2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
Paper ID #53977

Rethinking "Traditional Homework" in Thermodynamics: A Study on Optional Models and Their Impact on Student Success

Dr. Zahra Pournorouz, Stevens Institute of Technology (School of Engineering and Science)

"Zahra Pournorouz received her Bachelor of Science degree in Aerospace Engineering from Amirkabir University of Technology (Tehran Polytechnic) in Tehran in the Fall of 2014. After finishing her bachelor's studies, she got admitted directly to the Ph.D. program in Mechanical Engineering at the University of Texas at Arlington and graduated in August 2018. Her research interests mainly focus on oil-based nanofluids and enhancing the thermophysical properties of synthetic oils. This was the first demonstration of the work ever done in this field and resulted in broad environmental and cost benefits, especially in energy storage and heat transfer applications. She has more than three years of experience teaching thermofluidic, mechanical design, and solid and structure courses and supervising senior capstone projects collaborating with industries such as Saint-Gobain, Klein Tools, and Parker. She also has served in leadership roles at the Society of Women Engineers and STEM advisory task force to represent diversity and inclusion and improve student success and retention for underrepresented students."

Youmna Mahmoud, Stevens Institute of Technology (School of Engineering and Science)

Youmna Mahmoud is a dedicated Mechanical Engineering Ph.D. candidate at Stevens Institute of Technology, with a strong passion for teaching and enhancing the student learning experience. She has been actively involved in teaching thermodynamics for several years, serving as a TA and once as a lecturer. Mahmoud is particularly invested in improving students' understanding by fostering an empathetic approach to teaching, and creating a supportive learning environment. She values patience and clear communication as key tools to improve student outcomes. Outside of teaching, Mahmoud's research focuses on Additive Manufacturing, where she leverages sensory data, thermal modeling, and machine learning to optimize the mechanical performance of fabricated parts.

Rethinking "Traditional Homework" in Thermodynamics: A Study on Optional Models and Their Impact on Student Success

Abstract:
This paper examines a project-based model with optional homework support as an alternative to traditional graded homework in an undergraduate Thermodynamics course. Traditional homework has long been used to reinforce problem-solving skills in engineering courses; however, increasing access to solution manuals, online repositories, and AI-based tools has raised questions about whether graded homework reliably reflects student learning or primarily rewards compliance. This study investigates whether shifting the instructional emphasis from mandatory homework completion to structured, application-based projects can support student engagement, critical thinking, and academic performance while reducing reliance on repetitive homework grading.

The study was implemented in ENGR 234 Thermodynamics, a required sophomore-level course for non-mechanical engineering majors. A total of 102 students attended the same lecture section, taught by the same instructor, and completed the same exams, quizzes, and course assessments under the same grading scale. Students were separated into two recitation sections. Section RA, with 50 students, used a project-based model supported by optional homework. Section RB, with 52 students, followed a traditional homework-based model. In the project-based section, homework was available as an ungraded practice tool with fixed due dates. Students who submitted original attempts before the deadline received formative feedback within one week, and worked solutions were posted after the due date. Students were explicitly informed that homework would not affect their course grade and that feedback would be withheld if submissions appeared to rely on solution manuals or copied work.

Aggregate grade distributions suggest that the project-based section performed at least comparably to the homework-based section. In the project-based section, 56% of students earned grades of A, A-, or B+, compared with 40.4% in the homework-based section. The project-based section also had a slightly higher estimated grade-point average based on final course grades. However, optional homework participation was low, with approximately 6 of 50 students submitting optional homework, suggesting that feedback alone may not be a sufficient incentive for broad voluntary homework engagement when no grade credit is attached.

These findings indicate that project-based assessment may provide a viable alternative to traditional homework-heavy models in Thermodynamics, particularly when projects are aligned with students' majors and real-world engineering applications. The study also highlights important implementation challenges, including how to incentivize optional practice, how to provide scalable formative feedback, and how to balance student autonomy with academic accountability. The paper concludes with recommendations for refining optional homework

structures, improving feedback models, and developing future IRB-approved surveys to examine student motivation, ownership of learning, and critical-thinking development.

Introduction

Homework has historically been a central component of engineering education, intended to reinforce theoretical concepts, promote procedural fluency, and cultivate problem-solving proficiency [1]. In thermodynamics, homework is often used to give students repeated practice with property relations, energy balances, entropy calculations, and cycle analysis. For many students, especially those outside mechanical engineering, thermodynamics can feel abstract and mathematically intensive. Homework is therefore commonly viewed as a necessary mechanism for helping students translate lecture concepts into problem-solving practice.

However, the role of traditional graded homework has become increasingly difficult to interpret. Ready access to solution manuals, online repositories, generative AI tools, and peer-shared solutions has changed how students engage with assigned problem sets [2],[3],[4]. Instructors may invest substantial time grading homework submissions, but the resulting scores may reflect compliance, access to solution resources, or formatting effort rather than independent conceptual understanding. This concern is especially relevant in large technical courses, where grading many weekly homework submissions can consume significant instructional resources without always producing reliable evidence of student learning.

At the same time, engineering educators are asked to support outcomes that extend beyond procedural correctness. Industry and accreditation frameworks emphasize critical thinking, independent judgment, problem framing, communication, and the ability to apply knowledge in realistic contexts [5],[6],[7],[8]. Critical thinking in thermodynamics requires students to identify relevant system boundaries, justify assumptions, interpret physical meaning, evaluate alternative approaches, and reflect on the limitations of their analysis. Routine homework problems can support technical fluency, but they may not always provide sufficient opportunities for students to practice these broader forms of engineering judgment.

This paper investigates a project-based model with optional homework support as an alternative to a traditional homework-based recitation model in an undergraduate Thermodynamics course. Rather than eliminating practice opportunities, the model decouples homework from course points and repositions it as a formative learning resource. Students in the project-based recitation section were given optional homework with fixed due dates, opportunities to receive formative feedback, and posted worked solutions. However, the primary accountability mechanism was a structured project requiring students to connect thermodynamics to discipline-relevant, real-world engineering problems.

The purpose of this study is not to claim that homework is unnecessary. Instead, the study asks whether a course can preserve academic rigor and student performance while shifting some emphasis from mandatory homework completion toward project-based application and self-directed practice. The analysis uses Thermodynamics course implementation data from two recitation sections that shared the same instructor, lecture meetings, exams, quizzes, and grading scale. One section used a project-based model with optional homework support, while the other section used a traditional homework-based model.

Background and literature review

Homework has been studied extensively across STEM and engineering contexts, with mixed conclusions regarding its relationship to achievement. Prior work has found that homework can support learning when students engage productively with the problems, but grading homework alone does not guarantee improved performance [12],[13],[14]. Yalcin and Kaw, for example, found no statistically significant difference in exam outcomes between students whose homework was graded and those whose homework was assigned but ungraded [12]. Such findings suggest that the learning value of homework may depend less on point allocation and more on whether students use homework as meaningful practice.

In engineering courses, homework also serves multiple functions simultaneously: practice, assessment, accountability, pacing, and feedback. These functions are often treated as inseparable, but they do not have to be. A student may benefit from practice problems even when they are not graded, and an instructor may provide feedback without assigning points. Separating these functions is particularly important in courses where graded homework can become vulnerable to copying or solution-manual use.

The project-based model explored in this study is informed by self-regulated learning, ungrading, and formative feedback frameworks. Self-regulated learning emphasizes students' ability to plan, monitor, evaluate, and adapt their learning strategies [17],[22],[24]. Optional homework can support self-regulation by requiring students to decide when practice is necessary and how to allocate their learning effort. However, autonomy alone is not sufficient; students need structure, feedback, and clear connections between practice activities and course outcomes.

Ungrading and alternative assessment approaches emphasize feedback, reflection, and student agency over numerical scoring [15],[16],[18],[19], [20]. In this study, optional homework was not "unstructured" or ignored. Assignments were released on a schedule, had due dates, and were followed by worked solutions. Students who submitted original attempts before the deadline could receive feedback focused on reasoning, assumptions, conceptual understanding, and solution strategy rather than point deductions. This distinction is important because the intent was not to remove rigor but to shift homework from a compliance-based grading task toward a formative learning tool.

Project-based learning has been widely used in engineering education to connect disciplinary theory with real-world application [9],[10],[11],[21],[23]. In thermodynamics, project-based tasks can help students recognize the relevance of energy, heat transfer, pressure, phase change, power generation, and efficiency in fields beyond mechanical engineering. This relevance is especially important in ENGR 234 because the course serves students from multiple non-mechanical engineering majors. Critical thinking was an explicit target of the project-based model. Students were asked to define problems, identify assumptions, evaluate alternative strategies, interpret results, and discuss real-world implications. These tasks align with employability competencies emphasized by industry and accreditation bodies [5],[6],[7],[8]. By requiring students to connect thermodynamic principles to their own majors and interests, the project model was designed to support both conceptual understanding and professional relevance.

Methodology

The study was conducted in ENGR 234 Thermodynamics during Spring 2025 at Stevens Institute of Technology. ENGR 234 is a required sophomore-level engineering course for students in the School of Engineering and Science, excluding mechanical engineering majors. Students in the course represented multiple majors, including industrial and systems engineering, engineering management, software engineering, pure and applied mathematics, civil engineering, computer engineering, naval engineering, electrical engineering, and biomedical engineering.
A total of 102 students were enrolled in a common lecture section that met on Mondays and Wednesday mornings and was taught by the same instructor. All students received the same lecture content and completed the same exams, quizzes, and course assessments under the same grading scale. The instructional difference occurred in the recitation structure. Section RA, with 50 students, used a project-based model with optional homework support. Section RB, with 52 students, used a traditional homework-based model. Although a small number of students switched recitation sections during the semester, the final enrollment numbers remained nearly balanced.
The study was guided by the following research questions:
RQ1: How did final course grade distributions compare between the project-based recitation section with optional homework support and the traditional homework-based recitation section?
RQ2: To what extent did students voluntarily submit optional homework when homework carried no direct grade value but offered formative feedback?
RQ3: What implementation features appear necessary to make optional homework and project-based learning scalable in a required engineering Thermodynamics course?

The homework-based section served as the comparison section. Students in this recitation section followed a more traditional model in which homework was a required and graded component of the course structure. Homework reinforced the weekly thermodynamics topics and provided routine practice with quantitative problem solving. This model reflected the standard assumption that regular graded homework promotes accountability, preparation, and technical fluency.

The project-based section used a different recitation structure. In this section, homework was provided as an optional, ungraded practice resource. Optional homework assignments were still released with fixed due dates to preserve pacing and structure. Students who submitted original attempts before the deadline received formative feedback within one week. Worked solutions were posted after the due date so that all students, including those who did not submit, could review the solution process.

Table 1. Comparison table for the instructional model

	SECTION RA (Project-Based)	SECTION RB (Traditional)
Primary Accountability	Discipline-specific structured project	Mandatory weekly problem sets
Role of Homework	Ungraded, formative practice tool	Required, point-bearing assessment
Feedback Mechanism	Individualized feedback on reasoning/strategy	Correctness grading and point deductions
Incentive Structure	Exam preparation and project application	Point accumulation

The incentive for completing optional homework was intentionally non-grade-based. Students were encouraged to complete homework because it supported exam preparation, reinforced project-related concepts, provided access to individualized formative feedback, and helped them identify gaps in understanding before worked solutions were released. Students were explicitly told that optional homework would not affect their final course grade. They were also told that the purpose of homework in this section was honest practice rather than point accumulation. Academic integrity expectations were communicated directly. Students were informed that feedback would be provided only on original attempts. If a submission appeared to rely on a solution manual, copied work, or non-original sources, individualized feedback would be withheld. This policy was designed to reduce the incentive to submit copied work merely for points and to encourage students to use homework as a self-assessment tool.

A central concern raised in the implementation of optional homework is whether replacing grading with feedback actually reduces instructor workload. The model used in this study did not eliminate instructional effort; rather, it shifted the type and target of that effort. Traditional homework grading typically requires evaluating every submitted solution for correctness and assigning points. By contrast, the optional homework model provided formative feedback only to students who voluntarily submitted original attempts. Feedback emphasized reasoning, assumptions, conceptual understanding, and solution strategy rather than point allocation.

This distinction matters because correctness-based grading can become repetitive, especially when many students submit similar numerical solutions. Formative feedback can be more time-intensive per submission, but the number of submissions was much lower, and feedback could be structured using recurring comments, common-error summaries, and TA support. In this implementation, strong TA and grader support helped make the feedback model manageable. The model therefore reduced repetitive grading volume, while preserving opportunities for high-impact instructional interaction with students who actively sought feedback.

The project-based section completed a structured thermodynamics project designed to connect course concepts to real-world engineering applications. Students selected from a list of discipline-relevant project prompts connected to civil engineering, electrical engineering, biomedical engineering, industrial and systems engineering, engineering management, mathematics, software engineering, naval engineering, and computer engineering. The major labels were presented as suggestions rather than restrictions, and students could select topics based on their interests [25].

Project options included topics such as subway thermal management, water use, natural and artificial pacemakers, hyperbaric chambers, centrifugal blood pumps, residential energy systems, ocean power generation, prosthetic limb suction, blood pressure measurement, recycling and manufacturing, compressed-air energy storage, hydraulic fracturing, and phase-change materials in buildings. These topics were selected to help students recognize thermodynamics as a cross-disciplinary engineering tool rather than a topic limited to mechanical engineering.

The final project deliverable was a 10-minute group presentation due in Week 16. Required presentation components included a title slide, a slide connecting thermodynamics to each group member's major, an introduction to the problem statement, a solution section with well-labeled figures and tables, and a final slide indicating the end of the presentation. The rubric assessed the title/final slide, relationship between thermodynamics and group members' majors, problem statement, solution quality, presentation organization, presentation delivery, technical information, and visual aids. Table 2 summarizes the project presentation rubric.

Table 2. Project presentation rubric used in the project-based section.

Category	Description	Points
Title slide / final slide	Project and team title, group number, member names, course number, date, Stevens Pledge, and closing slide	5
Thermodynamics relation with group members' majors	Connection between thermodynamics and each represented major, including where thermodynamics is used in that discipline	25
Introduction to problem statement	Clear presentation of the engineering problem being addressed	5
Solution to problem statement	Multiple slides presenting answers, analysis, figures, tables, and solutions	25
Presentation organization	Clear main points, effective time use, and smooth flow	10
Presentation delivery	Strong understanding, appropriate word choice, and engaging delivery	10
Presentation information	Key information presented at an appropriate level of detail	10
Presentation visual aids	Attractive, error-free slides that support the presentation	10

The project served as the primary accountability mechanism in the project-based section. Optional homework was aligned with project-related concepts so that students could use it as a practice tool to strengthen the technical reasoning needed for both their projects and exams. In this way, homework functioned as formative support rather than a graded compliance task.

The original study plan included surveys and focus groups to examine student motivation, workload perception, and ownership of learning. However, IRB approval for student perception surveys and focus groups was not finalized before the Spring 2025 implementation period. As a result, surveys and interviews were not conducted during this phase. The present paper therefore reports only de-identified, aggregate course-level outcomes, including section-level grade distributions and optional homework submission patterns. No individual student records, names, identifiers, or personally identifiable performance data are reported.

Because the available grade data were aggregate rather than individual numerical exam scores, the analysis presented here is descriptive rather than inferential. Final course grade distributions were compared across the two recitation sections. Letter grades were also converted to a standard 4.0 grade-point scale to estimate an aggregate section-level grade index. This conversion was used only as a descriptive summary and should not be interpreted as a replacement for statistical analysis of individual numerical scores. Future analysis using de-identified individual-level data, if approved, would allow t-tests, regression models, or other inferential comparisons controlling for prior academic performance and section-switching.

Results

Table 3 presents the final course grade distribution for the project-based section and the homework-based section. The project-based section had 50 students, and the homework-based section had 52 students.

Table 3. Aggregate final grade distribution by recitation model.

Final grade	Project-based section RA (n = 50)	Homework-based section RB (n = 52)
A	10	6
A-	9	9
B+	9	6
B	9	14
B-	6	3
C+	3	6
C	2	4
C-	0	1
D+	0	0
D	1	3
F	1	0

In the project-based section, 28 of 50 students (56.0%) earned grades of A, A-, or B+. In the homework-based section, 21 of 52 students (40.4%) earned grades of A, A-, or B+. When B grades are also included, 37 of 50 students (74.0%) in the project-based section earned grades from A through B, compared with 35 of 52 students (67.3%) in the homework-based section. Conversely, 14.0% of students in the project-based section earned grades of C+ or lower, compared with 26.9% in the homework-based section.

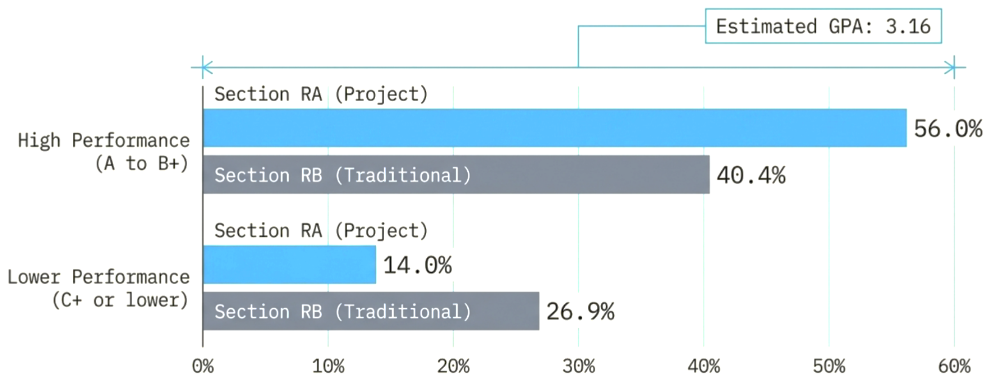

Figure 1. Grade comparison of both instructional models.

Using a standard 4.0 grade-point conversion for descriptive purposes, the project-based section had an estimated aggregate grade index of 3.16, while the homework-based section had an estimated aggregate grade index of 2.96. These results suggest that the project-based model with optional homework support did not reduce overall academic performance relative to the traditional homework-based model. The results are also consistent with the possibility that project-based application may support comparable or stronger course outcomes, although causal claims cannot be made from aggregate grade distributions alone.

Optional homework participation in the project-based section was limited. Approximately 6 of the 50 students submitted optional homework for feedback. This result is important because it shows that formative feedback alone was not sufficient to motivate broad homework submission when homework carried no direct grade value. Students may still have used posted homework solutions for practice or exam preparation, but voluntary submission for individualized feedback was low.

This finding clarifies the role of optional homework in the model. The optional homework component functioned as a support resource for a small subset of students rather than as the primary driver of engagement for the entire section. The structured project appears to have served as the main accountability and engagement mechanism. Therefore, the intervention is best characterized as a project-based model with optional homework support, rather than an optional-homework-only model.

The grade distribution results are encouraging because both sections shared the same lecture experience, instructor, exams, quizzes, and grading scale. The primary instructional difference was the recitation model. The project-based section did not appear to be disadvantaged by replacing traditional graded homework with project-based application and optional practice. In fact, the project-based section had a larger proportion of students in the A to B+ range and a smaller proportion of students in the C+ or lower range. At the same time, the low optional homework submission rate suggests that optional practice requires more deliberate incentive design. Students may need lightweight accountability mechanisms that do not fully restore the compliance pressures of traditional graded homework. Examples include reflection logs, short readiness checks, project-related homework checkpoints, or structured opportunities to apply homework concepts during recitation.

Discussion

The findings suggest that traditional graded homework may not be the only viable pathway for supporting student success in thermodynamics. In this implementation, a project-based recitation model with optional homework support produced aggregate course outcomes that were at least comparable to those in the traditional homework-based section. This is meaningful because all students shared the same lecture environment and common assessments, making the recitation model the major instructional distinction between the sections.

The project-based model may have supported learning by requiring students to apply thermodynamic principles in broader contexts. Instead of completing weekly homework primarily for points, students had to explain the relevance of thermodynamics to their majors, frame engineering problems, interpret technical information, and communicate solutions. These activities align closely with critical thinking competencies valued in engineering practice.

One of the most important implementation findings is that optional homework submission was low. Only about 12% of students in the project-based section submitted optional homework for feedback. This suggests that even when feedback is offered, most students may not submit optional work unless the incentive structure is clear and immediate. However, low submission does not necessarily mean optional homework had no value. Some students may have used the homework prompts and posted solutions without submitting. Others may have relied more heavily on project work, recitation activities, office hours, or exam preparation materials. The key lesson is that optional homework should not be expected to function like mandatory homework. If broad participation is desired, optional homework likely needs to be integrated into recitation activities, project milestones, or short reflective assignments that preserve autonomy while creating visible value.

The study also clarifies the relationship between optional homework and instructor workload. The model did not remove the need for feedback; instead, it reduced the number of weekly homework submissions requiring grading and redirected effort toward formative feedback, project mentoring, and common-error guidance. Because only a small number of students submitted optional homework, individualized feedback demand was manageable, especially with TA and grader support. For future implementations, scalability could be improved by using structured feedback templates, common-comment banks, whole-class feedback summaries, and project-linked feedback checkpoints. These mechanisms would preserve the benefits of formative feedback while avoiding a return to large-scale repetitive grading. The model may be especially useful in large technical courses where instructors want to reduce low-value grading while increasing meaningful interaction around reasoning and application.

The project structure directly responded to the need for critical thinking and professional relevance. Students were asked not only to solve a technical problem but also to explain how thermodynamics connects to their own majors. This requirement is particularly important in a service course for non-mechanical engineering majors. When students see thermodynamics only as a required technical hurdle, motivation may decline. When they are asked to connect thermodynamic principles to biomedical systems, civil infrastructure, energy systems, electrical devices, environmental decisions, or manufacturing, the course may become more meaningful and professionally relevant.

This study has several limitations. First, the sections were not randomly assigned. Students were enrolled in different recitation sections, and a small number of students switched sections during the semester. Therefore, the results should be interpreted as a quasi-experimental comparison rather than a randomized controlled trial.

Second, the analysis currently relies on aggregate final grade distributions rather than individual numerical exam, quiz, and assignment scores. Aggregate grade data are useful for describing overall course outcomes, but they do not allow statistical tests of significance or controls for prior academic preparation. Future work should use de-identified individual-level data, subject to appropriate approvals, to compare exam scores and course performance while accounting for baseline academic variables.

Third, student perception data were not collected during the Spring 2025 implementation because IRB approval for surveys and focus groups was not finalized before the semester. As a result, this paper cannot directly report student perceptions of motivation, workload, feedback usefulness, or critical-thinking development. Future implementations should include IRB-approved pre-, mid-, and post-semester surveys, as well as focus groups or structured reflections, to examine how students experience the model.

Fourth, optional homework submission was low, which limits conclusions about the effect of optional homework feedback itself. The positive descriptive outcomes of the project-based section may be more strongly associated with the structured project than with optional homework submission. For this reason, the model should be understood as project-based learning with optional homework support, not as an optional-homework-only intervention.

Future iterations of this study will strengthen both the instructional model and the data collection design. First, optional homework may be redesigned to include lightweight accountability structures, such as short reflection prompts, project-linked checkpoints, or low-stakes readiness activities. These mechanisms could help students recognize the value of practice without reinstating a traditional points-based homework system.

Second, future data collection will include IRB-approved student surveys and focus groups. Planned survey constructs include perceived usefulness of homework, motivation for completing or not completing optional assignments, perceived relationship between homework and exams, perceived development of critical thinking, ownership of learning, workload, and satisfaction with the project structure. Open-ended questions may ask students to describe why they did or did not complete optional homework, how the project affected their understanding of thermodynamics, and what types of feedback were most useful.

Third, future analyses should use de-identified individual-level assessment data to compare exam scores, quiz scores, project scores, and final course performance between instructional models. Such analyses would allow stronger conclusions about whether project-based assessment with optional homework support can maintain or improve academic performance while reducing repetitive grading workload.

Conclusion

This paper examined a project-based model with optional homework support as an alternative to traditional graded homework in an undergraduate Thermodynamics course. In Spring 2025, 102 students attended the same lecture section, completed the same exams and quizzes, and were evaluated using the same grading scale. The primary instructional difference was the recitation model: one section used structured project-based learning with optional homework support, while the other used a traditional homework-based model.

Aggregate final grade distributions suggest that the project-based section performed at least comparably to the homework-based section. A larger proportion of students in the project-based section earned grades in the A to B+ range, and the estimated aggregate grade index was slightly higher. These results suggest that replacing traditional graded homework with a project-based model did not compromise academic performance in this implementation. At the same time, optional homework submission was low, with approximately 6 of 50 students submitting optional homework for feedback. This finding indicates that feedback alone may not be sufficient to motivate widespread voluntary homework completion. The project, rather than optional homework submission, likely served as the primary engagement and accountability mechanism. Therefore, future models should preserve the benefits of project-based learning while redesigning optional homework to include clearer incentives and lightweight accountability structures.

Overall, the study contributes to ongoing discussions about how engineering educators can balance rigor, flexibility, academic integrity, and instructor workload. In courses such as thermodynamics, where traditional homework may not always provide reliable evidence of learning, project-based models with optional homework support offer a promising pathway for promoting application, critical thinking, and student ownership of learning.

References

[1] M. Prince, “Does active learning work? A review of the research,” Journal of Engineering Education, vol. 93, no. 3, pp. 223-231, 2004.
[2] T. Bretag et al., “Contract cheating and assessment design,” Assessment & Evaluation in Higher Education, vol. 44, no. 5, pp. 676-691, 2019.
[3] S. E. Eaton, “Academic integrity in the post-pandemic era,” International Journal for Educational Integrity, vol. 17, no. 1, 2021.
[4] E. Kasneci et al., “ChatGPT for education: Opportunities and challenges,” Learning and Individual Differences, vol. 103, 102274, 2023.
[5] National Association of Colleges and Employers, Career Readiness Competencies, 2023.
[6] World Economic Forum, The Future of Jobs Report, 2023.
[7] ABET, Criteria for Accrediting Engineering Programs, 2024-2025.
[8] P. A. Facione, “Critical thinking: What it is and why it counts,” Insight Assessment, 2013.
[9] S. Freeman et al., “Active learning increases student performance in science, engineering, and mathematics,” Proceedings of the National Academy of Sciences, vol. 111, no. 23, pp. 8410-8415, 2014.
[10] M. Prince and R. Felder, “Inductive teaching and learning methods: Definitions, comparisons, and research bases,” Journal of Engineering Education, vol. 95, no. 2, pp. 123-138, 2006.
[11] A. Kolmos, F. K. Fink, and L. Krogh, The Aalborg PBL Model: Progress, Diversity and Challenges. Aalborg University Press, 2004.
[12] A. Yalcin and A. Kaw, “Do homework grading policies affect student learning?” International Journal of Engineering Education, vol. 27, no. 1, pp. 202-209, 2011.
[13] R. Paschal, T. Weinstein, and H. Walberg, “The effects of homework on learning: A quantitative synthesis,” Journal of Educational Research, vol. 78, no. 2, pp. 97-104, 1984.
[14] H. Cooper, J. C. Robinson, and E. A. Patall, “Does homework improve academic achievement? A synthesis of research, 1987-2003,” Review of Educational Research, vol. 76, no. 1, pp. 1-62, 2006.
[15] S. D. Blum, Ungrading: Why Rating Students Undermines Learning (and What to Do Instead). Morgantown, WV: West Virginia University Press, 2020.
[16] M. Bonilla and D. Findley, “Evaluation of self-assessment and ungrading practices in engineering education,” Advances in Engineering Education, 2024.
[17] L. B. Nilson, Creating Self-Regulated Learners: Strategies to Strengthen Students’ Self-Awareness and Learning Skills. Sterling, VA: Stylus, 2013.
[18] F. Pyrtle, “Effects of homework policy on student performance,” ASEE Annual Conference & Exposition, 2019.
[19] W. Tsutsui and M. C. Loui, “Impact of supervised homework sessions,” IEEE Frontiers in Education Conference, 2016.
[20] D. D. Ragan and J. Geathers, “Collaborative homework in engineering materials,” ASEE Southeastern Section Conference, 2021.
[21] J. Mills and D. Treagust, “Engineering education: Is problem-based or project-based learning the answer?” Australasian Journal of Engineering Education, vol. 3, no. 2, pp. 2-16, 2003.
[22] B. J. Zimmerman, “Self-regulated learning and academic achievement: An overview,” Educational Psychologist, vol. 25, no. 1, pp. 3-17, 1990.

[23] D. A. Kolb, Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs, NJ: Prentice Hall, 1984.
[24] J. D. Bransford, A. L. Brown, and R. R. Cocking, Eds., How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academies Press, 2000.
[25] Z. Pournorouz, “Utilizing active learning to replace traditional homework in undergraduate engineering majors,” ASEE Annual Conference & Exposition, 2020.