***PASSION PROJECT FINAL PROPOSAL***

*The Math of Air Pollution*

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**Areas of study:** Mathematics & Environmental Science

**Supervisor:** Ge Qu

**Research Focus and Goal for Project:**

My goal for this passion project is to investigate on the application of mathematics in meteorology (air pollution in specific), and a mathematical model will be created. As I am writing this proposal, I am sitting in a room filled with PM2.5. As we can see, air pollution has been a serious problem in China for a long time since 2013, damaging the environment and meanwhile torturing every Chinese citizen physically and mentally. I have always been wondering about what causes the air pollution, and want to find some trend in the air pollution. Also, I am really passionate about mathematics and interested in its application. I believe the collision of mathematics and environmental science can help us gain an insight to this long-standing concern, and might help us to come up with better measures to deal with it.

**Method & Timeframe:**

1. Since all the knowledge required in this project is not taught in school, I will first read a large collection of literature in the area of meteorology, environmental science and advanced mathematics to gain some basic knowledge of the topic I am looking into. (7th December – 20th December)
2. After I have an overall understanding of this area, I will further consult some experts in this area. (20st December – 31th December)
3. At the meantime, I will collect all the data about the air pollution every day during the whole process in Changshu for later analysis. (15th December – 15th April)
4. Data analysis. (1st January – 15th January)
5. The formulation of different mathematical models. (16th January – 14st February)
6. The evaluation of the models. (15st February- 28th February)
7. A rough draft of the final report on the whole investigation will be created before the third meeting with my supervisor. (1st March – 20th March)
8. I will do the final research paper before the fourth meeting with supervisor. (21st March – 18th April)
9. After consulting the advice on the first draft from my supervisor, last modification on the final paper. (18th April – 22nd April)
10. The exhibition. (26th April)

**Interdisciplinary Approach:**

Mathematics: a mathematical model will be created to investigate on the air pollution issue. Most of the analysis will involve math for help.

Environmental Science: the topic is mainly focusing on environmental issue, so environmental science knowledge will definitely be needed to explain the components of air pollution, the effects of air pollution, etc.

Meteorology: air pollution is related to the atmosphere, and we need to predict the trends of air pollution and find the laws in air pollution using the knowledge of Meteorology.

Chemistry: Chemistry will definitely be used in this project, because I will be dealing with all kinds of toxic chemicals in the air.

Computer Science: this area will be really useful when doing the mathematical model, for collecting the data and analyzing.

**Materials:**

* Books and scientific documents – maybe I can find some in the library, but I have to buy more of that in order to do some further research.
* Air quality measure meter – that will be essential for me to collect all the data in Changshu. It is not available for me right now, but maybe I can borrow one or even buy one.
* Laptop – it is needed to do most of the researches, data collecting and analysis, and also writing the final paper.

**The Math of Air Pollution:**

**An Annotated Bibliography**

Aoun, C. El, et al. “Alpha Model: A Mathematical Modeling Approach Applied to an Air Quality Monitoring Network.” *Applied Mathematics & Information Sciences*, vol. 9, no. 1, 1 Jan. 2015, pp. 27–30., doi:10.12785/amis/090104.

In this article, a model called Alpha Model is introduced and tested it in the case of air quality. The model was expected to be able to predict the ozone formation in this experiment. The experiment was successful and all the data were well represented in different ways. Even though I can not understand some of the calculations and explanations yet, but that is a great sample for how I will be doing my own paper. And I believe I can read and understand all of them after I gain more knowledge in this area.

Liang, Xuan, et al. “PM2.5data Reliability, Consistency, and Air Quality Assessment in Five Chinese Cities.” Journal of Geophysical Research: Atmospheres, vol. 121, no. 17, 2016, doi:10.1002/2016jd024877.

This is a very detailed analysis of the air pollution is 5 major cities in China. Sufficient data are gathered and various comparisons are made using the nonparametric regression model. It not only reveals the difference between each cities and the potential reasons for that difference, but also makes comparison for the same city but different season or different years. This report is a big easier to understand because a great number of graphs, charts and tables are used to vividly display the data.

“空气质量状况报告.” 中国环境监测总站, [www.cnemc.cn/](http://www.cnemc.cn/).

This whole website will be really crucial to my whole project. This is the website for China National Environmental Monitoring, which has one of the most credible sources of data accessible. Apart from the data I collected by my own, I will mainly use the data from this website. Another benefit of this website is that not only the data is given, the analysis is also written in detail with explanation of the methodology used. I may use this website a lot in the future because it is really useful.

Louie, A. H., and R. C. Piercet. “Mathematical Models of Human Exposure to Air Pollutants.” Mathematical and Computer Modelling, vol. 10, no. 1, 1988, pp. 49–64.

Even though what this article is about is not directly linked to what I am investigating on, but I would like to choose this article because of two reasons. First, the whole process of mathematical model making will be similar to this one, so the reference value will be high. What is special about this article is that it draws out the data in coordinate system to calculate the explosion of pollution and the flow diagram is used to show the whole model clearly. Second, the whole journal will be quite useful because it is all about mathematical and computer modelling. Maybe I can use this as some reference for my own mathematical modelling.

Marion, Glenn. An Introduction to Mathematical Modelling. University of Bristol, 2008, people.maths.bris.ac.uk/~madjl/course\_text.pdf.

This is a e-textbook I found on mathematical modelling. It introduces and explains every step of mathematical modelling in detail. Sufficient examples are given in the textbook to help us understand easier. I have only read a small part of it, but I can see how concise and clearly explained the book is and I learned many things about mathematical modelling professionally.