

Public Interest in Technology: Enabling the Next-Gen Engineer with Project Management Skills for the Public Sector - A Community College Case Study

Prof. Dimitrios Stroumbakis PE, City University of New York, Queensborough Community College

Dimitrios Stroumbakis, holds a BSME / MSME from Polytechnic University (Summa Cum Laude), and Columbia University and is a licensed Professional Engineer in NY. Prior to transitioning to Academia, Dimitri acquired 24 yrs of experience in the undersea photonics systems industry contributing to the development of over 50 electro-optic devices for commercial and military markets. He served on two national industry standards groups and as core Team member, received two industry awards "Cisco's Optics Supplier of the Year" Award and "IBM's Quality Partner of the Year" Award.

Dimitri is an Assistant Professor at Queensborough Community College (CUNY) and has a strong interests in leveraging instructional technology, Flipped Class Room Learning, and online student-centered pedagogy. He is a strong advocate of authentic industry partnering at several levels to enhance students' job-readiness upon graduating. Dimitri's recent research has been in Micro-Fluidics Systems for DNA sequencing applications.

Public Interest Technology: Preparing the Next-Gen Engineer in Serving the Greater Good of the Public's Interest-A Community College Effort

Dimitrios Stroumbakis, PE
Queensborough Community College
Department of Engineering Technology

Abstract

The purpose of this paper is to document the creation, implementation and preliminary assessment of a series of mini-modules funded under the Public Interest Technology-University Network (PIT UN) initiative for two purposes: 1) to raise awareness among new engineering students thereby creating a pathway to higher educational goals in his field---all to for the noble case of serving greater good of society 2) learning new, valuable technical skills, in our case the study project management skills, with the longer term hope of working for the public sector who's technology infrastructure and technology services are known to quite outdated due to in house expertise. public policy makers for the good of society,

The instructional mini-modules in this report were designed with two objectives: 1) raise student awareness and knowledge about serving the good of the public through work at Public Sectors who are in very much need in technology. In fact, the dated technology in house of Public sectors have affected quality of services they can be offered to the general publics. The second purpose is to introduce teach community colleges students skills sets that contribute the growing field known as *Public Interest Technology (PIT)*. PIT describes a new brand of civic-minded engineering graduates who can apply high-end technology skills along with public policy to better serve the interests of the for the overall good of society. Moreover, as a consortium of 21 universities and funded by the Ford Foundation and New America, the PIT University Network (PIT-UN) is committed shaping educational course a curriculum to better integrate technology, public policy, and social sciences.

In this paper, we described the creation, implementation and first-pass assessment of mini modules design to teach Project management as the added value skill set and to indoctrinate the students to Public Sector over a 5-wk duration.

It's to be noted that this is the first series of experimental 5-week sub-track courses with the important research goal of assessing very preliminary student awareness , knowledge and attitude in the public sector context. Laboratory programs (in class and out of class) were designed to provide an experiential exposure of the professional skill(soft skills) and interdisciplinary skills which are the many benefits of project managements

Surveys administered at the start and end of 3-weeks of instruction (N=42) covered awareness, knowledge, and student attitude for the public sector. Results revealed a 70% awareness increase, an unchanged 90 % agreement on the value of the engineers' duty to welfare of society, and a marginal desire on the willing to pursue Project Management skills---at this point. We feel this will change in the next session. In-class and field-visit laboratories were cherry-picked as most important (70%) due to the value employer's place on authentic workforce experience . Technical learning gains were tempered at 55%. Although there was a low willingness to accept a full course in PIT (35 %), students selected "job security" and "low-stress environments" as the top two desired attributes (62% before / 58% after training) which are the in line with the benefits in working for a public sector.

Introduction / Background

A key mission of the Public Interest Technology - University Network (PIT-UN) [1] is to drive new education programs to create dual-expert technology graduates-- graduates endowed with public policy skills, yet fully adroit in the latest and emerging technology, defining a contemporary needed role for the good of the society. However, with a paucity of such talent (and jobs) available today, it's crucial to grow these new career pathways which are destined to be in high demand 5-10 years from now. [2]

Among its various charters, the PIT-UN is managing new curriculum introductions and courses across universities by first building awareness through various outreach programs. It's time to reshape the engineers traditional role into an expert where constant private sector innovations will face competent technical staff with public policy skills.

Figure 1 shows the PIT-UN first phase, high-level roadmap begins with **awareness** and **Skill-building**, the two of the areas cover in this paper. Nonetheless, the faculty undertook additional initiatives to cultivated relationships across several functional areas of municipalities (highlighted in red in Appendix A) as front-end preparation work for potential student-faculty community relationships for fact-finding visits.

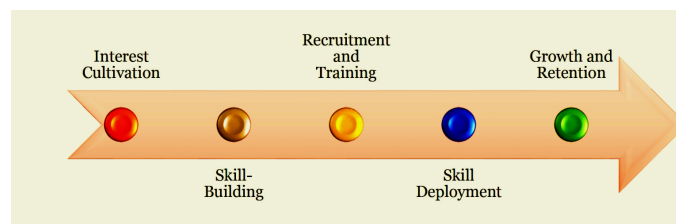


Figure 1. Early stages of educational milestones documented by the PIT-UN

Unlike 4-year schools, establishing new and forward-looking curriculums at community colleges are difficult to establish given administrative business plan emphasis on shorter terms initiatives for faster investment returns via enrollment. With this constraint in mind, we developed a series of mini-modular lecture units covering 5-week of instructions to deployed as sub-tracks, minimizing any organizational burdens. Lastly, to emphasize the growing momentum propelling the PIT-UN and I would like to share a bold vision statement proclaimed by the co-author of Ford Foundation's report titled "Changing the face of advocacy" [2], stating:

"The ability for government to improve operations and provide services to citizens more efficiently through effective use of technology is among the greatest contemporary opportunities for the public sector" – Co-Founder, Ford Foundation

In this paper, we focused on introducing our 5-wk *project management module* as the "skill-set" to be developed within the underlying PIT theme. For completeness, **Figure 2** depicts three additional teaching units (in modular form) developed and all listed as an Open Education Resource (OER) Commons resource repository at CUNY University OER commons.org page. These modules will also go through a 1st release, 5-wk test run to further expand public sector and PIT awareness and were components of the 2020 RF CUNY grant award. [3,4]

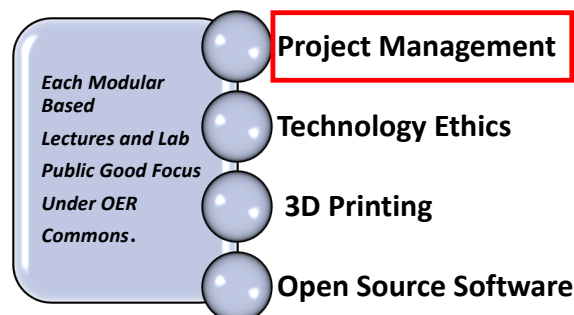


Figure 2. List of Skill Set Development Choices aligned for Public Sector as modules

Research Purpose and Modular Instructional Design

The research objective of this paper was to:

- a) to assess awareness, attitudes, and student knowledge of the public sector
- b) to evaluate students the future plans in multi-discipline majors

As we all learned, modules are a core approach to instructional design for on-line learning modality and often has its origins in backward curriculum design. One advantage of modularity is that it regulates content dose, regulates the pace of delivery, allows time for in-class problems, and relaxes the students, obligating the instructor to stay in-step with the tempo of his content. Additionally, we added some unique modular elements to monitor the progress of PIT projects to serve as constant motivation to our students, such as NYC's OPEN DATA [5], a 10-year, large data project of NYC in concert with an array of public and private technologists who created what they call, the "democratization of data". About 3200 individual data projects were realized along with the active visualization tools to manipulate data according to user preference. I used the visualization software to see how traffic tickets drop to near zero during the end of March 2010. More serious data and consequential data is offered in this database. I would strongly recommend visiting: <https://opendata.cityofnewyork.us/>

Why Project Management

Figure 3 depicts the scale of professional skills facilitated by the framework of project management. Project management was chosen as the skills to transfer to our students because of its ubiquitous value across technology, business, entertainment, and now it's becoming popular among social networking activists [7]. However, in a well-received marketing report titled "14 essential graduating skills for the post-pandemic workforce", released by Burning Glass just a month ago [8], it lists project management as one of the enduring and base skill sets required by the next generation workforce, as does Plato Kapranos in his most recently published book [9]. Nonetheless, as technology adoption cycles re-invent themselves for new markets, such as social media activist applications, there is no telling how suppliers will rebrand and remarket powerful business process tools in commoditized use of PM tools. The net result is that Project Management will continue to be a critical skill set as it proliferates up and down the business and social supply chains [10]. As a professional workforce skill, project management will continue to be a highly sought-after skill set regardless of its latest versions (agile) because it has the unique framework to develop all the professional skill sets so crucial for success in our fast technological world--- interpersonal skills, communication skills, interdisciplinary skills, stakeholder considerations and others as shown in Figure 3. These are what are known as critical "work-ready" skills desired by many technology employers [11].

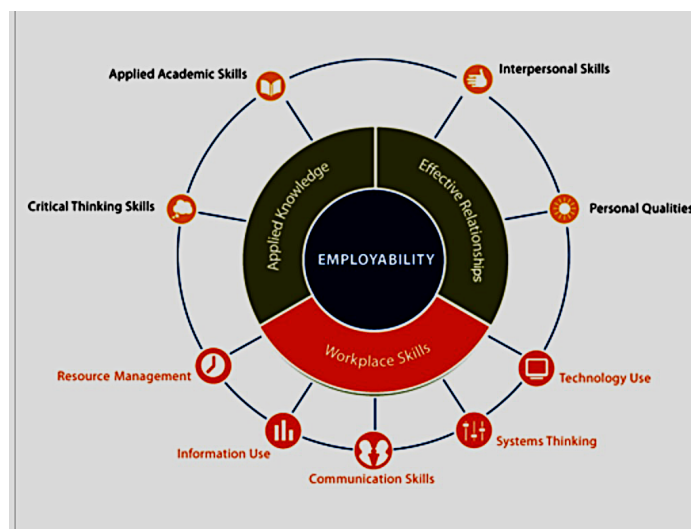


Figure 3. Graphical depiction of Project Management framework and the employability skills it cultivates

Our 5-week sub-track, mini-course consisted of four, student-centric, lecture modules along with laboratory components designated as *in-class* and *off-campus* (field – visit), assessment outcomes, program and mini-course outcomes, quizzes, rubrics, and a recently added section to accumulate new success material as progress on this emerging field unfolds. The labs will be covered in another section.

Our modular approach allowed for integration of new content into existing courses and also facilitates a standard uniform delivery of content in each different course. However, choosing the best course for this modular approach can be difficult and one has to consider the compatibility of goals and outcomes for a well-suited match. For our beta-trial, we chose an Introduction to Engineering course as our point of entry. This course was well match of our purpose due its diverse student major and multiple section availability.

Project Management Lecture Module

Our Project management modules used a student-centric, backward-design curriculum. To impact our students and keep them heavily engage--- Technology-centric PIT successes and projects stellar project management efforts are showcased to drill home the powerful impact of PIT. Following each “new clipping” our lecture series begins. Module 1 covers the Public Sector and its ties with the PIT.

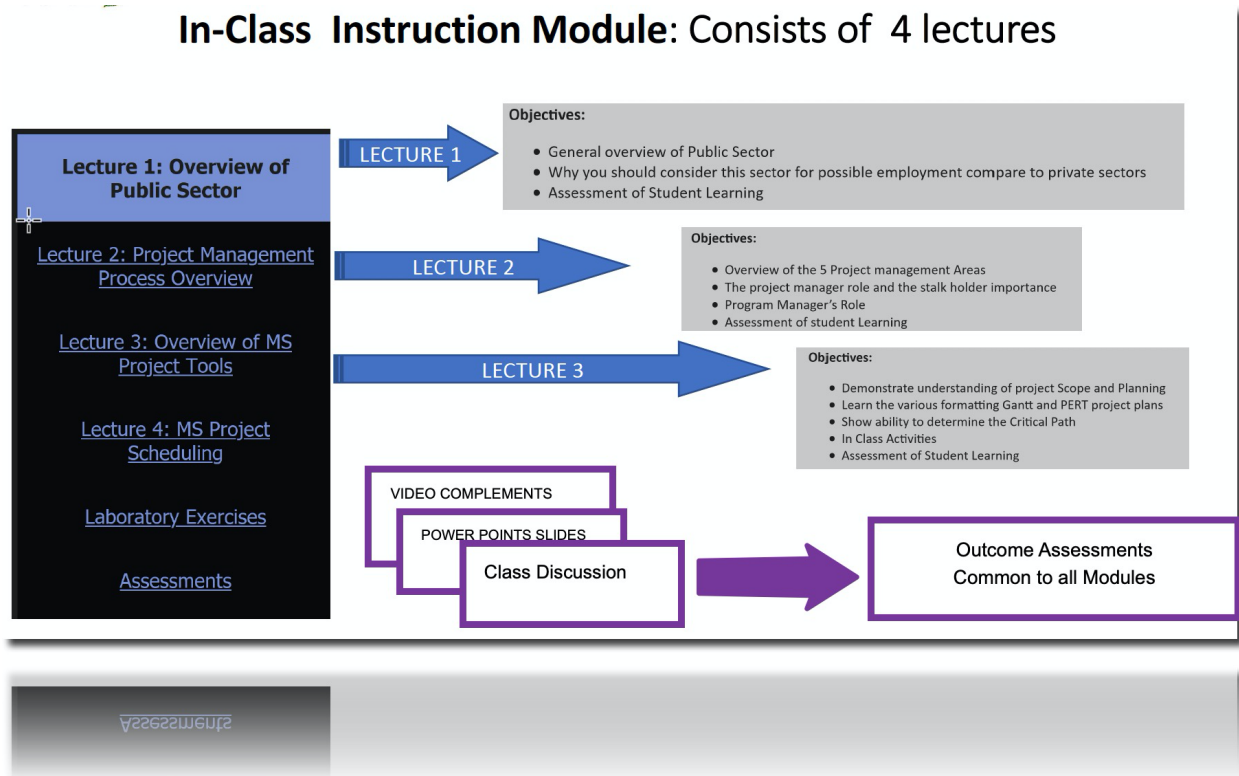


Figure 4. Module 1 (on-Line) to be taken by the students: Introduction to Public Sector

All three modules continue until we have a stark departure in scheduling techniques. For the Public Sector working on all matter of projects, we highly recommend a much more visual display of the project in which each box is a task own by a resource and the task dependencies can easily be identified, along with the critical Path and the Slack of the Critical Path. The slack is defined as the margin for lateness each critical path task has before it drives the final project date past the schedule date of completion. This is very valuable as an accountability tool and as a graphical display that allows one to see the whole project schedule at a

glance. An example of a critical task data entries and an overall PERT (or Network) Project schedule is show below:

Module 2, and 3 follow similar pattern of lecture, assessment, outcomes, and in-class projects and will not be covered in detail. Skipping to module 4, and example of non-Gantt task on the critical path is shown. A critical task is one in which it misses its deadline will impact the final project end date. The -2d circled in red indicates this task is -2day behind and will impact the finish date accordingly. Figure 5 depicts a task in network or PERT form.

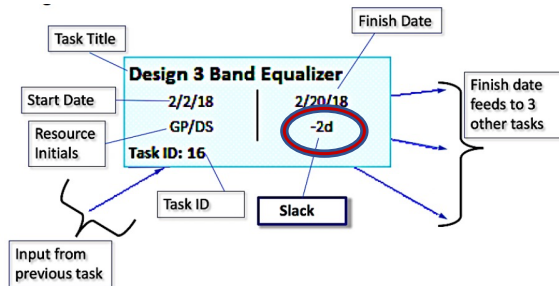


Figure 5. A critical task with -2d negative slack.

For completeness, a full PERT chart is shown along with the red outlines delineating the Critical Path

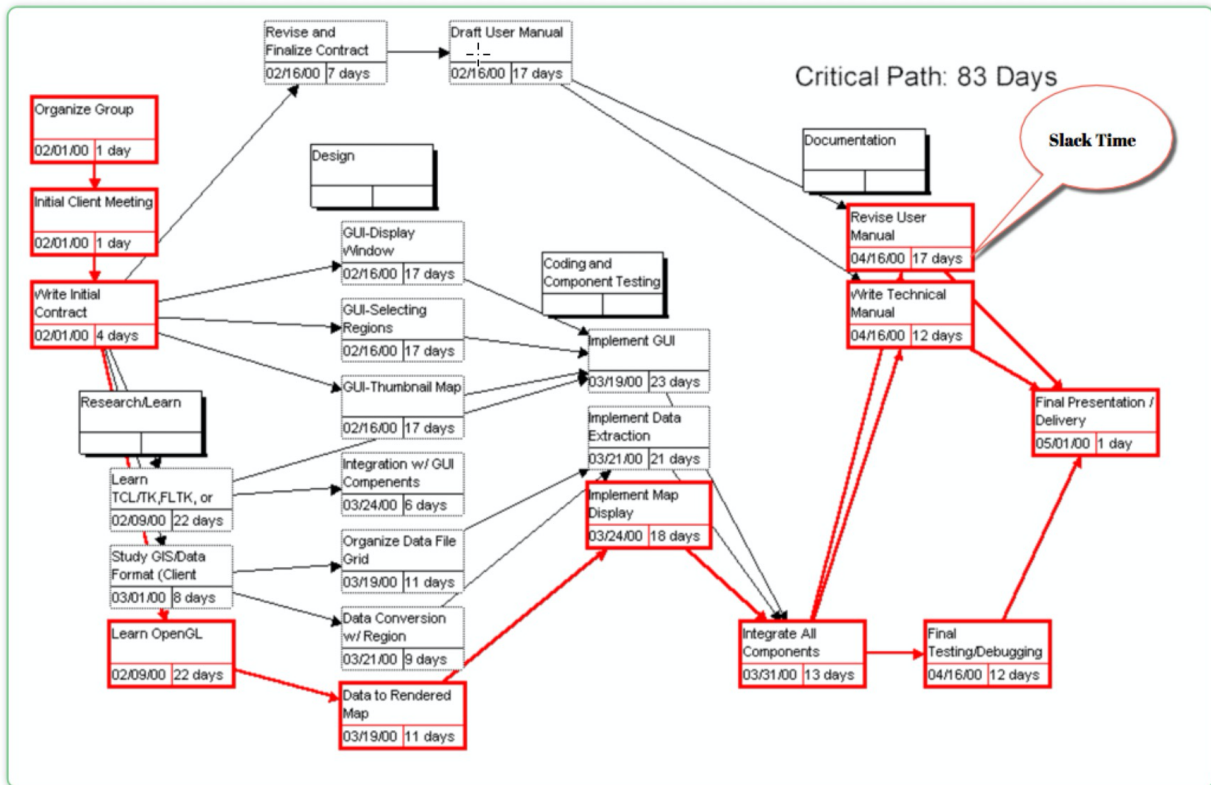


Figure 6. A PERT or Network Project Diagram showing the critical path in red. (example only.)

Methodology

Participants

We surveyed students at the start and end of 3 weeks of instruction. Out of 64 registered students, 36 and 42 responded to the pre (36) and post survey (42) – with both web-based surveys being nearly identical. The 5-week mini-module unit was deployed in two sections of **“Introduction to Engineering Technology course”** (TECH-100) during the spring 2021 semester, for a 3-hour on-line class, comprised of 1-hr lecture and 2-hr laboratory components, although there was flexibility in time allocation. Targeting this class gave us access to seven student major disciplines, allows us to observe any data clustering due to major.

Questionnaire

The SALG (Student Assessment of their Learning Gains) instrument had been rigorously validated for awareness, exposure, knowledge and awareness in nanotechnology [18-19] and was modified for our purposes. Again, given the experimental case study, we thought this would be appropriate for our 1st run.

Casual interviews introductory introductions with about 80% of the class during the first week where held for acquittance purposes. Felder’s “Index of learning style” [20] questionnaire was administrated to all students in the interview and only two students showed a pronounced bias in learning style---namely intuition category which is not too common. Collecting demographics included age, ethnicity, discipline major, gender, GPA, and HS diploma as shown in Table 3 and Table 4.

Our pedagogical approach to this fast-tracks the PM learning, using alternating forms of video and lecture instruction, with immediate use of MS Project software to model in-class 20-minute project exercises. Each class will consist of three or four groups for group exercises related to In-Class Laboratory sessions, and for the roll out of field visit to areas documented in the Lab instruction planning guide.

As the entire learning modules are accessible on line it is not recommended at this time to have your student take the lecture on line. The student can either download the modules and / or follow the instructor’s guidance. The learning objectives and outcomes, as well as assessment sheets (Quizzes, Exams, Discussion Questions) are all sequentially presented in user-friendly format in the website. Table 2 in Appendix D outlines the student SLOs along with assessment types and Figure 2 shows the landing page of the PM modules.

Engaging the Community

Collaboration with community stakeholders is a hallmark of public interest design, in general. In accordance with Christine Gasper, executive director for Urban Community Pedagogy (CUP), NYC, she explains that the goal of public interest work is not simply the resulting design, a software code, a website.....it is the organizing of the people using the design”.

Our PM skill falls into this category and we design our project effort to include engagement with local municipalities to uncover high-demand needs for assistive project management coordination. If emphatically incorporated the community in our off-site lab. Please view Attachment C for a depiction of a local municipality showing the organizational structure and the red outlines depicting express interest in Project Manage assistance and consultation.

Laboratory Exercise. Lab as high stakes and low stakes, and one can get a better view of the details in APPENDIX B and APPENDIX C

Lab 1: Develop Project Schedule local Work Force Community

Description: Case Study Creation of Project management applied to the Public Good in Training Displaced Workers.

Lab 2: Organizing Summer Community Students Event

Description: Case study design for community summer activity for under-privileged children

Lab 3: Public Assembly Councilmen Engagement.

Expose Student to hierarchy of local public assembly members, such as NYC Council Corey Johnson, and Council Member Joe Vallone

With assistance from instructor, students will secure volunteering experiences at Queens Public Library, the Municipality of Garden City, or Orthodox Archdiocese of US for Ground Zero Rebuilding of St Nicholas Chapel. This is left open, but more opportunities are surfacing specially under NYC Open Data [11-12]

Lab 4: Field Visit to NYC’s School Construction Authority.

Expose Student to SCA \$13B budget entity and their dominant and integral use of project management software tools.

Analyze precedents of how public interest design can be a meaningful part of professional practice

- identify the structure of public municipalities, roles, functions, and stakeholders
- test a step-by-step method of working with a community as an assisting partner
- apply communication skills in a collaborative process with multiple stakeholders

Discussion and Results

The following sections describe the student demographics, and a summary of the survey results before and after instruction.

**Table 4. Student Demographics
Majors across two class sections**

Majors	Count	Percent (5)
Architecture	13	31 %
Computer Eng. Tech	8	19 %
Electrical Tech	9	21 %
Mechanical Tech	4	9 %
Compass	3	7 %
Eng. Sciences	1	2 %
Biotech/Nursing	2	5 %
Undeclared	2	5 %
TOTAL	42	

Table 5. General Student Demographics

Category	Count Percentage	
HS Diploma	42 / 1	97.6%
Male / Female:	36 / 6	85.7%
Ethnicity		
White	10	23.8%
African-American	7	26%
African	4	
Hispanic	8	
Asian	8	
Other	4	9.5%

As anticipated from the start, it's imperative to get student buy-in on the concept of PIT. Passive lecturing describing the pros and cons and the organizational structures may not prove useful in exciting a student to pursue nor believe in PIT relevancy. Therefore, much care is required to position the benefits and challenges of this important upcoming transformation rule. To maintain a sense of excitement, we present a ***"PITs got Talent!"***, a 5 - 10-minute display of the most recent significant PIT accomplishments across the various technologies, but with an effort to personalize accomplishments to local efforts.

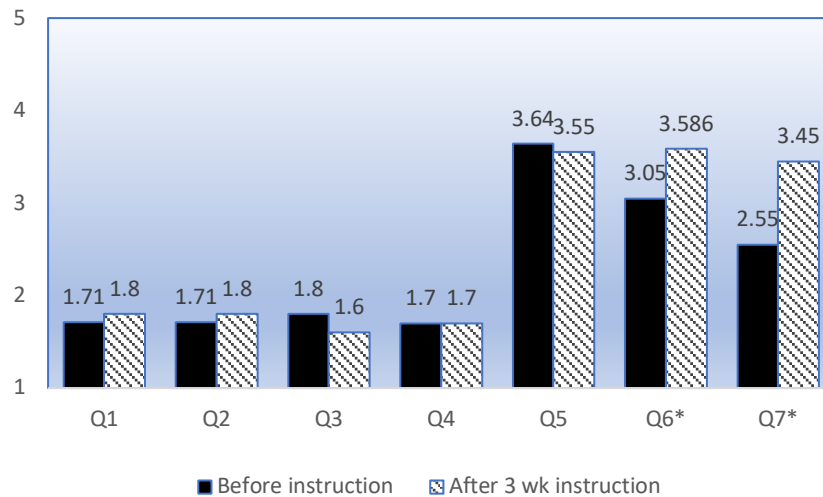


Figure 8. Mean Survey Data on Q1 – Q 7

(Q1) Did you ever hear about Public Sector in College

(Q2) Did you ever hear about Public Sector in High School

(Q3) Did you ever hear about any colleges introducing “PIT” Course work

(Q4) Did you ever hear about public sector outside of school (family discussion)

(Q5) Engineers and technologist well versed in public welfare is good for society

(Q6) Have you ever heard of the public sector in general.

(Q7) Do you agree that working in technical capacity at Public sector can be very rewarding career option

Dependent double t-tests with confidence intervals $\alpha = 0.05$ were performed to verify statistical significance. Another consideration, was to regroup the data into the 2 top and 2 bottom categories and perform contingency analysis on each case. However, we do plan to do more refine our statistics during our second pass in Fall. The attitudes, Knowledge, and survey was given to student at the start and end of a 3 weeks direction. Results can be summarized as (these are 1st experimental results):

- 1) A strong demonstrates moral character inclined to consider the better good of society.
- 2) A strong demonstrate moral character incline to consider the better good of society when it's your livelihood or job
- 3) As expected there was an improvement 75-85% increase in Public Sector known ledge
- 4) Students “perceive” public sector as a viable full-time job, by evaluating their top priorities a) Job Security of by c) Low Stress d) salary e) viability of self-employment

Conclusion

Our survey's showed an 80 % increase in awareness (meeting on our key research question), observed a surprisingly deep student appreciation for the role of the new-generation technologists aligned to public service for the good of society

Student awareness of public sector (and its tenant to serve the public good) was almost non-existent at the start yet questions on the moral good and value of public welfare was as high as 72% - 96% .


By including powerful, and operating large data demo programs of completed PIT design into our weekly PM Modules as a “ *New Flash* ” it was very well received by the students and we expect an innate understanding to increase considerably as well as motivation and excitement to take on larger gains.

In summary, the evidence from this study suggests that faculty should amend their PM modules By staying up to date on regional , city , state and university PIT accomplishments of the day or week with at least 5 to 10 minutes dwell time.

We met the high-level PIT program goals, by raising awareness of public sector employment opportunities on Public Interest Technology discipline—a high demand field and currently focusing its effort in supporting universities and colleges across the country to implement technology curriculums with Public Policy training to better serve the public sector in advancing its services for the good of society as a whole. QCC Students expressed strong desire to serve as agents of change by visiting public works to train and consult customers on the benefits of Project Management and MS project software tools.

Lastly, our PM assessments will be evaluated as they are a direct reflection of our module quality, but given the program importance on the student awareness, attitudes, and knowledge (42 questions), we will produce a more comprehensive summary of that data.

REFERENCES

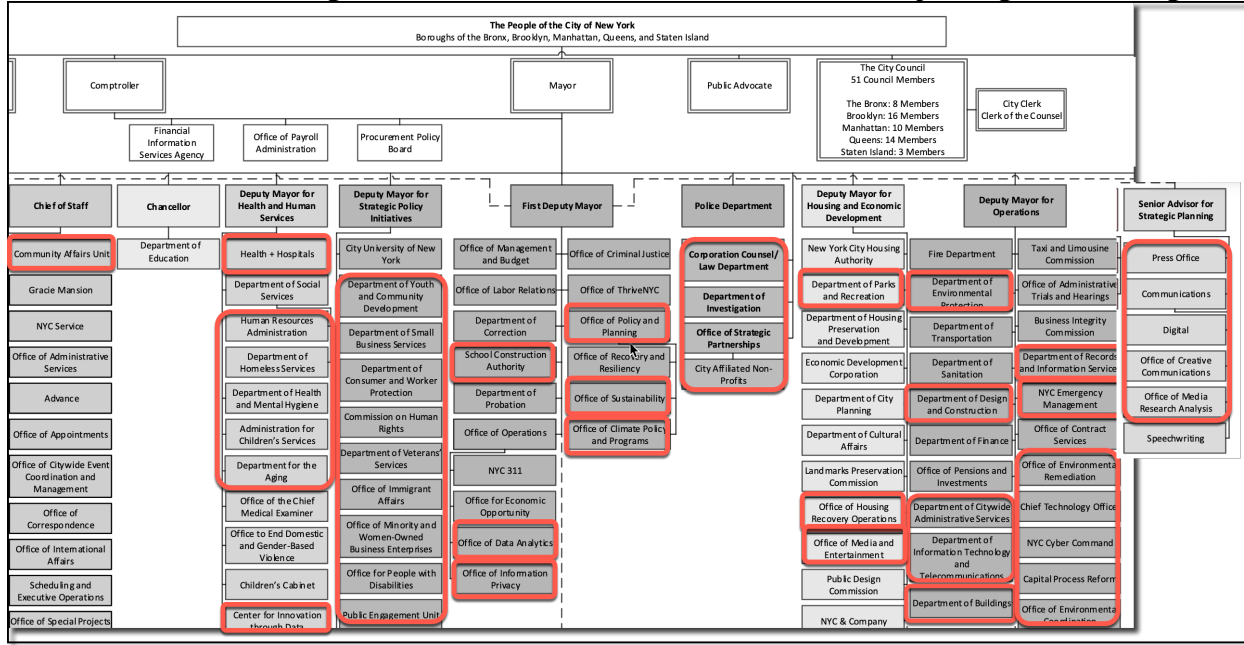
- [1] Public Interest Technology – University Network (PIT-UN), a consortium of 21+ higher education schools along with New America Inc and The Ford Foundation Inc.
- [2] Report co-written by Ford Foundation (Jan 2019)
- [3] “Engineering Technology for the Greater Good of Society”, Grant award to PI - D.Stroumbakis, Co-PI Dr. Ray Lam, Co-PI Maritza (RF CUNY Grant by funded by New America January 2020
- [4] RF CUNY awarded Phase 1 \$3.1M by New AMERICA Inc, Jan 2020
- [5] 2020, NYC Mayor’s Report: OPEN DATA CONNECTING NEW YORKERS

- [6]: “Public Policy and Technology---No Lawyers Necessary”, Freedman Consultancy Report 2019 (use for press release on CUNY RF; <https://www.newamerica.org/pit/university-network/about-pitun/>)
- [7] Project Management Offered as A Necessary Skill for Private and Public Sector, MI 2018
- [8] “The Interdisciplinary Future of Engineering”, Plato Kapranos, Published 2019, Routledge Publishing
- [9] Past Work on PM Successes in Public Sectors
- [10] Center For Urban Pedagogy in NY City
- [11] A Pivotal moment – Design new generaio of technokigist for the public interest. 2016, Freedman Consulting, LLC.
- [12] “Building the Future: Educating Tomorrow’s Leaders in an Era of Rapid Technological Change.” **Freedman Consulting** LLC, Report Release 2018
- [13] Toomey, L. (2012). Social networks and project management performance: how do social networks contribute to project management performance? Paper presented at PMI® Research and Education Conference, Limerick, Munster, Ireland. Newtown Square, PA: Project Management Institute.
- [14] <https://public-interest-tech.com/> --Public Interest Resources
- [15] World Economic Forum, <https://www.weforum.org/whitepapers/accelerating-workforce-reskilling-for-the-fourth-industrial-revolution>,
- [16] Matt Mitchell (Jan 2019), “[The Golden Hour](#),” Talks at Google.
- [17] Meet the future of TECH, <https://www.youtube.com/watch?v=LuTWnKC6U3I>
- [18] Seymour, E., Wiese, D., Hunter, A. & Daffinrud, S.M. (Marzo del 2000). Creating a Better Mousetrap: On-line Student Assessment of their Learning Gains. Paper presentation at the

National Meeting of the American Chemical Society, San Francisco, CA. [21] Dyehouse et al., 2008. In depth Analysis and validity of SALG Survey Instrument., 1999, Journal...

[19] R.M. Felder and B.A. Soloman. See < http://www.ncsu.edu/felder-public/Learning_Styles.html for additional details about the Index of Learning Styles and the Felder-Silverman learning styles model upon which the ILS is based.

APPENDIX A

Business Development areas in NY Public Sector for joint partnership



Appendix B

Examples of Laboratories and Field Visits

Lecture 1: Overview of Public Sector
Lecture 2: Project Management Process Overview
Lecture 3: Overview of MS Project Tools
Lecture 4: MS Project Scheduling
Laboratory Exercises
Assessments

LIST OF IN-CLASS AND FIELD VISITS (OR VIRTUAL)

Lab 1: Project Schedule Applied to Public Good *Description:* Case Study Creation of Project management applied to the Public Good in Training Displaced Workers.

[Go to Lab 1](#)

Lab 2: Organizing Summer Community Students Event *Description:* Case study creation of project plan for community summer activity for under-privileged Children

[Go to Lab 2](#)

Lab 3: Public Works Field Visits: Four Options

Option 1: Field Visit to NYC's School Construction Authority.

Goal: Expose Student to SCA \$13B budget entity and their dominant and integral use of project management systems.

Option 2: Public Assembly Councilmen Engagement.

Goal:

1. Expose Student to hierarchy of local public assembly members, such as NYC Council Corey Johnson, and Council Member Joe Vallone
2. With assistance of instructor, students will secure volunteering experience at Queens Public Library, the Municipality of Garden City, or Orthodox Archdiocese of US for Ground Zero Rebuilding of St Nicholas Chapel

[Go to Lab 3](#)

Appendix C

Laboratory 3 : Description of Options 1 and 2 Field Visits

Lab 3: Public Works Field Visits: Four Options

Option 1: Field Visit to NYC's School Construction Authority.

Goal: Expose Student to SCA \$13B budget entity and their dominant and integral use of project management systems.

Option 2: Public Assembly Councilmen Engagement.

Goal:

1. Expose Student to hierarchy of local public assembly members, such as NYC Council Corey Johnson, and Council Member Joe Vallone
2. With assistance of instructor, students will secure volunteering experience at Queens Public Library, the Municipality of Garden City, or Orthodox Archdiocese of US for Ground Zero Rebuilding of St Nicholas Chapel

[Go to Lab 3](#)

Lecture 1: Overview of Public Sector

[Lecture 2: Project Management Process Overview](#)

[Lecture 3: Overview of MS Project Tools](#)

[Lecture 4: MS Project Scheduling](#)

[Laboratory Exercises](#)

[Assessments](#)

Activity 3. Students will accompany Instructor in face to face or virtual meeting in 2021 with Local Orthodox Church Archdiocese to demonstrate Project Management software and its impact to local or office coordinators working on the rebuilding of the St Nicholas Shrine at Ground Zero NY.

Output: Students will write a field trip (or virtual tour) report to Ground Zero Reconstruction site of the St Nicholas Shrine and will provide assistance in addressing the already identified need for skill development in PM methods among the lower team members the reconstruction team.

After 911



July 2020



APPENDIX D

Program and Course Learning Outcomes 5-week Sub-track course SLOs and Assessments

Course Outcomes		Assessment Outcomes
Program (PIT) Level		
1	<p>To create awareness of public sector with evidence supporting as a viable employment option</p> <p>Identify the multi-tenant that the PIT-UN is concerned about: Include Finance, technology, Education, Project Roles of New Technologist and its top three tech concerns</p>	<p>Survey, Discussion Report, Lab Report</p> <p>Video take home essay example</p> <p>Write Report , 3 pages</p>
Course Level		
1	<p>List and define the 5 major parts of a project and indicate the order of importance .</p> <p>Explain why task duration is better than stating start and finish date of a task.</p> <p>Duration entry, and task connectivity using GANTT and PERT graphical techniques</p>	<p>List them in Project Schedule.</p> <p>Performance of four groups in competition</p> <p>Short Exam and Practical Exam with different functions for each team member</p>
2	<p>During lab exercises, validate a task as acceptable or unacceptable based on our class definition for Criteria</p>	<p>Fill in Response</p> <p>Oral review of your task entries</p>
4	<p>Student exposure to City Officials in fact-finding meetings to identify top-of-mind-needs. On weekends via Zoom.</p>	<p>Customer feedback on performance</p> <p>Faculty valuation on performance</p> <p>Interviews and Reflective activities</p>
5	<p>Understand project elements: requirements, creating task relationships</p>	<p>Exam and Group Questioning</p>
6	<p>Improved Communication and professional skills (Soft Skills)</p>	<p>Reflective write up, Interview and oral examinations based on Zoom meetings or face to face meeting.</p>