

Assessing Team-Based Capstone Projects: Challenges and Recommendations

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Abstract

Team-based capstone projects are vital in preparing computer science students for real-world challenges by fostering teamwork, communication, and industry-relevant technical skills. However, their assessment presents challenges, such as aligning academic criteria with other stakeholders' expectations, evaluating individual contributions within teams, fairly addressing the diverse skills required, and determining the appropriate level of external partners' involvement in the evaluation process. Moreover, the high stakes of these projects necessitate transparent and equitable assessment methods that all stakeholders perceive as fair. Our working group (WG) aims to address the challenges of assessing capstone projects by examining the perspectives of instructors, students, and other stakeholders to ensure fair and effective evaluation. Building on insights from our previous WG and a comprehensive review of the

literature, we will employ a mixed-methods approach to explore the issues faced by various stakeholders in assessing capstone projects and to capture both common challenges experienced (quantitative), and delve into nuanced individual experiences (qualitative). By conducting this research in a multi-national, multi-institutional context, we aim to capture a diverse range of global perspectives while accounting for the variation in capstone courses. Our goal is to provide actionable recommendations that enhance assessment practices, improve learning outcomes, and foster effective team collaboration in team-based capstone courses, ultimately preparing students for real-world challenges.

CCS Concepts

• **Social and professional topics** → **Computing education**.

Keywords

Capstone, Team-based Assessments, Individual Contribution

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1 Background and Related Work

Team-based capstone projects are a culmination of computer science education, allowing students to apply their knowledge and cultivate professional skills through real-world problem-solving [4, 5]. Fair and meaningful assessments in these courses ensure that students' individual contributions are recognized and learning outcomes are accurately measured [2]. However, instructors face challenges when assessing capstone projects, such as balancing subjective and objective criteria, managing team dynamics, and addressing diverse stakeholder expectations [8]. Meanwhile, students often struggle with equitable contribution distribution, understanding assessment criteria, and receiving actionable feedback. Moreover, generative AI developments require instructors to adjust to the challenges and opportunities of responsible use of AI in areas such as assessment [7].

Our WG aims to explore the complexities of capstone-specific assessments and builds on findings from a previous WG that identified assessment as a significant challenge in capstone courses [3]. Unlike the broader teamwork evaluation studied by a SIGCSE 2024 WG [6], capstone-specific assessments require focused investigation as they present distinct challenges. These challenges include aligning academic criteria with professional standards and real-world deliverables, often necessitated by the involvement of external clients/industry partners. Capstone projects require students to demonstrate diverse technical, managerial, and interpersonal skills, which must be evaluated consistently across varied contexts. The high stakes of capstone projects also require transparent and equitable assessments that all stakeholders perceive as fair.

2 Research Goals

Our Working Group (WG) seeks to investigate current assessment practices in team-based capstones by synthesizing insights from published research and first-hand discussions with instructors, students, and stakeholders. Our goals are to:

- **Analyze Effectiveness of Existing Practices:**
 - What assessment methods are commonly used in diverse capstone courses?
 - How effective are these methods in ensuring fair evaluation of team and individual contributions?
- **Identify Instructors' Assessment Challenges:**
 - What are the key obstacles instructors encounter when assessing team-based capstone projects?
 - What is the impact of generative AI in capstone assessment?
- **Understand Student Perspectives:**
 - How do students perceive the fairness and transparency of capstone project assessments?
 - What challenges do students face in understanding assessment criteria and receiving feedback?
- **Understand External Stakeholder Perspectives:**
 - What forms of involvement do external stakeholders have in capstone assessments?
 - How do external stakeholders judge the quality and value of capstone deliverables?

• Propose Evidence-based Solutions:

- What innovative strategies can address assessment challenges?
- How can these strategies be implemented to balance the needs of instructors and students?

3 Methodology

We use a mixed-methods approach, combining quantitative surveys and qualitative interviews to collect data for our study. Our work is guided by Creswell [1] to study the experiences of instructors and students who have taken or taught capstone courses. By combining quantitative survey responses with in-depth qualitative study that will include semi-structured interviews we plan to understand perspectives on assessment challenges and suggested strategies. This approach allows us to triangulate findings and provide robust recommendations for supporting effective capstone assessments.

4 Expected Deliverables

We expect to deliver the following outcomes from our work:

- **Comprehensive Literature Review:** A detailed review of existing research on assessment in team-based projects.
- **Data Analysis Report:** A report summarizing quantitative and qualitative findings, highlighting key challenges and effective practices in assessing team-based capstone projects.
- **Case Studies:** Examples illustrating innovative assessment strategies and their outcomes.
- **Best Practice Recommendations:** Guidance for academic institutions on supporting effective capstone assessment.
- **Follow-up Research Proposals:** Proposals for further research based on the findings, such as longitudinal studies to track the impact of assessment strategies over time.

References

- [1] John W Creswell and J David Creswell. 2017. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- [2] Martin R Fellenz. 2006. Toward fairness in assessing student groupwork: A protocol for peer evaluation of individual contributions. *Journal of Management Education* 30, 4 (2006), 570–591.
- [3] Sara Hooshangi, Asma Shakil, Subhashish Dasgupta, Karen C Davis, Mohammed Farghally, KellyAnn Fitzpatrick, Mirela Gutica, Ryan Hardt, Ellie Lovellette, Steve Riddle, et al. 2024. Experiences of Instructors Who Teach Capstone Courses in Computing Fields. In *Proceedings of the 2024 on Innovation and Technology in Computer Science Education V. 2*. 759–760.
- [4] Jayden Khakurel and Jari Porras. 2020. The Effect of Real-World Capstone Project in an Acquisition of Soft Skills among Software Engineering Students. In *2020 IEEE 32nd Conference on Software Engineering Education and Training (CSEET)*. 1–9. <https://doi.org/10.1109/CSEET49119.2020.9206201>
- [5] Ze Shi Li, Nowshin Nawar Arony, Kezia Devathanan, and Daniela Damian. 2023. "Software is the easy part of Software Engineering" - Lessons and Experiences from A Large-Scale, Multi-Team Capstone Course. In *2023 IEEE/ACM 45th International Conference on Software Engineering: Software Engineering Education and Training (ICSE-SEET)*. 223–234. <https://doi.org/10.1109/ICSE-SEET58685.2023.00027>
- [6] Alexander Mitchell, Michael James Scott, Bedour Alshaigy, Wendell Bento Gerdal, Rita Garcia, Mirela Gutica, Hieke Keuning, Ellie Lovellette, PD Parthasarathy, Seán Russell, et al. 2024. Exploring Approaches to Assessing Student Teamwork in Undergraduate Computing Projects. In *Proceedings of the 2024 on ACM Virtual Global Computing Education Conference V. 2*. 285–286.
- [7] José Carlos Sánchez-Prieto, Adriana Gamazo, Juan Cruz-Benito, Roberto Therón, and Francisco J. García-Peñalvo. 2020. AI-Driven Assessment of Students: Current Uses and Research Trends. In *Learning and Collaboration Technologies. Designing, Developing and Deploying Learning Experiences*, Panayiotis Zaphiris and Andri Ioannou (Eds.). Springer International Publishing, Cham, 292–302.
- [8] Saara Tenhunen, Tomi Männistö, Matti Luukkainen, and Petri Ihanntola. 2023. A systematic literature review of capstone courses in software engineering. *Information and Software Technology* (2023), 107191.