average daily fill rate data for the school division from SY16-17 to SY22-23. Data for SY22-23 is available through February 3rd, 2023, so it does not cover a full year of school, but the average daily fill rate for this year follows previous trends. Every year since SY16-17, the average daily fill rate has decreased by about 4.4 percentage points. We can expect the fill rate to continue based on present trends, so without intervention, the fill rate has the possibility to drop to under 50% in the next five years. However, HCPS has currently budgeted for 3 permanent substitutes in each elementary school and 1 in each middle school and the high school during SY23-24, which would increase the fill rate in the upcoming year. Assuming that the budget including these permanent substitutes is adopted in the coming months, this would cause an increase in the average daily fill rate of about 20 percentage points, but since underlying causes of the decrease in filled jobs and the increase in unfilled jobs are not addressed, we can still expect to see the average daily fill rate decrease annually by about 4.4 percentage points. This can be seen below in Figure 4.

Based on the assumption that these permanent substitutes will be included in SY23-24, the status quo is assumed to include them. Their inclusion does not change any of my analysis aside from the initial shift up and the ending fill rate at the end of 5 years for any given alternative.

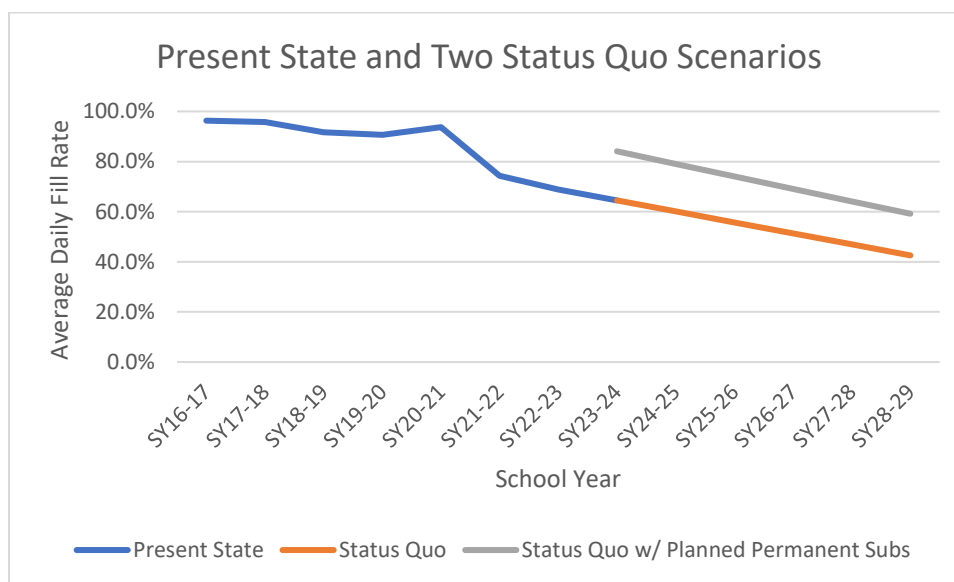


Figure 4: Average daily fill rate trend between SY16-17 and SY22-23, as well as projected average daily fill rates in the event that additional permanent substitutes are hired for SY23-24 or are not hired.

All projections are based on SY24-25, as the budget process has reached a point in which it is nearly impossible that an alternative would be implemented during SY23-24. Because of this, projections are based on anticipated fill rates in SY24-25.

Because the fill rate is expected to continue to decrease by about 4.4 percentage points while maintaining the status quo, **the effectiveness of the status quo ranks low/zero (0)**. While the recruitment of new substitutes would include costs such as travel, application, recruitment,

onboarding, and training costs, pursuing the status quo would not add any more costs to the substitute budget, so **the status quo is a low-cost (5) alternative**. However, it is also important to note here that while the status quo itself will not incur any additional costs, the permanent substitutes that are included in the SY23-24 budget will be a high cost to the school division. Since they are not an additional cost beyond what is budgeted, they are not included in the ranking. Because no major changes would take place, no further approval by school administrators and the school board would be necessary, and no additional resources beyond what is currently being used would be needed to implement the status quo, **administrative and political feasibility both rank high (5) for an overall feasibility score of high (5)**. Cost effectiveness will be \$0 for a decrease in average daily fill rate of 4.4 percentage points. While it is no cost, because it results in a decrease in fill rate, **cost-effectiveness for the status quo is low/zero (0)**.

Attendance Bonus Based on Days Worked

This alternative is based on evidence that pay incentives like bonuses can be successful in increasing teacher retention, and it aims to incentivize working more days during any given pay period. It will reward substitutes for working an increased number of days during a pay period, which lasts from the 15th of the month to the next. If a substitute works 5 consecutive or nonconsecutive days (one-quarter of the days) during a payroll period of 20 days, they will receive one additional day's pay as a bonus. This bonus is a nondiscretionary bonus, meaning it is included in the regular rate of pay, and the bonus amount will be \$105, which is the amount substitutes receive if they have completed two years of college (44 credit hours), completed high school, or have a GED (*Harrisonburg City Public Schools Job Description: Substitute Teacher and Teacher Assistant*, 2021; US Department of Labor, 2019). Substitutes will not receive a bonus for any additional days worked during a pay period and they will be eligible for another bonus at the beginning of the next pay period. Because it operates according to the payroll calendar, it will be paid out along with their normal wages when they receive paychecks. This bonus will be tracked, calculated, and disbursed by the Payroll and Benefits department of the school division.

Effectiveness: 4

There is limited information and research on how a bonus might affect on-call workers like substitutes, but there are some related studies that can help determine an approximate effect. A combination of financial incentives for attendance and monitoring reduced teacher absenteeism by about 21 percentage points in India in 2012 (Duflo et al., 2012). In the late 1980s, attendance bonuses in a New York school district reduced full-time teacher absences by about 2 days per year (Jacobson, 1989). This is only for the year, but it is important to note that these are teachers who are already working during the entire year, the majority of whom were only absent about 7 days out of the year (Jacobson, 1989). This was a decrease in absences of about 29 percentage points. Many teachers worked a couple extra days during their pay period of a full year, so it is our hope that substitute teachers would work just a few extra days during their pay period of a month because of this bonus. A study of American Express Financial Advisors found that a financial incentive increased the number of minutes advisors spent per phone call with clients by about 17% for a group that was already underperforming. This caused a convergence effect in which the underperforming group caught up to the higher performing

group (Hansen, 1997). We could see a similar convergence effect in substitute teachers, as those who do not work more than 5 days in a pay period start working more days and close the gap.

While there are incentive effects of bonuses, there can be disincentive effects as well. A 2021 study of retail stores in Germany found that an attendance bonus decreased attendance by about half a day per month on average (Alfitian et al., 2021). They discuss that this may have been due to a reduction in the psychological costs of absenteeism, the material consequences or by affecting the employee's connection with the employer (Alfitian et al., 2021).

Based on the estimates of decreases in absences of 21% and 28% in different studies, I estimate that a pay bonus could result in a 20% increase in jobs filled to be a bit more conservative.

The number of current average daily unfilled jobs is 21.4, of which 20% would be about 4 additional jobs filled per day, which would translate to 4 more people working any given day.

In order to account for the disincentive effects mentioned in the German retail store study, I estimate this bonus could cause between 3.5 and 4 more people to work any given day. To account for some error, these numbers are given as a low and high estimate. However, in order to account for the fact that not every single substitute will opt into this, and that the substitutes who opt in will likely not opt in every single pay period, I give an estimated take-up rate of 10% of the eligible substitutes who do not work more than 5 days per pay period. Additionally, I assume that the substitutes who buy in to the program will continue to buy in in future years, so the total number of substitutes will increase, but it will increase logarithmically. Additional information on how take-up rate was calculated can be found in Appendix B.

Each year, effectiveness is calculated as the increase in days worked (35 or 40 total during the year, or 3.5 or 4 per payroll period) times the number of substitutes who buy in (10% of those who work fewer than 5 days, or 10% of 211), then these are factored into the effectiveness equation, which can be found in Appendix A.

An increase of 3.5 jobs filled daily would translate into an average annual effectiveness of 13.8 percentage points compared to the status quo. Additionally, an increase of 4 jobs filled daily translates to an average of 15.7 percentage points compared to the status quo. However, this alternative does not completely overcome the downward trend in average daily fill rate. At the end of 5 years, the average daily fill rate will sit at about 77-83%.³ **Because of this, this alternative ranks medium-high (4) on effectiveness.**

Cost: 3

Cost will include wages and payroll costs including FICA and Medicare, among others. The wage rate will be \$105, which is the bonus amount for one person during one pay period, and the payroll cost is an additional 7.65% of wages tacked on. Considering the number of substitutes who opt in every year as well as the substitutes who were already working more than 5 days each pay period during the year, the total cost over the life of the program while discounting annually amounts to about \$438,000. Annually, this would be about \$87,000, so **this alternative ranks medium (3) on cost.**

³ If planned permanent substitutes are not added in SY23-24, the end point of this alternative will be about 57-63%.

Feasibility: 3-5

Administrative: 5

Substitutes already log their work in SmartFindExpress, the software HCPS uses for tracking workers, so this alternative would only require a payroll specialist to check which substitutes have worked more than 5 days during the pay period and process a pay bonus for them. This work could be done in the existing payroll software, and it does not require a substantial commitment from a payroll specialist to carry out. **This alternative ranks high (5) on administrative feasibility.**

Political: 3

This alternative could be a tough sell because substitute pay needs to stay under that of instructional assistants. If a substitute were to work all 180 days, which would cause them to receive the bonus every pay period, they would make \$20,850 (\$110 x 180 days + (\$105 x 10 payroll periods)). This would be above the salary for an instructional assistant in their first or second year (\$20,250 and \$20,521, respectively). Because of this, instructional assistant salaries would need to increase slightly as well, which would complicate the process and make it less popular. However, a substitute would need to work more than 176 days during the school year, which is highly unlikely, given that full-time teacher attendance rates put average attendance at 167 days out of the 180-day school year. Further, the bonus will be given to all substitute teachers who were already working more than 5 days per pay period, so it may face pushback from HCPS administrators, the school board, and city council because it would result in additional costs beyond just paying those who begin to work more than 5 days per pay period. Since staying under budget is necessary, additional costs that could put the division over budget would be a hurdle to overcome. Nevertheless, because of the way the hourly rate would shake out, this alternative would be less popular than others and could potentially require unanticipated costs of increasing other salaries. **Political feasibility for this alternative is medium (3).**

Cost-Effectiveness: 4

With an annual cost of about \$87,000 and an annual effectiveness of between 13.8 and 15.7 percentage points, the cost-effectiveness of a pay bonus is between \$5,600 and \$6,300 per percentage point increase in average daily fill rate. **This alternative ranks medium-high (4) on cost-effectiveness.**

Mentorship Program

This alternative is based on research showing that mentorship programs have been successful at increasing teacher retention and improving relationships between new teachers and current faculty. It also seeks to better integrate substitute teachers into the teaching community by connecting them with a current teacher mentor who supports and coaches newly hired substitute teachers. This in turn aims to help with their sense of belongingness, which will incentivize working more. This program would mimic the current teacher mentorship program that is in place at HCPS. This program will include both current and newly hired substitute teachers; however, it will not include retired teachers who have returned to substitute, as they have experience in the profession and/or the school division. Substitute teachers will be paired with a mentor who is a full-time teacher in the school division once they have worked 5 days

during the school year to ensure that only substitutes who are actively working, rather than substitutes who are not, are paired with teachers and participate in the mentorship program. There are currently 86 teacher mentors in the program. Pairings must meet at least once a week until the conclusion of the school year, and meetings must include a combination of in-classroom support and one-on-one meetings, in accordance with the Mentor Handbook (Harrisonburg City Public Schools Human Resources Department, 2017). Over the course of the year, meetings should include discussion of planning, preparation, classroom teaching strategies, orientation, resources for teachers, student discipline, and curriculum. Mentors must submit a mentor activity log after each meeting which includes the form of interaction, focus of the meeting, and time spent in the meeting in minutes. This form is included in the handbook and is also distributed to mentor teachers. Mentors will receive the same benefits from the current mentorship program, which are a \$350 stipend and one recertification point per hour spent mentoring a substitute teacher.

Effectiveness: 2

Studies by Ingersoll in the early 1990s suggest that the support provided in a mentorship program lowered the chance of beginner teachers quitting by 92% (Strong, 2005). A 1992 study of teachers in New Mexico found that 4 years after their mentored year, about 84% of the teachers were still teaching, which was 20 percentage points higher than the national retention rate (Strong, 2005). In the early 2000s, the TxBESS teacher mentoring program in Texas found a one-year retention rate of about 89% and a two-year retention rate of about 84%, compared to about 81% and 75% for non-mentored teachers (Strong, 2005). In 2002, an analysis of payroll data after the BTSA mentorship program in California found a four-year retention rate of 84%, 17 percentage points higher than the national rate of 67% (Strong, 2005). A 1999 study of the BTSA program found that BTSA teachers were retained at a rate of about 30 percentage points higher than their non-BTSA counterparts (Strong, 2005). These various studies show that mentorship programs have a variety of effects on retention, from about 8 percentage points to 30 between retention for mentored teachers and non-mentored teachers. If the effects of these different studies are averaged, we get an average of a little bit less than 20 percent.

Based on this, I assume that mentorship will have a 20% success rate at getting new substitute teachers to work more. In the case of this mentorship program, teacher-mentee pairings are expected to meet weekly for the school year for about 36 weeks (Harrisonburg City Public Schools Human Resources Department, 2017). If 20% of those meetings result in a substitute working one more day, we could expect substitutes to work about 7 more days per year. I also assume that new substitutes work an average number of days, which is about 5, since about half of substitutes work between 1 and 10 days during the school year.

Including new substitutes in the mentorship program could increase their days worked from 5 to about 12 each year.

In order to find how many substitutes will participate in this program, I assume that the substitutes who work the most days (40 or more days) are veteran substitutes or previously retired teachers, which leaves about 200 substitutes who worked fewer than 40 days. $\frac{3}{5}$ of this group worked between 5 and 40 days, so I assume that about $\frac{3}{5}$ of new substitute teachers will work more than 5 days in the school year. 157 new substitutes were hired in SY21-22, and,

assuming that approximately that many are hired each year, we could expect up to 94 new substitute teachers to participate in this program.

Based on this increase in days worked and this participation rate, the increase in average daily fill rate will be an average of about 4.7 percentage points annually, and the total effectiveness over 5 years will be about 23 percentage points. At the end of 5 years, we can expect the average daily fill rate to be about 64%.⁴ **Because of this, this alternative ranks medium-low (2) on effectiveness.**

Cost: 5

Costs of this program are very limited. Teacher mentors receive a stipend of \$350 annually when they act as a mentor. This year, there are 86 mentors in HCPS. If all mentors participated and mentored a substitute teacher, it would cost \$33,000 in the first year. Total cost over the life of the program while discounting annually is about \$150,000, or about \$30,000 annually, meaning that **mentorship is a low-cost (5) alternative.**

Feasibility: 2 - 4

Administrative: 2

Adding substitute teachers to the already-existing new teacher mentorship program would require very few additional resources including added labor, and capital resources. The current program is somewhat self-sustaining, as teacher pairings organize their own schedule with a mentee and there is little oversight required. Additionally, while meetings between mentors and mentees are supposed to include in-classroom support and one-on-one meetings, it is possible the latter could take place virtually. However, this could run into some administrative issues if a substitute teacher is placed with a teacher who is not at a school they often substitute at, or if a substitute does not work at the school in which the teacher they have been placed with teaches. Online methods of communication could mitigate this, but the disconnect still poses an issue within the program. Additionally, because about 94 substitutes might participate in this program, the current number of teacher mentors could double from 86 to 180, which would require more teacher mentors to participate, and it could be difficult to recruit this many additional mentors. **Because of this, mentorship ranks medium-low (2) on administrative feasibility.**

Political: 4

This alternative has the potential to be highly supported by the school division. However, because it has low effectiveness, it may not garner as much support as other alternatives proposed here since other alternatives have the potential to increase average daily fill rate more than mentorship. However, the current mentorship program is regarded very well by the school division, so this alternative should not face extreme opposition. Additionally, it is low-cost, so it will likely not face significant opposition from financial officer(s) in the school division and/or the school board. **Because of this, mentorship ranks medium-high (4) on political feasibility.**

⁴ If planned permanent substitutes are not added in SY23-24, the end point of this alternative will be about 44%.

Cost-Effectiveness: 4

With an average annual cost of about \$30,000 and an average annual effectiveness of about 4.7 percentage points, the cost-effectiveness of this alternative is about \$6,400 per percentage point increase in average daily fill rate. **This alternative ranks medium-high (4) on cost-effectiveness.**

Permanent Substitutes

Based on some evidence that permanent substitutes can successfully fill open jobs, this alternative aims to fill daily openings by increasing the number of permanent substitute teachers at schools. Additionally, because HCPS already has a few permanent substitutes in the division, and because they plan to add more in the upcoming school year, this alternative would increase the number of permanent substitutes rather than beginning to implement them. Permanent substitutes are hired and placed at a specific school for the entire school year, and they report to the school every day to check in with administrative and clerical staff to receive assignments for the day (Engle, 2019). These substitutes can fill in for a variety of reasons, including teachers leaving unexpectedly, extended medical leave, and general day-to-day absences. If no jobs are open on a given day, permanent substitutes can assist in other ways, like in the library, by distributing supplies, helping with lunch supervision, and in the front office (Engle, 2019). Their contract lasts for 180 days, and they will be paid \$19,800 per year, which is the current rate permanent substitutes are paid. Because they are full-time employees, they will receive non-wage benefits including medical, dental, and vision insurance, sick leave, and Virginia Retirement Service (VRS) options. Permanent substitutes have already been implemented in HCPS, as there is one in each of the six elementary schools and one at the Elon Rhodes Early Learning Center (ERELC). Further, current budget plans include adding one more to each elementary school, one to each of the two middle schools, and one in the high school. In this alternative, one more substitute will be added to each school in the division annually until the total at each elementary school is 2, at each middle school is 2, and at the high school is 5, or 9 total additional permanent substitutes over the course of phase-in. This will bring the total, considering the number of permanent substitutes before this alternative and those added in this alternative, to 22 permanent substitutes in the division.

Effectiveness: 3

This alternative is phased in, with 3 permanent substitutes being added the first year, followed by 3 more in year 2, and 1 more each year until year 5 for a total of 9 permanent substitutes added. Because there are about 2 positions open daily in each elementary school, 2 in each middle school, and 6 in the high school, substitutes will be added until they reach that number to fill in all jobs, with the elementary schools and middle schools receiving one extra. This aims to fill all positions daily, while accounting for some fluctuation day-to-day. Of course, there will be times of the year when there will be more absences, like flu season, in which case, more on-call substitutes would be called to fill in additional unfilled positions. In each year, it is assumed that permanent substitutes will attend school at the same rate as classroom teachers, which is about 92.5% of the school days, or 167 days.⁵

⁵ Teachers are absent for about 5-10% of school days; this is averaged to 7.5% (Joseph et al., 2014; O'Connor, 2009).

By placing permanent substitutes in schools, we might see an average daily fill rate increase annually of about 7.7 percentage points compared to the status quo and a total effectiveness over the life of the program of about 39 percentage points.

However, like a pay bonus, this alternative does not completely overcome the downward trend in the average daily fill rate. After the 5-year life of the program, the average daily fill rate will still sit at about 69%.⁶ The average annual effectiveness of this alternative is a bit higher than that of pay bonuses, but it ends at a lower final point, so it is a bit comparable overall. **This alternative ranks medium (3) on effectiveness.**

Cost: 1

Cost will include salaries and benefits for each additional permanent substitute. Beyond this, costs are negligible, as all other processes are conducted by salaried, rather than hourly employees, and all processes will be conducted using existing software and procedures. The salary for each permanent substitute is \$19,700 annually, and a benefits package amounts to a cost equal to 40% of their salary added on. The total cost over the life of the program while discounting annually is over \$870,000, or about \$175,000 annually, which is just under about one quarter of the current substitute budget. It would significantly increase costs, so **the cost of this alternative is very high (1).**

Feasibility: 3 - 4

Administrative: 3

This alternative adds a good deal of administrative work, especially in the first year, to create positions and hire people for 9 additional positions. However, because the program is currently in place, existing structures and processes can be used. Some difficulty is to be expected while implementing it in the middle schools and the high school, where there are currently no permanent substitutes. **This alternative ranks medium (3) for administrative feasibility.**

Political: 4

This alternative is very politically feasible, but it may still run into trouble. It not only will face limited pushback from faculty and administrators, but it has also been pushed for by the division. Because these substitutes fill in openings and allow teachers to regain planning blocks or lunch time, this is a very valuable alternative, and has great support in the division. One hold-up may be that the school board must approve all new hires and the addition of 9 more permanent substitutes, which brings the total in the school division up to 22, may cause some pushback, but due to the benefits of permanent substitutes, the school board will likely favor them as well. **This alternative ranks medium-high (4) on political feasibility.**

Cost-Effectiveness: 1

With an average annual cost of about \$175,000 and an average annual effectiveness of about 7.7 percentage points, the cost-effectiveness of adding additional permanent substitutes is

⁶ If planned permanent substitutes are not added in SY23-24, the end point of this alternative will be about 49%.

about \$22,700 per percentage point increase in average daily fill rate. **This alternative ranks low (1) on cost-effectiveness.**

Outcomes Matrix

	Effectiveness	Cost	Feasibility	Cost-Effectiveness	Total
Weight	35%	25%	15%	25%	
Current policy/ Status quo	0	5	5	0	2.25
Alternative 1: Pay bonus based on days worked	4 ~14-16 percentage points annually; 77- 83% end point	3 \$438,000 total	3 - 5	4 \$6,400- \$5,600	3.6 - 3.9
Alternative 2: Mentorship program	2 ~5 percentage points annually; 63% end point	5 \$138,000 total	2 - 4	4 \$6,400	3.15 - 3.55
Alternative 3: Adding permanent substitute teachers	3 ~8 percentage points annually; 69% end point	1 \$870,000 total	3 - 4	1 \$22,700	2 - 2.15

Recommendation

Based on my analysis, I recommend pursuing alternative 1, adding a pay bonus based on days worked per pay period.

It has medium effectiveness, but it has the highest estimated cost-effectiveness and medium cost, compared to the low cost-effectiveness and high cost of adding permanent substitutes. While adding new substitutes to the teacher mentorship program is the least costly, it also is slightly less feasible than the other two alternatives and is less effective.

My recommendation includes the planned substitutes for the 2023-2024 school year. They are already expected and budgeted for, but they alone will not solve the shortage. Implementing additional permanent substitutes in addition to the planned ones will be a much higher cost and will be less effective than implementing an attendance bonus in addition to the planned permanent substitutes in the upcoming school year.

While adding pay bonuses does not effectively reverse the course of the downward trend in average daily fill rate, it can slow the decrease and buy the school division some time to implement other policies to address full-time teacher shortages, or even make plans for implementing another alternative, like the other ones mentioned in this report. A pay bonus will result in the highest end point, followed by additional permanent substitutes, then the mentorship

program. The graph below (Figure 5) shows the projected effectiveness and end points for all alternatives.

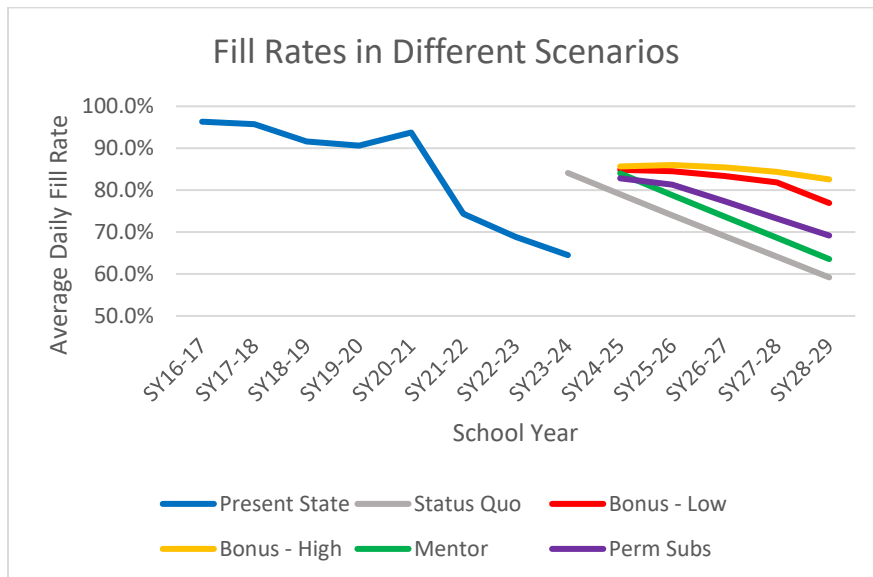


Figure 5: Average daily fill rate estimates in different scenarios including different alternatives.
 *Note: The x-axis begins at a 50% fill rate.

Implementation

Implementing attendance bonuses for substitute teachers will require many things to go right and many stakeholders to buy in and support the policy. The largest stakeholder threat to this alternative would be seen in those who control finances and budgeting, since a lack of or too few funds could result in complete dissolution of pay bonuses for substitutes. However, careful management and planning can help to combat these and ensure success of this policy.

Stakeholders

Management

HR oversees personnel in HCPS, including substitute teachers. They would be responsible for requesting funding for this alternative as well as advertising it to prospective and current substitute teachers.

Payroll specialists manage the payroll system and process paychecks for employees. They would be tasked with managing the payroll software and processing all bonuses, but they are already familiar with these processes.

Assistant principals oversee substitutes and their assignments at individual schools. They make calls to get substitutes to work on any given day. There is some room for breakdown here, as a negative is they could target specific substitutes who are not close to 5 days worked during a pay period in order to save money, or they might favor substitutes who work a lot of days—though the latter already happens since those subs have more experience and are favored.

Personnel

Substitute teachers would be the ones working and receiving bonuses and would choose whether or not to work additional days and receive the bonus.

Full-time teachers work with substitutes and interact with them in schools. It is possible they may push back against bonuses for substitutes since they themselves do not receive a bonus for attendance.

Financing

Fund managers will make requests for funding and manage specific funds, or line items, in the budget. In this case, HR would be the fund manager for this alternative.

The Chief Financial Officer will oversee the budgeting process and funding requests, as well as manages the budget approval and adoption process on behalf of the school division.

The HCPS School Board has the penultimate approval power of the budget, as well as decides how money will be spent within the school division.

Harrisonburg City Council has final approval power over the budget and determines how much total money the school division will receive, but it does not determine how money will be allocated or spent.

Next Steps

Overall, the goal will be to implement this in SY24-25. In order to do so, bonuses must be proposed in October 2023 during the budget process for SY24-25. Once the budget is approved by the division in November, it will be sent to the School Board for further approval. After this, the budget will be sent to the Harrisonburg City Council in April, then adopted in May. Immediately upon budget approval, HR should begin advertising the pay bonus to both current substitute teachers and prospective substitutes. This will be necessary both in the recruiting process and in order to see an effect of the bonus on daily fill rates during the school year. HR should also coordinate with the Payroll Division to ensure all employees are knowledgeable about the policy, the bonus itself, and processing the bonus for those who earn it. The pay bonus will officially go into effect in fall of SY24-25. The timeline can be seen below, in Figure 6.



Figure 6: Implementation timeline for attendance bonuses

What Could Go Wrong?

It is possible that this alternative does not receive funding from the school division, which would completely dismantle it. Additionally, it is possible this alternative receives less funding than is needed in order to see the effectiveness mentioned in the findings report. Making it clear to the school division and to the school that this alternative has the best effectiveness of the three proposed here, as well as it is medium cost and medium cost-effectiveness will be key to passage. It has a good chance for success, and should be pursued, as it can help address substitute teacher shortages and buy some time to continue addressing them and full-time teacher shortages.

It is also possible that far more substitutes buy in to the program than anticipated. While this may be a “good problem to have” since it would increase effectiveness greatly, it would also increase costs greatly, which would force a deficit in the substitute budget. Any overage in the sub budget would need to come out of another budget, or, in the worst-case scenario, stopping the bonus payouts. Some additional error may need to be built into the budget in order to account for this, which could make it more difficult to gather support, but in the event that fewer substitutes opt in than anticipated, the surplus could be used elsewhere in the budget. Additional information on whether or not current substitutes want a pay bonus will help to determine if buy-in will be much higher than originally planned. This will hopefully be added once the survey is complete.

As previously stated, main threats to this alternative lie in its financing, but with careful planning and efforts to gain support from various stakeholder groups, especially those managing finances, pay bonuses for substitute attendance will be successful in its implementation.

Conclusion

The substitute teacher shortage that HCPS currently faces has gotten worse in past years and will continue to do so. The downward trend in average daily fill rate, caused by the Covid-19 pandemic and other factors, shows no sign of reversal. Current strategies like increasing recruiting at local colleges and adding some permanent substitutes have been unsuccessful at fully reversing the shortage. If a successful policy is not implemented soon, it will continue have negative academic, mental, and emotional consequences for students, faculty, and staff in HCPS.

This report examined some possible causes of the shortage, presented evidence on solutions, and analyzed potential alternatives to address the current substitute teacher shortage. An attendance bonus for substitute teachers based on days worked is a better option than including new substitutes in the current mentorship program and increasing the number of permanent substitutes employed in the division.

While the recommended attendance bonus will potentially bring the average daily fill rate up to about 80%, it will not be able to completely solve the shortage and overcome the forces that are causing teacher shortages and increased unfilled jobs. It will, however, be able to buy the school division some time in order to find the underlying causes of these issues and address them. In the meantime, the substitute teachers who will be in the classroom will help to combat the staff burnout and learning loss caused by the shortage.

Appendices

Appendix A: Effectiveness Calculations

Status quo

Projections and trends are based on a simple linear regression analysis of data provided by HCPS. These projections are based on the trends seen in average daily total jobs, average daily unfilled jobs, and average daily fill rate in fill rate data provided by HCPS HR, which showed the daily fill rate for each workday from SY16-17 to SY22-23 to date which was February 3, 2023.

- Projected average daily total jobs: $71.0135 + (2.2578t)$, in which t is the year
- Projected average daily unfilled jobs: $24.4337 + (3.0147t)$, in which t is the year
- Projected average daily fill rate: $0.6450 - (0.0439t)$, in which t is the year

Fill rate equations

Due to a difference in the projected average daily fill rate according to trendlines and the projected average daily fill rate when using projected unfilled jobs and projected total jobs, each equation was zeroed out before full calculations were done to ensure there was no discrepancy in the fill rate equation which would cause an overestimation of effectiveness. Those equations are below, and are used for status quo as well as all three alternatives.

Year	Zeroed out equation
Year 0 (SY23-24)	$1 - (\text{Unfilled/Total}) - 0.01096$
Year 1 (SY24-25)	$1 - (\text{Unfilled/Total}) - 0.0257$
Year 2 (SY25-26)	$1 - (\text{Unfilled/Total}) - 0.04237$
Year 3 (SY26-27)	$1 - (\text{Unfilled/Total}) - 0.06079$
Year 4 (SY27-28)	$1 - (\text{Unfilled/Total}) - 0.0808$
Year 5 (SY 28-29)	$1 - (\text{Unfilled/Total}) - 0.10226$

Effectiveness

Effectiveness is calculated as the difference in projected average daily fill rate (status quo) and projected fill rate with an alternative, and it is measured in percentage points.

Effectiveness = $[100 - (\text{Projected average daily unfilled jobs} / \text{Projected average daily total jobs}) * 100] - [100 - (\text{Average daily unfilled jobs post-alternative} / \text{Projected average daily total jobs}) * 100]$

Average daily unfilled positions post-alternative = Projected average daily unfilled positions - Estimated increase in average daily jobs filled

Total effectiveness = Sum of effectiveness in years 1-5

Average effectiveness = Total effectiveness / 5 years

Appendix B: Cost Calculations

Discounting equation = $\text{Cost} / ((1 + \text{Social discount rate})^t)$, given that t is the year

Alternative 1: Pay bonuses

Assumptions:

- Bonus amount = \$105
- Payroll tax rate (FICA, Medicare, etc) = 7.65%
- Social discount rate = 3%
- Take-up rate = 10%

Number of substitutes who opt in = Take-up rate * Number of substitutes who were working fewer than 50 days per year (an average of 5 days per pay period) the year prior

Wages = Bonus amount * (Number of substitutes who opt in + Number of substitutes who were already working 50 or more days in the previous year) * 10 pay periods

Payroll taxes = Wages * Payroll tax rate

Total costs = Wages + Payroll taxes

Number of subs who work fewer than 5 days = The number of subs who worked fewer than 5 days the year prior – The number of substitutes who opted into the bonus in the last year

Year	Number of subs working less than 5 days	Take up rate	Number of subs who opt in
Year 1 (SY24-25)	211	0.1	22
Year 2 (SY25-26)	189	0.1	19
Year 3 (SY26-27)	170	0.1	17
Year 4 (SY27-28)	153	0.1	16
Year 5 (SY28-29)	137	0.1	14

Costs	SY24-25	SY25-26	SY26-27	SY27-28	SY28-29
Wages (\$)	53550	73500	91350	108150	122850
Payroll Taxes (\$)	4096.575	5622.75	6988.275	8273.475	9398.025

	SY24-25	SY25-26	SY26-27	SY27-28	SY28-29	Total Cost
	1	2	3	4	5	
Cost (\$)	57647	79123	98338	116423	132248	
Discounted Cost (\$)	55968	74581	89993	103441	114078	438,061

Alternative 2: Mentorship

Assumptions:

- Mentor stipend: \$350
- Number of new substitutes hired who participate: 94
- Number of mentors needed: 94
- Social discount rate: 3%

Mentorship stipend cost = Stipend * Number of mentors

Costs	SY24-25	SY25-26	SY26-27	SY27-28	SY28-29
Mentor stipend (\$)	32900	32900	32900	32900	32900

	SY24-25	SY25-26	SY26-27	SY27-28	SY28-29	Total cost
Cost (\$)	32900	32900	32900	32900	32900	
Discounted cost (\$)	31942	31011	30108	29231	28380	150,672

Alternative 3: Permanent substitutes

Assumptions:

- Permanent substitute salary: \$19,800/year
- Cost of benefits package: 40% of salary
- Payroll tax rate (FICA, Medicare, etc.) = 7.65%
- Social discount rate: 3%

Wages in year t = Permanent substitute salary * Number of total added permanent substitutes in year t

Cost of benefits package in year t = Wages in year t * 0.4

Payroll taxes in year t = Wages in year t * Payroll tax rate

Phase-in process

Number of total added permanent substitutes in year 1	3
Number of total added permanent substitutes in year 2	6
Number of total added permanent substitutes in year 3	7
Number of total added permanent substitutes in year 4	8
Number of total added permanent substitutes in year 5	9

Costs	Year 1	Year 2	Year 3	Year 4	Year 5
Total wages (\$)	59400	118800	138600	158400	178200
Cost of benefits package (\$)	23760	47520	55440	63360	71280
Payroll taxes (\$)	4544.1	9088.2	10602.9	12117.6	13632.3

	SY24-25	SY25-26	SY26-27	SY27-28	SY28-29	Total cost
Cost (\$)	87704	175408	204643	233878	263112	
Discounted cost (\$)	85150	165339	187277	207797	226963	872,526

Appendix C: Predicted Effectiveness

	Attendance bonus (Low estimate)	Attendance bonus (High estimate)	Mentorship	Permanent substitutes
Year 1 (SY24-25)	5.8	6.6	5.0	3.8
Year 2 (SY25-26)	10.5	12.0	4.8	7.3
Year 3 (SY26-27)	14.3	16.4	4.7	8.3
Year 4 (SY27-28)	17.7	20.3	4.5	9.1
Year 5 (SY28-29)	20.5	23.4	4.4	10.0
Total	68.8	78.7	23.3	38.5

Appendix D: Paying for Professional Development

One additional alternative was considered previously, but it was eliminated due to a lack of evidence supporting its effectiveness, which is critical to analysis of a policy. This alternative would pay substitute teachers for participating in PD opportunities that are available in the school division. Similar to mentorship, it is believed that participating in professional development could foster a better connection between the substitute and the school division, which could incentivize them to work more school days, but there was little evidence to support this. Additionally, the PD that would be included in this alternative would be less intensive than induction or mentorship programs that have been previously discussed, so it would not make sense to consider that research in an estimate of the effectiveness of paying substitutes for attending PD training.

It may have been fairly low-cost, as the only costs associated would be paying substitutes their hourly wage of just under \$15 or their daily wage of \$105, and there would be no further operational costs. Administrative and political feasibility would likely be medium-high to high, as it would include substitute teachers in an existing program, and existing payroll software would be used to process payment. Due to likely low costs, this alternative would likely have high political feasibility. However, it is not possible to determine a faithful estimate of effectiveness, as well as cost-effectiveness. Therefore, while this alternative may have some benefits, it is not possible to fully analyze it, and it was eliminated. With further analysis and exploration, it could be considered in the future, but at this time, it is not analyzed or advisable.

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