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Enrollment and Engagement: How to Revitalize a Dying sUAS Program

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This study investigates the impact of pedagogical innovation on student engagement and enrollment within the Unmanned Aerial Systems (UAS) program at Metropolitan State University of Denver. Initial research revealed a consistent pattern of high enrollment in the introductory UAS course, contrasted by low participation in intermediate and advanced courses. Through a combination of qualitative and quantitative methods, including surveys, interviews, and historical data analysis, the study identified a lack of engaging instructional methods as a key barrier to student progression. In response, the introductory course was redesigned using a flipped classroom model, integrated FAA Part 107 certification preparation, hands-on drone activities such as Drone Soccer and FPV simulators, and promoted real-world flight missions in upper-level courses. Post-implementation data showed a dramatic increase in student engagement and a significant rise in enrollment across all course levels. These findings underscore the importance of dynamic, student-centered teaching strategies and suggest that thoughtful curriculum design can directly influence program success and student retention.

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Introduction

When I was hired as a professor at Metropolitan State University of Denver, I was tasked with determining why our Unmanned Aerial System (UAS) program was struggling in student enrollment. To be fair, enrollment in the Introduction to UAS course was robust and often created a substantial waitlist; it was the intermediate and advanced courses that experienced low or non-existent enrollment numbers. My research showed this trend for the past five years but it's likely been the norm from the beginning of the program.

Durning my first year, I conducted both qualitative and quantitative research to answer the question, why was enrollment flatlining after students were successfully in completing the introduction to UAS course. Observations, surveys and historical research were the vehicles for my data accusation.

As professors, we excel in being experts within our industry, conducting research to be at the forefront of our fields. Most are successful in this endeavor but often come up short in teaching pedagogy. We often neglect to ask the question, am I a good teacher and reflect on better teaching practices.

The results of my research aligned with this exact notion, subject matter over teaching pedagogy was creating the enrollment deficit in our upper division UAS courses. Taking this data into account, I used my own pedagogy in program/curriculum development and findings from education experts to create a positive shift towards increasing enrollment in the upper division UAS courses.

As hypothesized, the changes made to these programs did have a direct positive impact on student engagement and ultimately student enrollment. The data also strengthens other research showing that classes shouldn't be focused on power point knowledge transfer, but on strong teaching pedagogy.

Literature Review

A flipped classroom involves students pre-loading information before they attend class. This allows for better use of time during class including scenario based learning, small groups and more one on one instruction from the instructor.

In a recent study by Masha Smallhorn, students were transitioned from a traditional classroom to a flipped classroom. She begins by saying, "an analysis of the weekly reflection responses found that, in the first two weeks of the semester, students reported neutrally about preparing for the flipped class by reading through the resources, watching the online videos and completing the quiz" (Smallhorn 2017). Overall, the students' response from the new flipped classroom model is to be expected. We have been trained for generations in what a traditional classroom should be. As educators, we tend to stay in our lanes. Smallhorn expands by saying, "As the semester progressed, students' attitudes towards the flipped classroom improved. In week nine, students were asked to reflect on the flipped classes they had attended and discuss how they had helped them to understand the material provided in the online resources"

(Smallhorn 2017). “An analysis of their responses (n=59) found that 95% of students who responded thought that overall, the flipped classroom had been a positive learning experience” (Smallhorn 2017). One of her students said, “They have allowed me to not just have knowledge passed on in a passive manner, like most other topics, but instead apply what we are learning in a practical sense, in an environment where there is help available (both from other students and teachers). They have also made me feel better prepared for the exam” (Smallhorn 2017). Her study went on to analyze student engagement. Smallhorn explains, “students were defined as highly engaged, moderately engaged or poorly engaged, based on the number of flipped classes attended over the semester. 88% of students who achieved a high distinction grade were highly engaged, compared to only 33% of students who achieved a passing grade. Of the students who failed the topic, 57% were poorly engaged, while 20% were moderately engaged. She goes on to say, “This suggests that attending flipped classes is strongly linked to learning outcomes and that students who are poorly engaged are more likely to fail the topic (Stronghorn 2017).

The flipped classroom model demonstrates positive outcomes in student engagement and success, grounded in the principle of student ownership of learning. To support this ownership, incorporating hands-on learning technologies can help create a dynamic and effective educational environment.

A study was done involving 68 students being immersed in Virtual Reality to create hands on learning. “The research results indicate that in the VR hands-on learning environment, participants engage in reflection through the provided feedback, effectively enhancing their engagement, cognitive levels, and hands-on task abilities. Simultaneously, it also successfully assists participants in developing problem-solving skills and critical thinking in higher-order thinking” (Huang) 2024). The results of the study showed, “Participants actively engaged in reflection on their own learning tasks and actions within the hands-on learning environment, enabling them to develop a deeper understanding of the learning material and enhance their real-world hands-on tasks abilities, we encourage the integration of reflection strategies in VR learning environments for hands-on learning, as they can yield positive benefits for learners” (Huang 2024). This study makes it clear that utilizing up to date technology not only enhances learning but also aligns with the current generation learning styles.

Methods

Does student engagement translate into student enrolment? Specifically, does changing the traditional classroom model presently used in our Introduction to UAS course help increase the low enrollment in the upper division UAS courses. For clarity, our UAS program is as follows:

- Introduction to Unmanned Aircraft Systems (Introduction)
- Unmanned Systems Flight and Controls (Intermediate)
- Unmanned Aircraft Data Collection and Analysis (Advanced)
- Aviation Weather
- Aviation Elective

Student enrollment numbers from the UAS program were compiled from the last five years to acquire quantitative data. Anonymous surveys were administered to 25 students who had previously taken the introductory UAS class. These students were selected randomly without prior knowledge of knowing who had continued to the upper division UAS courses or dropped out of the program. Short impersonal interviews were also conducted to provide qualitative data on their experiences in the program. After analyzing the information, we transitioned the class into a Flipped Classroom model that provided high student engagement. After a year, enrollment in the upper division UAS courses was re-evaluated with positive results.

Results

Table 1

Percentage of enrollment for all three courses prior to the class transition

Year	Introduction to UAS	Intermediate UAS	Advanced UAS
2020	90%	0%	31%
2021	93%	21%	12%
2022	92%	6%	0%
2023	92%	15%	0%
2024	94%	0%	0%

Table 2

Student survey results before the class transition

Did you feel prepared to take the FAA Part 107 written test after completing Introduction to UAS?	YES 1	NO 22	Not Sure 2
How often did you fly the drones while in the Introduction to UAS class?	Did not fly 25	1-10 Times	11-15 Times
Would you recommend this class to other students?	Yes 3	NO 22	
After completing Introduction to UAS, how likely were you to enroll in the intermediate or advanced UAS course?	Likely 1	Unlikely 21	Not Sure 3

Table 3

Percentage of enrollment for all three courses after class transition

Year	Introduction to UAS	Intermediate UAS	Advanced UAS
2025	100%	100%	82%

Table 4
Student survey results before the class transition

Did you feel prepared to take the FAA Part 107 written test after completing Introduction to UAS?	YES 22	NO 1	Not Sure 2
How often did you fly the drones while in the Introduction to UAS class?	Did not fly	1-10 Times	11-15 Times 25
Would you recommend this class to other students?	Yes 25	NO 0	
After completing Introduction to UAS, how likely were you to enroll in the intermediate or advanced UAS course?	Likely 23	Unlikely	Not Sure 2

Discussion

Based on survey results collected prior to any program changes, it was clear that students did not enjoy the Introduction to UAS course. To address this, I focused on increasing student engagement, operating under the hypothesis that this change could lead to higher enrollment in upper-division courses.

The first major change was integrating the flipped classroom model. It took the students a few weeks to adapt to the new learning style but quickly became popular. Integrating Part 107 into the curriculum was the next step. Part 107 is a widely sought out credential that was missing from our program. Additionally, we introduced Drone Soccer, a hands-on e-sport that enriched our program by providing students with hands on flying, a student lead organization and programming experience. Lastly, we introduced an FPV (first person view) drone simulator into the classroom. This created excitement and familiarity with current trends.

Lastly, we advertised the exciting flight missions that students would experience in the upper division UAS courses. These flights include, search and rescue, inspections, thermal, photogrammetry and geo-spatial missions utilizing our new Autel Evo-Max 4T drone.

Conclusion

The results of this research clearly show an increase in enrollment in upper division UAS courses after the changes were made to the Introduction to UAS course. The student surveys also strengthen this conclusion with 88% of the students feeling prepared to take the FAA written test. 100% of the students flew drones more than 11 times during the semester. 100% of the students would recommend taking the course. 92% of the students are considering taking both upper division courses after completing the intro UAS class. These results came from building a program based upon hands on learning, a flipped classroom model and current generation relevancy. In short, we made the program fun while maintaining a rigorous curriculum.

This study also serves as a reminder for educators to think creatively and broaden our teaching pedagogy. While we are experts in our academic disciplines, we must also strive to be experts in how we deliver knowledge. Maybe a flipped classroom doesn't work for your environment or current funding wont allow for new tech, but there are hundreds of ways to make a class more interesting, you just need to take that first step away from the PowerPoint lecture.

References

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