Determinants of Effective Experiential Learning Experiences in ISYE Senior Design Capstone Courses: An Eight-Year Analysis

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Recent studies have explored the benefits of senior design capstone courses; however, there remains a lack of empirical research categorizing project taxonomies and quantifying the specific pedagogical benefits unique to Industrial and Systems Engineering (ISYE) capstone experiences. This study aims to: 1) categorize the different types of projects in which students choose to engage, 2) map course subjects and skillsets utilized in these senior design capstone projects, 3) contrast best practices for teaching a senior design capstone project, and 4) provide insights on achievements gained through the senior design capstone course. This study presents a longitudinal analysis of Senior Design Capstone projects spanning an eight-year period. By examining ISYE-specific data using statistical analysis, the research identifies evolving patterns in project selection and the consistent skillsets required for professional success. Our results show that teams who select industry projects, start planning early, leverage team members' strengths, and work cohesively with clear roles tend to perform better in oral presentations, reports, and video deliverables, often leading to recognition or awards. This longitudinal study demonstrates how analyzing historical project records facilitates the identification of shifting trends and the underlying pedagogical rationale within senior design capstones.

Keywords: senior design capstone project, industrial and systems engineering, ISYE, COVID-19, experiential learning, historical records

INTRODUCTION

Experiential learning emphasizes active participation and reflection with real-world application. This approach allows learners to immerse themselves in genuine engineering challenges, engage in hands-on, collaborative experimentation, that results in solutions based on integrated knowledge, ideally, from multiple disciplines. It further enhances learners' adaptability in working on interdisciplinary teams, broadens their knowledge base, and refines their critical thinking skills. The most popular form of experiential learning involves real-world applications through course-based projects (Killian et al., 2024). The shift from an instructional paradigm to an experiential learning paradigm began in the 1980s (Thyroff, 2019). This paradigm shift is largely attributed to Kolb's groundbreaking four-stage Experiential Learning Framework (Kolb, 1984), in which the learner reflectively observes when a new situation is encountered, and questions inconsistencies between the current experience and the learner's a priori knowledge. The learner then develops an abstract conceptual model to understand and address these inconsistencies. Frontczak (1998) further suggests that the learner applies to the newly developed conceptual model to see what happens. Finally, (Killian et al., 2024) posits that (1) the learner reflectively observes inconsistencies between their anticipated response and actual reviewer feedback, and (2) learners benefit from a variety of perspectives by receiving diverse feedback. Experiential learning curricula have been shown to positively affect student engagement in the classroom (AlJurdi & Salloum, 2025).

Practical, Experience-Based Skill Development

The literature suggests that experiential learning can improve undergraduate students' personal, interpersonal, civic, and professional development (Sweitzer & King, 2013) and post-graduate outcomes (Rilotta et al., 2022). Further, Pozzulo et al., (2024) suggest that experiential learning can offer more depth in understanding course materials versus a traditional classroom setting. One such example is provided by Uhm et al. (2019), who demonstrated that a structured SBAR (Situation, Background, Assessment, Recommendation) communication program incorporating role-playing scenarios led to significant improvements in nursing students' data accuracy, interprofessional clarity, and handover confidence compared to a control group receiving standard practicum education. Similarly, Lenoir & Van Metre (2024) observed significant gains in political advocacy and efficacy among students participating in experiential learning. Their findings indicate that direct engagement empowered students to interact with elected officials, fostered positive perceptions of the political process, and enhanced their perceived agency to effect systemic change. Real-world experiences, such as immersive fieldwork, laboratory work, and research activities, contribute to the development of a systems thinking approach when analyzing the complexity and interrelationships between the parts and wholes of a problem (Alford et al., 2025). Kolb (1984) asserts that knowledge results from the combination of obtaining and transforming experience.

Experiential Pathways to Professional Skill Development

ABET, formerly known as the Accreditation Board for Engineering and Technology, Inc., is a non-profit, non-governmental accreditation organization for post-secondary programs in engineering, engineering technology, computing, and applied and natural sciences. While ABET does not provide a singular formal definition of experiential learning, its accreditation criteria necessitate a culminating experience. This requirement mandates that students integrate both technical and professional competencies to address complex engineering problems, a standard typically fulfilled by the Senior Design Capstone (ABET, 2025). For Industrial and similarly named engineering programs, the curriculum must employ real-world experiences and business perspectives (ABET, 2025). Beyond industry engagement in a capstone course (Abellán-Nebot, 2020; Badir et al., 2023), other examples of experiential learning that meet ABET requirements include community service, service-learning projects, undergraduate research, internships and co-op programs, student teaching, simulations, and role-playing (ABET, 2025). Alternative forms of experiential learning include Vertically Integrated Projects (Penry & Son, 2024), collaborative-competitive team design events (Gadola & Chindamo, 2019), interacting with one's campus community (Pozzulo et al., 2024), social media experiential learning projects (Childers & Levenshus, 2016), mixed reality (Aguayo & Eames, 2023), volunteer activities and practicum courses (Austin & Rust, 2015), focus groups (Senok et al., 2022), hosting an event (Lei et al., 2015), field trips (Rone, 2008), and outdoor recreation programs (Campano et al., 2024).

Purpose of the Present Study

The purpose of this research is to provide academic departments with a useful structure for compiling and evaluating their past senior design capstone courses via a longitudinal study to identify industry, concept, and course trends and anomalies in the projects students engage in.

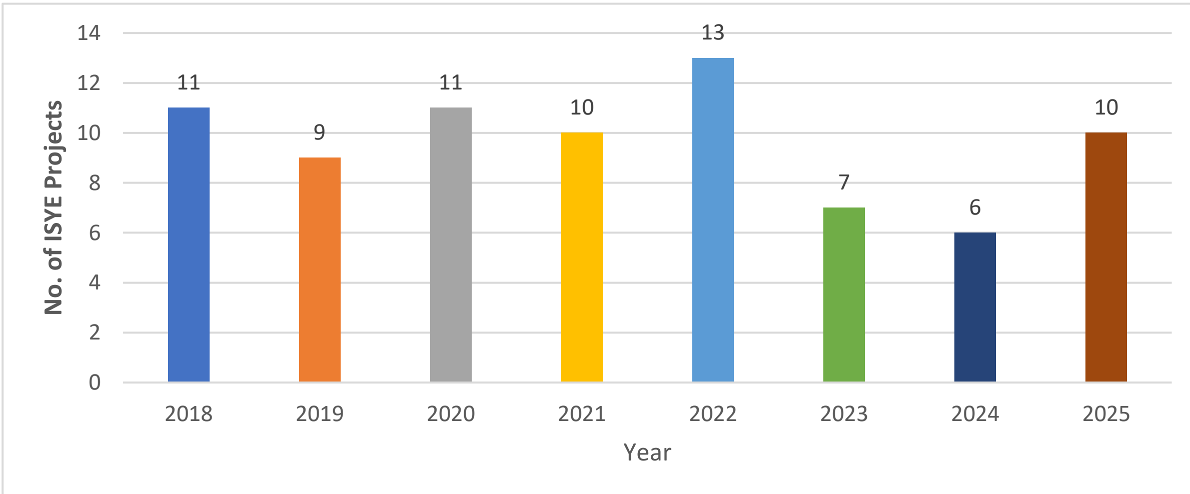
METHODOLOGY

Participants

This study employed a historical design research approach. The sample data was retrieved from the university's Digital Commons repository. Although our ISYE degree program began in 2015 following the consolidation with a larger, nearby university, our sample data for ISYE senior design projects is from Spring 2018 through Fall 2025, when students were required to upload their files to the Digital Commons repository. During the past eight years, we discovered 77 senior design project uploads, as shown in Figure 1, consisting of a Final Report, Poster, PowerPoint slide presentation, and YouTube video.

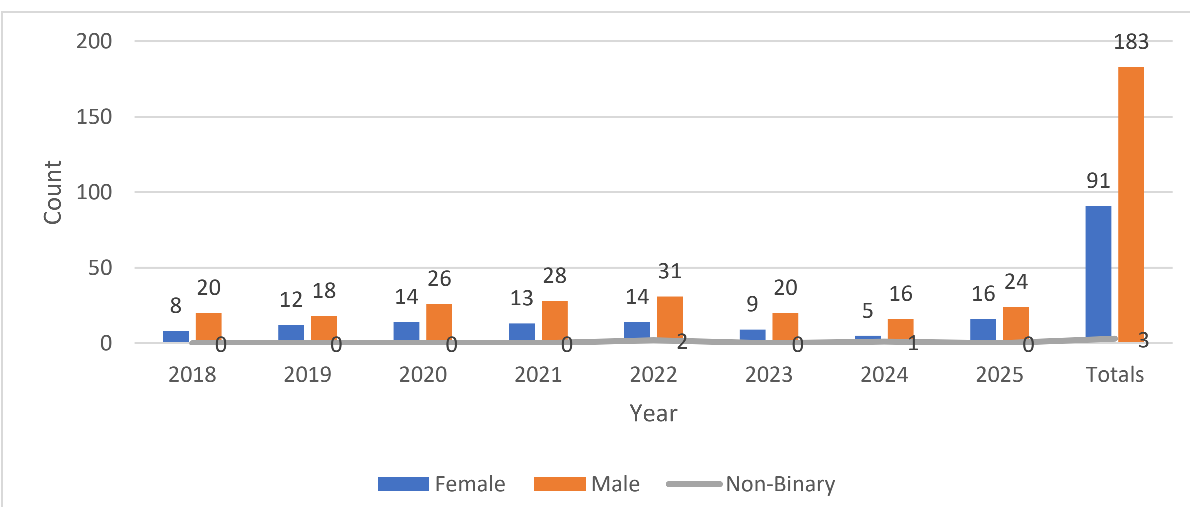
Figure 1 displays the number of ISYE senior design projects completed each year over the study period. Overall, the number of projects shows a consistent range with a slight dip beginning in 2023. This can be attributed to disruptions caused by the COVID-19 pandemic between 2020 to 2022, leaving aftereffects. The most recent year showed an increase that returned to the original range of project numbers, suggesting reestablished program stability.

FIGURE 1
NUMBER OF SENIOR DESIGN CAPSTONE PROJECTS BY YEAR



'An additional senior design course requirement is to showcase students' findings in a Poster presentation at the Senior Design Expo at the end of the semester. The university is in the Metro-Atlanta area. Attendees at the Senior Design Expo include university faculty, students, administrators, internship and co-op hosts, alumni, Industry Advisory Board (IAB) members, and business partners from each engineering department. Faculty, alumni, internship and co-op hosts, IAB members, and business partners may register in advance to serve as judges for the Senior Design Expo. First-place, second place, and third-place awards are given at the end of the Senior Design Expo based on the number of points earned during the judging process. Team photos with the college Dean are taken and then featured in the weekly electronic college of engineering newsletter, along with a summary of the Senior Design Expo.

FIGURE 2
DISTRIBUTION OF STUDENT GENDER IN ISYE SENIOR DESIGN CAPSTONE COURSES (2018-2025)



Senior design capstone teams typically consisted of four students. As shown in Figure 2, of the 273 total number of students who participated in the senior design projects, approximately 33% identified as female, while 66% identified as male and 1% identified as non-binary.

Figure 2 illustrates the number of senior presenters each year disaggregated by gender. Over the years, there are consistently more male presenters than female or non-binary. The number of female presenters remains consistent, with a slight drop in 2023 and 2024. This may suggest decreased female enrollment in ISYE during the COVID-19 period or declining interest among female students. However, a fair increase is seen by 2025.

We observed that the number of male students outnumbered the number of female and non-binary students combined during each of the eight years in this study. Overall, there were twice as many male students as female students; however, females accounted for 33.3% of all participants in the Industrial and Systems Engineering STEM discipline, which aligns with the 33.3% of bachelor's degrees awarded to women in the Industrial/Manufacturing/Systems Engineering discipline reported by the American Society of Engineering and Engineering Technology (ASEE, 2025).

Figure 3 presents the longitudinal breakdown of student demographics by race and ethnicity.

FIGURE 3
LONGITUDINAL DISTRIBUTION OF STUDENT RACE AND ETHNICITY IN ISYE SENIOR DESIGN CAPSTONE COURSES (2018-2025)

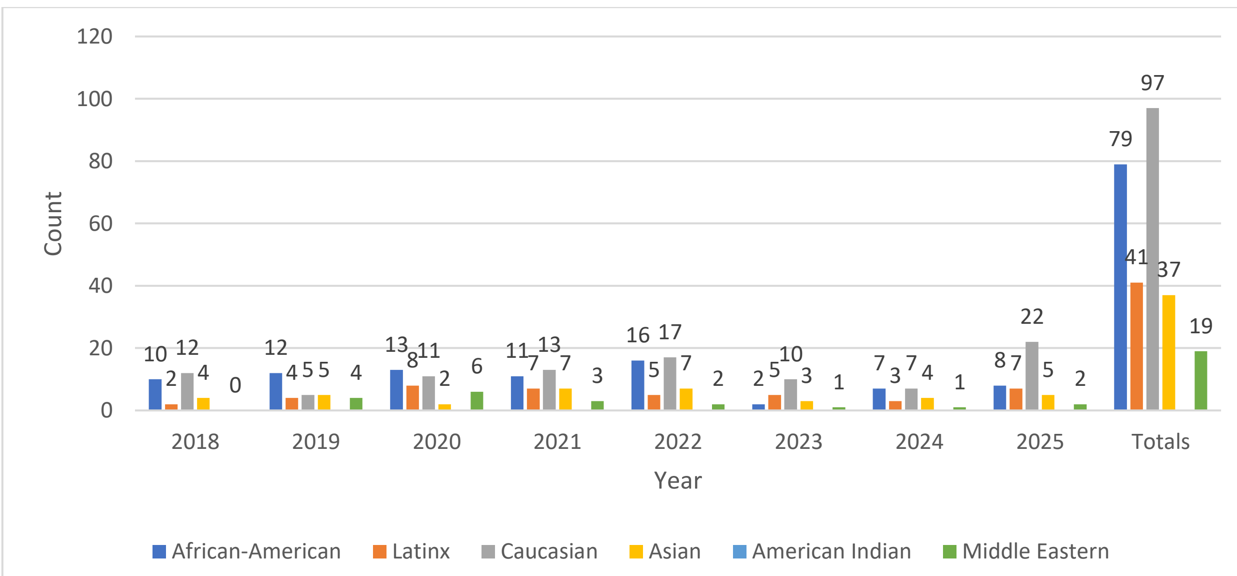
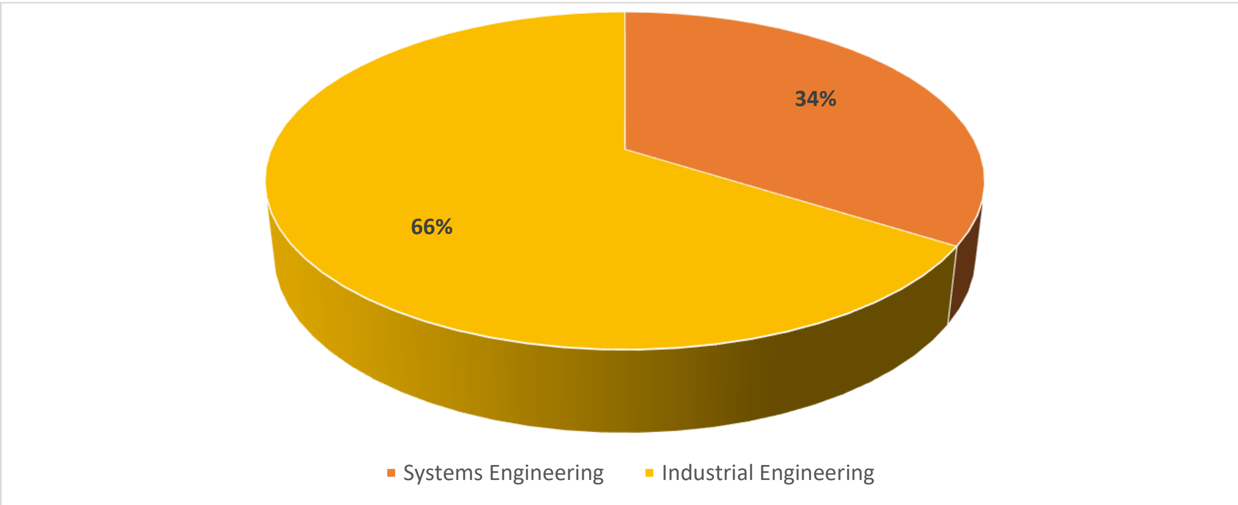


Figure 3 highlights the demographic composition of students within ISYE senior design groups by race/ethnicity. Certain racial groups are more represented than others, perhaps reflecting the general racial composition of the College of Engineering, where approximately 60% of undergraduate students identify as non-White (KSU, 2026). The racial distribution can also result from demographics across the entire university, where approximately 50% of all students identify as non-White (College Factual, 2026).

During the eight-year study period from 2018 to 2025, there were more Caucasian students (97) than African American (79), Latinx (41), Asian (37), and Middle Eastern (19) students participating in the ISYE Senior Design Capstone Course. We note that in years 2019 and 2020, African American students outnumbered all other races/ethnicities.

A breakdown of Industrial Engineering versus Systems Engineering students between 2018 and 2025 is presented in Figure 4.

FIGURE 4
LONGITUDINAL DISTRIBUTION OF STUDENT CONCENTRATIONS IN INDUSTRIAL VS. SYSTEMS ENGINEERING (2018-2025)



Here, we see a 2:1 ratio between students with an Industrial Engineering concentration vs. a Systems Engineering concentration during the eight-year study period.

Table 1 displays gender and racial/ethnicity demographics of the ISYE senior design students and the Southern Polytechnic College of Engineering and Engineering Technology (SPCEET).

TABLE 1
DEMOGRAPHICS OF ISYE SENIOR DESIGN STUDENTS VS DEMOGRAPHICS OF THE ENTIRE ENGINEERING COLLEGE

	ISYE Senior Design Participants						SPCEET Overall Demographics					
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Female	35%	32%	31%	31%	16%	40%	15%	16%	16%	18%	18%	19%
Male	65%	68%	69%	67%	84%	60%	86%	85%	84%	82%	82%	81%
African American	38%	29%	36%	8%	33%	18%	25%	25%	26%	26%	26%	27%
Latinx	24%	18%	11%	21%	14%	20%	16%	18%	19%	20%	22%	24%
Caucasian	32%	34%	38%	58%	33%	44%	50%	49%	47%	45%	42%	40%
Asian	6%	18%	16%	13%	19%	18%	9%	8%	9%	9%	10%	10%
American Indian	0%	0%	0%	0%	0%	0%	<10	<10	<10	<10	<10	<10

As can be seen, Table 1 supports the idea that the demographic data collected among ISYE students is representative of the demographics of the engineering college. Longitudinal data indicates that male students consistently represented most of the cohort compared to female students. Regarding ethnicity, White students comprised the largest demographic group, followed by African American students. This is important to show that no bias is attributed towards one gender or racial/ethnic group, which enhances the generalizability of our findings.

Research Design

This study explores the types of senior design capstone projects in which ISYE students engage. The senior design projects are evaluated by industry, concepts employed, and skillsets learned in the undergraduate ISYE curriculum. We also offer insights into a few student reflections and achievements gained through the senior design capstone experiential learning experience.

Below are the four research questions that represent the theme for this experiential learning study. Results for each research question will follow in the Conclusions section.

RQ1: *What are the predominant industries used by ISYE students in their Senior Design Capstone projects?*

RQ2: *What are the most utilized ISYE concepts in senior design capstone projects?*

RQ3: *Which ISYE courses are most utilized in senior design capstone projects?*

RQ4: *What patterns or trends are discernable from the data?*

Materials

Leveraging the university's Digital Commons repository, where all ISYE senior design capstone project files are safely stored, we examined each project from Fall 2018 through Spring 2025. We created Excel spreadsheets to categorize and tabulate data for answering each research question, and for creating all tables and charts.

Procedure

Our research team applied for and received approval from our university's Institutional Review Board (IRB), receiving "Exempt" status to conduct this study.

From Fall 2018 through Spring 2024, the Senior Design Capstone course was completed in one semester. However, beginning Fall 2024, the College of Engineering transitioned to a two-semester sequence. Throughout the study period, senior design teams were required to find an industry partner in which to conduct their senior design project. Project themes are not directly assigned to senior design teams. Rather, each team created their own theme based on the objective(s) of each project. In some cases, the instructor visited the industry partner's facility prior to the beginning of the semester to establish relationships and identify possible senior design projects to convey to students on the first day of class. In other cases, students were able to find a senior design project either at their workplace or through an industry contact person via a friend or family member. Senior design teams were required to visit their industry partner's facility and/or meet with industry representatives in online meetings throughout each semester. Although most ISYE senior design capstone projects were concentrated in the metro-Atlanta area, some projects were farther away, and all projects were completed in Georgia.

The initial on-site visit between the student team and industry partner typically consisted of a meet-and-greet followed by a facility tour. Back-and-forth communication ensued after the initial visit to narrow down a specific project topic, identify objectives and deliverables, and establish timelines. In the two-semester sequence, the first semester is a one-credit-hour course with the goal of identifying an industry partner and an agreed-upon topic while establishing objectives and deliverables. During the second semester, project objectives, deliverables, and timelines are formalized within the initial two weeks. Teams then transition into the execution phase, which requires consistent on-site engagement to conduct current-state assessments, perform gap analyses, and facilitate iterative ideation and data collection. Once all data were collected, the senior design team performed data analysis, summarized findings, and created deliverables such as the final report, poster, PowerPoint slide presentation, and YouTube video of their project. All senior design teams were required to upload all files in the university's secure Digital Commons repository and present their work via a poster presentation at the Senior Design Expo at the end of the semester.

Analytic Strategy

Data cleaning involved including only ISYE senior design capstone projects related to industrial or systems engineering and whose final report was submitted to the university's Digital Commons repository. All ISYE senior design capstone teams during the eight-year study period submitted the required final report. Therefore, no missing data was detected. Descriptive statistics using MS Excel were used to produce results for each research question.

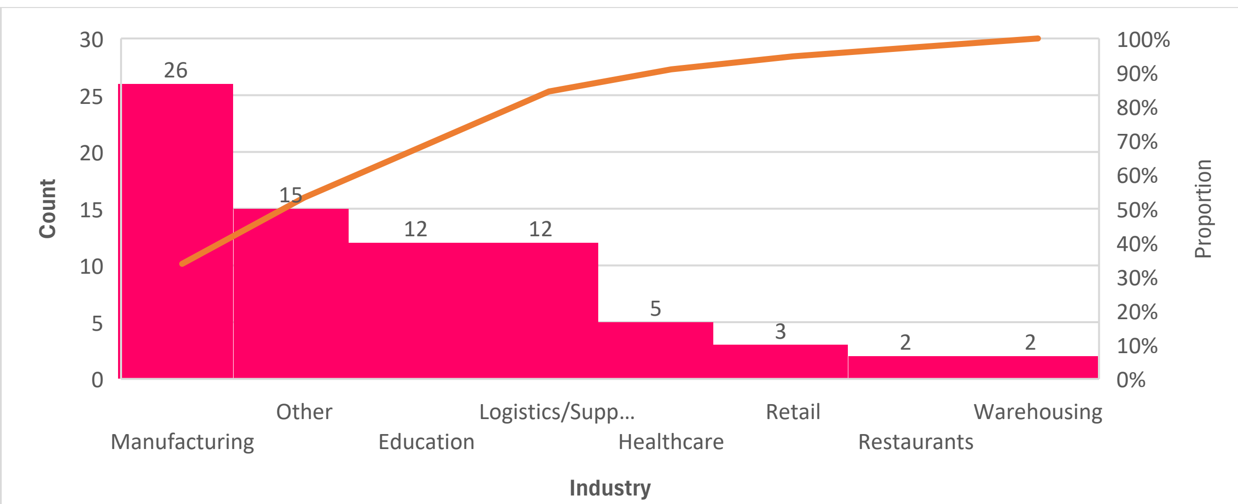
RESULTS

Data collection involved reviewing archival information stored in the university's Digital Commons repository for ISYE Senior Design Capstone projects from Fall 2018 through Spring 2025. This section presents the five research questions and their corresponding results.

RQ1: *What are the predominant industries used by ISYE students in their Senior Design Capstone projects?*

Figure 5 displays the corresponding industries associated with each senior design project.

FIGURE 5
DISTRIBUTION OF ISYE SENIOR DESIGN PROJECTS BY INDUSTRY



Most students chose to focus on the manufacturing industry, where ISYE concepts are commonly applied, while steering away from service-heavy sectors such as retail.

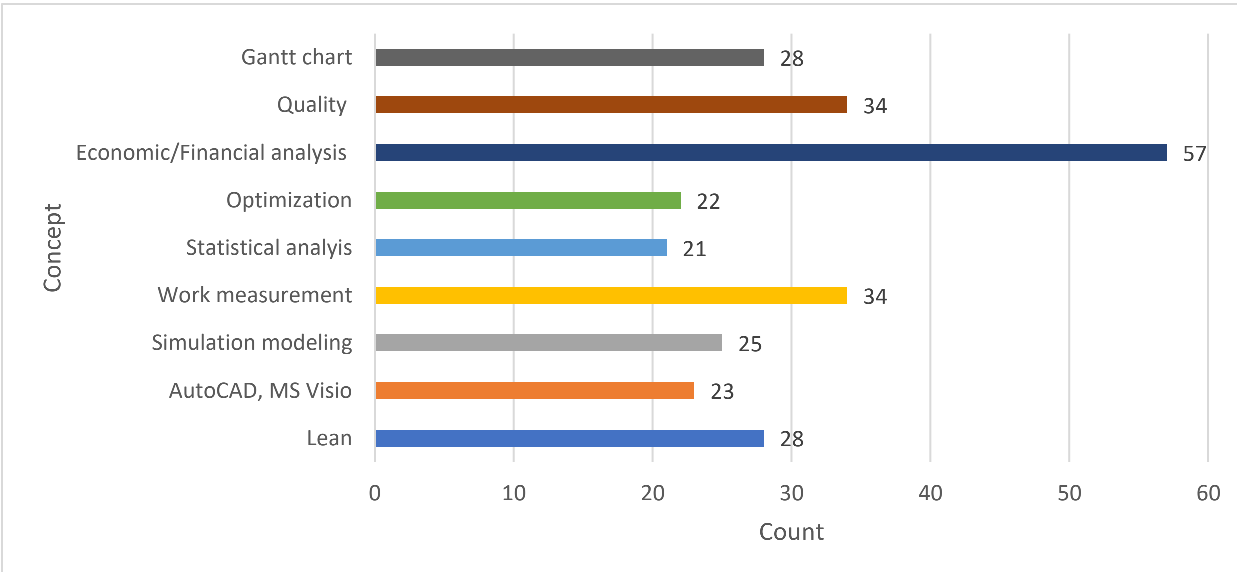
The metro-Atlanta area is robust with a booming economy and a wide variety of industries. As indicated in Figure 1, the industry with the highest number of ISYE senior design projects is Manufacturing (26), followed by Other (15), Education (12), and Logistics and Supply Chain (12). The number of senior design projects in the Education industry (12) is tied with the Logistics and Supply Chain industry (12), largely due to the COVID-19 years 2020-2022, when the university transitioned into and out of the remote learning environment.

Of the 77 ISYE senior design projects during the eight-year study period, the Manufacturing (26) and Logistics/Supply Chain (12) industries dominated with approximately one-half of all projects, and this is attributed to the university's ideal location in the metro-Atlanta area, where manufacturing and distribution companies are abundant.

RQ2: *What are the most utilized ISYE concepts in senior design capstone projects?*

Figure 6 illustrates various ISYE concepts and the number of completed projects within each concept.

FIGURE 6
FREQUENCY OF CORE ISYE CONCEPTS APPLIED IN SENIOR DESIGN CAPSTONE PROJECTS



Many projects analyze industry objectives, suggesting strong student interest in quantitative, data-driven problem-solving to improve system performance.

Economic cost and financial analysis (57), identified in 74% of all projects, play a vital role in ISYE senior design projects. This involves concepts such as cost/benefit analysis, breakeven analysis, determining return on investment, calculating the present worth, annual worth, and future worth of cash flow streams, computing the economic order quantity (EOQ), and performing sensitivity analysis.

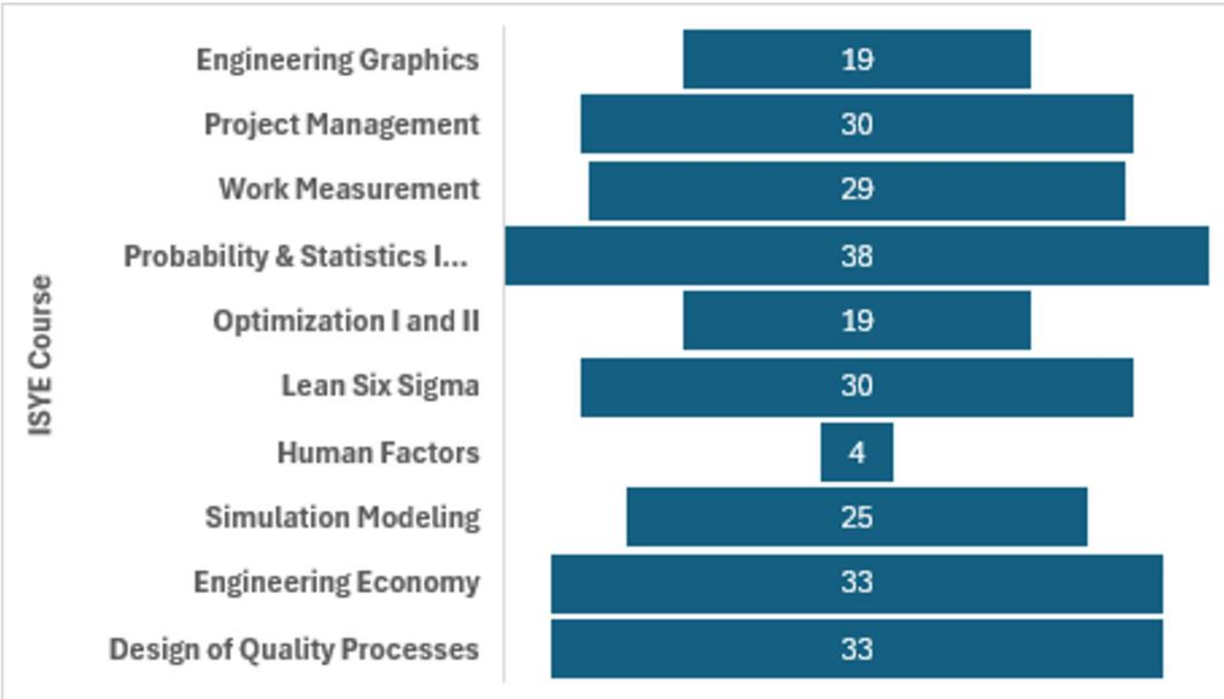
Additionally, evidence shows that Quality (34) and Work Measurement techniques (34) also play pivotal roles in ISYE senior design projects. Quality incorporates concepts such as Six Sigma, the Seven Tools of Quality, Quality Function Deployment, House of Quality matrix, the DMAIC process, and root cause analysis techniques. Work Measurement concepts include direct time study, various types of process flow charts, workplace arrangement, and creating standard operating procedures (SOPs).

Next, Gantt chart (28) and Lean concepts (28) were tied as the third most utilized concepts in ISYE senior design projects. Gantt charts aid in visually planning, scheduling, and tracking project tasks against a timeline, to help maintain a project's progress towards meeting an established deadline. Lean concepts involve a wide variety of techniques, including 5s, waste reduction efforts, Kanban, current and future state value stream mapping, color coding, labeling, visual management signage, poka-yoke, Gemba, spaghetti diagrams, Kaizen, and the Voice of the Customer.

RQ3: *Which ISYE courses are most utilized in senior design capstone projects?*

The ISYE senior design concepts were mapped to industrial and systems engineering courses, as displayed in Figure 7.

FIGURE 7
FREQUENCY OF MOST PREVALENT COURSES USED IN ISYE SENIOR DESIGN PROJECTS



Since ISYE concepts are mapped to their respective ISYE courses, Figure 7 shows the most prevalent industrial and systems engineering courses that students use in their ISYE senior design projects. Here, Probability and Statistics I and II (38 projects) lead all other courses, followed by a tie between Engineering Economy (33) and Design of Quality Processes (33). Close behind is a tie between Project Management (30, Gantt chart) and Lean Six Sigma (30).

RQ4: *What patterns or trends are discernable from the data?*

A breakdown of ISYE senior design projects by industry during the three phases of COVID-19 are shown in Table 2.

TABLE 2
ISYE SENIOR DESIGN PROJECTS BY INDUSTRY DURING THE THREE PHASES OF COVID-19

	Pre-COVID-19		During COVID-19			Post-COVID-19			
Industry	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Totals**
Manufacturing	4	3	7	2	2	4	3	1	26
Healthcare	1		2					2	5
Education			1	3	5	2	1		12
Logistics/Supply Chain	4	3		1	2		2		12
Restaurants					1	1			2
Correctional Facility					1				1
Energy					1				1
Retail				2	1				3
Bakery				1					1
Order Fulfillment				1					1
Food Distribution			1						1
Social Work		1							1
Building Materials		1							1
Non-profits		1							1
Recycling	1								1
Information Technology	1								1
Airline								1	1
County Government								1	1
Finance								1	1
Maintenance								1	1
Warehousing								2	2
Mining								1	1
Totals	11	9	11	10	13	7	6	10	77

In examining the three phases of COVID-19, during the pre-COVID-19 years of 2018 to 2019, Manufacturing (7) and Logistics/Supply Chain (7) senior design projects were dominant. However, whereas the Manufacturing industry (11 projects) was still dominant during the height of the COVID-19 pandemic (years 2020-2022), the Education industry (9 projects) followed closely behind as the world at large transitioned to remote learning. This pattern continued during the ensuing three post-COVID-19 years with Manufacturing (8 projects) and Education (3 projects) as the leading industries for ISYE senior design projects.

Beyond the Manufacturing, Education, and Logistics/Supply Chain industry staples throughout the eight-year study, noticeable differences exist among the three phases of COVID-19. For example, during the pre-COVID-19 years of 2018-2019, ISYE senior design projects included social work, building materials, non-profits, recycling, and information technology, but these industries were not addressed by senior design projects during- and post-COVID-19. During the COVID-19 years of 2020 to 2022, we observed a transition to include service industries, such as restaurants, correctional facility, energy, retail, a bakery, and an order fulfillment company. Another transition occurred during the post-COVID-19 years of 2023 to 2025, whereby other service establishments were incorporated into ISYE senior design projects, including an airline, county government, finance, maintenance, and warehousing. The continued use of service organizations for ISYE senior design projects during the ensuing three years post-COVID-19 is attributed to the aftereffects of transitioning to remote work via online meeting platforms like Teams or Zoom, which had become normalized as an acceptable business practice by then.

Student Reflections

Examples of student reflections on their senior design capstone project experience are presented in the following four categories:

1. **Educational Value:** where students cite meaningful and valuable connections of their ISYE senior design capstone project experiences to their overall educational preparation.
   Example 1: I was able to highlight knowledge gained from classes like: Lean Six Sigma, Systems Modeling, Statistical Quality Control, and Systems Dynamics. During the project, I found myself using my notes and resources from these classes as references to my existing knowledge base.
   Example 2: The GSM project provided meaningful connections to our overall educational preparation. By developing a costing matrix and conducting time studies, we were able to directly apply optimization techniques and data analysis methods to a business context.
2. **Connectedness Insights:** where students gain new insights on the connectedness and integration of the academic preparation of industrial and systems engineering to the applied settings of their ISYE senior design capstone experience.
   Example 1: This experience reinforced the significance of systems thinking and operational efficiency, concepts that are central to ISYE. In developing a real-time inventory tracking system, the project brought to life concepts like database management, resource optimization, and statistical analysis.
   Example 2: Creating an accurate costing model highlighted the crucial role of data collection and statistical analysis in decision-making. By using our academic knowledge in statistics, project management, and optimization, we were able to help bridge the gap between theory and practice.
3. **Integrated Problem-Solving:** where students build upon prior knowledge and experiences to respond effectively to the new and challenging demands of their ISYE senior design capstone settings.
   Example 1: Throughout this project, I gained new insights on understanding how to communicate with corporate partners and understand their needs. I also learned how to deal with real-world data and setbacks, ensuring that the quality of the project was not compromised.
   Example 2: With the nature of data analysis and an undocumented process, our group had to adjust our models and assumptions throughout the project. Deciding what tools to use and their interpretation were key to developing a good understanding of the model.
4. **Values Growth:** where students demonstrate growth in professional and personal core values and sense of self because of their ISYE senior design capstone experience.
   Example 1: The integration of time studies and data analysis into recommendations like inventory optimization, enhanced SOPs, and equipment redistribution demonstrated the impact of data-driven decisions. Overall, the project balanced immediate operational enhancements with strategic recommendations.
   Example 2: This project taught me the value of collaboration and accountability. This experience not only enriched my academic preparation, but also instilled lasting professional and personal values, shaping me into a more resourceful, resilient, and socially responsible engineer.

Recognition and Awards

The ISYE department participates in the annual Institute of Industrial and Systems Engineering (IISE) Senior Design Capstone Competition. This international competition is eligible to all accredited Industrial and Systems Engineering departments globally. During the 2024 IISE Senior Design Capstone Competition, an ISYE senior design team from Fall 2023 won the third-place award in the world with a project entitled, “Imerys: Tube Mill Optimization Project.” Instrumental concepts included process flow chart, Iterative Design Process, animation, decision matrix, sensitivity analysis, statistical process control, process capability, normal probability plots, breakeven analysis, and environmental analysis. Additionally, during the 2025 IISE Senior Design Capstone Competition, a different ISYE senior design team finished in the Top 12 worldwide with a project entitled, “Carlstar Group: LTL and TL Optimization Project.” Key concepts included the use of smart technologies such as a time study app, process flow maps, and statistical analysis (descriptive statistics, histograms, box-and-whisker plots, probability distributions, and statistical process control).

DISCUSSION

Evaluating the ISYE senior design capstone projects during the past eight years revealed some intriguing insights during the three phases of COVID-19. For example, during the pre-COVID-19 years, Manufacturing and Logistics/Supply Chain were the dominant industries while simulation modeling and optimization techniques were the dominant concepts. However, during the height of the COVID-19 pandemic, we saw a shift to Manufacturing and Education for senior design projects and an increased use of surveys, quality concepts like DMAIC and Six Sigma tools, and Lean techniques as the primary concepts employed. During the post-COVID-19 years, there was a more equitable distribution of industries selected by students: Manufacturing, Healthcare, Education, and Logistics/Supply Chain. In addition, we observed the return to predominant uses of simulation modeling, optimization, Lean techniques, quality concepts, and smart technologies.

Limitations of the Present Study

This longitudinal study was conducted on one discipline at one university, so its results cannot be generalized across all disciplines.

Implications for Education

This study provides a baseline methodology for using statistical analysis to identify evolving patterns in project selection and the consistent skillsets required for professional success.

Future Research

Future research could include performing longitudinal studies on other engineering disciplines at this university and including other universities to generalize the results.

CONCLUSIONS

The senior design capstone experience is designed to encapsulate many topics and courses into a real-world application by teams of students. This is a critical experience that helps to bridge the gap between theory and application. The senior design project also strengthens soft skills, such as communication with various stakeholders (industry partners, team members, the Senior Design instructor), collaboration, creativity, critical thinking, project management, responsibility, presentation skills, and professionalism, while navigating through various constraints. Significant life (i.e., COVID-19), university (i.e., transitioning from R2 to R1 Carnegie Classification status), or major department (i.e., replacing key faculty specializing in one field with faculty specializing in a different field) events may alter the trajectory of targeted industries or concepts applied by students over time. An examination of historical records aids in recognizing changing trends and the rationale behind them.

ACKNOWLEDGEMENT

This study was approved by the university’s Institutional Review Board (IRB-FY25-437) on March 6, 2025.

This study consists of a review of archived data in the university’s Digital Commons repository of senior design capstone projects from students who had already graduated.

REFERENCES

Abellán-Nebot, J.V. (2020). Project-based experience through real manufacturing activities in mechanical engineering. *International Journal of Mechanical Engineering Education*, *48*(1), 55–78. https://doi.org/10.1177/0306419018787302

ABET. (2025). *Criteria for accrediting engineering programs, 2025–2026*. ABET. Retrieved from https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2025-2026/

Aguayo, C., & Eames, C. (2023). Using mixed reality (XR) immersive learning to enhance environmental education. *The Journal of Environmental Education*, *54*(1), 58–71. https://doi.org/10.1080/00958964.2022.2152410

Alford, K.R., Stedman, N.L., Bunch, J.C., Baker, S., & Roberts, T.G. (2025). Real-world experiences in higher education: Contributing to the developing a systems thinking paradigm. *Journal of Experiential Education*, *48*(1), 169–188. https://doi.org/10.1177/10538259241259626

AlJurdi, N.T., & Salloum, S. (2025). Experiential learning in upper elementary science classrooms: Influence on students' problem-solving and affect in science. *Journal of Experiential Education*, *48*(1), 87–117. https://doi.org/10.1177/10538259241265964

ASEE. (2025). *Engineering and engineering technology by the numbers*. American Society for Engineering Education. Retrieved from https://ira.asee.org/by-the-numbers/

Austin, M.J., & Rust, D.Z. (2015). Developing an experiential learning program: Milestones and challenges. *International Journal of Teaching and Learning in Higher Education*, *27*(1), 143–153. Retrieved from http://www.isetl.org/ijtlhe/

Badir, A., O'Neill, R., Kinzli, K.-D., Komisar, S., & Kim, J.-Y. (2023). Fostering project-based learning through industry engagement in capstone design projects. *Education Sciences*, *13*, 361. https://doi.org/10.3390/educsci13040361

Campano, M., Langdon, S., Hodges, J., & Deringer, A. (2024). That special time of the month: Feminine hygiene in college outdoor recreation. *Journal of Experiential Education*, *47*(3), 326–340. https://doi.org/10.1177/10538259231189171

Childers, C.C., & Levenshus, A.B. (2016). Bringing the digital world to students: Partnering with the university communications office to provide social media experiential learning projects. *Communication Teacher*, *30*(4), 190–194. https://doi.org/10.1080/17404622.2016.1219041

College Factual. (2026). *KSU Georgia student racial-ethnic demographics*. Retrieved from https://www.collegefactual.com/colleges/kennesaw-state-university/student-life/diversity/chart-ethnic-diversity.html

Frontczak, N.T. (1998). A paradigm for the selection, use and development of experiential learning activities in marketing education. *Marketing Education Review*, *8*(3), 25–33. https://doi.org/10.1080/10528008.1998.11488641

Gadola, M., & Chindamo, D. (2019). Experiential learning in engineering education: The role of student design competitions and a case study. *International Journal of Mechanical Engineering Education*, *47*(1), 3–22. https://doi.org/10.1177/0306419017749580

Killian, G., McClure, T., & Smith, S. (2024). Course projects as value co-creation tools: Developing university collaboration opportunities. *Marketing Education Review*, *34*(1), 44–59. https://doi.org/10.1080/10528008.2023.2253799

Kolb, D.A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall. Retrieved from https://www.amazon.com/Experiential-Learning-Experience-Source-Development/dp/0132952610

KSU. (2026). *Common data set 2024–2025*. Kennesaw State University. Retrieved from https://www.kennesaw.edu/data-strategy/institutional-research/publications/common-data-set/docs/cds-2024-2025-06102025.pdf

Lei, W.S., Lam, C.C., & Lourenço, F. (2015). A case study on hosting an event as an experiential learning experience for event education. *Journal of Teaching in Travel & Tourism*, *15*(4), 345–361. https://doi.org/10.1080/15313220.2015.1073573

Lenoir, B.W., & Van Metre, A. (2024). Leveraging experiential learning to increase undergraduate students' advocacy skills and political efficacy. *Communication and Democracy*, *58*(2), 284–303. https://doi.org/10.1080/21689725.2024.2341615

Penry, T., & Son, E.H. (2024). Course design for leadership learning in an experiential program. *Journal of Experiential Education*, *47*(4), 667–684. https://doi.org/10.1177/10538259241226972

Pozzulo, J., Vettese, A., & Stone, A. (2024). A community mental health and well-being university-level course design and implementation. *Journal of Experiential Education*, *47*(4), 704–722. https://doi.org/10.1177/10538259231217460

Rilotta, F., Gobec, C., & Gibson-Pope, C. (2022). Experiences of mentoring university students with an intellectual disability as part of a practicum placement. *Mentoring & Tutoring: Partnership in Learning*, *30*(3), 333–354. https://doi.org/10.1080/13611267.2022.2070991

Rone, T.R. (2008). Culture from the outside in and the inside out: Experiential education and the continuum of theory, practice, and policy. *College Teaching*, *56*(4), 237–246. https://doi.org/10.3200/CTCH.56.4.237-246

Senok, A., John-Baptiste, A.-M., Al Heialy, S., Naidoo, N., Otaki, F., & Davis, D. (2022). Leveraging the added value of experiential co-curricular programs to humanize medical education. *Journal of Experiential Education*, *45*(2), 172–190. https://doi.org/10.1177/10538259211021444

Sweitzer, H.F., & King, M.A. (2013). Stages of an internship re-visited: Facilitating learning and development through engagement. *Journal of Human Services*, pp. 56–72. Retrieved from https://link.gale.com/apps/doc/A418982814/AONE?u=anon~292b15d4&sid=googleScholar&xid=f5f632e5

Thyroff, A. (2019). Teaching qualitative marketing research: An experiential approach. *Marketing Education Review*, *29*(1), 75–87. https://doi.org/10.1080/10528008.2018.1514979

Uhm, J.Y., Ko, Y., & Kim, S. (2019). Implementation of an SBAR communication program based on experiential learning theory in a pediatric nursing practicum: A quasi-experimental study. *Nurse Education Today*, *80*, 78–84. https://doi.org/10.1016/j.nedt.2019.05.034