

The River Hawk Flight Plan: A Quest-Based, Gamified Approach to Collaborative STEM Recruitment (Work in Progress)

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Introduction

Recruiting and retaining a diverse and well-prepared engineering student body remains a persistent challenge across institutions of higher education[1]. Nationally, many students enter college with limited understanding of what engineers do, often relying on narrow or stereotypical perceptions of specific disciplines (e.g., mechanical or electrical engineering) while remaining unaware of less visible fields such as chemical, plastics, or industrial engineering[2]. These limited perceptions can disproportionately impact first-generation students, women, and students from historically marginalized backgrounds, who may have had fewer opportunities for prior exposure to engineering careers or role models. As a result, recruitment efforts that emphasize early specialization may inadvertently constrain students' exploration and reinforce inequities in access to engineering pathways. These constrained early perceptions and limited exploration opportunities may also contribute to broader retention challenges in engineering education: national data show that a substantial proportion of students change majors or leave engineering programs early in their college careers, with roughly 30% of engineering students dropping out before their second year and most attrition occurring within the first two years of study[3].

Open house events are a primary recruitment mechanism used by many colleges to introduce prospective students and their families to academic programs, facilities, and campus culture. However, traditional open house models often mirror the siloed structure of engineering curricula, organizing activities by department and requiring students to self-select which majors to visit. This structure assumes that prospective students arrive with well-formed disciplinary interests and sufficient prior knowledge to make informed choices. In practice, many students, particularly those who are undecided or exploring engineering for the first time, rely on open house experiences to discover what engineering disciplines exist. However, these students are constrained to a small set of choices and may never encounter fields that align well with their interests simply because they did not know those options were available.

Department-centric open house models can also create unintended internal consequences. When departments compete for limited student attention, high-enrollment or high-visibility programs benefit while marginalizing smaller departments. This dynamic not only affects student exposure but can also undermine a shared college-level recruitment mission, reinforcing disciplinary boundaries rather than highlighting the collaborative nature of modern engineering practice.

Recent work in engineering education and informal learning environments suggests that experiences grounded in exploration, autonomy, and relevance can improve student engagement and motivation[4]. Gamification and quest-based learning approaches in the classroom have been shown to increase curiosity, persistence, and voluntary participation by reframing tasks as meaningful challenges rather than obligations[5]. We hypothesize that the addition of gamification elements into a college wide open house

may increase students' engagement and interest. When paired with real-world problem contexts, a gamified approach may also help students better understand how multiple engineering disciplines intersect to address complex societal challenges, such as healthcare, sustainability, infrastructure, and global connectivity. The pilot also seeks to increase interest and enrollment in historically smaller departments such as Plastics and Chemical Engineering. We aspire to attract students who may not have previously considered these majors but are excited by what they see in action and in connection with the designed impact areas.

Gamification refers to the intentional application of game elements such as quests, points, rewards, narrative framing, and choice to non-game contexts in order to increase engagement, motivation, and sustained participation[5]. Effective gamification transforms an experience by reframing participation as purposeful exploration, emphasizing curiosity, progress, and agency. In educational settings, gamification has been used to promote play, collaboration, motivation, and student choice, while encouraging learners to engage more deeply with activities they might otherwise approach passively. It is possible that these benefits are well-suited to recruitment environments such as engineering open houses, where students often feel overwhelmed, time-constrained, or unsure how to navigate unfamiliar academic spaces.

In response to these challenges, the Francis College of Engineering at the University of Massachusetts Lowell redesigned its traditional open house into a quest-based, gamified recruitment experience organized around interdisciplinary impact areas rather than academic departments. This work-in-progress paper describes the design and pilot implementation of the River Hawk Flight Plan, a themed game-board system that encouraged prospective students to explore multiple engineering disciplines through hands-on activities, student interactions, and shared problem contexts. The initiative aimed to (1) broaden students' exposure to the full range of engineering programs offered by the college, (2) reduce departmental competition for foot traffic, and (3) increase engagement with historically smaller departments.

Theoretical Framework

Gamification aligns closely with self-determination theory (SDT), which posits that motivation is enhanced when individuals experience autonomy, competence, and relatedness[6]. Quest-based structures allow students to exercise autonomy by choosing which activities to pursue and how deeply to engage; point systems and tangible progress markers support perceptions of competence; and collaborative, student-led interactions foster relatedness. Applied to open house design, gamification shifts recruitment from a transactional, department-driven model to an exploratory experience that encourages students to engage broadly across disciplines, make connections between engineering fields, and view themselves as active participants rather than passive consumers of information.

Gamified Approach to College Open House

Traditional Model

At the Francis College of Engineering at University of Massachusetts Lowell, our

traditional open house model consisted of two entrance times for families that started with a 45-minute Dean's Talk. Families are then given about 30 minutes to view one chosen department. This structure led to unintended internal competition among departments as they try to increase their department's visibility to convince students to pick their department above others. This also did not allow for interdisciplinary exploration for students, as undecided students were forced to pick one department to tour. Because of this system, the three smallest departments had very little foot traffic.

Gamified Open House Model

In Fall 2025, the college piloted a redesigned, gamified open house using quest-based game boards called *River Hawk Flight Plans* (Figure 1 and Appendix A). Departments were organized into four interdisciplinary impact areas—Healthcare, Sustainability, Infrastructure, and Connected World—rather than presented as isolated units. Each impact area functioned as a “biome” staffed by faculty and students from multiple departments.

Departments were designated as “main quests,” with students earning points, stamps, and small branded incentives for each departmental interaction. Additional experiences (e.g., student organizations, advising, MakerSpace, photobooth, Dean's talks) were framed as “side quests” with lower point values. Accumulated points qualified students for tiered prize raffles (bronze, silver, gold), incentivizing broader exploration. Dean's presentations were shortened and offered multiple times throughout the event to allow flexibility and reduce bottlenecks.

Front Side (Left):

Engineering a Healthier World

River Hawk Flight Plan

Start

1 Biomedical Engineering
Perry 104- Discover how Biomedical Engineering innovations are advancing medical devices and healthcare solutions.

2 Plastics Engineering
Ball 116- Life in Plastics, it's fantastic! Watch how plastics innovation is delivering safer, more effective medical devices.

3 Chemical Engineering
Perry 110- Watch how bio processing within Chemical Engineering is changing the world of medicine.

4 Mechanical & Industrial Engineering
Falmouth 102- See how mechanical engineers design life-saving medical devices and assistive technologies.

5 Bonus Departments!
We also invite you to check our Electrical & Computer Engineering (Ball 402) and Civil & Environmental Engineering (Perry 156) departments!

6 Side Quests
Earn extra points by visiting our Makerspace, Sports Engineering Minor, clubs, Photo booth, and more!

7 Dean's Talk
Ball 214- Dean Roberts will be speaking at 10am, 10:30am, and 11am.

8 Student Clubs
Visit our student clubs Southwick Quad- JACKIE BAKES, eNABLE, M202, NSBE, SHPE, SPE, SWE.

Name: _____

Email: _____

Reverse Side (Right):

Francis College of Engineering

River Hawk Flight Plan

UMASS LOWELL

Main Quests:
5 Points per department

Biomedical Engineering	Chemical Engineering	Civil & Environmental Engineering
Electrical & Computer Engineering	Mechanical & Industrial Engineering	Plastics Engineering

Side Quests:
3 Points per stamp

Dean's Talk	Academic Advising	Career & Co-op	Photo booth	Makerspace	Sports Engineering
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club

I would like to know more about: _____

Total Points: _____

Figure 1 Example “Flight Plan” gameboard for the “Engineering a Healthier World” quest, front (left), reverse (right)

Preliminary Results

Preliminary evaluation focused on descriptive participation patterns from the October 2025 open house. Participation was tracked using stamped *Flight Plans*, allowing the college to document departmental visits independently of pre-event registration data. Two participation measures are reported: Registered, reflecting pre-event interest indicated through RSVP by department, and Visited, reflecting completed in-person departmental interactions during the open house. Data from the November open house are still being analyzed and are not included here.

Overall student registrations increased from 123 registrants in 2024 to 213 registrants in 2025, representing a 1.73-fold increase. Registrants were informed at the time of registration that the open house would follow a gamified format. Despite this increase in registrations, show rates (RSVP to attendance) were similar between the traditional and gamified formats (66% in 2024 and 69% in 2025), suggesting that the introduction of gamification did not inherently increase students' likelihood of attending the open house itself.

Across departments, in-person visits substantially exceeded pre-event registrations. This discrepancy indicates that registration data alone underrepresents actual engagement when participation is structured around interdisciplinary exploration rather than department-specific sign-ups. Across all departments, 148 students registered for departmental visits prior to the event, while 253 unique departmental visits were recorded during the open house, indicating that many students engaged with more than one department.

This pattern was particularly pronounced for departments that have historically experienced lower visibility under the prior open house model. Relative increases in departmental visibility for smaller programs ranged from approximately 100% to over 1200%, while larger, traditionally high-enrollment departments experienced more modest increases ranging from approximately 23% to 32%. *Figure 2* compares registered interest and observed visits by department for the October 2025 open house and illustrates these differential gains.

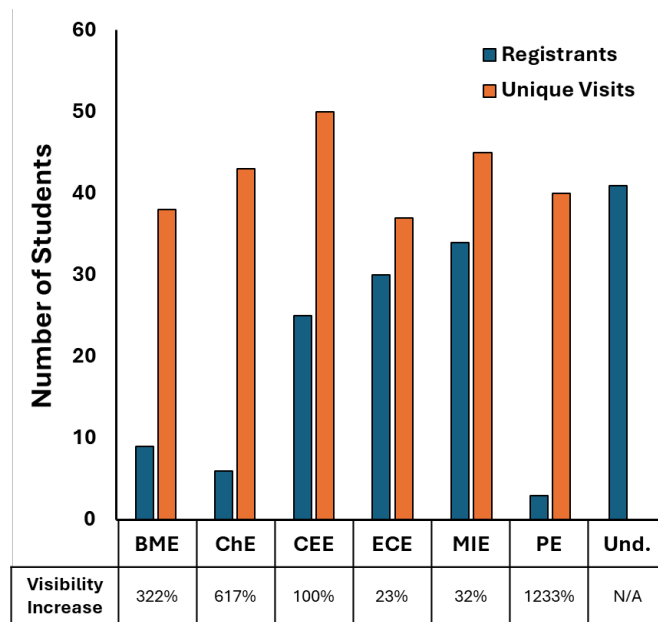


Figure 22. Registered interest (blue) and unique in-person departmental visits (orange) recorded during the October 2025 gamified open house. Percentage values indicate the relative increase from registration to observed visits by department. BME = Biomedical Engineering; ChE = Chemical Engineering; CEE = Civil & Environmental Engineering; ECE = Electrical & Computer Engineering; MIE = Mechanical & Industrial Engineering; PE = Plastics Engineering; Und. = Undeclared Engineering.

Stamp data further indicate that students were able to visit multiple departments rather than limiting their engagement to a single intended major. This behavior aligns with the design intent of the *Flight Plan* structure, which encouraged exploration through themed impact areas and point-based incentives. Under prior open house formats, students typically visited only the departments for which they registered. In contrast, the gamified format increased exposure to additional departments that were still aligned with students' interests through shared impact areas.

Participation in side quests (e.g., student organizations, advising, MakerSpace) further suggests sustained engagement throughout the event rather than brief, transactional visits. Many students completed multiple side quests in addition to departmental interactions, indicating continued movement and engagement across the open house space.

Student feedback supports this interpretation. One survey respondent noted:

“Best open house I’ve been to. Collecting the stamps incentivized me to go look at programs I wouldn’t have otherwise looked at. Everyone was super nice and very passionate about what they were doing.”

Anecdotal observations from staff debriefs similarly suggest that this expanded exposure broadened students' perspectives and prompted interest in departments and programs they had not previously considered.

While these findings are preliminary and descriptive, they provide early evidence that a gamified, impact-area-based open house model can broaden departmental exposure,

mitigate competition for foot traffic, and support smaller programs in reaching prospective students who may not have otherwise engaged with those disciplines.

Next Steps

As a work in progress, several next steps are planned to strengthen both implementation and evaluation of the *River Hawk Flight Plan* model. First, additional data analysis on longer-term outcomes would be useful to explore whether increased exposure during the open house translates into downstream effects. This includes changes in application behavior, yield, and enrollment patterns across departments. As a first indication of possible impact, RSVPs to the “Welcome Day” event for admitted students increased 25% over 2025 RSVPs. We wish to analyze data on student admission numbers, number of student deposits, and final student enrollment. Data disaggregation by student characteristics (e.g., first-generation status, low-income background) would be beneficial to better understand differential impacts of the gamified format. In addition, this gamified experience should be repeated in future years to assess consistency across events and to examine whether observed engagement patterns persist as the model scales.

Second, future iterations should incorporate more robust data collection mechanisms. The current paper-based Flight Plans could be refined or potentially digitized to improve accuracy, reduce administrative burden, and enable real-time tracking of departmental and side-quest participation. Survey instruments can be more intentionally integrated into the Flight Plan experience to increase response rates and to better capture student motivations, perceptions, and decision-making processes.

Finally, additional stakeholder perspectives should be incorporated through structured feedback from families, faculty, staff, and student volunteers to better understand how the gamified open house experience shapes perceptions of engineering, departmental culture, and institutional identity. Collectively, these next steps will inform continued refinement of the *Flight Plan* model and contribute to a broader understanding of how gamified, impact-area-based recruitment experiences can support equitable exploration in pre-college engineering education.

References

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Engineering a Sustainable World

River Hawk Flight Plan

start		1	
Civil and Environmental Engineering Perry 105- Discover how waste water systems and resilient infrastructure protect the planet.			
	2		
Chemical Engineering Perry 110- Discover how chemical engineers are creating cleaner energy and greener manufacturing.			
		3	
Plastics Engineering Hall 110- Life in Plastics, it's fantastic! Watch how Bioplastic and recycling breakthroughs are transforming industries toward sustainability.			
	4		
Mechanical & Industrial Engineering Falmouth 102- Learn how advanced manufacturing and clean energy systems reduce environmental impact.			
	5	6	
Bonus Departments! We also invite you to check out Biomedical & Computer Engineering (Ball 402) and Biomedical Engineering (Perry 104) department!		Side Quests Earn extra points by visiting our Makerpace, Sports Engineering Minor, clubs, Photo booth, and more!	
7	8		
Dean's Talk Fall 216- Dean Roberts will be speaking at 10am, 10:30am, and 11am.			
Student Clubs Visit our student clubs in the Southwick Quad and Falmouth Annex- AICHE, Concrete Cancer, Steel Bridge, NISE, SHPE, SFE, SWE.			

Name: _____

Email: _____

Francis College of Engineering

River Hawk Flight Plan

Main Quests:

5 Points per department

Biomedical Engineering	Chemical Engineering	Civil & Environmental Engineering
Electrical & Computer Engineering	Mechanical & Industrial Engineering	Plastics Engineering

Side Quests:

3 Points per stamp

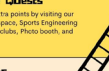
Dean's Talk	Academic Advising	Career & Co-op	Photo booth	Makerspace	Sports Engineering
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club

I would like to know more about:

Total Points: _____

Engineering a Connected World

River Hawk Flight Plan

			
start		1	Electrical & Computer Engineering Ball 432- Watch how robotics, AI, and advanced circuits are driving global connectivity.
	2	Mechanical & Industrial Engineering Falmouth 102- Learn how automation, robotics, and design innovation keep industries moving forward.	
		3	Civil and Environmental Engineering Perry 106- Discover how smart infrastructure and transportation networks link communities and strengthening city life.
	4	Biomedical Engineering Perry 104- See how students collaborate on 3D printed prosthetics and wearable sensors that connect patients to care.	
	5	Bonus Departments! We also invite you to check our Plastics Engineering (Ball 156) and Chemical Engineering (Perry 110 department)!	6
	7	Dean's Talk Ball 214- Dean Roberts will be speaking at 10am, 10:30am, and 11am.	8
	7	Student Clubs Visit our student clubs: StudentLink Qward and Falmouth Area- BMES, Concrete Canal, Axioms, IEEE, MORS, NISE, Gulf Bridge, SWE, SIUE, and many more!	

Name: _____

Email: _____

Francis College of Engineering

River Hawk Flight Plan

Main Quests:
3 Points per department

Biomedical
Engineering

Chemical Engineering

Civil & Environmental
Engineering

Electrical &
Computer
Engineering

Mechanical &
Industrial Engineering

Plastics Engineering

Side Quests:
3 Points per stamp

Dean's Talk	Academic Advising	Career & Co-op	Photo booth	Makempace	Sports Engineering
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club
Club	Club	Club	Club	Club	Club

I would like to know more about: _____

Total Points: _____



Engineering Stronger Communities

River Hawk Flight Plan

start

1

Plastics Engineering
 Ball 110- See how plastics engineering supports infrastructure, housing, and everyday essential workloads.

2

Civil and Environmental Engineering
 Perry 100- Explore how civil engineers design bridges, roads, and buildings that strengthen society.

3

Electrical & Computer Engineering
 Ball 002- Discover how electrical engineers develop technologies that support safety, communication, and growth.

4

Biomedical Engineering
 Perry 104- Learn how biomedical research is improving access to life-saving treatments and empowering healthier lives.

5

Chemical Engineering
 Perry 110- See how chemical engineers design products and systems that fuel economies and improve daily life.

6

Side Quests
 Earn extra points by visiting our Makerspace, Sports Engineering Minor, clubs, Photo booth, and more!

7

Dean's Talk
 Ball 214- Dean Roberts will be speaking at 10am, 10:30am, and 11am.

8

Student Clubs
 Visit our student clubs Southwick Quad and Falmouth Annex!

Name:

Email:

Francis College of Engineering

River Hawk Flight Plan



Main Quests:

5 Points per department

Biomedical Engineering

Chemical Engineering

Civil & Environmental Engineering

Electrical & Computer Engineering

Mechanical & Industrial Engineering

Plastics Engineering

Side Quests:

3 Points per stamp

Dean's Talk

Academic Advising

Career & Co-op

Photo booth

Makerspace

Sports Engineering

Club

Club

Club

Club

Club

Club

Club

Club

Club

Club

I would like to know more about:

Total Points: