

## **Work-in-Progress: Generative AI to Support Teamwork Evaluation in Engineering Design and Professional Practice Courses**

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# **Work-in-Progress: Generative AI to Support Teamwork Evaluation in Engineering Design and Professional Practice Courses**

## **Abstract**

This Work-in-Progress paper examines the use of generative AI tools, specifically Microsoft Teams' Intelligent Recap and Copilot, to enhance the evaluation of student teamwork in an engineering design and professional practice course. The study was conducted in a Level 2 undergraduate chemical engineering course, where 72 students worked in teams of six to develop sustainable chemical processes or products. The paper documents how Intelligent Recap generates detailed meeting summaries, providing instructors with valuable insights into teamwork dynamics and problem-solving processes at the team level. It also demonstrates how Copilot can extract individual student contributions from meeting transcripts. The findings suggest that integrating generative AI tools offers a promising approach to improving both learning design and the overall student experience by delivering structured, actionable insights into team collaboration.

## **Introduction**

Design thinking is a problem-solving method that focuses on developing user-centric solutions through rigorous user research and testing [1]. It complements conventional engineering design approaches by prompting engineers to consider the needs, challenges, and perspectives of stakeholders [2]. Within the field of chemical engineering, design thinking has found increased application in developing systems, processes, and products aimed at addressing complex industrial, environmental, and societal issues [3]. This ensures that students understand engineering design and development must meet not only technical requirements but also environmental and societal criteria.

Professional skills are non-technical competencies necessary for engineers to perform well, contribute to their field and lead [4,5]. Key components include communication skills, that is, the ability to effectively convey, receive, and interpret information through verbal, non-verbal, and written means for different audiences; teamwork, which entails collaborating effectively with others and exhibiting leadership; and the metacognitive skills needed to remain effective in a rapidly evolving field, including problem-solving, leadership, project management and self-management.

At the University of New South Wales (UNSW Sydney, Australia), design thinking and professional practice are taught to Chemical Engineering undergraduate students in the Level 2 course DESN2000 Engineering Design and Professional Practice using a project-based learning (PBL) approach [6]. Over a period of 10 weeks, 72 students work in teams of 6 members on real-world challenges, such as designing sustainable chemical processes or products. The student teams are required to address competing technical, economic, environmental, and social requirements in their design. An emphasis is placed on producing innovative and viable solutions that meet stakeholders' needs through user research and testing.

Students are expected to gain practical experience in applying design thinking principles and developing their professional skills. However, past offering of DESN2000 revealed that the breadth of activities and the fact that the course is the first exposure of students to user-centered design principles made instruction and learning challenging. This is generally the case for large classes as teams of students have to quickly iterate through user research involving observations, surveys, and interviews, to brainstorming and evaluating designs or solutions, to hands-on activities in the institution's makerspaces and laboratories where students design, test, and refine their designs or solutions on one hand and instructors have to provide timely feedback [7]. Note here that DESN2000 is taught to undergraduate students across all eight engineering schools at UNSW Sydney, and number of student enrolled per term range from <25 to >500, depending on the engineering discipline.

To address the abovementioned challenges, the instructor of DESN2000 began integrating generative AI with a variety of learning tasks in the course. Generative AI can now summarize content, create personalized learning materials, simulate complex scenarios, and support idea generation and problem-solving in engineering education [8]. Moreover, generative AI can potentially assist the instructor in interpreting artefact generated by students in their learning process, for example, written work or transcripts of verbal interactions, thus enabling the instructor to provide a more personalized support directly to students [9,10].

The aim of this Work-in-Progress paper is to document the practice of the instructor using Intelligent Recap and Copilot, two in-built AI tools in Microsoft Teams Premium, to uncover the underlying aspects of student teamwork dynamics at the individual and team level. The research questions are:

1. What kind of information can be extracted from meeting transcript by integrated generative AI tool; and
2. How can the extracted information be used to enhance the learning design and experience of teamwork in an engineering design and professional practice courses.

The findings will inform future work on how to better integrate generative AI tool with course design and student needs, and guide future endeavor to improve student teamwork in chemical engineering courses.

## **Project Approach**

### *Overview of Students' Project*

12 student teams were tasked with developing methods to valorize spent coffee grounds from on-campus cafés, leveraging a user base they could access easily. Their solutions needed to meet two key requirements: (1) the solution must be feasible for the café to implement, either independently or in collaboration with others; and (2) it must generate a profit for the café. These criteria encouraged students to engage with their users (i.e. café owners and customers), and design solutions tailored to the café's operational scale and business goals. These criteria also serve to steer students away from conventional solutions like biofuel production or using coffee grounds as soil improvers.

The project also required teams to conduct systematic prototyping and user testing to demonstrate their solution's feasibility. Students were supported with access to materials, workshop facilities, online resources, and services through the institution's library, makerspace, and laboratory. Ethical approval for the study was obtained from University of New South Wales Human Research Ethics Committee prior to data collection (Project Reference Number: HC200047). Student participants were informed of the study's purpose and their rights, and written informed consent was obtained from 69 students.

### *AI Analysis of Student Teams Meeting Transcripts*

DESN2000 was delivered in person but students are required to meet outside of class to plan and complete their project tasks throughout the term. Geographic and scheduling constraints meant in-person meetings can be challenging for some students as UNSW Sydney is a commuter campus. Most student teams planned to meet online on Microsoft Teams and the meetings were set to record automatically. At the conclusion of each meeting, Intelligent Recap used data from meeting transcripts, attendance records, and shared content to generate detailed summaries of the meeting. Qualitative content analysis was then employed to systematically extract key themes related the cohort's teamwork dynamics and engagement with the project tasks from the summary [11]. In a subsequent step, Copilot was used to extract information about individual student's contribution to their team from the meeting transcript. The prompts used (listed below as dot points) were based on four dimensions (shown below in bold fonts) from the Association of American Colleges and Universities' Teamwork VALUE Rubric [12]:

#### **VALUE rubric Teamwork Dimension 1: Contributes to Team Meetings**

- 'Identify instances where a [student's name] evaluates or discusses the merits of different ideas or proposals and help their team make progress in their discussion'.

#### **VALUE rubric Teamwork Dimension 2: Facilitates the Contributions of Team Members**

- 'Identify instances where a [student's name] actively engages team members by building upon or synthesizing their contributions',
- 'Identify instances where a [student's name] encourages quieter members to participate or invites input from those who have not spoken'.

#### **VALUE rubric Teamwork Dimension 3: Fosters Constructive Team Climate**

- 'Identify instances where [student's name] fosters a positive team climate by communicating respectfully, using polite language, and providing constructive feedback or support to team members',
- 'Identify instances where [student's name] uses a positive vocal or written tone to express enthusiasm, encouragement, or appreciation for their team and its work',
- 'Identify instances where [student's name] motivates teammates by expressing confidence in the importance of the task and the team's ability to successfully complete it', and
- 'Identify instances where [student's name] offers assistance or encouragement to team members to support their contributions and overall team progress.'

## VALUE rubric Teamwork Dimension 4: Responds to Conflict

- ‘Identify instances where [student’s name] directly and constructively addresses conflict, working to resolve disagreements in a way that strengthens team cohesion and improves future collaboration’.

A fifth dimension, ‘Individual Contributions Outside of Team Meetings’, was excluded because Copilot cannot evaluate students' contributions outside the context of the meetings. The information extracted by Copilot was verified by cross-referencing with the meeting transcript and recording.

## Results and Discussion

### *Use of Microsoft Teams’ Intelligent Recap to Explicate Student Teamwork Dynamics and Problem-Solving Process*

Figure 1 shows screenshots of a typical meeting summary generated by Microsoft Teams’ Intelligent Recap feature from the transcript of a meeting. The ‘Speakers’ section provides an overview of each student’s participation in the meeting, including a visualization of the duration and cadence of individual student’s participation. The ‘Topics’ section categorizes the students’ discussion into distinct, color-coded topics by duration. The ‘Chapters’ section (not shown) provides a structural overview of the meeting by breaking down the discussion into thematic or contextual sections that are time-stamped, reflecting the flow of the students’ discussion. The ‘AI Notes’ section has two parts: ‘Meeting notes,’ which break down student discussions and key decisions; and ‘Follow-up tasks’ which detail the action items. The AI recap also includes a searchable transcript and recording of the meeting which allow quick location and verification of the transcripts and AI recaps.

The meeting summaries is a rich source of information about students' teamwork dynamics and problem-solving process. Instructors can monitor student teams’ discussions and decisions in the ‘Meeting notes’ section to ensure students focus on project goals. The section can also assist course instructor in identifying any student misunderstandings and areas for improvement, and thus, provide just-in-time feedback to student teams. Action items in the ‘Follow-up tasks’ section can help instructors monitor task delegation, ensure even distribution of responsibilities, and adjudicating team conflict objectively.

Table 1 presents a qualitative content analysis of the text from the ‘AI notes’ section, based on 12 meeting recaps generated over the term for one student team. The table illustrates the type of information that can be extracted using this approach. The AI extracted data revealed that, overall, the student cohort of DESN2000 was engaged and focused on achieving their project goals through coordination, collaboration, forward planning and adaptability. They developed communication and collaboration protocols, discussed strategies to improve time and task efficiency, ensured fair and equitable workload distribution and accountability, prioritized coursework, and implemented contingency plans. Discussion related to project tasks revealed students are aware of their capability gaps, notably around user research, as well as prototyping and user testing approach. This is expected as these concepts are new to students. There were also fewer discussions related to the solution design aspect of the project. We postulate that this is due to discussions related to the solution design are more likely to occur in person when the students were in-class or at the makerspace.

**Table 1. Topics of discussion extracted by Microsoft Teams Intelligent recap and mapped to teamwork dimension and project tasks.**

<b>Dimensions</b>	<b>Topics Discussed</b>
<b>Coordination</b>	<p><b>Communication Protocol</b></p> <ul style="list-style-type: none"> <li>• Technical difficulties with collaboration and communication platforms (e.g. audio quality and computer network connectivity issues).</li> <li>• Strategies to maintain clear communication between team members and avoiding misunderstandings.</li> </ul> <p><b>Collaboration Protocol</b></p> <ul style="list-style-type: none"> <li>• Establishing meeting location, schedule and frequency.</li> <li>• Establishing process for documentation and information sharing within the team, including file sharing.</li> </ul>
<b>Time, Task and Team Management</b>	<p><b>Time Management</b></p> <ul style="list-style-type: none"> <li>• Setting project milestones and individual responsibilities.</li> <li>• Streamlining the preparation and execution of concurrent tasks.</li> <li>• Coordinating timelines across interdependent tasks to avoid delays.</li> <li>• Ensuring sufficient time for preparation and execution of tasks.</li> </ul> <p><b>Task Management</b></p> <ul style="list-style-type: none"> <li>• Optimizing tasks division to maximize efficiency, avoid duplication of efforts and leverage individual strengths and specializations.</li> <li>• Managing course workload and other commitments.</li> <li>• Maintaining consistent progress.</li> <li>• Prioritizing tasks to ensure deadlines are met.</li> <li>• Contingency planning to handle unexpected disruptions and ensure project continuity.</li> </ul> <p><b>Team Management</b></p> <ul style="list-style-type: none"> <li>• Ensuring team member are engaged to maintain progress (e.g. meeting attendance and participation).</li> <li>• Ensuring equitable distribution of workload based on individual capacities and roles.</li> <li>• Ensuring team members are accountable for their contributions.</li> <li>• Managing the impact of COVID-19 on team member ability to contribute.</li> </ul>
<b>User Research and Problem Identification</b>	<p><b>Research Approach</b></p> <ul style="list-style-type: none"> <li>• Selecting the best method for user research and literature review.</li> <li>• Establishing criteria for selecting candidate for user research.</li> </ul> <p><b>Survey and Interview Design</b></p> <ul style="list-style-type: none"> <li>• Developing effective survey and interview questions.</li> <li>• Refining and targeting questions to align with user research goals.</li> <li>• Integrating survey and interview questions cohesively.</li> </ul> <p><b>Data Collection and Execution</b></p> <ul style="list-style-type: none"> <li>• Scheduling and conducting interviews with users efficiently.</li> <li>• Contingency planning to handle unexpected disruptions.</li> </ul> <p><b>Problem Identification and Framing</b></p> <ul style="list-style-type: none"> <li>• Identifying operational challenges faced by users through observations and research.</li> <li>• Using insights from specific cases to inform understanding.</li> <li>• Developing a unified and focused problem statement to guide the project.</li> </ul>

Dimensions	Topics Discussed
<b>Solution Design</b>	<b>Project Constrains</b> <ul style="list-style-type: none"> <li>Developing design that satisfies both sustainability and profitability constrains.</li> </ul> <b>Project Adaptation</b> <ul style="list-style-type: none"> <li>Adjusting the project scope or pivoting to an alternative solution.</li> <li>Adapting to delays such as equipment malfunctions or lack of response from external parties.</li> </ul>
<b>Prototyping and User Testing</b>	<b>Prototype Feasibility and Planning</b> <ul style="list-style-type: none"> <li>Evaluating feasibility and practicality of different prototype options.</li> <li>Considering alternatives like proof-of-concept flow sheets versus physical prototypes.</li> </ul> <b>Materials and Preparation</b> <ul style="list-style-type: none"> <li>Identifying necessary materials and ingredients for prototypes.</li> <li>Developing safe and viable processes for valorizing spent coffee grounds.</li> </ul> <b>Task Allocation and Management</b> <ul style="list-style-type: none"> <li>Dividing and managing prototyping tasks efficiently among team members.</li> <li>Ensuring smooth transitions when team members switch prototyping tasks.</li> </ul> <b>Technical Validation and Documentation</b> <ul style="list-style-type: none"> <li>Establishing steps for validating prototypes technically and documenting the process thoroughly.</li> </ul> <b>External Dependencies</b> <ul style="list-style-type: none"> <li>Addressing challenges in obtaining permissions for prototype testing (e.g. testing at specific locations and human testing).</li> </ul> <b>Timeline and Completion</b> <ul style="list-style-type: none"> <li>Ensuring timely completion and validation of all prototypes within the project schedule.</li> </ul>

### *Use of Microsoft Teams' Copilot to Explicate Individual Student's Team Contributions*

Table 2 shows selected summaries generated by Microsoft Teams' Copilot which captured an individual student's (referred to as 'Student X') contributions to their team, generated by Copilot from a meeting where the team discussed and finalized their presentation. Only summaries generated using prompts based on the first two dimensions of the AAC&U VALUE rubric for teamwork: 'Contributes to Team Meetings' and 'Facilitates the Contributions of Team Members', were shown for brevity.

The meeting summaries generated by Copilot can help qualify an individual student's contribution to their team by providing instructors with structured insights into their contribution, engagement, and impact on team discussions. These summaries can explicate the frequency and depth of contributions, as well as the student's role in key points of the problem-solving process. Instructors can now easily identify students who are actively contributing versus those who may be disengaged. This can help ensure accountability and fair workload distribution, as well as the provision of meaningful feedback and targeted interventions to support individual students who were struggling with teamwork.

14 September 2024 7:00 pm - 8:18 pm

Part 1

Part 2

Open in Stream

Copilot

Microsoft Teams

Team I Meeting Room

2024-09-14 09:00 UTC

Recorded automatically

Meeting Rooms

Channel

Microsoft Stream

Speakers

# Topics

Chapters

Nina Thornicroft

Ariana Miller

Isabella Busini-Mitchell

Alexander Young

Sherlyn Charnate

Is this info useful?

Content

Attendance

AI notes

Mentions

Transcript

Generated by AI. Make sure to check for accuracy.

Copy all

Meeting notes

Survey and Interview Questions: Nina, Ariana, Isabella, and Alexander discussed the preparation of survey and interview questions for their project. They have already started compiling questions and are refining them to ensure they are effective.

Initial Questions: The team has already started compiling questions for the survey and interview. Ariana mentioned that they copied and pasted some questions into a document but have not yet formatted or refined them.

Additional Questions: Isabella added a couple more questions that she thought of, which were not initially included in the document. These questions were based on her observations and understanding of the project requirements.

Question Refinement: The team discussed the need to refine and format the questions to ensure they are effective. They emphasized the importance of having clear and relevant questions for both the survey and interview.

Document Location: The compiled questions are stored in the "Workshop 2A" folder in their shared Team I file. This ensures that all team members have access to the latest version of the questions.

Survey and Interview Focus: Isabella clarified that the survey will be sent out digitally to a broad audience, while the interviews will be conducted in person with cafe owners. They also plan to conduct another observation.

Choosing a Cafe for Observation: Ariana, Nina, and Isabella discussed the importance of choosing a cafe for their observation. They decided to wait before making a final decision and to prepare for the observation in the meantime.

Interview and Survey Clarification: Ariana and Sherlyn clarified that the interviews will be conducted with cafe owners, while the surveys will be directed at customers. They also discussed the need to move questions to the appropriate documents.

14 September 2024 7:00 pm - 8:18 pm

Part 1

Part 2

Open in Stream

Copilot

Microsoft Teams

Team I Meeting Room

2024-09-14 09:00 UTC

Recorded automatically

Meeting Rooms

Channel

Speakers

# Topics

Chapters

Team Meeting: Discussing Prepar...

Importance of Setting Expecta...

Group Discussion on Survey Inter...

Coffee Cafe Waste Management

Planning for a Sustainable Coffee ...

Coffee Business Operations and ...

Business Management and Waste...

Planning and Implementing a Caf...

Coffee Consumption Habits and S...

Design and User Base of a Coffee...

Demographics and Survey Design...

Planning and Discussion of Meetl...

User Research and Sustainable Pr...

Circular Economy and Sustainabl...

Potential of Office Equipment for ...

Are these topics useful?

Content

Attendance

AI notes

Mentions

Transcript

Download

Delete

Search

Ariana Miller 5:41

I guess we don't know. The problem is like because we haven't like really gone through the task a lot. We don't really know when we're supposed to choose. I feel like we should maybe wait a bit to decide, right. I don't know. We were supposed to.

Isabella Busini-Mitchell 5:41

Oh.

Nina Thornicroft 5:49

Yeah.

Yeah, I've yeah, I feel like we are just now preparing for the observation at the moment. Yeah, makes sense.

Oh.

Ariana Miller 6:06

Yeah.

I think whoever sorry is it sherlyn.

Sherlyn Charnate 6:12

Yeah.

Ariana Miller 6:13

Yeah. So I I think that like the interview, I don't know if did anyone answer this. The interviews like what we asked the cafe and then the surveys. What we asked the customers.

Is this transcript useful?

**Figure 1. Screenshots of a typical meeting recap generated by Microsoft Teams’ Copilot showing the meeting notes, as well as identity of speakers (top) and topics of discussion (bottom).**



**Table 2. Summary of a student's teamwork contribution, as extracted by Copilot from the meeting transcript, and mapped to the AAC&U VALUE rubric dimensions of teamwork.**

Dimension and Prompt	Copilot Summary
<p><b>Contributes to Team Meetings</b></p> <p>‘Identify instances where a [student’s name] evaluates or discusses the merits of different ideas or proposals and help their team make progress in their discussion’.</p>	<p><b>[Student X] evaluates and discusses the merits of different ideas or proposals in several instances, helping the team make progress in their discussion:</b></p> <ul style="list-style-type: none"> <li>- [Student X] discussed the merits of the presentation's coherence, stating, "Oh yeah, everyone's here. Oh, I I look at the presentation, it looks great. Thank you."</li> <li>- She evaluated the animations, saying, "Oh, I like the animation. Like it just flow in and out. That's cool."</li> <li>- [Student X] appreciated the user testing section, "Also love the user testing section so much like."</li> <li>- She provided feedback on the presentation's flow, "No, I feel like. Wait, sorry, I feel like. [Student C]'s and [Student E] parts are like very great, but it's just like it's not flow if you know what I mean."</li> <li>- [Student X] suggested using the AI script to improve the presentation, "I feel like if after this you go to like the. AI script from this meeting and then kind of like. Copy and paste what you said in this meeting so that you don't need to write the whole thing for your script."</li> <li>- She discussed the importance of making the presentation fluent, "Yeah, but I'm pretty sure like like if if we speak like fluently, it will be on time."</li> <li>- [Student X] suggested improvements to the presentation's ending, "Oh, also, I was gonna say like. It's it's kind of I feel like the ending's kinda weird. Like I just say. As well as and student societies. And that's it. Like to say thank you."</li> </ul>
<p><b>Facilitates the Contributions of Team Members</b></p> <p>‘Identify instances where a [student’s name] actively engages team members by building upon or synthesizing their contributions’.</p>	<p><b>[Student X] actively engages team members by building upon or synthesizing their contributions in several instances:</b></p> <ul style="list-style-type: none"> <li>- [Student X] builds on [Student C]'s and [Student E]'s parts by suggesting improvements for better flow, "No, I feel like. Wait, sorry, I feel like. [Student C]'s and [Student E]'s parts are like very great, but it's just like it's not flow if you know what I mean."</li> <li>- She synthesizes the team's input on the script, "I feel like if after this you go to like the. AI script from this meeting and then kind of like. Copy and paste what you said in this meeting so that you don't need to write the whole thing for your script."</li> <li>- [Student X] collaborates with [Student A] to refine the presentation's timing, "Yeah, but I'm pretty sure like like if if we speak like fluently, it will be on time."</li> <li>- She suggests a more concise way to mention potential partners, "Key potential partner inertia includes includes like. Organisation no. Organ. I don't know."</li> <li>- [Student X] proposes a concluding statement to enhance the presentation's ending, "And to conclude [solution name]. [team name], solution [team name] is an awesome solution."</li> </ul>
<p><b>Facilitates the Contributions of Team Members</b></p> <p>‘Identify instances where a [student’s name] encourages quieter members to participate or invites input from those who have not spoken’.</p>	<p>There are no specific instances in the meeting transcript where [Student X] explicitly encourages quieter members to participate or invites input from those who have not spoken. The transcript does not provide evidence of [Student X] directly addressing or encouraging quieter members to contribute.</p>

## Conclusion

Evaluating teamwork in engineering design and professional practice courses is often resource-intensive and presents reliability and validity challenges, especially in large classes. Previously, student teamwork evaluation typically relied on one or more of three sources: (1) assessments by an external observer, (2) students' self-reflections, (3) peer feedback from team members [12].

This Work-in-Progress (WIP) paper shows Intelligent Recap and Copilot, two built-in AI tools in Microsoft Teams, can help explicate teamwork processes by generating detailed summaries of student meetings. This assists external observer in evaluating both individual and team-level teamwork dynamics and contributions. The insight gained can be used to improve the learning design and experience of teamwork in an engineering design and professional practice courses. While not investigated in this study, the meeting summaries can potentially help students recall, reflect on, and evaluate both their own and their team members' contributions by offering a clear overview of discussions, decisions, and individual roles. Future work will examine the extent to which the meeting summaries (collected from both online and face-to-face meeting) can enable accurate, reliable and fair grading of teamwork, ensuring that individual efforts are recognized and appropriately evaluated. Another key issue identified is the challenge of distinguishing the quality of student contributions from their quantity. Visualisation of the teamwork dynamics using sociogram generated from the meeting summaries should also be explored [13].

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