

## **GIFTS: Passports to Engage Students in Engineering**

### **Dr. Abigail Clark, Ohio Northern University**

Abigail Clark is an assistant professor of mechanical engineering at Ohio Northern University. She holds a PhD in Engineering Education from The Ohio State University. She also holds degrees in Mechanical Engineering from Ohio State and Ohio Northern University. Prior to her time at OSU, she worked at Battelle Memorial Institute in Columbus, Ohio. Her research interests include pre-college engineering education, informal engineering education, and identity development.

### **Dr. Stephany Coffman-Wolph, Ohio Northern University**

Dr. Stephany Coffman-Wolph is an Assistant Professor at Ohio Northern University in the Department of Electrical, Computer Engineering, and Computer Science (ECCS). Previously, she worked at The University of Texas at Austin and West Virginia University Institute of Technology (WVU Tech). She is actively involved in community outreach with a goal of increasing the number of women in STEM and creating effective methods for introducing young children to CS concepts and topics. Dr. Coffman-Wolph's research interests include: Artificial Intelligence, Fuzzy Logic, Software Engineering, STEM Education, and Diversity and Inclusion within STEM.

### **Dr. Lauren H. Logan, Ohio Northern University**

Lauren H. Logan is an assistant professor of civil and environmental engineering at Ohio Northern University. Her research focuses on quantifying the impacts of thermal pollution from thermoelectric-power-plant water use on aquatic ecosystems. She earned

# **GIFTS: Passports to Engage Students in Engineering**

## **Introduction**

In the last several decades, many engineering colleges have started a first-year engineering program, designed to provide a foundational experience to their incoming students [1]. Though these programs vary widely in content [2] and structure [1], these programs have been widely adopted and offer opportunities to introduce students to the university, college, and major in which they are now enrolled, as well as student success efforts [2]. These activities are often thought to promote a sense of belonging and identification within engineering, which are tied to retention within engineering [3]. In addition to these activities inside the classroom, a great deal of benefit has been shown from student engagement in extra- and co-curricular activities, including a greater sense of belonging and increased academic achievement [4]. However, particularly since the COVID-19 pandemic, many first-year students do not engage in these valuable activities for a range of reasons including lack of information, feeling overwhelmed, and intimidation [5]. This GIFTS paper discusses one effort to engage students in high-impact practices within the College of Engineering at Ohio Northern University through their first-year orientation course.

## **Context**

Ohio Northern University (ONU) is a small, rural, private university located in Ada, OH and serves primarily undergraduate students. One of five colleges at the university, the engineering college enrolls approximately 700 students across six majors. The engineering college uses a common-first year approach [1] to the first-year engineering program, which consists of three classes: Foundations of Design 1 & 2 (FoD), and Engineering Orientation. Foundations of Design 1 & 2 are a two-semester course sequence focused on the introduction of the design process and engineering tools such as 2D and 3D modeling, computational tools, basic circuits, experimentation and data analysis, and more. Engineering Orientation is a one semester, zero credit hour course which meets once a week during the fall semester and all incoming first-year students are enrolled in a department-specific section of the course, plus an additional course section for undecided engineering students. This course focuses on an introduction to the college, their major, university resources, career exploration, and college success skills. For a few select activities (e.g., social event, guest speakers), sections are combined as appropriate. The general course outcomes for engineering orientation are listed below:

In completing this course, students will...

- Build connections with the college community, including students, staff, faculty, and alumni
- Develop a career plan, including a plan of study that will support that career plan
- Develop an awareness of curricular and co-curricular opportunities
- Build foundational skills for college success, including self-reflection, study skills, time management, and goal setting

## Historic Efforts

Engineering Orientation is a long-standing course at ONU, and has long sought to encourage students to engage with the college through co- and extra-curricular activities. Historically, students enrolled in engineering orientation were required to attend two professional society meetings during the semester and report their attendance at these meetings to their faculty via email. However, anecdotal evidence indicated that this approach resulted in a high faculty workload from managing significant incoming emails and tracking student participation, and students needing continual reminders to complete the professional society meetings. Additionally, while most students typically attended their required professional society meetings, they were not engaged in other activities that are known to be high impact, such as visiting faculty office hours and interacting with FoD teaching assistants (TAs) (e.g., [6], [7]). Due to these and other issues, we sought to develop a new approach to engaging students with the college of engineering while reducing the grading burden on orientation faculty.

## Engineering Passport

In efforts to increase student engagement and decrease faculty workload in tracking participation, we implemented an “engineering passport” as part of Engineering Orientation during the fall semester 2023. The idea of a passport (in our case, meaning a physical booklet with tasks listed and places for passport stamps) was appealing as it allowed us both to provide a physical reminder of the activities in which students were to engage, and it centralized the tracking of their activities, rather than these being reported via email throughout the course of the semester. We began by searching for engineering passports in the ASEE PEER repository. While we found many instances of engineering programs implementing a passport in some capacity (e.g., [8] - [13]), we did not find an example which we could implement in our context, either due to lack of specificity in the paper, or because the passport was used for another purpose (such as an engineering outreach program). Therefore, we decided to develop our own. This process began by reviewing the course outcomes (listed above) and identifying activities which could support students’ achievement of them. We sought to be particularly mindful of the workload, as our orientation class has zero credit hours. Some, such as outcomes 2 and 4, were covered in other assignments. However, outcomes 1 and 3 were sparsely addressed and assessed in the orientation curriculum, and thus became the primary goal of the passport. The activities detailed in Table 1 were identified to meet course outcomes 1 and 3:

*Table 1: Passport activities and aligned course outcomes*

Activity	Description	Outcome
Meet two faculty members	Students had two short meetings with faculty members in the college of engineering, one in their department and one in another department, during the faculty member’s office hours. They were to ask the faculty member questions about their teaching, research, and personal interests.	1
Meet one administrative assistant	Students met one of the college of engineering’s four administrative assistants. Meeting with administrative assistants ensured students would learn where to go for paperwork, forms, and other tasks associated with registration, etc.	1
Attend two professional	Students could pick from a list of any two professional societies in the college of engineering and attend two meetings. The societies selected did not have to align	3

society meetings	directly with their major to allow for maximum choice and a diversity of student attendance at meetings/events.	
Visit FoD TA office hours	Students visited the evening office hours for the Teaching Assistants for FoD, which could also earn them extra credit in FoD.	3
Attend one pop-up workshop	Various one-hour workshops were offered by faculty, student organizations, and outside speakers. These included workshops designed to improve an engineering skill (e.g., spatial visualization), a life skill (e.g., changing a tire), or other important topics (e.g., mental health).	3

Within the passport, students were provided with additional instructions, plus a place to record their participation in each activity via a stamp. Each faculty member, administrative assistant and student organization was given a unique self-inking stamp to facilitate this process. In addition to recording their activities, the passport also included the course schedule, contact information and locations for essential offices on campus, and other resources. The complete passport can be found in the appendix.

### Implementation and Assessment

The passports were introduced and distributed to students during the first week of the semester, and completed passports were due to their instructor by the close of business on the last day of classes. Periodic reminders and check-ins were provided throughout the semester. To assess the student perception of the passport, both closed- and open-ended questions were included in the end of semester survey administered in FoD 1, shown in Table 2. The closed-ended questions were assessed using a 6-point Likert-type scale with no neutral option. In addition to demographic information (gender, race, student-athlete status, first-generation status), the following questions were asked.

*Table 2: Survey Questions*

Closed-Ended Questions	Open-Ended Questions
To what extent do you agree with the following statements?	What did you find most useful about the orientation passport?
The orientation passport helped me keep track of what I needed to do for ENGR 1001 Orientation	What passport activity did you enjoy the most?
The orientation passport helped me try activities I otherwise wouldn't have tried.	What would you change about the orientation passport?
The orientation passport helped me meet faculty, staff, & TAs I otherwise wouldn't have met.	

There were 85 survey responses, or 44.7% of students enrolled in the course, which were complete and consented to the use of their responses. The demographics of the respondents are shown in Table 3:

*Table 3: Demographics of survey respondents (n=85)*

Gender	Percent	Race	Percent
Male	74.1%	Asian	3.5%
Female	24.7%	Black/African-American	1.2%
Non-binary	1.2%	Hispanic	7.1%
Other		Other/Not Listed	1.2%
First generation student	4.7%	White, Non-Hispanic	87.1%

The responses to the closed-ended questions are shown in Table 4:

Table 4: Closed-ended question responses (n=85)

	Helped me keep track of tasks for orientation	Try new activities	Meet new faculty/staff/TAs
Strongly Agree	27.1%	27.1%	36.5%
Agree	23.5%	25.9%	29.4%
Somewhat agree	21.2%	30.6%	22.4%
Somewhat disagree	9.4%	3.5%	7.1%
Disagree	16.5%	10.6%	4.7%
Strongly disagree	2.4%	2.4%	0.0%

The open-ended question data was evaluated and sorted into categories. The top three responses for each are shown in Table 5:

Table 5: Open-ended frequent responses

Most useful activity (n=86)	Most enjoyable (n=83)	Change about passport (n=78)
Meeting faculty/staff (38.4%)	Pop-up workshops (41.0%)	Nothing/I don't know (29.5%)
Getting involved in student organizations (14.0%)	Student organization meetings (32.5%)	Require fewer activities (9.0%)
Trying new things (12.8%)	Meeting faculty/staff (16.9%)	Get rid of passport (9.0%)

In regard to what was most useful about the passport, one student said *“I met a lot of the engineering faculty and feel comfortable approaching them.”* Another student found a similar experience when asked what was most enjoyable, saying *“Meeting the teachers, it was a lot more personable and friendly than I imagined. I met Dr. [A] and Dr. [B] and had a very good conversation.”* Students also found it helpful to require them to attend TA hours, saying *“Had me visit TAs which I visited after I got it stamped.”* Overall, the students seem to indicate a positive experience with the passport and the activities within.

In addition to the positive student experience, the authors found that the passports allowed for fewer reminders throughout the semester and allowed them to centralize the assessment of these activities into one timeframe rather than dispersed throughout the semester. Additionally, the introduction of the passport further facilitated student engagement at the engineering student organization fair, which we paired with orientation class at the beginning of the semester.

### Future iterations & translating into other contexts

Plans are ongoing for future iterations of the engineering passport. In the future, we plan to engage with the campus printing center to see if the booklets can be made on their equipment. Additionally, we will be assessing adding, expanding, or removing activities from the passport. For example, some students suggest expanding the “visit FoD TA” task to include TAs for other classes or the tutoring sessions offered by Tau Beta Pi, the engineering honor society.

We believe that an engineering passport, or similar activity, can help guide students into engaging with the engineering college community. We suggest you begin by determining what outcomes are critical for your context, and what activities can help your students achieve that. Try little ways to make it fun, such as silly stamps or other tokens to engage students.

## References

- [1] X. Chen, C. Brawner, M. Ohland, and M. Orr, "A Taxonomy of Engineering Matriculation Practices," in *2013 ASEE Annual Conference & Exposition Proceedings*, Atlanta, Georgia: ASEE Conferences, Jun. 2013, p. 23.120.1-23.120.13. doi: 10.18260/1-2--19134.
- [2] K. J. Reid, D. Reeping, T. Hertenstein, G. Fennel, and E. Spingola, "Development of a Classification Scheme for 'Introduction to Engineering' Courses," in *2013 IEEE Frontiers in Education Conference (FIE)*, Oklahoma City, OK, USA: IEEE, Oct. 2013, pp. 1564–1570. doi: 10.1109/FIE.2013.6685101.
- [3] B. D. Jones, M. C. Paretti, S. F. Hein, and T. W. Knott, "An Analysis of Motivation Constructs with First-Year Engineering Students: Relationships Among Expectancies, Values, Achievement, and Career Plans," *J. Eng. Educ.*, vol. 99, no. 4, pp. 319–336, Oct. 2010, doi: 10.1002/j.2168-9830.2010.tb01066.x.
- [4] R. Yu and D. Simmons, "Synthesis of Engineering Undergraduate Students' Out-of-Class Involvement," in *2015 ASEE Annual Conference and Exposition Proceedings*, Seattle, Washington: ASEE Conferences, Jun. 2015, p. 26.1450.1-26.1450.16. doi: 10.18260/p.24787.
- [5] N. Kholiavko, T. Detsiuk, and O. Tarasenko, "Extracurricular activity of engineering students: trends and motives," *J. Educ. Sci. Psychol.*, vol. X, no. 1, 2020.
- [6] M. Guerrero and A. B. Rod, "Engaging in Office Hours: A Study of Student-Faculty Interaction and Academic Performance," *J. Polit. Sci. Educ.*, vol. 9, no. 4, pp. 403–416, Oct. 2013, doi: 10.1080/15512169.2013.835554.
- [7] S. Atwood and T. Estrada, "Characteristics of Successful Student-Faculty Interaction Outside the Classroom," in *2011 ASEE Annual Conference & Exposition Proceedings*, Vancouver, BC: ASEE Conferences, Jun. 2011, p. 22.320.1-22.320.10. doi: 10.18260/1-2--17601.
- [8] K. Chen, L. Christensen, and A. Runciman, "Passport To The Materials World: Materials Engineering Outreach Activities," in *2005 Annual Conference Proceedings*, Portland, Oregon: ASEE Conferences, Jun. 2005, p. 10.990.1-10.990.8. doi: 10.18260/1-2--14339.
- [9] R. Olson, F. Jacobitz, and K. Kramer, "Do Engineering Freshmen Find Value In Extracurricular Seminars Designed To Enhance Collegiate Success?," in *2005 Annual Conference Proceedings*, Portland, Oregon: ASEE Conferences, Jun. 2005, p. 10.485.1-10.485.10. doi: 10.18260/1-2--15084.
- [10] C. Wong and C. Carlson, "Resilience Within and Resilience Without: Mindfulness and Sustainability Programming Using an Embedded Engineering Librarian Approach," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 35153. doi: 10.18260/1-2--35153.
- [11] S. Kurwadkar, D. Marble, and J. Edwards, "Summer Merit Camp and Environmental Communication Week: Targeted Approaches to Environmental Engineering Education," in *2012 ASEE Annual Conference & Exposition Proceedings*, San Antonio, Texas: ASEE Conferences, Jun. 2012, p. 25.1213.1-25.1213.15. doi: 10.18260/1-2--21970.
- [12] J. Evans, A. Van Epps, M. Smith, S. Matei, and E. Garcia, "A Transdisciplinary Approach for Developing Effective Communication Skills in a First-year STEM Seminar," in *2015 ASEE Annual Conference and Exposition Proceedings*, Seattle, Washington: ASEE Conferences, Jun. 2015, p. 26.127.1-26.127.12. doi: 10.18260/p.23468.

- [13] J. Mohammed, "Freshmen Engineering Course in an Oil & Gas University," in *2014 ASEE Annual Conference & Exposition Proceedings*, Indianapolis, Indiana: ASEE Conferences, Jun. 2014, p. 24.628.1-24.628.10. doi: 10.18260/1-2--20519.