Survey Analysis of E-Cigarette and Volunteer Team Optimized Organization in High School in the Those to USA Based on Information Technology

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Abstract. E-cigarettes have become extremely popular among adolescents. Although much research has been conducted to find ways to reduce vaping, the results mostly recommend educating students about the detriments of doing so. However, in schools where students were well aware of the risks associated with vaping, the deans needed to take a different approach to combat the E-cigarette problem. One such school is Stuyvesant High School in New York - one of the best public schools in the state. We decided to survey its students to find the best way to reduce vaping in the aforementioned circumstances and that schools should clarify their policies on vaping and punish students, especially those who sell E-cigarette pods to other students. In addition to exploring the school's policy changes, we also helped student groups aimed at reducing vaping by showing a method they could use to determine the number and kind of members they need to incorporate into their club through an optimization model. The method suggests dividing potential members into different categories, represented by different variables and separated through their special skills. Then, make an intuitive assumption about the likely situation after the team is formed, such as the time committed by each member every week and the tasks that should be performed in a set amount of time. Estimate the amount of time and effort the task requires from each member with a different skill. This will plainly show the minimum number of members with the skills required to complete the task on time, thus forming one of the constraints in the optimization problems. After creating as many constraints as the situation requires, the problem solver can consolidate the constraints into a model, which can be entered into a program to find the solution.

Keywords: E-Cigarette · Survey Analysis · Volunteer Team Organization · High School

1 Introduction

E-cigarettes, also known as vapes, are a new form of nicotine delivering system that uses an electric device to produce vapors instead of traditional cigarette fumes. It was invented in 2003 but only entered the market in 2007 as a replacement for cigarettes

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for people trying to quit smoking [4]. However, E-cigarettes rapidly gained popularity among young adults as a new form of addiction. Its vapors, which do not have the pungent smell of cigarette fumes, make it very appealing to youngsters. Its advertisements also targeted the young adult population with themes in advertisements designed specifically to attract them: 68% of ads include themes of happiness, 41% friendship, and 24% sex [9].

As a result, E-cigarettes are especially prevalent among young adults. According to the CDC's report *Introduction, Conclusions, and Historical Background Relative to E-cigarettes* [8], e-cigarette use is more prevalent among people of age 18–24 than aged 25 and above.

E-cigarettes are very harmful to their users. According to a report by the National Academies of Sciences, Engineering, and Medicine [7], E-cigarette vapors contain a variety of potentially toxic substances. For example, it contains ariel, which could cause acute endothelial cell dysfunction, a type of coronary artery disease. In addition, E-cigarettes are more addictive than normal cigarettes. Researchers found that the nicotine dependence level among E-cigarette users is more than twice as high as traditional smokers [6].

As E-cigarettes grew in popularity, many schools found their students using these devices, and the number is growing at an alarming rate. In 2018, 20.8% of students use E-cigarettes [3]. According to a study in 2019, 27.5% of high school students and 10.5% of middle school students in the United States reported using E-cigarettes [2]. Similarly, according to the 2019 National Youth Tobacco Survey [1], 69.6% of students report noticing E-Cigarette use in school, with bathrooms and locker rooms being the most common locations, at 33.2%.

Currently, most schools combat the surge in E-cigarette use by educating their students. They inform students about the risks associated with vaping and attempt to persuade them from attempting to vape. However, in many schools, students are aware of these risks but still choose to use E-cigarettes despite the drawbacks. This paper studies methods school officials can take to reduce vaping in such an environment. It then aims to help student interest groups organize campaigns to reduce E-cigarette use at their school. Specifically, our contributions can be summarized as follows:

- We propose ways schools whose students were aware of the detrimental effects of vaping can further reduce the use of E-cigarettes.
- We present a method for students who desire to start a volunteer group about vaping to evaluate the number and kind of members their group requires.

In order to find a method that students looking to start an extracurricular group could employ to determine the number of people, we could use the military's recruitment model as a point of reference. Ample research was conducted to determine the best model for military recruitment, and the current method is an optimization model. The Planned Resource Optimization Model [5], for example, is a model used by the navy to recruit members. It accounts for factors such as advertising, enlistment bonuses, and education incentives to minimize the cost of recruiting.

We can also use optimization in the student organization problem because the situation is very similar to the military recruitment problem. The military recruitment problem

is designed to meet a certain recruitment goal while spending the least amount of money possible. The student extracurricular problem is aimed at meeting the goals of the club while recruiting the minimum possible members.

The rest of the paper will be organized as follows. In Sect. 1, we formulate the methods schools whose students are aware of the detrimental effects of vaping could use to reduce the use of E-cigarettes. In Sect. 2, we will indicate how student advocacy groups could use mathematical models to evaluate the members their group requires.

2 Survey Analysis of E-Cigarettes in High School and Recommendation for School Management

To combat the rise in student use of E-cigarettes, most schools chose to take the educative approach. They discourage students from using E-cigarettes by informing students about the detriments associated with them. In this section, we will explore how schools, where students are aware of the damage of E-cigarettes, could further reduce vaping among their students. We will first present how we gathered our data. Then, we will explain and analyze the implications of our results.

In order to research the use of e-cigarettes among teens, we used Stuyvesant High School of New York City as a sample. It was one of the best public high schools in New York and took many steps to ensure student knowledge of the detrimental effects of E-cigarettes. It incorporated the harm of vaping into its mandatory health curriculum and has many public information posters in its hallways. It fits our target demographic perfectly: a school whose students have adequate knowledge of the detrimental effects associated with E-cigarette use.

We gathered our data through a survey of the students. We posted the survey on the official school Facebook page and many of its smaller class-based social media groups. Students were assured about the anonymity of the survey and volunteered to answer the various questions in the study.

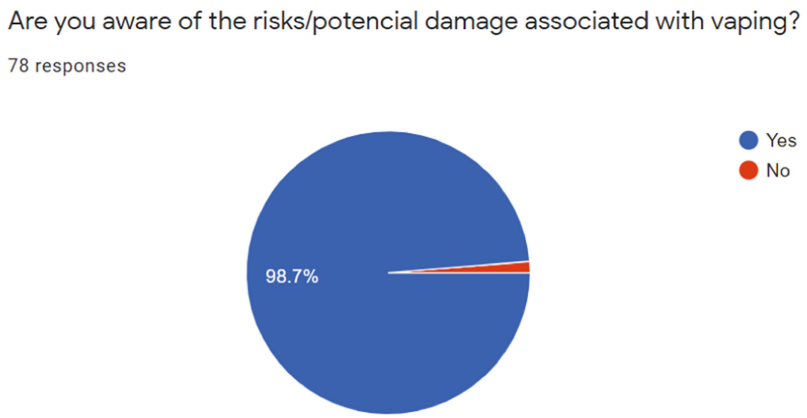

Fig. 1. Are you aware of the risk/potential damage associated with vaping?

The results of the survey agree with our assumption that the school has done a great job at informing students about the damage associated with vaping. As shown in Fig. 1, 98.7% of the students from the sample report that they are aware of the damage associated with vaping, with 69.8% of the students marking the public health announcements of the school as an important source of this information. Yet, despite this knowledge, vaping is still a significant issue in this school.

According to Fig. 2, 51.4% of the students report witnessing E-cigarette use more than twice a week, with 10% reflecting more than 10 times a week. Figure 3 reflects that 76.9% of the students have seen other students using or selling E-cigarettes, and 3.8% of the students report that they use E-cigarettes, with 7.1% who do not use E-cigarettes considering trying them in the future. The real percentage of students that vape can be

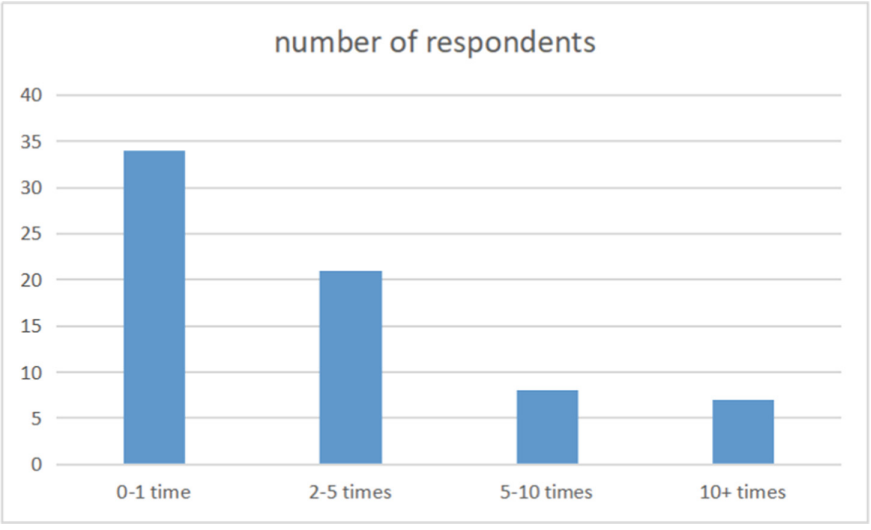

Fig. 2. How many times a week do you see someone vaping? (pre-COVID)

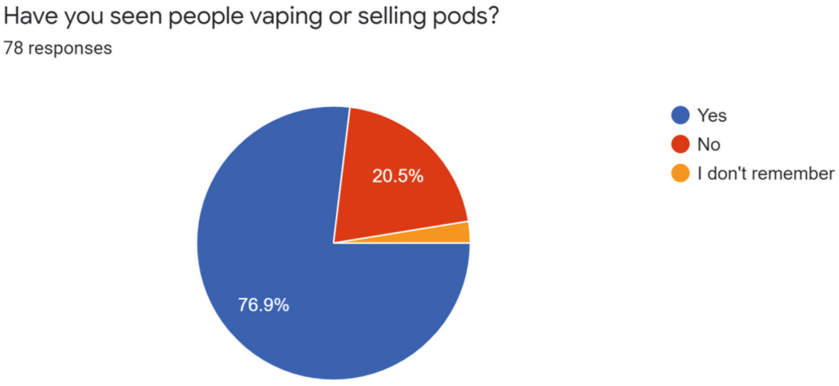

Fig. 3. Have you seen someone vaping or selling E-cigarette pods?

higher. In another question, 6.4% of the students chose the answer that only applies to students who vape. This makes the actual percentage of students who vape or are thinking about vaping 13.5% (Figs. 4 and 5).

Overall, the data shows that although the issue of vaping in the student population is less severe than the national average according to the National Youth Tobacco Survey (27.5%), there is still a significant portion of the student population who are engaged in vaping or plans on doing so in the future.

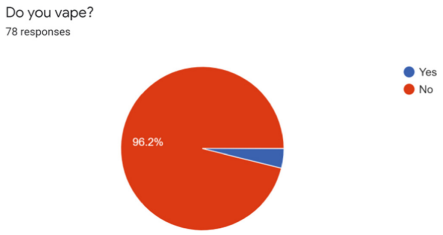

Fig. 4. (a) 3.8% of the respondents use E-cigarettes

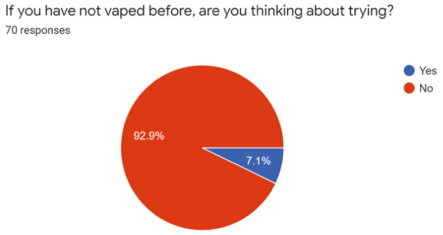

Fig. 5. 7.1% of nonusers are thinking about trying

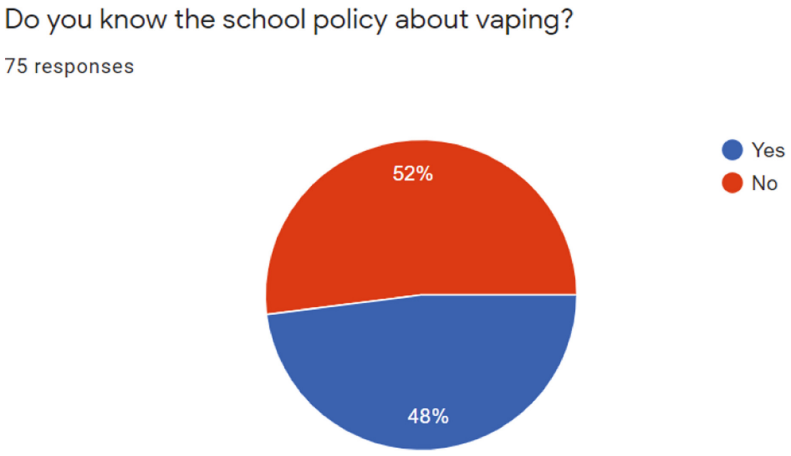

Fig. 6. Do you know the school policy about vaping?

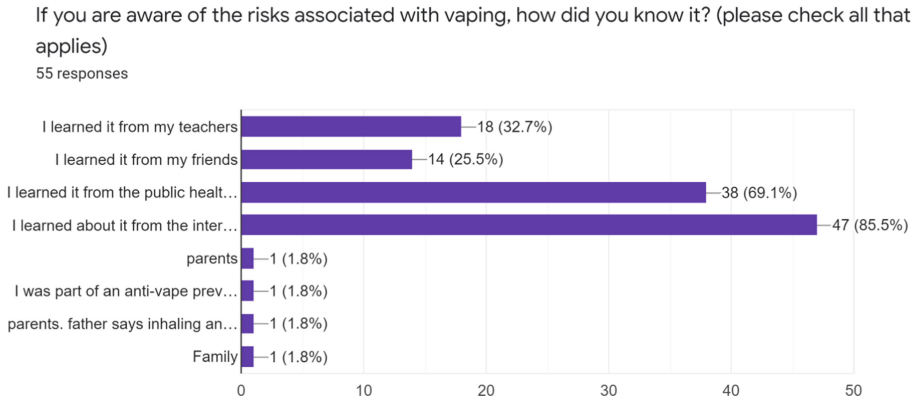

Fig. 7. If you are aware of the risks associated with vaping, how did you know it? (please check all that applies)

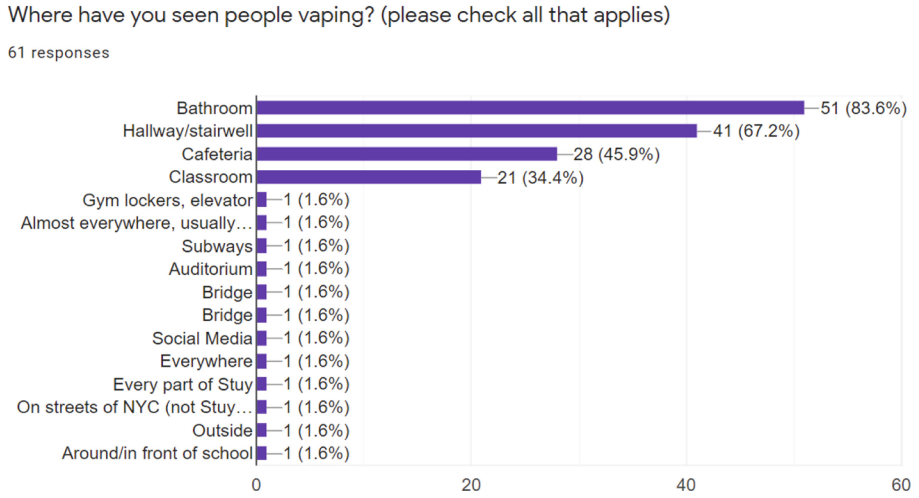

Fig. 8. Where have you seen people vaping? (Check all that applies)

The study also offers many significant clues about how schools could reduce E-cigarette use among students. Firstly, schools could make their stance against vaping clearer. According to Fig. 6, 52% of the respondents reflect that they do not know the school's policy about vaping, with only 1.4% of students reflecting that they do not use E-cigarettes because of the school policy. If the school can use the school website and public health posters in its hallways (according to Fig. 7, 85.5% and 69.1% states that these sources helped them learn about the risks associated with vaping, respectively), more students will be discouraged from vaping.

The school can also target several locations when advertising its policies. According to Fig. 8, 83.6% of the students report witnessing e-cigarette use in the bathrooms, 67.2%

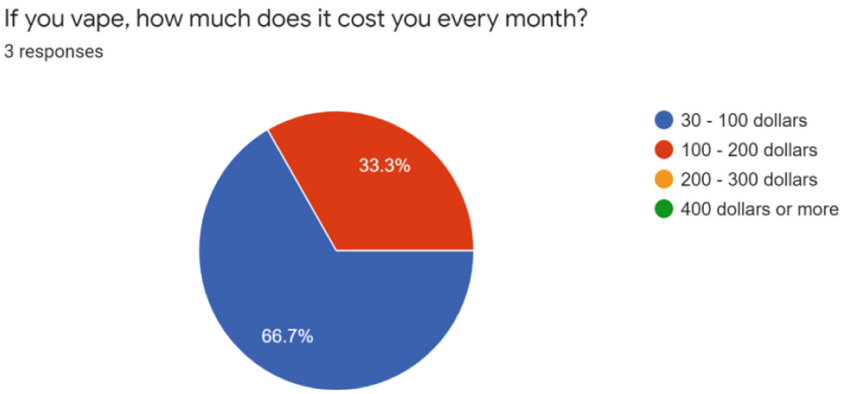

Fig. 9. If you vape, how much does it cost you every month?

in the hallways, and 45.9% in the cafeteria. If the school can focus its advertisements in these places, it can ensure most students who vape know these policies.

In addition to informing the student population, the school must also enforce its rules. According to the survey, two-thirds of the students who vape report obtaining E-cigarette pods from other students, and a majority of these deals occur in the restrooms. If the school could inform the students about its policies against vaping and enforce those rules, especially against those who sell illicit E-cigarette pods, it can effectively reduce vaping.

Another solution is that the school can ask parents and family members to help with reducing vaping among students. Some may think that parents can easily identify student vaping through tracking the students financially. However, it is not possible. According to Fig. 9, students spend between 30 to 200 dollars a month on vaping. This means that the average allowance, coupled with a fraction of the lunch money, is sufficient to cover the expenses of vaping. This makes it very difficult for parents to detect vaping through sheer finance alone, and the school should not encourage parents to do so. Instead, it can teach parents to identify electronic nicotine delivery systems in their child's possessions, which will be a more effective alternative to identifying e-cigarette use.

Even if parents observe student vaping, it must be noted that they shouldn't limit the child financially. According to the survey, only 2.8% of the students cite the cost of vaping as a factor that discourages them. This means, at least partially, that e-cigarette users may resort to other ways to obtain the money. This may be through illicit means, such as selling pods to other students. Thus, it is not desirable for parents to limit students financially to discourage vaping (Fig. 10).

Instead, family members should be encouraged to influence students against vaping. According to Fig. 9, the majority of students who vape cite family and friends as the most important reason that caused them to start using E-cigarettes. It is, then, only reasonable that family can also play a large part in helping students quit vaping. If the school could take actions such as informing the parents about the damage of E-cigarettes and asking them to identify and discourage electronic cigarette use, it could reduce the number of students who vape.

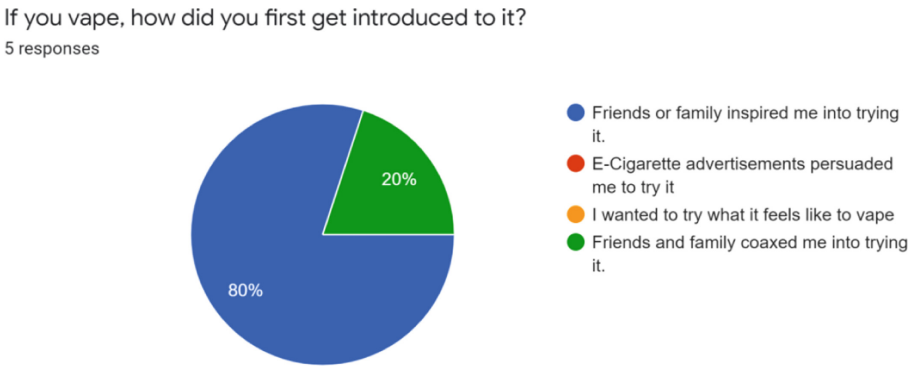

Fig. 10. If you vape, how did you get introduced to it?

3 Volunteer Team Optimized Organization Problem

As stated in contributions, this paper is aimed at aiding two populations, students and school officials, to reduce E-cigarette use in their school. In the first section, we suggested policy changes for schools. In this section, we will focus on student interest groups and how students looking to reduce vaping in school could determine the people their group required. We will recommend a method where students could determine the members their group requires. Then, we will use a fictitious model to illustrate our method.

To determine the number of people required, we will use the optimization method. This method is used to determine the least or greatest solution such that it meets a certain set of conditions. Therefore, the student must simplify their recruiting process into a series of conditions in order to find the optimal number of students they will need to start their group.

Firstly, the student looking to start their interest group will compile a list of actions they will take as a group. Then, the student must identify the different skill sets required in order to complete these actions. These skills will be marked as variable 1−k, with X1, X2, X3…Xk, for k for the number of students with these skills that the group needs.

With these variables, the student looking to start the club could set up different inequalities that describe these variables based on the situation. For example, a limit on the number of students in the group can be written as $X1 + X2 + X3\ldots + Xk \leq$ maximum number of students. Another constraint would be the goal of the model, which is to find the minimum number of students required to complete the project, which could be expressed as Min $X1 + X2 + X3\ldots Xk$.

After we have these variables, we can simply enter our equations into an excel spreadsheet and use it to find the optimal solution.

4 Experimental Analysis

To best recruit people in a public information project, students must first compile a list of actions they want to take to inform our community about the damage of vaping. In

this section, we will construct a fictitious scenario to demonstrate the method stated in the previous section.

In our example, we will construct a website that informs students about the damage of vaping and enlist a few students to disseminate this information to others. We need one volunteer with HTML skills to set up the website. The website will require a section that informs students about the definition of vaping, a mission statement that states our goal of reducing vaping among adolescents, a brief introduction to the history of vaping, and a section on the detrimental effects of using E-cigarettes. In addition, we also require two volunteers with public speaking skills to inform other students about the detriments of e-cigarette use.

To model this situation, we separate the potential volunteers into three categories. The first category consists of those with no special skills. They can do research and write our articles, but cannot do anything else. The second category is those who are good public speakers and also can write articles but cannot do anything more. The last category is made up of volunteers who are good at computer science. They can help us set up the website and can also write articles, but are not good at presenting our ideas to other students.

We also need to establish a timeframe for our work. We intend to complete the website within two weeks, and only after we have finished building our websites will we begin our presentation to other students, as we need our website as a jumping-off point for our presentation. We decide that researching and writing each part of our website will take two hours per person while setting up our website needs three hours of work. Finally, we do not want to require each member of our group to commit more than one hour per week, otherwise, the project will become too demanding. The information above could be summarized by the table in Table 1.

Lastly, to make the project more attractive, we will give volunteers monetary rewards. We will offer a 10 dollar incentive to people who do not have any special skills and 25 dollars to those who do, as they are harder to find. The total monetary reward should not exceed 150 dollars, as that is the maximum funding we want to put forth for the project.

Under these circumstances, we want to find the least number of people that will allow us to complete the project. In order to solve this problem, we decided to use

Table 1. Summary of tasks and requirements in our example.

Mission	People Required	Special Skill Required	Time required
Making a website	1	HTML Coding	3 h
Write mission statement	1	N.A	2 h
Write the history of vaping	1	N.A	2 h
Write the introduction of vaping	1	N.A	2 h
Write detriments of vaping	1	N.A	2 h
Propagating ideas	2	Public Speaking	1 h/person/week

	x1	x2	x3			
Goal	1	1	1	6		
Website	2	2	2	12	>=	11
Speaker		1		2	>=	2
Website Contructor			2	6	>=	3
Monetary	10	25	25	135	<=	150
	x1	x2	x3			
Solution	1	2	3			

Fig. 11. Excel page demonstrates the answer

integer programming, because the solution, or the number of people, must be an integer; and we want to find the least number of people required for the project.

To solve this problem, we first establish variables X1, X2, and X3, each representing members with no special skills, members apt at public speaking, and members good at computer science, respectively. Then, we describe each of our requirements in mathematical equations as followed:

- Recruit the least number of people possible: Min: X1 + X2 + X3
- Finish the website in two weeks, one hour per week per member: 2X3 > 3
- At least two members good at public speaking are needed: X2 > 2
- Write the articles on the website in two weeks, one hour per week per member: 2(X1 + X2 + X3) >= 11
- Monetary reward should not exceed 150 dollars: 10X1 + 25 (X2 + X3) <= 150
- The number of members for a certain category cannot be negative: x1, x2, x3 >= 0.

To find the optimal solution, we enter these equations into a Microsoft Excel Spreadsheet and use the solver program as a tool to solve our problem. Figure 11 demonstrates this process.

In the end, the optimal solution is that we require one student with no special skills, two with public speaking skills, and three with computer science skills.

5 Conclusion

In our research, we conducted a survey to study e-cigarette use in a school whose students have a good understanding of the risks associated with vaping. We analyzed the results and concluded that the school could further reduce vaping among its students by informing them about its policies, enforcing its rules against e-cigarette use, and reducing negative family influence on students. In addition to researching school policy, we also created a model that uses the optimization method to determine the number of members a student activist group will need to further its stance against vaping.

There are some flaws in our study that warrant further research. We conducted our study with data from one school. If additional research could gather data from an array of schools whose students have adequate knowledge about the detriments of vaping, the results will be more conclusive and generalizable to the whole population.

Another path of further research is how students could determine their activities before recruiting members. In our example of the recruitment optimization problem, we created a series of arbitrary tasks that the student must recruit volunteers to complete. Future researchers could strive to devise a way that helps student organizations design these tasks so that they could find the activities that best help to meet their goals.

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