**IMPACTS OF PROJECT SPARTA**

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# Introduction

## Background of SPARTA

Smarter Philippines through Data Analytics R&D, Training, and Adoption (SPARTA), which was officially launched in February 2020, is a project which aims to establish the necessary online education, research, and development mechanisms, and infrastructure to enable the industry of data science and analytics (DSA) and foster smart governance practices. It is a project of the Department of Science and Technology (DOST) and Development Academy of the Philippines (DAP), in collaboration with Analytics Association of the Philippines (AAP) and Coursebank.

In 2017, Asia Pacific Economic Cooperation (APEC) Human Resources Development Working Group published projected DSA workforce demand in selected economies. The working group estimated that the Philippines would need 340,880 DSA workers by 2022. This increase will be driven by the demand from smart cities and the public sector, which will generate exponential volumes of big data in 2022. This projection predicates the creation of a platform for training and infrastructure support to develop this data-driven workforce.

In response to this, the knowledge democratization component of SPARTA aimed to develop 30 localized massive open online courses (MOOCs) on DSA and related fields across different learning pathways that aligned with the DSA roles that are in demand by the industry. The assumption was that the educational scalability of MOOCs would accelerate upskilling of a data-literate workforce, help meet the DSA job demand, and narrow the data skills gap. With the program in its second year now, it is good to revisit how effective SPARTA has been so far and to what extent it has contributed to its scholars' skills and career advancement.

## Results of Previous Tracer Study

In December 2020, DAP conducted a tracer study to know if there is an immediate impact in taking SPARTA courses on the career advancement and employability of the scholars. Based on the survey responses of 488 approved scholars from October 14 to December 6, 2020, the study found that SPARTA helped improve learners' Computational Thinking, Domain Knowledge, Research Capability, Learning Efficiency, Operations Productivity, and Problem-Solving Skills. Given that the project was in its earlier stages when the study was conducted, there was not enough evidence to support that SPARTA contributed to the scholars' salary improvement and promotion or exposed them to local and international communities with fields of specialization. Nonetheless, course completion allowed the scholars to apply their new learnings on data science and analytics in their work, particularly in research.

## Kirkpatrick's Training Evaluation Framework

The Kirkpatrick Model of Evaluation, developed by Donald Kirkpatrick in 1959, is the most popular approach for evaluating training program effectiveness across four levels: (1) reaction, (2) learning, (3) behavioral change, and (4) results (Kirkpatrick, 1994). Each level of evaluation has its place and significance. Each level of assessment builds on the other. Figure 1 shows the model and what each level assesses.



**Figure 1: Kirkpatrick’s Training Evaluation Model**

Kirkpatrick’s model provides a clear and logical structure and process to measure the impact of training programs. The model also provides a basis for an actionable measurement plan. It stresses a more holistic and comprehensive training evaluation across the different essential aspects to all relevant stakeholders: the learner, the instructor, and the employer.

Goh, Wong, & Ayub (2018) used Kirkpatrick’s framework to explore learner acceptance and effectiveness of massive open online courses (MOOCs). The same framework is also employed in this study to measure the effectiveness and impact of SPARTA. Each of the four levels of Kirkpatrick’s model is incorporated in the design and analysis of the tracer survey.

## Objectives

The main goal of this study is to evaluate the effectiveness of SPARTA as a program for building and improving the data science and analytics capability of the existing and future workforce in the Philippines. Likewise, this study aims to determine the program's early impacts on the scholars' career outcomes.

Specifically, this study aims to answer the following questions:

1. How did the scholars view the learning experience from the courses and the SPARTA program, in general?
2. To what extent did the scholars improve their knowledge and skills and change their attitudes due to course completion?
3. To what extent did the scholars change their behavior back in the workplace due to course completion?
4. How much did the scholars benefit professionally from the program?
5. What are the key segments of the target population for SPARTA?

## D. Scope and Limitations

As of August 2021, 27 out of the 31 MOOCs to be developed are already live. Three (3) learning pathways have already been completed―Data Analyst, Data Steward, and Analytics Manager. Given that the course development team will only complete the courses and the pathways within the second year of SPARTA, evaluation of the effectiveness and impact of the program could only be based on learner feedback after course-specific completions, instead of after pathway graduation. The contribution of SPARTA to the labor market success of its graduates will need to be reassessed once enough scholars have finished their pathways and earned their certificates.

Three data sources are used in this study:

1. **Tracer Survey** – is an online survey combining Likert scales, rating scales, nominal, and open-ended questions, which explored the level of learning gained by scholars and identified possible positive behavioral changes on the part of the scholars and improvements in career competencies and outcomes. This survey is based on a voluntary response sample of 702 learners who have completed at least one course under their pathway. It has a ±3.5% error margin at the 95% confidence level. It should be acknowledged that, since the sample is made up of respondents who self-select into the survey, feedback may be biased towards those of learners who have a strong opinion about the courses and SPARTA, whether favorable or not.
2. **Learner Gradebook** – reflects the grades the learners received by course per learning assessment. Data as of July 15, 2021, was extracted from the Coursebank platform.
3. **Course evaluation survey** – is an online exit survey that learners have to accomplish upon completion of every course. It evaluates the initial response of the scholars to courses’ content scope and quality, as well as subject matter experts (SMEs). Data as of August 21, 2021, was extracted from the Coursebank platform. Drill-down of the learners' ratings by the different aspects of the course (e.g., course objectives, course expectations, organization, methodology, learning of participants, subject matter, and speaker) is not within the scope of this study. The granular data for a number of the courses are unavailable due to the change in the platform where the survey is delivered and some of the survey questions since the start of the program. For the same reason, analysis of the relationship of level 1 evaluation with the other levels based on learner level data is likewise out-of-scope.

# II. Methodology

In this descriptive study, the tracer survey is mainly analyzed to evaluate SPARTA across three levels of the Kirkpatrick model: learning, behavioral change, and results. For level 4 evaluation, instead of assessing the impact on business or organizational outcomes, this study will focus on outcomes relevant to the learners' careers. For level 2 evaluation, analysis of the general weighted average (GWA) from the learner grade book is performed to complement the results of the tracer survey.

On the other hand, evaluating learners' reactions to the program and the courses is solely based on the course evaluation surveys.

## Evaluation Level 1: Reaction

To measure the learner's reaction to the courses, two key performance indicators (KPIs) are examined―average satisfaction rating and net promoter score (NPS). Both KPIs are generated per course and are based on the question that asks the respondent to rate the course from 1 to 10, an extended Likert scale. The average satisfaction rating is simply the mean of the ratings given by the respondents on each course. On the other hand, NPS is computed as the percentage of respondents who gave a rating of 8-10 (considered promoters) minus the percentage of respondents who gave a rating of 1-3 (considered detractors). Palmer & Devers (2018) used NPS to assess participants’ overall satisfaction with a specific MOOC.

Average satisfaction rating measures learner satisfaction with the course, while NPS measures learners' loyalty to the program. Since the 2 KPIs are complementary, analyzing them to gauge learner reaction to the courses can give a rich insight (Seaman, Allen, & Seaman, 2019).

To evaluate the learners’ overall satisfaction with the SPARTA program, averages of both the average satisfaction ratings and NPS of all live courses as of August 2021 are analyzed.

## Evaluation Level 2: Learning

To measure how much the scholars learned from the courses, analysis of GWA from Coursebank’s learner grade book and perceived improvement in DSA skills from the tracer survey is performed.

According to the approved instructional design, learners will have to pass the exit assessments (which consist of quizzes, peer-graded assignments, and capstone projects) for all the modules (referred to as Weeks in the program) and get a final grade of at least 70% to earn a certificate of completion for a course. The grades help gauge how much information was effectively absorbed by the scholars during the course. To evaluate the overall performance of the scholars in SPARTA as of July 2021, GWA is calculated as the average of the learners’ grades from all their completed courses as of the period. GWA distribution on both pathway and program levels is examined to confirm if the scholars get marks close to the minimum passing grade or significantly above it.

Additionally, to assess if the SPARTA courses have helped increase the learners' proficiency in required DSA skills, learners were asked to rate their proficiency before and after taking the courses. Deep-dive of shifts in proficiency levels is performed by skill to understand which areas SPARTA effectively trains scholars in immediately applicable data skills.

1. Evaluation Level 3: Behavior

Ideally, SPARTA scholars, having been immersed in the program and its culture, would either (1) immediately apply their learnings from the courses they finished back to the workplace or their projects or (2) impart their newly acquired knowledge with others. To capture these behaviors among scholars, the two questions which had been asked in the survey were: (1) “*Did you apply any of your learnings on your personal/professional tasks in the last three months?"* and (2) *“Have you shared to / taught other people your new knowledge or skills in the last three months?"*

To confirm if it can be expected that the majority (i.e., more than 50%) of the scholars would demonstrate either or both of the aforementioned desirable behaviors, one proportion Z-test (Frost, 2020) is employed to test the following null hypotheses:

* H01: Proportion of learners who would immediately apply their DSA learnings = 50%
* H02: Proportion of learners who would share their DSA knowledge = 50%

Open-ended questions about how the scholars applied or shared their learnings were also asked in the survey. To group the declared learning applications and knowledge sharing activities into broad categories, topic modeling was applied to the free-form text responses to these questions (Aggarwal & Zhai, 2012). To enable the labeling of automatically generated categories, visualization using word clouds (Smith et al., 2017) and examining top text responses under each category are done.

Scholars were also asked about the facilitating factors and barriers to the behaviors to further understand the drivers of learning application and knowledge-sharing behaviors.

## Evaluation Level 4: Results

SPARTA scholars were asked to rate the program's contribution to improvements in their career competencies and career advancement, from not applicable, low to very high. Competencies considered are Domain Knowledge, Research Capability, Learning Efficiency, Operations Productivity, Problem Solving Skills, and Computational Thinking Skills. On the other hand, career outcomes examined are Job Security, Career Movement (e.g., new job, lateral move into a different job family, promotion), Increased Income, and Exposure to local and international communities within fields of specialization.

## Other Feedback

Lastly, respondents were also asked open-ended questions to capture other feedback that can aid in the course and program enhancements. These questions were: (1) *“What did you find particularly rewarding about the program”* and (2) *“How can the delivery of the courses/program be enhanced?”*

Topic modeling, visualization, and labeling are similarly performed on free-form text responses to these questions to categorize the focus or emphasis of the given feedback.

# Results

## Motivation of SPARTA Scholars

Among approved scholars who have completed at least one course, the main reasons for their scholarship applications were upskilling and genuine interest in data science and analytics, followed by a passion for learning and employment opportunities (Figure 2). This result suggests that scholars who have progressed in their pathways are motivated primarily by self-development through learning new things and career growth.



**Figure 2: Motivations for SPARTA Scholarship Application**

## Evaluation Level 1: Reaction

### Program Level

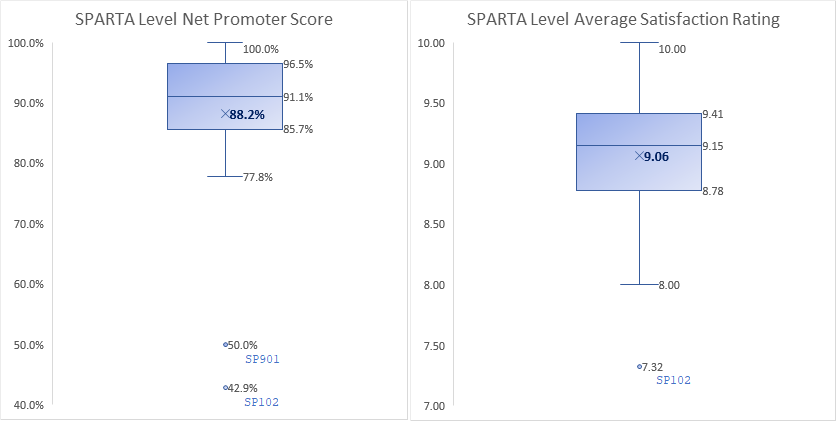
Course evaluations for the 27 live courses are analyzed, except for SP302: Enterprise Data Governance, which did not have any evaluation yet as of the time of extraction.

Figure 3 shows the distribution of both NPS and average satisfaction rating based on the following statistics:

* *Maximum –* highest value (excluding outlier)
* *Third quartile –* values within the 75th percentile (i.e., 25% of the data are above this level)
* *Median –* midpoint value (the line that divides the box plot)
* *First quartile –* values within the 25th percentile (i.e., 75% of the data are above this level)
* *Minimum –* lowest value (excluding outlier)
* *Interquartile Range –* mid-spread represented by the box plot (i.e., the range between the 25th and 75th percentile)
* *Mean –* average value
* *Outliers*

The SPARTA program scores an average of 88.2% NPS. The resulting median among the live courses is 91.1%, while the mid-spread shows 85.7% to 96.5%, which signifies relatively favorable satisfaction for the majority of the courses. Notably, there are two outliers, SP901: Data Science and Machine Learning using Python and SP102: Designing and Building Data Products, with NPS of 50%and 42.9%, respectively.

Overall average satisfaction rating (1 to 10, 1=lowest, 10=highest) for the SPARTA program is 9.06, close to the resulting median of 9.15. The mid-spread shows 8.78 to 9.41 ratings, which also signifies favorable satisfaction. Based on this KPI, SP102 is again an outlier, with an average satisfaction rating of 7.32.



**Figure 3: SPARTA Overall Net Promoter Score and Average Satisfaction Rating**

### DSA Competency Level

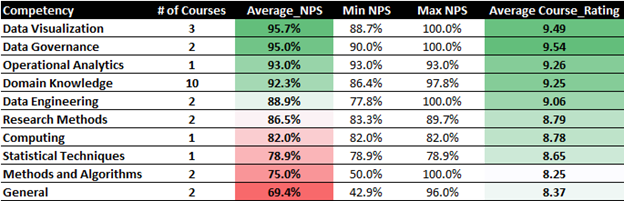
The courses are grouped according to their respective competency category. Table 1 shows the average NPS and satisfaction ratings per competency.

**Data Visualization** scored the highest NPS at 95.7%, while **General** scored the lowest at 69.4%. Notably, the spread between the two courses under **General** appears to be high (42.9% for one course and 96.0% for the other course).

In terms of NPS, the SPARTA program seems to be more well-received for its courses focused on business and organizational DSA competencies (i.e., data visualization, data governance, operational analytics, and domain knowledge), notwithstanding the generally high NPS (>70%) across competency categories.

The average satisfaction ratings among all competencies appear to be relatively high, with the highest satisfaction rating of 9.54 (**Data Governance**) and lowest at 8.25 (**Methods and Algorithms**).

**Table 1: Average NPS and Average Satisfaction Rating by DSA Competency Category**

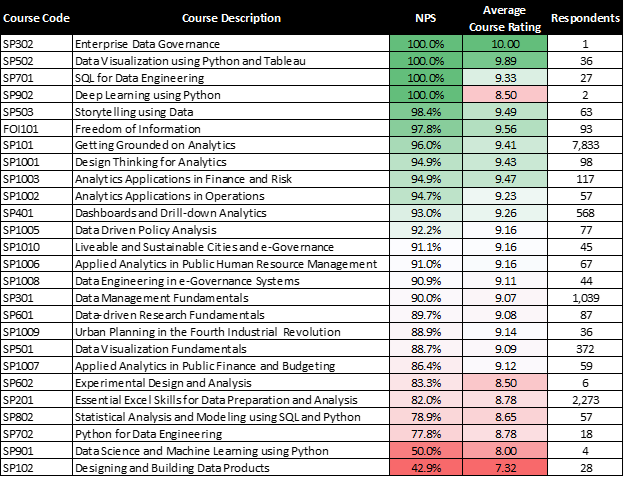


### Course Level

Table 2 provides a course-level view of NPS and satisfaction rating. In terms of NPS, all courses marked over 70% levels, except for SP901 and SP102. Both courses also garnered the lowest satisfaction ratings. Among all courses, the course development team should immediately prioritize these two for revisions or enhancements.

While SPARTA courses are mostly highly rated, other courses which could also be prioritized for enhancements are SP201: Essential Excel Skills for Data Preparation and Analysis, SP802: Statistical Analysis and Modeling using SQL and Python, and SP702: Python for Data Engineering.

**Table 2: Course Level NPS and Satisfaction Rating**



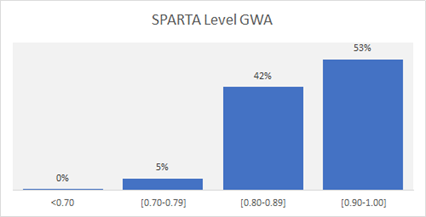
## Evaluation Level 2: Learning

### Based on General Weighted Average (GWA)

Learners’ GWA is aggregated and grouped into four bins:

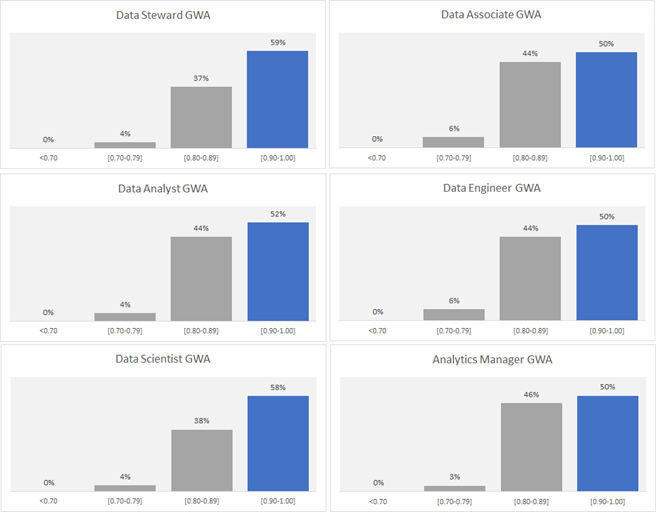
* + <0.70 (below passing mark of 70%)
  + 0.70-0.79 (70% to 79%)
  + 0.80-0.89 (80% to 89%)
  + 0.90-1.00 (90% to 100%)

Figure 3 presents the resulting distribution on a SPARTA level view. Most scholars, who finished at least one course, received GWA significantly higher than the passing mark.



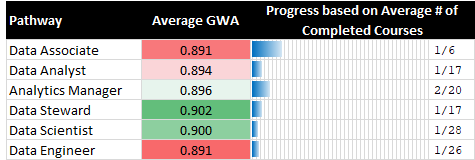
**Figure 4: Distribution of GWA of All SPARTA Scholars as of July 15, 2021**

Examining the distribution of GWA by learning pathway highlights that grades are consistently high across pathways. Notably, the scholars from the Data Steward and Data Scientist pathways mostly received very high grades (90% - 100%) after completing their courses, on average (Figure 4). Table 3, which shows the average GWA per pathway, also highlights this observation.



**Figure 5: Distribution of GWA by Learning Pathway**

**Table 3: Average GWA and Number of Completed Courses by Learning Pathway**



### Based on the Change in Perceived Proficiency in DSA skills (Before SPARTA vs. DURING SPARTA)

Distribution of learners based on their perceived proficiency level in specific DSA skills before joining SPARTA is compared against that which is based on skills proficiency while undergoing SPARTA. It is noted that, for DSA skills in which a considerable percentage of learners already have some experience before applying for the scholarship (e.g., Microsoft Excel, Data Visualization, Drill-Down Analytics, Research Method, Statistical Techniques, Domain Knowledge, Dashboard Generation, and Data Governance), more learners get to proficient or expert level after taking some SPARTA courses (Figure 6).



**Figure 6: Distribution Shift (Before SPARTA vs. During SPARTA)**

**by Proficiency Level per DSA Skill in which Majority of Learners Have Some Experience before Scholarship**

On the other hand, for DSA skills in which the majority of learners have no experience before their scholarship (e.g., SQL, Python, Tableau, Data Engineering, Machine Learning, and Deep Learning), more learners get to competent or proficient level while undergoing SPARTA (Figure 7).



**Figure 7: Distribution Shift (Before SPARTA vs. During SPARTA)**

**by Proficiency Level per DSA Skill in which Majority of Learners Have No Experience Before Scholarship**

## Evaluation Level 3: Behavior

### Application of DSA Learnings

About 69% of the sampled scholars declared that they had applied the knowledge and skills they acquired from the SPARTA courses they have taken so far on their professional and personal tasks in the past three months. This figure is statistically significantly greater than 50%, which suggests that it can be expected that the majority of SPARTA scholars would immediately apply their learnings on their projects or back in the workplace, even before graduating from the program (Table 4).

**Table 4: Proportion of SPARTA Scholars who Applied Their Learnings**

|  |  |  |
| --- | --- | --- |
| **Applied DSA Learnings in the Last 3 Months** | **#** | **%** |
| Yes | 482 | 68.7% |
| No | 220 | 31.3% |
| TOTAL | 702 | 100.0% |
| Z-stat: 10.659 | p-value: 0.000 | |
| Reject the H0. → p > 50% | | |

Upskilling and self-motivation are key reasons driving SPARTA scholars to apply what they learned from the DSA courses immediately. Ease of access to analytical tools, such as Excel, Google Sheets, Python, SQL, or Tableau, is also highlighted as a top facilitating factor for learners to apply their newly acquired knowledge and skills (Figure 8).



**Figure 8: Percentage of Scholars by Driver of Learning Application Behavior**

Conversely, the primary barrier to applying DSA learnings from SPARTA is being relatively new to the program (Figure 8).

Topic modeling of the free-form text responses of scholars, who applied their SPARTA learnings, to the question *“How did you apply any of your learnings on your personal/professional tasks?”* uncovered 12 categories of how learners apply their newly acquired knowledge and skills (Table 5).

**Table 5: Categories of Ways Scholars Apply their Learnings**

|  |  |  |
| --- | --- | --- |
| **Application of DSA Learnings** | **#** | **%** |
| **Application in Work, Report, Research** | 60 | 12% |
| **Application in Personal and Work-related Projects** | 58 | 12% |
| **Data Analysis for Research** | 54 | 11% |
| **Process Improvement using Excel** | 51 | 11% |
| **Use of Excel in Data Preparation and Analysis** | 49 | 10% |
| **Dashboard Generation** | 38 | 8% |
| **Application in Teaching, Research, and other School Requirements** | 36 | 7% |
| **Data Analysis and Reporting** | 35 | 7% |
| **Excel-based Database Creation and Maintenance** | 30 | 6% |
| **Data Gathering, Processing, and Visualization** | 28 | 6% |
| **Analytical Support for Decision Making** | 24 | 5% |
| **Data Management and Visualization for Research** | 20 | 4% |

Table 6 shows the top approaches and some sample responses under them.

**Table 6: Top Ways Scholars Apply their Learnings**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Approaches** | | | | | | **Sample Responses** |
| |  | | --- | |  | |  |  |  |  |  | “Currently teaching health research and health information. Involved in health information management and member of research technical team." |
|  |  |  |  |  |  | “I become part of the strategic planning committee, and I was assigned to analyze and generate a report for the data need for the undertaking.” |
|  |  |  |  |  |  | “conducting research in my area of work." |
|  |  |  |  |  |  | “I applied my learning on excel work like budgeting and reporting." |
| **Application in Work, Report, Research** | | | | |  | “Improved report submissions and data presentations; helped in my master's subjects in terms of presentation improvement." |
| |  | | --- | |  | |  |  |  |  |  | “Mostly on aligning analytics with business objectives via drill-down analytics. I'm also able to apply skills matching when seeking additional manpower on my projects.” |
|  |  |  |  |  |  | “Personal Projects in School” |
|  |  |  |  |  |  | “I tried to create small projects." |
|  |  |  |  |  |  | “Applied Basic Python skills for data engineering in consolidating data for my project.” |
| **Application in Personal and Work-related Projects** | | | | |  | “I am using Excel to organize my tasks. I am using my Python skills for learning other courses, for example, in Kaggle. Python for Data Engineering makes me feel confident to play around with data sets.” |
| |  | | --- | |  | |  |  |  |  |  | “I analyzed composition and trends of my student population. I also applied them to gain insights with personal surveys.” |
|  |  |  |  |  |  | “I used it on my research studies. In fact, one of my manuscripts recently got published in an international journal. I used my learnings to prepare my data for analysis, and it also helped me in completing the analysis needed for our quantitative study.” |
|  |  |  |  |  |  | “Study” |
| **Data Analysis for Research** |  |  |  |  |  | “Statistical analysis of research (and experiment) data.” |
|  | | | | |  | “Research and data analysis” |
| |  | | --- | |  | |  |  |  |  |  | “I often use Excel to fast track my tasks. “ |
|  |  |  |  |  |  | “I practice with excel in our office works, and given the time to accomplish a task, I use what I learn in excel to simplify the reports.” |
|  |  |  |  |  |  | “Advance use of Excel Data Cleaning “ |
|  |  |  |  |  |  | “Developing monitoring matrixes and preparing reports through the use of advanced excel techniques.” |
|  |  |  |  |  |  |  |
| **Process Improvement using Excel** | | | | |  |  |
| |  | | --- | |  | |  |  |  |  |  | “Thru our shared Google spreadsheet, I used the dropdown, the excel formulas in data counting, etc." |
|  |  |  |  |  |  | “Using Excel to create macros." |
|  |  |  |  |  |  | “In having deeper Excel Skills, I can now create Excel file for a large amount of data and analyze them. “ |
|  |  |  |  |  |  | “I applied my knowledge in excel in preparing records and grades of my students |
| **."**  **"Use of Excel in Data Preparation and Analysis"** |  |  |  |  |  | “We own a sari2x store, and I started keeping a record on sales, inventory, etc., for practice to improve my skills in DS.” |
|  | | | | |  |  |

### Sharing of DSA Learnings with Others

About half of the respondents declared that they had imparted their learnings to others in the last three months. The hypothesis test result shows that there is not enough evidence to expect that most SPARTA scholars will share their newly acquired DSA knowledge and skills with family, friends, colleagues, or peers (Table 7).

**Table 7: Proportion of SPARTA Scholars who Shared Their Learnings with Others**

|  |  |  |
| --- | --- | --- |
| **Shared DSA Learnings with Others in the Last 3 Months** | **#** | **%** |
| Yes | 368 | 52.4% |
| No | 334 | 47.6% |
| TOTAL | 702 | 100.0% |
| Z-stat: 1.285 | p-value: 0.099 | |
| Failed to reject the H0. → p = 50% | | |

Top facilitating factors that encourage knowledge-sharing behavior are (1) office/business culture, (2) ease of access to analytical tools, and (3) workplace/business requirement. Self-motivation is likewise highlighted as a significant driver of the behavior mentioned above (Figure 9).



**Figure 9: Percentage of Scholars by Driver of Knowledge Sharing Behavior**

Topic modeling of the free-form text responses of scholars, who shared their SPARTA learnings, to the question *“How have you shared to / taught other people your new knowledge or skills?”* revealed 13 themes of how learners share their knowledge and skills with others (Table 8).

**Table 8: Categories of Ways Scholars Share their Learnings with Others**

|  |  |  |
| --- | --- | --- |
| **Knowledge Sharing of DSA Learnings** | **#** | **%** |
| **Learning, coaching, or brown bag sessions** | 47 | 13% |
| **Teaching the use of Excel for process improvement and data analysis** | 41 | 11% |
| **Informal knowledge sharing to employees, peers, and friends** | 40 | 11% |
| **Sharing DSA basics and ideas through projects** | 34 | 9% |
| **Demonstration / Hands-on Tutorial** | 32 | 9% |
| **Teaching students** | 29 | 8% |
| **Sharing data-driven outputs** | 27 | 7% |
| **Sharing of Excel How-to's and Tips** | 24 | 7% |
| **Recommending SPARTA and sharing SPARTA resource materials** | 22 | 6% |
| **Sharing info, answering questions about DSA, giving feedback on data-related work** | 22 | 6% |
| **Sharing of knowledge with students, colleagues, and friends** | 21 | 6% |
| **Mentoring at work** | 15 | 4% |
| **Teaching on the use of analytical tools at work** | 12 | 3% |

Table 9 shows the primary knowledge-sharing approaches the scholars have done and some sample responses under them.

**Table 9: Top Ways Scholars Share their Learnings with Others**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Approaches** | | | | | | **Sample Responses** |
| |  | | --- | |  | |  |  |  |  |  | "Learning session in a small group monthly meetings" |
|  |  |  |  |  |  | "During peer to peer meetings and School Learning Action Cell. " |
|  |  |  |  |  |  | "Learning session with teammates " |
|  |  |  |  |  |  | "Conducted brown bag sessions to share my new knowledge and skills. " |
|  |  |  |  |  |  | "During coaching sessions, I get to apply MS excel execution." |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Learning, coaching, or brown bag sessions** | | | | |  |  |
|  |  |  |  |  |  |  |
| |  | | --- | |  | |  |  |  |  |  | "My spouse uses Excel in financial analysis, and I taught him how to get more analysis from the pivot table." |
|  |  |  |  |  |  | "I taught them how to use and interpret the data analysis and its results from Excel." |
|  |  |  |  |  |  | "I teach them some techniques I learn, like how to generate pivot tables, especially when working on almost big data." |
|  |  |  |  |  |  | "I taught some applicable excel commands based on their current workplace needs to make their task easier and support their management." |
| **"Teaching the use of Excel for process improvement and data analysis."** | | | | |  | "Teaching them a bit of excel function to simplify tedious office work." |
|  |  |  |  |  |  |  |
| |  | | --- | |  | |  |  |  |  |  | "On one occasion, I taught someone how to make a histogram, choose amount of bins for the graph." |
|  |  |  |  |  |  | "Sharing and providing benefits of the KPI dashboard." |
|  |  |  |  |  |  | "Knowledge sharing to co-employees" |
|  |  |  |  |  |  | "Through conversation" |
|  |  |  |  |  |  | "When doing an assignment with my classmates, if the things I learned are applicable, then I share my insights." |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Informal knowledge sharing to employees, peers, and friends** | | | | |  |  |
|  |  |  |  |  |  |  |
| |  | | --- | |  | |  |  |  |  |  | "Orienting people on the proper use and powerful application of Excel/Database Tables. Collaborating with IT and teammates to create new tables with the proper metadata to start capturing business-critical data and interpret it into useful information and insights." |
|  |  |  |  |  |  | "I was required to improve an existing excel tool and train a colleague how to run it. We also have a regular meeting where we share and comment on each others' projects. I use this venue to share knowledge by giving constructive comments and suggestions on how to improve projects." |
| **Sharing DSA basics and ideas through projects** | | | | |  | "mentoring and projects" |
|  |  |  |  |  |  |  |
| |  | | --- | |  | |  |  |  |  |  | "I helped my friend create her own tracker and dashboard that will be useful in the department where she's assigned." |
|  |  |  |  |  |  | "Showing others how to create their own dashboards, helping out with a few excel questions. " |
|  |  |  |  |  |  | "Since my colleague is in the same line of work with me, I share what I know and let him improve his skills by finding solutions to technical errors when using SQL. I also let him create dashboard reports for him to be familiar with the tools that we use as well as to improve his critical-thinking skills." |
| **Demonstration / Hands-on Tutorial** | | | | |  |  |

## Evaluation of Level 4: Results

Respondents were asked to rate the extent to which SPARTA contributed to improvements in 2 broad areas of personal and career growth: career competencies and career outcomes, with = Not Applicable, 1 = Low, 2 = Moderate, 3 = High, and 4 = Very High.

On average, the scholars considered SPARTA's impact on their career competencies and outcomes moderate (i.e., below 3). It is observed that SPARTA's influence thus far is mostly on improvements in learners' competencies (Table 10).

**Table 10: Average Rating of SPARTA’s Contribution to Personal and Career Growth**



In terms of competencies, SPARTA has had a more significant impact on improving the learners' problem-solving skills, computational thinking skills, and learning efficiency, with the majority of the respondents rating SPARTA's contribution from high to very high in these areas (Figure 10).

As for career outcomes, most scholars rated the program's impact from moderate to high across outcomes, except for the increase in income, as a considerable percentage of the respondents have not had a salary increase at the time of the survey (Figure 10). Relative to other outcomes, the program's impact seems mostly on career movement (e.g., new job, lateral move into a different job family, promotion) and job security. Further, exposing SPARTA scholars to an international community of DSA practice seems to be an area of opportunity.



**Figure 10: SPARTA’s Contribution by Career Competencies and Outcomes**

## Learner Segmentation

Five learner segments are identified among SPARTA scholars who have had progress with their pathways: (1) academics, (2) dabblers, (3) shifters, (4) engaged, and (5) progressives. Table 11 presents the profiles of the different segments, based on their demographics, information source, learning progress, behaviors, and perception of SPARTA’s impact on their personal and career advancement.

Twenty-five percent (25%) of the sampled scholars are progressives, while 15% belong to the engaged segment. These 2 are the ideal segments of learners. Dabblers, who comprise 22% of the participating scholars, is the least ideal segment, as most drop-outs could come from this learner group. On the other hand, Academics and Shifters comprised 17% and 20% of the sample, respectively.

**Table 11: Learner Segments**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Academics** | | **Dabblers** | **Shifters** | |
| Demographics | ● **Mostly female**  ● Mostly 35-44 y.o. **Oldest among five segments** (Ave. Age = 34 y.o.)  ● Mostly from **NCR, Central Luzon**, and **CALABARZON**  ● Most completed Bachelor's Degree. **The highest percentage of post-graduate degree holders** among the five segments  ● Mostly from the **Academe** and **Public sector** | | ● **Predominantly male**  ● Mostly **25-34 y.o**. Ave. age = 31 y.o.  ● Mostly from **NCR** and **CALABARZON**  ● Most completed Bachelor's Degree  ● Mostly from public and private sectors | ● **Mostly female**  ● **Mostly 18-34 y.o.**  ● Mostly from **CALABARZON** and **NCR**  ● Mostly, Bachelor's degree holders.  ● Mostly from public and private sectors | |
| Application | ● Found out about SPARTA mostly **from social media and through organizations**  ● **Motivation** for applying in SPARTA: **Upskilling**, **Genuine Interest in DSA, Passion for Learning, Privilege of being a Scholar, Employment Opportunities**  ● Mostly Data Scientist, Data Associates, and Data Analysts | | ● Found out about SPARTA mostly from **social media**  ● Motivation for applying in SPARTA: **Upskilling, Genuine Interest in DSA**  ● Mostly **Data Scientists and Data Engineers** | ● Found out about SPARTA mostly from **family, friends, colleagues, and acquaintances,** and **social media**  ● Motivation for applying in SPARTA: **Upskilling, Genuine Interest in DSA, and Employment Opportunities**  ● Mostly Data Scientist, Data Analysts, and Data Associates | |
| Learning | ● **Lowest average GWA** (88.7%)  ● Average pathway completion rate: 18%  ● **Moderate increase in proficiency in most required DSA skills** during SPARTA; **except SQL, Python, Research Methods, Statistical Techniques**, and **Domain Knowledge** | | ● **Lowest average pathway completion rate**: 12%  ● **Marginal increase in proficiency in a few DSA skills during SPARTA** overall; moderate improvement particularly Data Governance, Dashboard Creation, Drill-Down Analytics, and Data Visualization | ● Average completion rate: 15%  ● **Lowest perceived improvement in required DSA skills**; moderate improvement particularly in Excel, Data Governance, Dashboard Creation, Drill-Down Analytics, Data Visualization, and Data Engineering | |
| Behavior | ● Immediately **applied and shared their learnings** from SPARTA  ● **Facilitating factors** driving **the application of learnings**: **Upskilling, Self-motivation, and Access to Tools**  ● **Facilitating factors of knowledge sharing** behavior: **Access to Tools, Self-motivation** | | ● Have **neither applied nor shared their learnings from SPARTA**  ● **Barriers to learners applying their learnings**: **Too early** in the learning pathway, **No workplace/business requirement**  ● **Barriers to knowledge sharing behavior** is being **too early** in the learning journey and **lack of time** | ● **Immediately applied their learnings but have not shared them with others**  ● **Facilitating factors of learners applying their learnings**: **Upskilling, access to tools, Self-motivation**  ● **Barriers to knowledge sharing** behavior: **Too early** in the learning journey, **Lack of knowledge sharing opportunities**, **Lack of time** | |
| Career Outcomes | ● Thinks SPARTA had a high contribution to improvement in career-related competencies and moderate contribution to career outcomes. | | ● **Thinks SPARTA had low to moderate contribution to personal and career growth overall.** | ● **Thinks SPARTA highly contributed to improvement in some career-related competencies like Learning Efficiency, Research Capability, Problem Solving, and Computational Thinking**, but only **moderately contributed to** other competencies like Domain Knowledge and Operations Productivity and **career outcomes.** | |
|  | **Engaged** | **Progressives** | | |
| Demographics | ● **Predominantly male**  ● Mostly 25-34 y.o. **Youngest among five segments** (Ave. age = 29 y.o.)  ● Mostly from **CALABARZON** and **NCR**  ● Mostly, Bachelor's degree holders.  ● Mostly from private and public sectors and academe | ● **Predominantly male**  ● Mostly **25-44 y.o.** Ave. age = 32 y.o.  ● Mostly from **NCR** and **CALABARZON**  ● Mostly Bachelor's and Master's Degree holder. Has the **2nd highest percentage of post-graduate degree holders**  ● Mostly from private and public sectors | | |
| Application | ● Found out about SPARTA mostly from **social media**  ● **Most interested in DSA among five segments**  ● Motivation for applying in SPARTA: Upskilling, Genuine Interest in DSA, Passion for Learning, Employment Opportunities, Privilege of being a Scholar, Diversion during Pandemic, and Application of DSA Learnings. Other reasons include: Earning CPD credits, Curiosity, and Preparation of MS Data Science  ● Mostly Data Scientists and Data Associates | ● Found out about SPARTA **mostly from family, friends, colleagues, and acquaintances**, and **social media**  ● Motivation for applying in SPARTA: **Upskilling, Genuine Interest in DSA, Passion for Learning**  ● Mostly Data Associates, Analytics Managers, and Data Analysts | | |
| Learning | ● Average pathway completion rate: 15%  ● **Declared the most considerable improvement in all required DSA skills among the five segments** | ● Highest average pathway completion rate: 22%  ● **Moderate increase in proficiency in most required DSA skills during SPARTA**; except SQL, Python, Tableau, Statistical Techniques, and Machine Learning | | |
| Behavior | ● Immediately applied and shared their learnings from SPARTA. **One of the two segments with the highest percentage of learners who applied their learnings.**  ● **Facilitating factors of learners applying their learnings**: **Upskilling, Self-motivation, Access to tools**; marginally, workplace requirement  ● **Facilitating factors of knowledge sharing** behavior: **Office culture, Workplace requirement, Access to tools, Self-motivation** | ● **The highest percentage of learners who applied and shared their learnings among all segments**  ● **Facilitating factors to applying and sharing knowledge**: **Upskilling, Self-motivation, Access to Tools**  ● Additional **facilitating factor to knowledge sharing** behavior: Workplace requirement, Office culture | | |
| Career Outcomes | ● Thinks **SPARTA highly contributed to improvement in career-related competencies as well as Job Security**; but only moderately contributed to career outcomes like Career Movement, Increased Salary, and Exposure to the local and international community within fields of specialization | ● Thinks **SPARTA had a high contribution to improvement in career-related competencies** and moderate contribution to career outcomes. | | |

## Other Feedback

When asked, "What did you find particularly rewarding about the program?" twenty-two themes emerged from the learners' responses based on the results of topic modeling. Table 12 lists these themes.

Learning new things about DSA stands out as what learners find rewarding about the program. Although marginally, learners also consider applying their new knowledge, access to self-paced study, and satisfaction of finishing a course as fulfilling aspects of the program.

**Table 12: Themes in What Scholars Find Most Rewarding about SPARTA**

|  |  |  |
| --- | --- | --- |
| **What scholars consider most rewarding about SPARTA** | **#** | **%** |
| New Learnings | 40 | 7% |
| Gaining new knowledge | 40 | 7% |
| Obtaining certificates | 38 | 6% |
| Learning DS at their own pace | 35 | 6% |
| Sense of accomplishment of finishing a course | 33 | 6% |
| Self-paced study | 32 | 5% |
| Acquiring new skills | 32 | 5% |
| Application of DS learnings at work | 30 | 5% |
| Knowledge of data science | 29 | 5% |
| Applicability of DSA to current fields and others | 28 | 5% |
| Overcoming challenges in the course of the learning journey | 28 | 5% |
| Benefits of the program | 28 | 5% |
| Satisfaction of finishing a course | 27 | 5% |
| New learning and upskilling | 25 | 4% |
| Career growth | 25 | 4% |
| Learning opportunity | 24 | 4% |
| Skills expansion and privilege of being a DOST scholar | 24 | 4% |
| Learnings | 22 | 4% |
| Practical application of learnings | 15 | 3% |
| Learn additional knowledge and skills | 14 | 2% |
| Learning Data Analytics | 12 | 2% |
| A better understanding of data and DSA and their importance | 11 | 2% |

On the other hand, when asked for improvement points on SPARTA, 19 themes emerged from the responses, as shown in Table 13. Further combining similar themes, it is noted that course content, peer-grading process, and course delivery are critical areas of improvement. Moreover, many learners are requesting the required time to complete courses or a pathway, and the duration for SPARTA itself, to be extended, especially in consideration of beginners in DSA and the working segment.

**Table 13: Areas of Improvement of SPARTA Program According to the Learners**

|  |  |  |
| --- | --- | --- |
| **Improvement Areas of SPARTA** | **#** | **%** |
| **Improvement to course delivery** | 54 | 10% |
| **Longer time allowance for completing pathway for working individuals and beginners in DSA** | 52 | 10% |
| **Improve / Increase projects (e.g., capstones, hackathons)** | 45 | 8% |
| **Program extension beyond three years** | 44 | 8% |
| **Positive feedback on course delivery** | 40 | 7% |
| **Content improvements** | 34 | 6% |
| **Minimize peer-graded assignments** | 33 | 6% |
| **Improved course delivery and more real-life applications** | 28 | 5% |
| **More practical and hands-on exercises** | 26 | 5% |
| **Improve certificate generation and extend deadlines** | 26 | 5% |
| **Learner support/learning aids** | 25 | 5% |
| **Make courses beginner-friendly** | 24 | 4% |
| **Learner support to reduce time to complete and rate peer-graded assessments** | 22 | 4% |
| **Additional content and interactive sessions** | 20 | 4% |
| **Improve peer-grading process** | 20 | 4% |
| **Increased / Improved projects** | 14 | 3% |
| **Easier exit assessments and improved rating process** | 13 | 2% |
| **Cohorting, Group Study** | 10 | 2% |
| **Positive feedback about SPARTA** | 10 | 2% |

# Discussion

Overall satisfaction of scholars on the SPARTA programs is remarkably high, except for two courses, SP102 and SP901, which need to be systematically reviewed and revised the soonest. Notably, courses covering more business and organizational DSA competencies (i.e., data visualization, data governance, operational analytics, and domain knowledge) are highly rated by scholars.

In general, scholars got significantly higher than passing GWA, irrespective of the learning pathway. Perceived proficiency improvement is also evident across all DSA skills. However, skills in which learners get to proficient to expert levels are those in which they already have prior exposure or experience before enrolling in SPARTA (Microsoft Excel, Data Visualization, Drill-Down Analytics, Research Method, Statistical Techniques, Domain Knowledge, Dashboard Generation, and Data Governance). 5 out of 8 of these skills also happen to be related to business and organizational DSA competencies, which could be why courses that cover the same topics are also quite well received. It should also be noted that the average number of courses completed across pathways is 1, except for Analytics Manager. Courses on more technical competencies would also likely be taken by the learners much later in their pathways. This could mean that how learners perceive these technical courses and how much they learn from them would probably improve over time as more scholars progress in their pathways.

Most SPARTA scholars would likely immediately apply their newly acquired knowledge and skills from the courses, but a lower percentage would likely impart what they learned. A common facilitating factor of both behaviors is self-motivation and access to tools. An additional factor driving scholars to apply their learnings practically is their opportunity to expand their DSA skills. For knowledge sharing behavior, office culture and workplace requirements are also identified as facilitating factors.

The main reason for the learners not imparting and applying their DSA learnings is that it is still too early for them in their pathway. Lack of training or knowledge sharing opportunities and lack of time were also identified as barriers to knowledge sharing behavior.

The project team can incorporate these facilitating factors and barriers in creating messaging and interventions towards SPARTA's existing and potential community of learners as part of the program's communications and community management strategy. The project team can also combine this with the five learner segments for the design and implementation of messaging and interventions tailored to the segments' unique needs, perceptions, attitudes, and concerns.

Additionally, the project team can use learner segmentation to target ideal profiles of learners for lead generation. Since social media is the primary information source and acquisition channel of SPARTA, hyper-targeting through the different platforms can be explored using the demographic and geographic characteristics of the ideal segments and their interests.

In terms of SPARTA's contribution to the learners' personal and career growth, consistent with the findings of the tracer study in December 2020, there is still not enough evidence to claim that the program helped significantly improve career outcomes for the learners. Based on performance so far, SPARTA has been more effective in building the DSA knowledge and upskilling of its learners and motivating and evoking positive learner behavioral changes.

Drilling down into the learner segments, it is noted that the ideal, more engaged segments (i.e., Engaged, Progressives), who are the ones most likely to practice the desirable learner behaviors consistently, are also the ones who seem to have professionally benefitted the most from the program. As more SPARTA scholars consistently apply and share what they learned from the courses, the more likely they will realize the benefits of the scholarship on their personal and career growth.

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