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Implementing Reflections in Student's Project Work to Enhance Study Performance – Lessons Learnt

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Abstract

In today's fast-paced and interconnected work environments, higher education institutions are turning to project-based courses to cultivate collaborative learning. While effective, this approach may overwhelm students, potentially affecting their motivation and group performance. To address these challenges, two undergraduate courses incorporated mandatory reflective practices grounded in Kolb's Learning Cycle. These reflections were designed to boost individual engagement and critical thinking, mitigating problems related to group dynamics and motivation. The study focused on how students responded to these reflective exercises, investigating their impact on teamwork, communication, and overall project results. It highlighted the importance of instructor involvement and customized support. Insights are provided for educators aiming to integrate reflection into their teaching, as it proved to be a powerful tool for fostering student autonomy and improving project-based learning outcomes in higher education.

Keywords: *reflection, group work, projects work, self-reflection.*

1. Introduction

As project-based learning becomes more widespread in higher education, it has sparked a reconsideration of traditional student assessment strategies: (Cuseo, 1992; Siegeris and Pfennig, 2022) prioritizing student-centered experiences, fostering collaboration and problem-solving within real-world scenarios: (Sjølie, Espenes, & Buø, 2022). Self-reflection has emerged as a promising criterion for evaluation: (Bohd, 2015; Goel, 2017). Within this framework, group processes are vital for fostering collaboration, with team members participating in critical dialogue and operating as self-organized units: (Sjølie, Espenes and Buø, 2022; Johnson & Johnson, 2009). Regular team reflections enable participants to assess their performance, refine their methods, and proactively address potential challenges (Kneisel, 2020; Edmondson, 1999).

This practice proves especially beneficial in online project settings, where it aids in adapting to virtual learning environments: (Sjølie, Espenes and Buø, 2022).

Reflective practices, such as regular team reflections and pre- and post-project evaluations, enhance collaboration and adaptability in project-based learning. Team reflections allow members to assess goals, refine workflows, and adapt to changing conditions, while pre- and post-project reflections emphasize social interdependence over individual skills: (Sjølie, Espenes and Buø, 2022; Kneisel 2020). High-achieving students use self-reflection for both formative and summative assessments, aligning well with agile methodologies through retrospective evaluations to improve team efficiency and enabling them to align better with educators' expectations: (Bohd, 2015). Evidence suggests that reflective training enhances test scores: (Schneider, 1986). In engineering education, combining team-based efforts with portfolio assessments provides valuable insights into student learning (Knipfer, Kump, Wessel, Cress, 2013). Similarly, reflective practices in fields like arts and reading education contribute significantly to personal growth and professional development: (Carpe, 2019). While self-reflection delivers rich feedback, it may demand additional time and effort: (Coertjens, 2021).

Despite their potential, research on the impact of self-reflection on individual performance in group projects is limited. A study employing Kolb's Reflective Learning Cycle: (Kolb, 1984) and a blind review process found that reflective practices can improve teamwork and final product quality. However, insufficient attention has been given to students' perspectives, well-being, and personal learning outcomes. The here addressed findings underline the importance of supportive conditions for effectively integrating reflections into engineering education.

2. Method: The reflection process in IT and mechanical engineering courses

Reflection levels vary in depth and are delineated by various reflective models, e.g. descriptive, simple, value based, evaluative, analytical and concluding as outlined by: (Moon, 2004) and expanded upon by: Dowling, 2019) (summarized by: (Pfennig and Siegeris, 2024).

It's crucial to recognize that a comprehensive reflection often integrates elements from these diverse levels. However, achieving a truly "insightful" reflection necessitates reaching an "analytical" or "conclusive" level of depth, as emphasized by: (Dowling, 2019). Connecting reflective practice to the learning process, Kolb's Learning Cycle: (Kolb, 1984), as previously discussed by: (Siegeris and Pfennig, 2024), posits reflection as one of the four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Figure 1 refers to the reflective tasks and main observation during the reflection cycles.

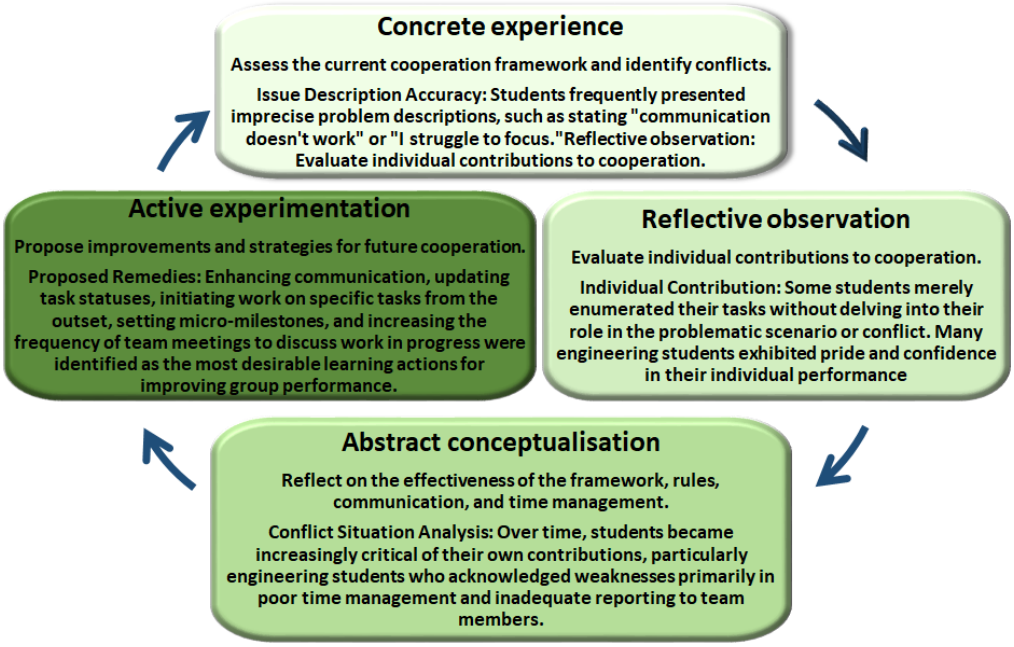

Figure 1: Kolb's Learning Cycle delineates four stages within the learning process: It begins with a concrete experience, proceeds to reflective observation of what transpired, moves on to an attempt to comprehend the occurrences and their underlying reasons, and culminates in testing the comprehension through experimentation. Source: Adapted from: (Kolb, 1984 p. 42) in: Dowling (2019) modified from: (Siegeris and Pfennig, 2024).

Communication challenges emerged as a predominant issue in both projects. Initially, students found reflections to be time-consuming and did not perceive them as beneficial for project outcomes. However, subsequent reflection cycles revealed their positive impact on communication and task clarification (Pfennig and Siegeris, 2024). In the IT course, project results could not be directly linked to reflective statements due to multiple stakeholders involved. Conversely, in the Materials Science course, lecturers outlined main issues addressed in student reflections post-course and assigned weighted scores based on wording, emotional involvement, and rational statements (Figure 2). Notably, there was no correlation between rules, micro tasks, communication, cooperation, scientific performance, individual time management, and individual project assessment. Groups demonstrating superior time management skills, including meeting deadlines, achieving milestones, and holding informal meetings, tend to receive higher grades compared to those with poor time management. Figure 2 allows to estimate a modest correlation between improved group and time management and higher grades.

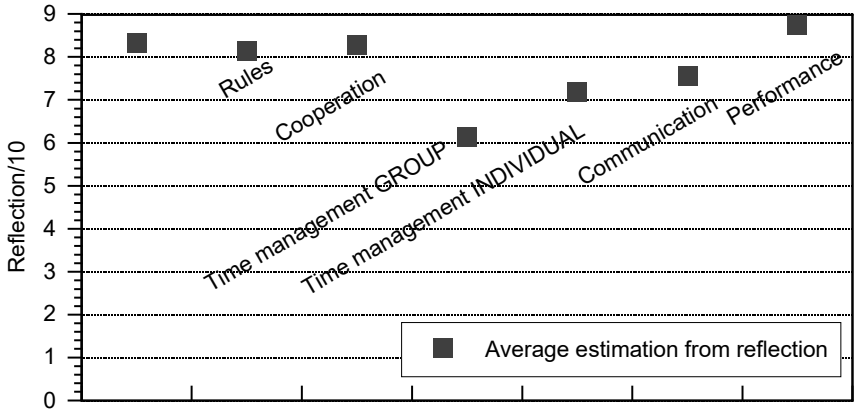

Figure 2. Weighting of the main topics issued within students` reflection with regard to influence on the project outcome (0 poor, 10 outstanding).

In the following, the authors focus on lessons learnt from students` feedback and implementing the reflection method for 5 semesters. First findings were presented at ICERI 2024: (Pfennig and Siegeris, 2024).

3. Results: Student`s feedback

MB students' reflections on the scientific task offer valuable insights into their experiences with research and collaboration. They highlight key challenges, including unfamiliar topics, distractions, frustration, and demotivation. Students recognize the importance of a structured research approach and suggest strategies for future improvement, such as acknowledging the often-overlooked role of research. Furthermore, their reflections address group communication challenges and propose actionable steps to enhance communication in future projects.

The IT course focused on product development implementing agile methods. However, the remote setting of the course was found to add extra challenges to mastering the project. As key issues from the Summer School IT Students in mixed team (German/Australian) agile projects students remind of the importance of clear communication, adherence to guidelines, technological support for data management, addressing time-related challenges, ensuring adequate subject knowledge, enhancing agile skills, resolving specific issues promptly, and addressing language barriers to foster effective collaboration and project success.

Students prioritized the frequency and timing of reflections, feedback and engagement of instructors along with structure and guidance as most critical to their personal study success (Figure 3). The relationship and regular meetings were not rated important. Team dynamics, authenticity and team practical as well as emotional support is rated with medium priority to IT students.

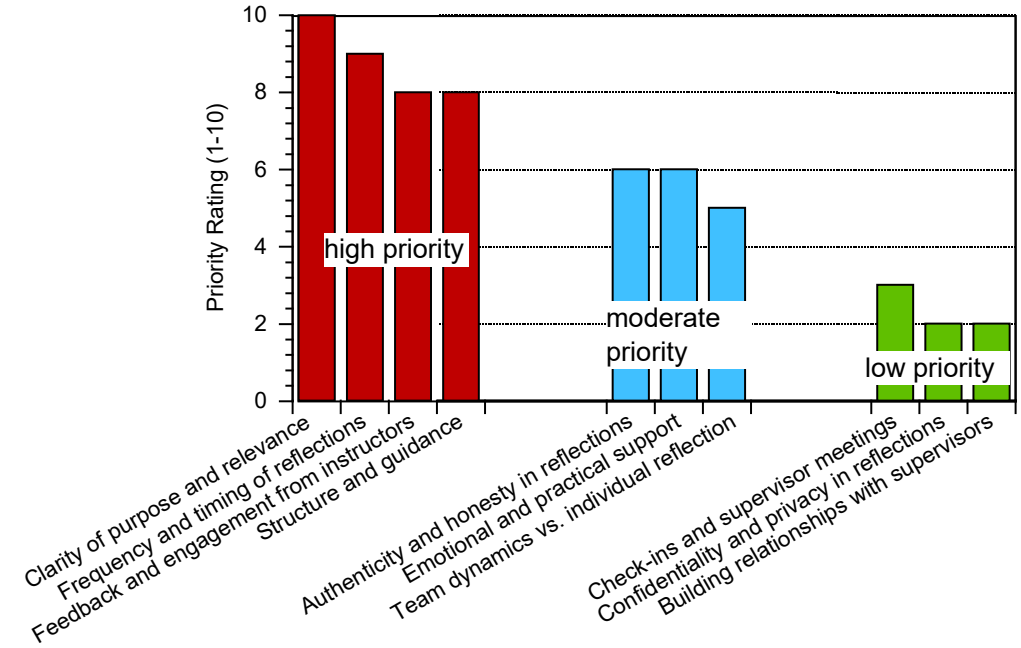

Figure 3. Key issues related to reflection grouped by students` priority rating. Data was obtained anonymously 2022-2023 during 3 months summer school. An external counselor regularly discussed issues with students finalizing the given results from multiple student inputs, findings and feedback.

4. Discussion: Lessons learnt

Reflections in higher education have both benefits and drawbacks. On the positive side, they provide a structured way for students to engage in metacognition, fostering deeper understanding, critical thinking, and self-directed learning. They also empower students to take ownership of their education, making them more active participants: (Kolb, 1984; Moon, 2004; Kneisel, 2020; Pfennig and Siegeris, 2024). However, reflections can be time-consuming, overly subjective, and disconnected from students' academic or career goals, particularly when clear guidelines or grading criteria are absent.

Students prioritize structured and consistent elements of their education, such as timely reflections, feedback, instructor engagement, and clear guidance, as critical to their study success. Personal relationships and regular meetings are considered less important, suggesting a preference for efficiency and autonomy in learning. Team dynamics, authenticity, and emotional support hold medium priority, indicating that while collaboration and a supportive environment are valued, they are secondary to instructor-led support. For IT students, these findings highlight the whish for programs that emphasize clear instructions and practical feedback while placing less focus on fostering personal connections. This suggests a broader

preference for individualized and task-oriented learning processes, but is not in agreement with the aim of higher education where students take over responsibility for their learning progress and. Moreover, students it shows, that students do not realize that personal connection is the key issue to successful collaboration and team progress.

Many students complete reflections purely for grades, lacking intrinsic motivation. To address this, instructors should integrate reflections meaningfully into the curriculum, align them with course objectives, and provide clear directions. Additionally, factors such as students' prior experience, learning preferences, and cultural context (e.g., international summer school settings) influence the effectiveness of reflections.

First-year engineering students often overestimate their abilities due to limited project experience or past inflated praise, necessitating lecturers to bridge the gap between self-evaluation and actual outcomes in group projects. Despite strong individual time management skills, students rate group coordination poorly, highlighting the need for strategies and preparatory workshops in cross-cultural training, language adaptation, team building, and agile skills. To enhance reflection activities, educators should provide clear guidelines, link reflections to learning objectives, integrate them into assessments, and offer examples and feedback for authentic self-reflection (Pfennig and Siegeris, 2024). Continuous review and adjustment of reflection strategies can further optimize learning outcomes and support student success.

In general, from incorporation of reflection as learning and assessment practice in mechanical engineering and IT the most important lesson is that students relate their study success mostly upon external criteria, such as guidance, deadlines, engagement and support offered by lecturers and feedback. Therefore, comprised lessons learnt are: (Pfennig and Siegeris, 2024).

Structured research/project guidance:

- emphasize research as a critical aspect of academic work, not just a task.
- provide clear guidelines, resources, and workshops on research methods, academic databases, and source evaluation. Clear mile-stones need to be respected.
- highlight that research and organization contribute over 70% to project success.

Managing distractions:

- encourage creating dedicated study spaces and setting time blocks for focused work.
- suggest using techniques like the Pomodoro Technique for concentration.

Addressing frustration and demotivation:

- offer regular check-ins to monitor progress and provide encouragement.
- facilitate peer support networks and provide constructive feedback.

Preparatory workshops for international IT groups:

- cross-cultural training: cultural awareness and sensitivity for better team dynamics.
- language adaptation: strategies for clear communication among multiple backgrounds.
- team building: trust, rapport, and a sense of shared responsibility among the team.
- agile skills: agile principles and practices for effective project management.

However, the authors want to note, that higher education trains young adults to be responsible for their own career and learning progress and the need to find a suitable balance between the request for strong guidance and demands of their future professional environment that will rely upon self-management, critical thinking and creative goal-driven project outcomes.

5. Conclusion

Reflection cycles in project-based IT and material science courses revealed challenges such as: insufficient guidance, miscommunication, poor time management, navigating unfamiliar topics, and dealing with frustration and distractions. Reflections helped improve team dynamics, task clarity, and collaboration.

The lessons learnt from implementing reflection cycles in undergraduate project-based IT and material science courses highlight several key insights: Students emphasized the need for external criteria as viable to their study success, such as: structure, engagement of lecturers, feedback clear communication, agile skills, and addressing language barriers. Instructors are encouraged to provide structured research guidance, foster a supportive learning environment, and incorporate preparatory workshops on team building, cross-cultural training, and agile skills. Key recommendations for instructors include:

1. clarity: clearly defining expectations, offer clear guidelines
2. lecturer engagement: supporting self-reflection and authenticity.
3. communication: promoting effective communication and structured research.
4. feedback: addressing frustration, distraction, and time management challenges.
5. skills: provide team-building and agile skills training.

Reflections demonstrate student's self-awareness and willingness to learn from their experiences, suggesting opportunities for growth and development in their academic progress. When implemented thoughtfully, reflections can enhance learning, collaboration, and personal growth, preparing students for academic and professional success. The authors emphasize that higher education must balance providing guidance with preparing students for professional environments that demand self-management, critical thinking, and goal-oriented creativity.

References

Bohd, J.D. (2006). Reflective Assessment: Including Students in the Assessment Process. *Form of the Public Policy*, 1-17.

Carpe, D. (2019). Tool: Self reflection / assessment as didactic tools. Project: Teaching Interdiscipl. Artistic Research. DOI:10.13140/RG.2.2.11230.18244.

Coertjens, L., Lesterhuis, M., De Winter, B. Y.c, Goossens, M., De Maeyer, S., Michels, N.R.M. (2021). Improving Self-Reflection Assessment Practices: Comparative Judgment as an Alternative to Rubrics, *Teaching and Learning in Medicine*, 33(5), 525-535, DOI: 10.1080/10401334.2021.1877709.

Cuseo, J. B. (1992). Tips for students when forming learning teams: How to collaborate with peers to improve acad. performance. *Coop. Learning and College Teaching* 7(3), 11-16.

Dowling Carew Hadgraft (2010). Engineering your future, Chapter 3 Learning to be an Engineer. Retrieved from: https://e.pdfpremiumfree.com/downloads/dowling-carew-hadgraft-engineering-your-future/ January 2023

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350–383.

Goel, Sanjay (2017). Reflection in Action Information. Retrieved from: Engin. & Comp. Ed. Reflections and Ideation. http://goelsan.wordpress.com/2010/08/20/design-is-a-reflective-practice-a-summary-of-schons-views/.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38 (5), 365–379. https://doi.org/10.3102/0013189x09339057.

Kneisel, E. (2020). Team reflections, team mental models and team performance over time. *Team Performance Management*, 26(1–2), 143–168. DOI: 10.1108/TPM-09-2018-0061.

Knipfer, K.; Kump, B.; Wessel, D.; Cress, U. (2013). Reflection as a catalyst for organizational learning. *Studies in Continuing Education*, 35(1), 30–48, 2013.

Kolb, D. (1984), Experiential Learning: Experience as The Source of Learning and Development. Prentice Hall, New Jersey.

Moon, J. (2004), A Handbook of Reflective and Experimental Learning: Theory and Praxis, Routledge Falmer, London.

Pfennig, A., Siegeris, J. (2024). Reflections from a student perspective – response to action. In: *Proceedings 2024 of the ICERI 17th annual International Conference of Education*, 1260-1269. doi: 10.21125/iceri.2024.0389.

Schneider, W., J. G. Borkowski, B. Kurtz, and K. Kerwin. (1986). Metamemory and motivation: A comparison of strategy use and performance in German and American children. *Journal of Cross-Cultural Psychology* 17(3), 315-336.

Siegeris, J.; Pfennig, A. (2022). Team Formation and Project Assignment − the dilemma of assigning students to project groups. In: *Proceedings of the HEAd'22*, 1313-1320, 2022.

Sjølie E., Espenes T.C., Buø R. (2022). Social interaction and agency in self-organizing student teams during their transition from face-to-face to online learning. *Computers & Education* 189, 104580. https://doi.org/10.1016/j.compedu.2022.104580.