

Board 1: Empowering Underrepresented Minority Students in One Aviation Program: Integrating a National Airport Design Competition into the Curriculum

Dr. Yilin Feng, California State University, Los Angeles

Yilin Feng is an assistant professor at California State University, Los Angeles. She received her Ph.D. degree from Purdue University. Her research interest is in airport simulation, operation, and management.

Empowering Underrepresented Minority Students in One Aviation Program: Integrating a National Airport Design Competition into the Curriculum

Abstract

This research paper examines the integration of the Airport Cooperative Research Program (ACRP) University Airport Design Competition into a junior/senior level undergraduate course within the Aviation Administration Program at California State University, Los Angeles (Cal State LA), a Minority Serving Institution characterized by a predominantly Hispanic/Latino student enrollment. Many of these students arrive with varying levels of academic preparedness according to conventional standards.

The study explores the approach of using the ACRP University Airport Design Competition as the focal point of the curriculum, fostering a dynamic learning environment that directly engages underrepresented minority students (URM). Participation in the ACRP University Airport Design Competition serves as a transformative experience, enabling students to recognize and harness these inherent community cultural wealth, such as aspirational capital, navigational capital, resistant capital, and social capital. This recognition not only bolsters their confidence but also bridges the gaps in their academic proficiency.

This paper presents the design and implementation of the course, highlighting how it enables students to apply classroom theory and their practical work experiences to the project to solve real-world problems. The changes made by the instructor to address the diverse situations and needs of our students is explained. This paper also discusses how participating in national competitions could potentially benefit student self-confidence, as well as their professional and academic growth. The impact of these practices is evaluated through an analysis of students' project reports, feedback, and survey results.

Introduction

One Airport Administration course is provided in the aviation administration program in a Minority Serving Institution (MSI). The majority of the students enrolled in the Airport Administration course come from underserved community who face numerous barriers that impede their academic success. As one part of the course redesign in 2022, the Airport Cooperative Research Program (ACRP) University Airport Design Competition was added into the course curriculum as the student project. The ACRP University Design Competition encourages undergraduate and graduate students to identify challenges faced by the airport in the U.S. and propose a possible solution. This integration aims to connect the lecture topics with real world problem and provide students the opportunity to apply what they have learned in class to solve some real-world problems.

However, the instructor neglected to incorporate the unique characteristics of the students into the course redesign in 2022. The course was improved to a "student-centered" approach in 2023 based on students' feedback, as well as the inspiration of the Community Culture Wealth

framework [1] and the pull learning strategy [2]. A report from the National Academies [3] also underscored the importance of fostering a learned-center culture that could “meet students where they are” (page 4). This paper first presents the adjustments of the course curriculum in 2023 fall semester. The effect of the adjustment is assessed and discussed through the assessment of students project reports in 2022 and 2023 fall semester.

Literature Review

Two theories, Community Culture Wealth framework and the pull learning strategy, inspire the integration of ACRP University Design Competition in the Airport Administration course.

Community Culture Wealth framework

Dr. Tara Yosso's Community Cultural Wealth framework, as articulated in her 2005 article "Who's Culture Has Capital?" [1], challenges conventional deficit perspectives on communities of color by defining six forms of capital embedded within them. The six types of capital include:

“Aspirational capital refers to the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers.

Linguistic capital includes the intellectual and social skills attained through communication experiences in more than one language and/or style.

Familial capital refers to those cultural knowledges nurtured among familia (kin) that carry a sense of community history, memory and cultural intuition.

Social capital can be understood as networks of people and community resources.

Navigational capital refers to skills of maneuvering through social institutions.

Resistant capital refers those knowledges and skills fostered through oppositional behavior that challenges inequality.” (pages 76-80)

Pull learning strategy

“Push learning” occurs when the learners have limited power over the definition of the problem, action and knowledge needed to improve the performance [2]. Instead, the instructor decides what kind of knowledge the learners would learn and “push” the knowledge to learners. “Pull learning”, on the other hand, happens when the learners have certain level of authority to define the problem, action and knowledge needed [2]. Santos and Powell use a cases study to explore the effectiveness of push and pull learning strategies, and the findings suggest that establishing an effective “learning mood” is more probable within a supportive environment characterized by “pull learning” [2].

Airport Administration Course

Airport Administration is an undergraduate-level core major course included in an aviation administration program at Cal State LA. Cal State LA is a Minority Serving Institution with a predominantly Hispanic/Latino student enrollment. A considerable portion of the students come from socioeconomically disadvantaged communities, with the distinction of being the first generation within their family to engage in pursuits of higher education. For example, 76.5% of the students enrolled in Fall 2022 were Hispanic/Latino students, with 15.8% being White and 14% being Asian. The student demographics in the Aviation Administration program are similar

to the university-wide trend. 55.43% of the students were first-generation college students. 51.4% of the students enrolled in the Aviation Administration program were Hispanic/Latino, and 44.33% of the students in the Aviation Administration program were first-generation college students [4]. The majority of the students in the Aviation Administration program are transfer students who finish the first two years in community colleges, usually in related aviation program.

The Aviation Administration is one 3000 level class. There is no prerequisite to take the course. Most of the students in the Aviation Administration program are advised to take this course in their Junior or Senior year after finishing the lower-level major courses. Table 1 shows the information about the students who took the course in Fall 2022 and Fall 2023.

Table 1. Information about Students Who Took the Course in Fall 2022 and Fall 2023.

	Senior	Junior	Sophomore	Total
Fall 2022	17	13	2	32
Fall 2023	15	8	3	26

The course description states [5] that

Provided in each fall semester, the objectives of the course are to understand the fundamental mechanisms and principles of airport planning and development, airport finance management, airport marketing and communication, and governmental and public relations.

The course was initially designed in an in-person lecture and discussion format with textbooks such as *Airport Planning & Management* by Seth B. Young and Alexander T. Wells [3] and the FAA advisory circulars and articles in news and journals. It was taught remotely online in 2020 and 2021 fall semesters due to the pandemic and was redeveloped in 2022 fall semester when the university moved back to in-person classes. One significant change was adding the ACRP University Design Competition to the course structure as a student team project to enhance students' engagement and hands-on experience. This competition, which evolved from the former FAA Design Competition for Universities, aims to foster college students' engagement in addressing pertinent challenges within the aviation domain. The competition calls upon undergraduate and graduate students, alongside faculty advisors, from institutions across the United States to propose innovative solutions to airport-related issues in one of the four broad areas: Airport Operation and Maintenance, Runway Safety/Runway Incursions/ Runway Excursions Including Aprons, Ramps, and Taxiways, Airport Environmental Interactions, and Airport Management and Planning [7]. The competition requires each student team to identify one challenge faced by the airports in the U.S., propose a potential solution design, conduct safety risk assessment and cost-benefit analyses, and discuss other possible impacts of their design on the airport. The complete design report must also include a thorough literature review and interviews with at least three airport experts.

Table 2. Course Project Final Report Evaluation Rubrics, adopted from [8].

Category	Criteria	Potential points
Introductory Material	Does the Executive Summary accurately encapsulate the design?	2
	Is the Table of Contents present and does it follow the structure in the Competition Guidelines?	3
Problem Statement and Background	Is the Design Challenge clearly stated?	3
	Does the section of the design submission demonstrate that the individual or team has a clear understanding of the issues surrounding the design challenge, including current problems and issues as well as state of the art approaches?	7
Literature Review	An effective summary of literature review is provided.	7
	The literature review includes relevant ACRP studies and reports or notes if no relevant ACRP studies found.	4
Problem Solving Approach	How sound is the team's approach? Are solid engineering/scientific methodologies employed? How effective is the technical analysis?	10
	Is there evidence of thorough design process?	5
	Is the design supported by appropriate drawings, mockups, computer codes, charts, tables or other data as appropriate?	5
	The degree to which the design shows evidence of understanding of appropriate regulatory and certification issues.	4
	How well are the student's/team's conclusions supported?	5
	Evidence of effective interaction with airport operators and industry experts in the design process. Note: per the guidelines, students must connect with both airport operators and industry experts. Is there evidence of effective interaction with an airport operator and impact on the design process/result?	6
	Is there evidence of effective interaction with one or more industry experts with a resulting impact on the design process?	6
Practicality and Feasibility of the Proposed Design	Is a solid cost-benefit analysis provided? Does the proposed solution offer increased affordability and utility?	5
	What is the potential real-world impact of the proposed solution, including commercial potential?	5
	Is there a description of the processes that would need to be undertaken to bring the design to the product/implementation state?	5
Safety Risk Assessment	A safety risk assessment of the proposed design considers inherent risks and describes how these risks should be addressed to ensure safe operations.	4
	Appropriate FAA documents, including Introduction to Safety Management Systems for Airport Operations (FAA Advisory Circular 150/5200-37) and FAA Safety Management System Manual, are understood and referenced in the assessment.	4
Innovation	-Does the design offer fresh thinking or new ways of approaching the problem considering that students are not in the field and possessing expertise or specific working knowledge? -Does the design reflect creativity and imagination on the student's or team's part?	14
Overall quality of the design package	Is the design well written?	5
	Does the report effectively present the design solution?	3
	Does the report follow the required format and reference citation requirement?	3
Total points		115

The course structure was not changed significantly when the ACRP University Design Competition was first added into the course in 2022 fall semester. The course still mainly focused on the lecture topics with some additional guidance and support for the student project. For example, the ACRP University Design Competition was introduced to students at the beginning of the semester and the last 30 minutes of each class was set aside for students to work on the project.

Student projects were evaluated using the rubrics that were adopted from the ACRP University Design Competition Evaluation Criteria [8], as shown in Table 2. The rubric includes 8 categories and 22 criteria. The qualities of students' final project reports, however, were not as good as expected. The average grades of all the students project reports were 76.4 out of 115.

One team's project, Innovative Noise Mitigation & Casting System, received an honorable mention award in the Airport Environmental Interactions design challenge category.

The instructor discussed with students about their feelings and perspectives about the project in the end of the 2022 fall semester. The main findings from the discussion about students' feedback are:

- 1) Students felt affirmed and more confident by participating in this kind of national competition. Several students mentioned that they did not think they were "qualified" or "able" to participate in the national competition before this project.
- 2) Students found the project a good opportunity to connect what they have learned with real-world problems, and
- 3) Many students mentioned that more guidance and resources were needed to help them to improve their project report, especially on the solution design, safety risk assessment, and cost-benefit analyses, as well as on some non-technical skills, such as writing skills and research methods.

In response to student feedback and drawing upon insights from the community cultural wealth theory and the pull learning strategy, the course was redesigned in 2023 fall semester, transitioning to a "student-centered" approach. The lecture topics comprise textbook topics and project support, as shown in Table 3. Project support includes lectures specifically designed to help students with their projects, mainly focusing on soft skills, writing skills, and research methods. The lecture topics are organized in an order that reinforces each week's project activities. The course weekly plan includes a timeline to complete each part of the ACRP University Design Competition. Students are required to turn in several drafts during the semester instead of only one final report at the end of the semester.

The course is divided into six segments, each focusing on one required part of the ACRP University Design Competition report, shown in Table 4. One advantage of this arrangement is that students could immediately apply what they have learned from the lecture in project activities in the same week.

Table 3. Course weekly plan and ACRP project activities used in the course in Fall 2023.

Week	Lecture Topics	Project Activities	Assignments due
1	Course introduction	ACRP Airport Design competition introduction. Previous projects overview	<i>Lecture assignment:</i> Weekly quiz 1
2	<i>Textbook Topic:</i> Structure of airport	Project topic brainstorming and selection	<i>Lecture assignment:</i> Weekly quiz 2
3	<i>Textbook Topic:</i> Airport planning <i>Project Support:</i> How to write research problem statements	Project topic presentation	<i>Lecture assignment:</i> Weekly quiz 3
4	<i>Project Support:</i> Introduction of literature review, citation, and reference	Topic finalization Literature review	<i>Project assignment:</i> Project topic statement
5	<i>Textbook Topic:</i> Airport design and construction	Literature Review and Solution Design	<i>Lecture assignment:</i> Weekly quiz 4 <i>Project assignment:</i> Draft of literature review due
6	<i>Textbook Topic:</i> Airport operation	Literature Review and Solution Design	<i>Lecture assignment:</i> Weekly quiz 5
7	<i>Project Support:</i> Microsoft Word 101 <i>Project Support:</i> How to explain your solution design in a professional manner	Literature Review and Solution Design	
8	<i>Textbook Topic:</i> Airport safety (SMS)	Solution Design	<i>Lecture assignment:</i> Weekly quiz 6 <i>Project assignment:</i> Draft of Solution design due
9	<i>Textbook Topic:</i> Risk matrix <i>Project Support:</i> Safety risk analysis	Safety risk analysis of the design	Weekly quiz 7
10	<i>Textbook Topic:</i> Airport marketing	Safety risk analysis of the design	<i>Lecture assignment:</i> Weekly quiz 8 <i>Project assignment:</i> Draft of safety risk analysis due
11	<i>Project Support:</i> Cost-benefit analysis	Cost-benefit analysis of the design	
12	<i>Textbook Topic:</i> Financial management, funding, and financial impact	Explore the potential impact of your design on the airport	<i>Lecture assignment:</i> Weekly quiz 9 <i>Project assignment:</i> Draft of cost-benefit analysis due
13	<i>Project Support:</i> Guest speaker about communication and interview skills	Experts interview	
14	<i>Textbook Topic:</i> Governmental, legal, and public relations	Project finalization	<i>Lecture assignment:</i> Weekly quiz 10
15	Project presentation		

Table 4. Course segments (Fall 2023).

Project Part	Lecture topic	Lecture to support support
Problem statement	Structure of airport Airport planning	How to write research problem statements
Literature review		Introduction of literature review, citation, and reference
Solution design	Airport design and construction Airport operation	Microsoft Word 101 How to explain your solution design in a professional manner
Safety risk assessment	Airport safety (SMS) Risk matrix	Safety risk analysis
Cost-benefit analyses	Airport marketing Financial management, funding, and financial impact	Cost-benefit analysis
Industry interaction	Governmental, legal, and public relations	Guest speaker about communication and interview skills

As mentioned previously, over 50% of the student body in the Aviation Administration program comprises first-generation college students with varying levels of academic preparedness. Many of these students receive limited help and support in crafting professional academic reports. Recognizing this need, additional lectures focusing on honing these essential soft skills (“project support” in the course plan) are added to the class, which could benefit not only the student in the current project but also their future academic study.

Discussion

There are great differences in the choice of project topics between the student teams in 2022 and 2023 fall semester, shown in Table 5. Students in 2023 fall semester show greater diversity in the selection of project topics, encompassing both conventional and innovative areas of interest. These range from established issues such as wildlife management and runway incursions to more novel inquiries such as runway excursions at General Aviation airports, the prospective utilization of social media platforms for enhancing passenger engagement, and service road safety. Conversely, the projects undertaken by students in 2022 fall semester mainly revolve around conventional topics, such as airport noise control and wildlife management.

Table 5. List of student projects in 2022 and 2023 fall semester

	2022 fall semester	2023 fall semester
Project	<ul style="list-style-type: none"> • Airport electric luggage cart • Airport wildlife control • Impact of noise on wildlife • Innovative noise mitigation and casting system (INMCS) • Airport noise control 	<ul style="list-style-type: none"> • Bird detection system • Speed over under landing light (SOULL) system • Runway hold-short detection sensors (RHSDS) • Social media platform • Service road status lights

An attributed factor behind this shift in project selection may stem from the instructor's emphasis on the value of the fact that many students enrolled in the course are already working at a local airport (either full-time or part-time). The instructor encourages students to reflect on areas for

improvement within their work environment or observations made during their work experiences. For example, one student enrolled in the 2023 fall semester class works at a major commercial service airport. He discerns a recurring pattern of unreported incidents involving ground service vehicles improperly traversing taxiways. He and his teammates then undertake the design of a system, “Service road status lights”, to mitigate this issue. In total, 3 out of the 5 project topics in 2023 fall semester stem from students’ own work experience.

Table 6. Comparing assessment data for the project reports in 2022 and 2023.

Category	Average Points in Fall 2022	Average Points in Fall 2023
Introductory Material (5pts)	3	3.4
Problem statement (10pts)	5	8.6
Literature review (11pts)	7.2	9.3
Problem-solving approach (41pts)	28	35.8
Practicality and Feasibility of the Proposed Design (15pts)	10.6	12.6
Safety Risk Assessment (8)	5.2	6.8
Innovation (14)	10.5	12.2
Overall quality of the report (11)	6.9	9.4
Total (115)	76.4	98.1

Note. The grading criteria used in the course are adopted from “*Evaluation Criteria for University Design Competition for Addressing Airport Needs*,” published on the ACRP University Design Competition website [8].

All the students' final project reports are evaluated using a grading rubric adopted from the ACRP University Design Competition evaluation criteria [8]. Student projects’ average points in each category, as well as average total points, are included in Table 6. In general, student performances in 2023 fall semester improved greatly compared the performance in 2022 fall semester, especially in the following five evaluation categories: “literature review”, “problem-solving approach”, “safety risk assessment”, and “the overall quality of the report”. The improvements in those five categories indicate the effectiveness of the project lecture provided in weeks 4, 7, and 9.

Conclusion

This paper presents how one undergraduate level core major course is improved by integrating the ACRP university design competition into the curriculum at one MSI. The course is redesign with a “student-centered” approach. Several project support lectures are added into the curriculum to provide students additional assistance in refining their writing skills, mastering research methods, and understanding reference and citation formats.

Rather than adopting a deficit mindset that could impede students' academic success, the instructor emphasizes the unique capital inherent in students and encourages them to leverage their distinctive community cultural wealth to their advantage. For example, in the project topic selection stage, the instructor highlights the value of the fact that many students enrolled in the course are already working at a local airport (either full-time or part-time) and encourages students to reflect on areas for improvement within their work environment or observations made

during their work experiences. 3 out of the 5 student teams in 2023 fall semester select their project topic based on their work experience. The analysis of assessment data from student reports in the fall semesters of 2022 and 2023 reveals a significant improvement in student performance in the latter, suggesting the effectiveness of the adjustments implemented in 2023.

References

- [1] T. J. Yosso, "Whose culture has capital? A critical race theory discussion of community culture wealth," *Race Ethnicity and Education*, vol. 8, no. 1, pp. 69-91, 2006.
- [2] S. Aguinaldo and J. A. Powell, "Effectiveness of push and pull learning strategies in construction management," *Journal of Workplace Learning*, vol. 13, no. 2, pp. 47-56, 2001.
- [3] E. a. M. National Academies of Sciences, "Minority Serving Institutions: America's," The National Academies Press, Washington, DC, 2019.
- [4] CSULA, "Institutional effectiveness," [Online]. Available: <https://www.calstatela.edu/InstitutionalEffectiveness>. [Accessed 1 February 2024].
- [5] Y. Feng, "Lessons learned from designing an effective online course with Community of Inquiry framework," in *American Society for Engineering Education Annual Conference and Exposition*, Minnesota, 2022.
- [6] S. Young and A. Wells, *Airport Planning and Management*, McGraw-Hill Education.
- [7] V. S. G. Consortium, "ACRP University Design Competition," [Online]. Available: <https://vsge.odu.edu/acrpdesigncompetition/>. [Accessed 1 February 2024].
- [8] "2023-2024 Evaluation Criteria for University Design Competition for Addressing Airport Needs.," [Online]. Available: <https://vsge.odu.edu/acrpdesigncompetition/evaluation-2/>. [Accessed 1 February 2024]