

Optimization Within Chronic Absenteeism in The Detroit Public Schools Community District

Introduction:

Equal opportunity is something that is constantly preached in this nation. One of the greatest assets to address opportunity here is through education. And yes, everyone does have access to education. But to what extent is that education accessible and is the quality of that education equal everywhere? In my mind, the simple answer is no. I have always been fascinated by the education system in the United States. In less privileged areas the education system generally is not as accessible or as productive as in wealthier areas. Obviously, this makes sense in some ways - there is less funding, less desire to necessarily stay in school, less family and public resources, etc. However, I wondered what could be done to help improve upon this disparity. This led me to choosing to do my Capstone in the Public Service Focus Area with the Detroit Public School District.

In my first meeting with a member of the district, I was told skills in data analytics, programming, etc. would be useful for the district because they tend to lack staff with this kind of experience. Since this was the kind of skill set I was hoping to apply to this sector - it seemed like a perfect fit. Upon further discussions with staff, it was determined that a project with chronic absenteeism would be beneficial as there are a lot of new ideas and resources being looked into for it. Chronic absenteeism is as it sounds: repeated absences for a student to where it is affecting their overall education (greater than or equal to 10% of school days missed). The Detroit Public Community School District (DPCSD) is one of the nation's leaders in chronic absenteeism. The issue has only heightened with the arrival of Covid to our world three years ago, and with it the send-off of remote learning. Remote learning, though sometimes convenient, often requires more technological resources that primary education does not necessarily have the immediate funding to provide for its students. Furthermore, many students in these less privileged communities do not have access to the necessary technology to accommodate remote learning.

After it was determined that a project in utilizing data analytics and programming for chronic absenteeism in DPSCD could help, I began researching this issue in general. Wayne State University has actually done a lot of studies on this chronic absenteeism. They've looked into different variables that have a positive correlation with high absences. Some of this include socioeconomic status, parents work habits, ethnicity, distance from schools, etc. I was intrigued by all those different components and wanted to dig further as to what is causing this chronic absenteeism. This was a fairly exploratory project in the sense that I had the ability to talk to several people and choose how I could utilize my knowledge and skill sets and apply them towards some of the issues that were present in these districts.

Additionally, my interest in these issues had been piqued by some volunteering I had the opportunity to do at an afterschool center in Ann Arbor through CAN (Community Action Network) in the Winter 2022 semester. Here, I would play games with the kids, help them with their homework, and assist in other miscellaneous activities with them. Most of these children were not economically privileged, and I got to learn more about their lives and certain hardships that can sometimes be faced for kids living in this environment.

I had the opportunity to meet with different employees of the Detroit Public Schools Community District and with that came many perspectives on the state of the issue: what was causing it, and what solutions are currently available. There are many factors that could be leading to the lack of attendance in DPSCD. First being the notion that many of these families don't have a history of completing higher education and therefore do not feel a need for their children to. They may have gotten jobs without these degrees and thus find it more beneficial to just have their children start working earlier rather than continuing with education. At the end of the day, there is no clear cut answer to the exact cause of high chronic absenteeism rates in DPSCD. With that being said, one thing I thought really stood out when talking to staff in the district was the issue of transportation. If a student doesn't have a mode of transportation to get to school and they live too far to walk, then there is not much that can be done to get them to school. Oftentimes parents in these communities are trying to work and may be working hours that make it difficult to get their child to school. That is, assuming there is even a car or other modality to get the student to school. To further this, I learned that many people in general are moving out of Detroit, and with this comes closures of schools because there is less student demand and less staff supply. The biggest issue with this is that as schools then become more

spread out, it heightens the issue of getting to school as students now need to travel even further. As far as existing transportation goes in DPSCD, there is not a lot. There are some buses but they are few and far in-between. There are services for homeless students through the McKinney-Vento Act, and one school has begun a new service called pilot cars to pick-up students. Overall, though, there is not a uniform method of transportation across the whole district - it is a patch-work and difficult for parents to utilize

With this emphasis on transportation as a stresser in chronic absenteeism, I determined this was a sector that I wanted to focus on. In my coursework, I had experience in building efficiency problems that I believed could help solve this issue. In particular, I had practice in building an algorithm called “The traveling salesperson problem.” Essentially, this algorithm takes a set of locations that a “salesperson” would have to go to, and creates the fastest route that allows them to hit every spot in the least amount of total distance traveled. With a new concept recently being deployed at one school in the district, I felt a potential route method algorithm would be helpful to maximize the number of students that could be picked up in the most efficient manner. This algorithm can address the “how” to create a method to pick up kids in need.

Outline (Problems Addressed):

Why does DPCSD have such high chronic absenteeism?

-Detroit has high levels of poverty, which can make it difficult to get students to school. School is not always the number one priority in comparison to things like keeping children sheltered, fed, etc.

-The pandemic only heightened this issue with the start of remote learning. Remote learning required more technology (resources that may not exist in low-income areas) and sometimes less incentive to attend

What are some of the leading factors to such high chronic absenteeism rates?

-Ability to get students to school has caused a lot of chronic absenteeism. If there is no way for them to get to school, they simply cannot be there.

Why is transportation specifically such an issue?

-A lot of bus systems have been removed from the district

-Choice schools (where students go to school that is not as close but usually has better academics), thus furthering the distance that needs to be traveled

-People moving away from the general Detroit area, causing schools to close, and thus making the community (school-based off proximity) further for the students

-Some families may not have a vehicle to transport their children in

What are some of the existing solutions to help combat absenteeism in DPCSD?

-attendance agents are assigned to schools to help build relationships with families who are missing a lot of school and work to help incentivize and assist them in getting to school

-as of the last few months, a new system called pilot cars has been deployed at one school to test its success rate. Essentially the school-provided pilot cars are vans that will be used to pick up students who do not have other modes of transportation to get there.

What could help benefit and optimize transportation?

-utilizing a traveling salesperson algorithm (TSP). TSP takes a set of locations and produces the most efficient route to hit every location. This way, these cars can minimize the amount of time taken to pick up students and thus ideally increase the number of students they can get to school.

How can I as a student use engineering tools like TSP to help DPCSD?

-Having experience both building a traveling salesperson algorithm and with User Interface, I can build a prototype of how an efficient pilot car system can be built across the whole district.

-This prototype will demonstrate how an interface can be used by a parent of a child, how the traveling salesperson algorithm will produce a route each day, and ultimately get the student to school in an efficient manner!

Methods(acquiring data):

Upon several meetings with various members of the district, I was able to acquire attestations from people that had been in the district for years and seen a lot of changes from pre-covid, during covid, and this new post-covid world we are currently living in. This qualitative information I deemed useful to determine what areas of chronic absenteeism could be addressed given my skill sets. This is a large problem that has been going on for a long time, and one student's capstone project was not going to solve the problem overnight. With that being said, I wanted to pinpoint some research that could be beneficial for the district. Taking in the Wayne State Data that already existed, I didn't want to run a bunch of analytics that had already been done. I wanted to use those statistics that were already built, to help them influence the direction of my project. This ultimately brought me to focusing on utilizing existing transportation methods and making them more efficient and looking into adding alternate transportation modes to address the problem.

Once I decided that adding a TSP algorithm to help make pilot cars more efficient would likely be the direction of my project, I began working on building an algorithm. As I said, I had some experience with building a TSP algorithm before and the beauty of code and algorithms is that often times a lot of it can be reused for different applications if it used the same base ideology. Thus, I began fine-tuning an algorithm that I believed would be able to be utilized for the pilot cars in the school district. It should be noted that at this time, I was waiting to meet with an attendance agent to get some more details on how the pilot cars were currently being exploited. This meeting kept getting pushed back (to be discussed further in the conclusion section) and thus I continued to work on this algorithm without full knowledge.

One of the biggest difficulties I had when trying to build this TSP algorithms for DPCSD, was trying to make it user friendly. I once took a course that covered user interface and human computer interaction. This is very important in the programming world because technology is something that many people use but not something that many people are familiar with the building blocks of. The code I was writing made sense to me and others familiar with the type of code I was writing and the platform I was building it on. However, to someone whose specialty isn't in this field, it would be very difficult to use. I personally didn't have the experience or skill set to implement this algorithm in a more user friendly environment that could be used by the

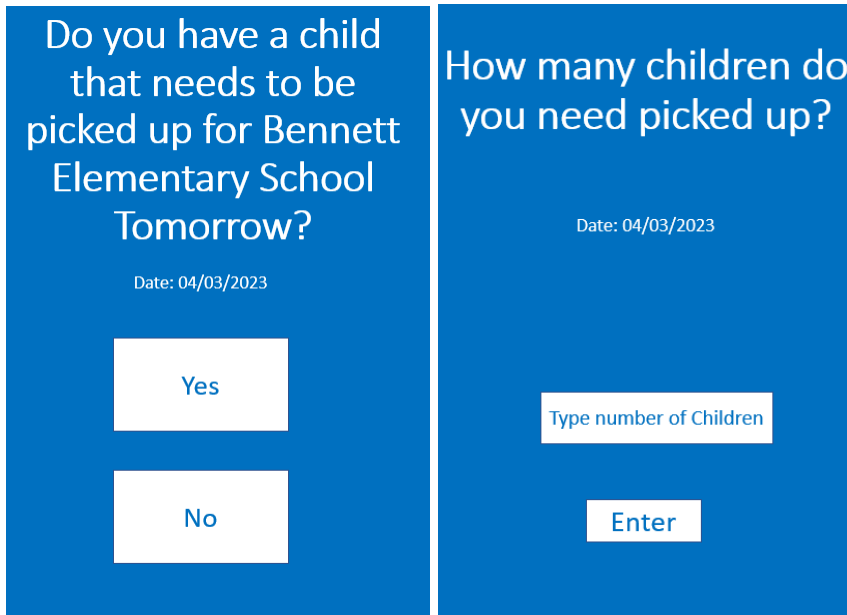
people trying to solve this chronic absenteeism issue. At this point I was a little stuck with the work I was doing and struggling to find a deliverable that I felt could actually be used by the Detroit Public School Community District.

At this point, I was finally able to meet with an attendance agent in the district. It was very insightful but the findings were a little different than I had anticipated. As previously mentioned, I was mostly interested in learning about the existing pilot car system to see how I could optimize it using the TSP algorithm. What I learned in turn, though, was that the pilot car concept was very new to the district. In fact, it was only just starting to get deployed and only at one school. At this point, I was even more unsure of how my TSP algorithm would be beneficial to the district if this pilot car concept was so new.

Upon further discussion, I decided (with the help of my advisor) that this project would turn more into developing a prototype of how tsp could be utilized for the pilot cars and how it would benefit the deployment of these pilot cars and ultimately help decrease absences in the district. This prototype would include the software used to gather information from the parents, run the traveling salesperson problem, and give an optimal route to a driver for a pilot car all in an orderly fashion.

Results:

I built a template of how an app, website, or other platform could be used to ask the parents whether or not their child would need to be picked up for school for the next day. The idea behind this is that the evening before every school day, a parent would get a notification on their smartphone, email, or whatever the district deems most effective. This way it is a day-to-day basis that guarantees a secure form of transportation for that given day. What the parent would see and have to answer can be seen below. It should be noted the second page only appears if the parent responds yes to the first question.

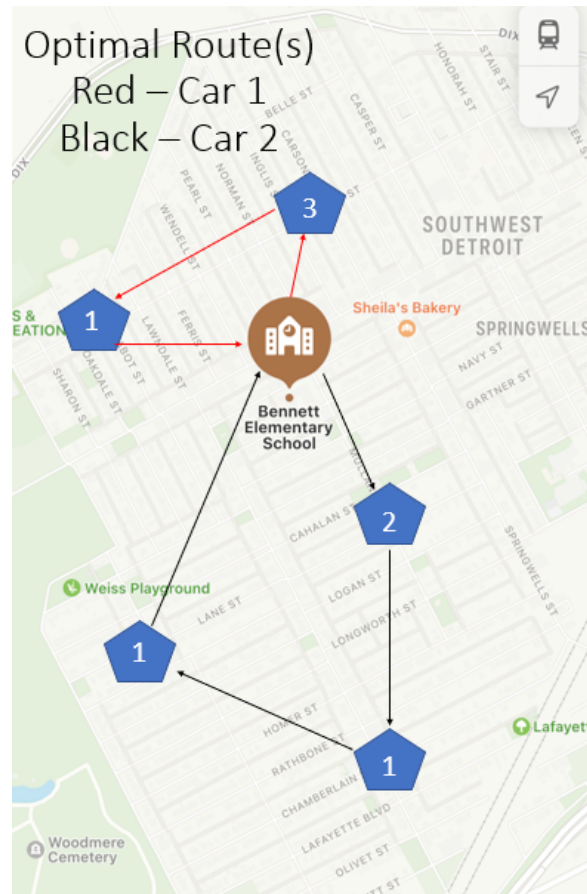
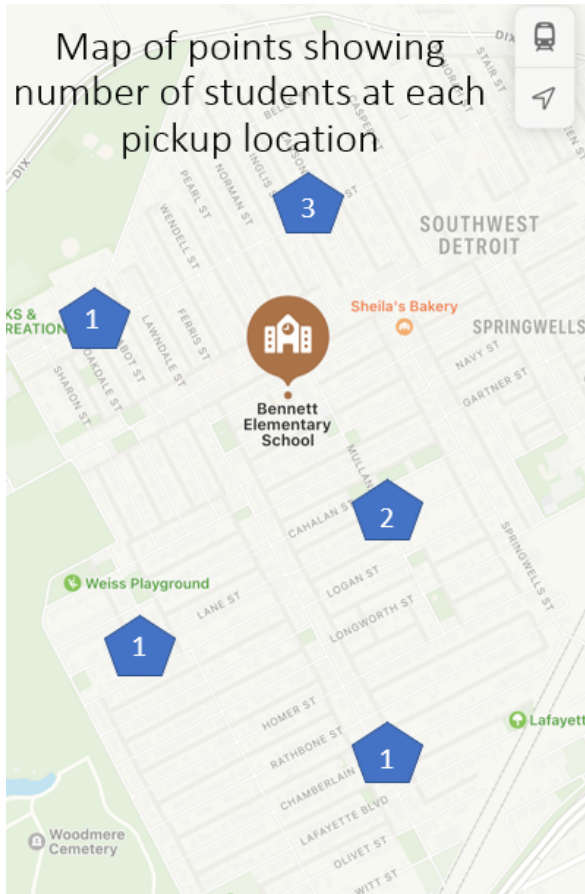


Once the parents have selected the number of kids they need picked up for the next stay at a given school, a database will read in this specific day information (number of students that need to be given a ride to school from a certain family /location). This database can be seen below.

Family Number	Family Address	Number of Students in family at School	Number of Students That Need to be picked up Tomorrow
Fam1	123 ABC Street Detroit, MI 48226	2	2
Fam2	594 ABC Street Detroit, MI 48226	1	1
Fam3	12 Fifth Ave Detroit, MI 48201	3	2
Fam4	36 Well Street Detroit, MI 48226	1	0

The data in black ink would be content throughout the year - with exceptions like students moving schools. The red data, though, is unique to that day and comes from the information filled out by the parents.

At this point, the TSP algorithm would be run given the stops that the pilot car would need to make and its starting point as well as ultimate destination (the school)! Below, demonstrates the map around the school of the different pickup stops (and within each hexagon represents the number of students that need to be picked up at each location). The second image displays the optimal routes using two pilot cars that can seat up to 4 children. Obviously, in practice the cars could be larger (probably passenger vans) and therefore suit more students utilizing available resources, but that is a decision the employees of the district can make once this is fully put into practice.



Once the optimal routes are created, the model will return back to a database that then shows the route stop (start and end point included as well), the number of students being picked up at each spot, and the estimated time of arrival at that pickup spot (this is something the TSP algorithm would handle). This is the visual that would be given to the driver to know when to leave, where to go, and to stay on-track time-wisely. This component can be seen below.

Stop Address	Number of Students being picked up at stop	Estimated Arrival Time
[Start point]	N/A	7:30 AM
594 ABC Street Detroit, MI 48226	1	7:41 AM
12 Fifth Ave Detroit, MI 48201	3	7:48 AM
[School]	N/A	7:53 AM

In addition to building the prototype, I built a survey to evaluate the effectiveness of this prototype and its ability to be implemented. This survey was sent along with the prototype to the district to get their feedback on it. An example of some of the questions asked, along with responses can be seen below:

How much do you agree that this would be useful for the parents?

 Copy

1 response



How much do you agree that this would help with student attendance?

 Copy

1 response



Discussion/Conclusion:

After completing the prototype for pilot cars in DPSCD, I recorded a demonstration of how the interface along with the interaction would work. It showed a lot of the interaction between the parent, the interface, the algorithm, and the pilot car driver. I created a form to send to the district to get feedback on the usefulness of this prototype and ability to implement. Overall consensus was that this is something that would be useful but how applicable it would be given the resources in the district and other factors involving chronic absenteeism is uncertain at this time. Again, the transportation aspect, though important, is just one small piece of this puzzle. This project helps identify a specific factor towards an issue and gave a potential solution. Whether DPSCD decides to implement this prototype or not, it will at least get them thinking about an idea and hopefully help them brainstorm solutions.

There were a lot of challenges that came with this project. Because of how much free reign I was given, sometimes I got caught trying to force certain things. I was trying to solve a sociology issue with straight engineering at first, which was not practical. I think incorporating engineering towards more sociology issues is important; however, it is not the straight-forward solution but more so a tool. You have to be able to understand the application of the engineering and respect the fact that there will be limitations to it - something I learned while working to apply the TSP to the issue of transportation. A prime example of this was when I realized I had to find a way to make the tsp applicable for people that don't work these kinds of algorithms on a day-to-day basis. Hence, the incorporation of User Interface and doing the app prototype. Another challenge I had while working on this project was communication to get proper data and qualitative information. From the start of this project, I definitely had a hard time finding contacts in DPSCD and then ultimately, scheduling meetings when I needed information. At the end of the day, the staff in these districts are very busy and although very respectful of me and my research, I learned I would have to be the one who took more of an initiative in scheduling meetings and being explicit about what I needed from them. I learned that being persistent but respectful worked best in communication with them. With all that being said, I'd like to thank those in DPSCD who took time out of their day to help me build this project and those on the Honors Staff that helped me get into contact with the district! I hope future work can be done on this project to fully incorporate these tools in the district!