Program-Level Assessment: Annual Report

Program: Post-baccalaureate certificate in Analytics	Department:
Degree or Certificate Level: Post-baccalaureate/graduate	College/School: School for Professional Studies
Date (Month/Year): June 2021	Primary Assessment Contact: Srikanth Mudigonda

In what year was the data upon which this report is based collected?

Summer 2020, Spring 2021

In what year was the program's assessment plan most recently reviewed/updated?

2021

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle?

The learning outcome assessed during this cycle is, *Graduates will be able to implement analytics systems that facilitate context-appropriate decision making.*
We assessed this last year as well. Re-doing it because of the importance of this in terms of preparing students for employment in professional areas associated with analytics.

2. Assessment Methods: Student Artifacts

Which student artifacts were used to determine if students achieved this outcome? Please identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

The final projects that students submitted as part of: (a) AA 5300: Advanced Analytics; (b) AA 5800: Simulation and modeling.
The program is offered in an entirely online format, so each course in the program is offered in an entirely online format.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the student artifacts, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and include them in/with this report.

Rubrics that were used for evaluating the final projects of the students were used in assessing the learning outcomes. In addition, data from end-of-course evaluations by the instructor of the courses, along with end-of-course evaluations by students taking the course.

4. Data/Results

What were the results of the assessment of the learning outcomes? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

The course AA 5800 (Summer 1, 2020) had 9 students, of whom 6 did very well on the final project, 1 did not complete the project (dropped the course), and 2 did reasonably well. Based on the final projects (rubric in file

"AA5800-project-rubric.pdf"), it was evident that there was a struggle with creating/adapting the code needed for running the analyses. While helping the students with the projects, I realized that the struggles stemmed from not developing a fluency in the specific way in which the statistical models needed to be specified. This problem, in turn, stemmed from relying heavily on the learning materials (code, in particular) provided by the author of the course's textbook – students knew how to read the code and use it, but were uncomfortable in coming up custom code to analyze their unique datasets for the project. This finding holds, to different degrees, across all but one student's work (so 7 out of 8 students who completed the final project struggled, to varying degrees, with creating the code from scratch).

The course AA 5300 (Spring 1, 2021): Advanced Analytics had 16 students of whom 3 students were not from the MS Analytics or the PBC Analytics programs, so their work has not been included in the assessment (as their academic preparation coming into the class is not necessarily the same as that of a typical student in the MS Analytics program taking the course). Of the remaining 13 students, 1 did poorly, 2 reasonably well, and 10 very well. Based on the experience gained during the previous time this course was taught, changes were made to the choice of learning materials (software framework used, sequence in which concepts were presented, etc.). These appear to have led to more positive outcomes. Speaking with the students, in conjunction with looking at the anonymous feedback provided via Blue, and their performance on the final project, it appeared that the current cohort are more comfortable with writing the needed code by building upon what they learned both during this course and in AA 5000: Foundations of Analytics, which is a key pre-requisite.

The PBC program in Analytics is relatively new, with relatively few students taking it. In addition, the sequencing of the electives meant that in AY 2020-21, only 2 of the 4 students who are/were in the PBC program in Analytics took only one of these two courses – AA 5300. This paucity of data will be addressed in the next assessment cycle when three of the four required course, viz., AA 5000: Foundations of Analytics, AA 5100: Information Retrieval, and AA 5200: Information Visualization and Presentation will be included in the assessment process – these courses will coincide with the assessment of learning outcomes of the MS Analytics courses with which the PBC program in Analytics shares all of its courses.

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

Reflecting on the assessments performed in AA 5300 and AA 5800, it is clear that the recent changes made within AA 5000 (which is a key pre-requisite to both AA 5300 and AA 5800) were largely helpful. In addition, it was evident that the changes made to the content and its delivery in AA 5300 were also helpful. Additionally, a weakness in the choice of learning materials (specifically, code) used in AA 5800 became apparent.

Synthesizing these findings, here are the next steps:

1. continue with the approach used in AA 5300;
2. revisit the choice of coding-related content of AA 5800: use a combination of material from the textbook's author initially in the course, and switch to a wider variety of code libraries and associated code syntax in later part of the course, to increase student's fluency with writing the code needed for building sophisticated statistical models;
3. investigate to what extent learning in AA 5000, AA 5100 and AA 5200 will be sufficient/insufficient in preparing students for the advanced elective (one of AA 5300, AA 5750: Contemporary Issues in Analytics, AA 5800).

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

The program director will, through one-one meetings, share the findings of this cycle of assessment with the faculty teaching other courses in the program, specifically those courses that are related to this learning outcome and/or are pre-requisites for courses that address this learning outcome. In particular the following course's instructors will be informed and made aware of the larger context of assessment: AA 5100: Information Retrieval; AA 5200: Information Visualization and Presentation; AA 5750: Contemporary Issues in Analytics. This will help them prepare for having their courses being part of the next cycle of assessment.

B. How specifically have you decided to use findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Student artifacts collected • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of the findings.

As mentioned earlier in sections 4 and 5, AA 5800 would be revised to improve student's fluency, and thus confidence, in creating the code needed for sophisticated statistical analyses. Additionally, instructors in courses that are auxiliary and help in addressing the LO of "*Graduates will be able to implement analytics systems that facilitate context-appropriate decision making*" (AA 5100, AA 5200) will be informed of the results of the current assessment cycle. These instructors' inputs will be sought in determining the changes that are needed, if any, to their courses to improve the competence and self-efficacy of students. The goal is to develop the students' confidence in writing code that is part of different phases in the sequence of activities that are part of designing and implementing analytics systems.

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

During the previous assessment cycle, changes were made to AA 5000: Foundations of Analytics, which is a key

pre-requisite to AA 5300 and AA 5800. During the current academic year, changes were made to AA 5300 to address the needs for revision that were discovered during the previous assessment cycle. The current version appears to have resulted in a better learning experience for the students. Additionally, weaknesses discovered as part of assessment associated with AA 5800 during the 2020-21 assessment cycle will be addressed in the current (i.e., summer 2021) iteration of the course, and the results will be assessed.

B. How has this change/have these changes been assessed?

As explained previously in this document, the changes made to AA 5000 and AA 5300 led to positive outcomes – this conclusion is limited in its applicability by the fact that not all students in the PBC in Analytics may choose to take AA 5300 (or AA 5800) as an elective.

C. What were the findings of the assessment?

Please see part A above.

D. How do you plan to (continue to) use this information moving forward?

Please see part A above.

IMPORTANT: Please submit any assessment tools and/or revised/updated assessment plans along with this report.

AA 5300 Rubric for data analysis project

Rubric for data analysis project

Criteria	Ratings	Pts
Introduction - overview of data 1. Overview of the dataset: a) Contextual information: i. Source of the data. (1) ii. A brief description of objectives behind the collection of the data. (1.5) iii. The entity that collected the data. (0.5) iv. Questions that audience interested in the dataset and its analyses might seek to see answered, etc. (2.5) Present the questions in a numbered list. (0.5)	This area will be used by the assessor to leave comments related to this criterion.	6 pts
Introduction - variables b) Variables present: i. Their types (categorical/continuous). (1) ii. Their roles (predictor or outcome). (1) Present this information in a table with appropriate column headers. (0.5)	This area will be used by the assessor to leave comments related to this criterion.	2 pts
Type of analyses 2. Type of analyses: a) A brief explanation of which analytical techniques are applicable for regression and why. (1) b) A brief explanation of which analytical techniques are applicable for classification and why. (1) The descriptions of the methods will be in brief in this section; detailed explanations are to be provided in the Analyses section – see the first requirement in Analyses below.	This area will be used by the assessor to leave comments related to this criterion.	2 pts
Analyses - overview 1. Overview: In a table with three columns and one row per method, describe in sufficient detail: a) Methods of analyses that are applicable. (3) b) For each method, an explanation of whether you intend, or not, to use the method (3) c) Present concisely the rationale behind using or not using the method, within the context of your dataset, and what you know about the method's strengths and weaknesses. (3) d) If you have used clustering or dimensionality reduction, explain in what way this/these technique/techniques aided the model building process. If you have not used either of these approaches, explain why these methods were not used (2 points). e) If you have used subsampling to obtain a reduced (rows) version of your dataset in order to achieve model fit in a reasonable amount of time, explain the details of the approach you have used (please feel free to use the approach that was described during the week 7 Zoom session and in the Canvas Q+A discussion thread (response posted on March 6, 12:06 AM) by the instructor to substantiate your choice	This area will be used by the assessor to leave comments related to this criterion.	13 pts

Criteria	Ratings	Pts
of subsampling strategy. If you did not use subsampling, explain why that was not needed. (2 points)		
Analyses - summary of results 2. Summary of results: Create a table for each method that you have used (that is, if you have used three modeling techniques, you will include three individual tables, one per each technique), where you present: a) Details of the validation method used (k-fold CV, preferably with repetitions, using Caret or hand-written k-fold CV code) (1) b) Model formulas of the various models you have fit using the particular method. (3) c) An explanation, using appropriate evidence, of model selection and evaluation measures used for identifying the best model, and determining the range of its applicability. (3– see point 2 in Conclusions)	This area will be used by the assessor to leave comments related to this criterion.	7 pts
Conclusions - 1 Based on a comparison of the results from the modeling techniques you have employed, and the results of the associated “best” models, explain which modeling technique performed the best. (4)	This area will be used by the assessor to leave comments related to this criterion.	4 pts
Conclusions - 2 Provide a description of the results of the best model. Explain them within the context of your dataset, taking into account the assumptions and theory associated with the modeling technique. For example, if you found that a random forest model out-performed all other models built using several modeling approaches, explain why you think that is. Then, explain what the importance statistics/variation in parameter estimates associated with the model imply to a decision-maker. (6)	This area will be used by the assessor to leave comments related to this criterion.	6 pts
Conclusions - 3 Based on your understanding of the dataset and your analysis of it, what future work do you think will provider deeper insights into how the dataset can help a decision-maker who is associated with the context within which the dataset was collected? (4)	This area will be used by the assessor to leave comments related to this criterion.	4 pts
Submission requirements 1. In addition to the project report, please provide the R source code in an individual .R file. (1) 2. Be sure to include your name and the “final data analysis project” the filename. Also, please include your name at the top of the R source file. (1) 3. Where needed, include meaningful comments in the R source code so that the reader can understand your intent. (2) 4. Be sure that the comments are consistent with the code (if you copy+paste code from previous assignments, you may, inadvertently include comments that are not applicable to your final project – be sure to check for consistency!). (1) 5. Along with the source file, please include your dataset in a form that is readily	This area will be used by the assessor to leave comments related to this criterion.	10 pts

Criteria	Ratings	Pts
readable in R. In the R source code files, when you use read.csv(…) or similar function calls for loading the data into the R environment, please embed the name of the datafile directly, that is, pass the name of the file directly into the read.csv(…) function as its first argument. Do not make the user type the name of the file at run time. Please ensure that the data file can be read from the current folder/directory, rather than from a directory that is specific to the folder/directory structure on your computer. (1) 6. When submitting your work, please include the following files into a folder, create a compressed archive of it (zip format), and upload the compressed archive (2): a) Your project report in the form of a PDF file, with appropriate filename (indicating your name and “final project” in it). (0.5) b) R source code file (0.75) c) Your datasets in a readily-readable form (0.75)		
		Total Points: 54

Name AA 5800 Applied data analysis project's rubric

Description

Rubric Detail

Criteria	Levels of Achievement Score on the criterion
Introduction 1.a.	**0 to 1 points** a) the source of the dataset and the purpose for which it was collected
Introduction 1.b	**0 to 3 points** b) description of the specific variables in the dataset, presented in a table with three columns, which are, successively: name of the variable, its measurement type, and its purpose (predictor and/or outcome)
Introduction 2.	**0 to 4 points** 2. Three research questions, which you intend to answer via analysis of the dataset
Introduction 3.	**0 to 4 points** 3. Specific hypotheses derived from your research questions, stated in a manner that they can be addressed via measures of ROPE and HDI of the appropriate model parameters.
Models 1.	**0 to 3 points** 1. A description of your model, or models, specified in the form of equations containing specific combinations of predictors and their associated parameters.
Models 2.	**0 to 4 points** 2. A diagram, representing the relationship among the outcome, predictors, various model parameters, their priors and the likelihood function. Please use a schema similar to the figures used in our textbook. You are welcome to draw the figure by hand and include an image version of it in your document.
Results 1.	**0 to 6 points** 1. Appropriate graphical and numerical output that is relevant in the context of the hypotheses stated in Introduction.
Results 2.	**0 to 6 points** 2. An interpretation of the output to determine whether there is support for the hypotheses (use ROPE and HDI in your arguments).

Criteria	Levels of Achievement Score on the criterion
Conclusions 1	**0 to 6 points** 1. Summarize your results and explain what they mean, together, in the context of the initiative that led to the collection of data that you used.
Conclusions 2	**0 to 4 points** 2. Identify and describe at least two avenues for future work that builds on your findings.
Conclusions 3	**0 to 3 points** 3. Explain any difficulties you encountered while completing your project and what approach(es) you have used for overcoming them.
Additional requirements	**1 to 5 points** 1. Please proof-read your report to reduce the occurrence of errors in spelling, grammar, and argumentation. 2. Include a footer, with page number, on each page. 3. Include a title page, with your name, the name of your dataset/project, and the course number + name. 4. Ensure that you include all of the relevant information and that your report is no longer than 10 pages (using 1” margins, 11-point serif font (like Times New Roman), and a reasonably-sized line-spacing. 5. Include appropriate comments to annotate your R source code. 6. Be sure to submit your dataset in a form that can be imported readily into R. either perform all data manipulations ahead of time, and use a “cleaned” version of your dataset in your analysis or include all of the cleaning operations’ commands in your R source file

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