Links to the CHANCE journal of statistics and probability (only a portion of the article is provided for those who are not members. The full article is provided below)

<https://chance.amstat.org/2021/02/outreach-project/>

<https://www.tandfonline.com/doi/abs/10.1080/09332480.2021.1885930>

Full published article



The Data Science Public Schools Outreach Project : *An initiative for diversity and inclusion*

American University has a strong and robust Data Science program that features extensive training in the R programming language, Machine learning, and Statistics. Our graduated students are equipped to contribute significantly in the arena of employment and higher education. With vigor and exuberance we desire to teach and expose the essentials of Data Science to an unconventional but deserving audience.

The initial idea to extend Data Science learning opportunities to teachers and students of the District of Columbia Public Schools originated with Dr. Jane Wall (The Director of Data Science here at American University). It was suggested to her that perhaps I could help in some capacity given my background in Secondary Education (30 years, teaching, instructional support roles and school administration). Jointly we were able to broker a partnership arrangement that includes the District of Columbia public schools, American University and the NASA Space Grant Consortium. Immediate and long term goals of the coalition include the following:

* Offering selected Teachers of the DC public schools the opportunity to take 2 graduate level Data Science courses at American University at no cost.
* Offering select DCPS students the opportunity to take 1 undergraduate level Data Science course at no cost
* Offering professional development opportunities over the summer for DCPS teachers so that they can share Data Science concepts and routines with their students and other colleagues.
* Assisting DCPS with the effort to develop their own elective course that has a significant Data Science focus.

One primary goal of the initiative is to share the potential and benefits of Data Science with underserved an underrepresented populations of the District of Columbia secondary education landscape. Although reaching out to a more diverse target population is our goal, no social class or ethnic group will be denied participation in this Data Science awareness and participation endeavor.

In particular, the 2021 spring courses of interest are **STAT 612 STATISTICAL PROGRAMMING IN R** and  **STAT 412 STATISTICAL PROGRAMMING IN R** The strand STAT 612 is for graduate students and the strand STAT 412 is for undergraduate students**.** These particular Data Science courses feature training in the programming language **R.** Students are taught how to use this programming language to process, manipulate, and graphically display quantitative and categorical data. Specific learning objectives of the courses are given below.

Learning Objectives;

* *Reproducible research using R*
* *Use R as a powerful calculator*
* *Import data from external sources*
* *Perform analyses including hypothesis testing and regression*
* *Write basic R programs using control and data structures*
* *Install and use packages for specific applications*
* *Use graphical tools to visualize and understand data*

The courses are cross populated, but the graduate students are required to do more extensive work than the undergraduate students.

We are infinitely grateful for the support of the NASA Space Grant Consortium (headed by American University Physics professor Nate Harshman) for its immediate financial support. As a consequence of this funding commitment, we are able to cover the matriculation costs of 4 teachers and 2 students in the spring of 2021. Also, Professor Harshman’s team was essential in helping with the teacher application and final selection process. Our effort to support the DC public schools develop the curriculum for its Data Science course will involve the contributions of several educators in the Department of Mathematics and Statistics here at American University. Other faculty have already voiced a willingness to provide creative curriculum ideas for a Data Science course that would be suitable for high school students. I am very thankful to the AU community at large with the support that Dr. Wall and I have received for this Data Science based initiative.

Of the 8 teacher applicants, we were able to offer four slots to deserving candidates. We are very pleased with our selections for they are talented and dedicated teachers who are highly qualified and who expressed a genuine desire to educate their students about the basics and the nuances of Data Science. Our top four selections service students from all over the city including student groups that have been underrepresented in STEM related fields. Two of the teachers who were not selected presented strong applications and I feel that they would had also been good choices. We are currently exploring ideas and connections, so that we can possibly extend this opportunity to at least one additional teacher.

Ongoing support and focus in the following areas are critical to the success of our initiative:

1) As mentioned, we were only able to support 4 teachers; it would be ideal to offer a matriculation opportunity to at least 7 teachers per semester. The plan would be for them to take two graduate courses in succession; STAT 612 and DS 613. Both feature a heavy emphasis on Data Science foundational competencies and R programming

2) We would like to offer a dual enrollment opportunity to two students per semester. The specialized training that they would receive in STAT 412 would give them a unique opportunity to start college with a valuable programming language under their belts.

3) Ideally a point person, should be compensated for tracking and supporting the DCPS teachers and students as they matriculate during the semester. This is additional help that would supplement the tutorial assistance and guidance counseling normally offered by the University

4) We would like to offer professional training opportunities on a large scale over the summers so that teachers can prepare and train their students in Data Science when school resumes for them in the fall. In particular teachers would be trained to teach the special Data Science Elective developed with the help of AU faculty.

5) It would be ideal and beneficial if we could also support professional development that would be ongoing and impactful throughout the school year. In theory, AU instructors could offer assistance formally or informally by way of professional development efforts to follow up on experiences over the summer.

6) A special vision and worthwhile goal is to offer assistance under the umbrella of Data Science to younger students and teachers of middle school students. Supporting High School teachers and high school students is the normal target for colleges and universities. Preliminary work would have to be done in order to find out the best way and best practices associated with this special group of teachers and students, but the long term rewards are substantial.

7) The grant that we are currently operating under does not allow participation if you are not a US citizen. There are many teachers in the public school system who are servicing our students who are not US citizens but they are doing a great job teaching and helping students day to day. We had to turn away two excellent applicants because they had citizenship issues. We are currently brainstorming on ways to include this pool of educators effectively.

A great idea and genuine intent will both suffer without follow up action. It was necessary to contact elements of the DC public school system to communicate our goals and desire to form a partnership with them regarding Data Science education. This effort involved introductory, numerous, and ongoing emails and zoom conferences to simply find out who should be contacted. Directed calls to the DCPS central office were initially unsuccessful and phone calls to individual schools that were made resulted in limited success. After about a week, we were able to break through by getting help from an AU official who had a contact in the DCPS school system. She turned us on to a STEM coordinator who worked in the central office of the DCPS system’s office. We took advantage of this relationship and were able to ultimately make necessary contact.

Gabriel Cartegena is the director of Mathematics and Computer Science for the DCPS system. After multiple conversations with him and other central office and instructional support personnel in the DCPS system, we were able to forge required relationships necessary for collaboration. Multiple emails and zoom sessions ensued that involved an exchange of ideas and a vision for spreading the gospel of Data Science to the students and teachers of the DCPS system. Mr. Cartegena has a demanding schedule due to his position in DCPS; but he was and still is very supportive and active in helping and providing guidance for the joint initiative.

These meetings as well as other collaborative efforts led to productive efforts in the arena of Data Science awareness. In addition to the goal of offering DCPS teachers the opportunity to take courses in Data Science, we agreed that American University would assist the DCPS system develop an introductory Data Science course for its high schools. We also reached consensus and clarity on the ultimate goal of training enough teachers so that DCPS can offer Data Science experiences and instruction to its students via its own teaching force. And it was during the early phases of contact and discussion that the dual enrollment option for selected high school students was discussed and agreed upon.

Current and past Challenges:

Patience regarding the MOU process has to be exercised. For the student and teacher participation initiative, separate MOUs had to be developed that entails analysis and approval by American University and the DCPS. Since the initiative involves students and teachers (4 teachers, and 2 students), two separate MOUs have to be prepared. The MOU work involves legal teams from District of Columbia Public School System and American University. There is continuous analysis and scrutiny regarding each MOU proposal that has to be examined and edited so that both entities are satisfied with the final result germane to language, content, and clarity.

Notifying qualified and deserving teachers that they were not selected due to limited funding and or their citizenship status was difficult, especially after they had expressed a sincere desire to be formally trained in the classes. We received eight teacher applications for the four available slots. A selection committee ranked and decided on the top four applicants.

Next Steps:

Funding for the Spring Semester teacher and student matriculation has been secured, essential contacts have been established in the DCPS system and at American University, it is now critical that we continue to monitor and give support to required MOU protocols so that the course registration process for the teachers and the students can begin.

Also, continued efforts must be undertaken to provide and/or maintain a consistent stream of funding so that we continue these Data Science grounded matriculation and professional development opportunities to teachers and students of the District of Columbia Public School System.

I am excited, positive and grateful for we are off to a promising start. Moreover, I am grateful for the opportunity to share the detail of our program with faculty and students of other universities similar to American University who might develop such a program in their cities.

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