DGGL Research Report: Embedding RRI through Science Communication Training at JAIST

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1. Introduction: Background

In recent years, Responsible Research and Innovation (RRI) has received increasing attention worldwide. Science Communication (SC) is regarded as an indispensable foundation for promoting RRI, which emphasizes anticipation, inclusion, reflexivity, and responsiveness (Stilgoe et al., 2013). However, when the author (Motoyama) asked students to explain their research to peers from other disciplines, it became clear that many had never attempted such communication, and several challenges emerged. Specifically: (1) students had few opportunities to present their research outside their own fields, (2) even when such opportunities arose, discussions tended to stop at academic significance without considering broader societal impact, and (3) students often relied heavily on technical jargon without strategies for translating it into more accessible language. These barriers not only limited the ability to convey the significance of their research but also hindered the development of communication skills essential for collaboration with diverse stakeholders. This suggests that many graduate students are not yet fully prepared to practice RRI in their research.

To address these challenges, the Research Center for Knowledge Innovation (KI Center) launched the Diversity Gathering for Future Global Leaders (DGGL) as a forum for practicing science communication. Originally initiated in 2022 as a weekly discussion on global and societal issues, DGGL was restructured in 2025 as a space for graduate students to experiment with new forms of communication and explore how their research connects to broader society. The operational design, session structure, and documentation methods are described in detail in Section 2.

This report examines DGGL as a testing ground where communication theory and RRI principles intersect. It analyzes how structured training sessions and multicultural exchanges prepare students to bridge the gap between science and society. The objective is to evaluate DGGL as a practical model for embedding RRI into higher education, by identifying when and how communication and miscommunication occur in interdisciplinary and multicultural contexts. Furthermore, the analysis demonstrates how DGGL activities—such as one-sentence summaries, poster sessions, and metaphor-based exercises—can transform miscommunication into a resource for fostering reflection, inclusivity, and stronger connections between science and society.

2. Data and Documentation of DGGL

2.1 Participant Date

This report presents data on participant numbers, disciplinary backgrounds, and nationalities to illustrate the degree of diversity maintained within the program. Combined with participation continuity and task completion rates, these quantitative indicators provide a foundation for assessing DGGL's inclusivity and overall reach.

Between April and July 2025, a total of 13 DGGL sessions were held. Graduate students from diverse disciplinary, national, and gender backgrounds took part in these activities. Figure 1 distinguishes Japanese and non-Japanese participants, showing steady engagement and strong representation of diverse student groups. Across this period, 59 individuals attended, with an average of 4.5 students per session. This indicates consistent attendance even during a busy academic term. The participant pool was culturally diverse, including 34 non-Japanese and 25 Japanese students, demonstrating that international students formed a slight majority and that DGGL serves as an inclusive platform for cross-cultural exchange.

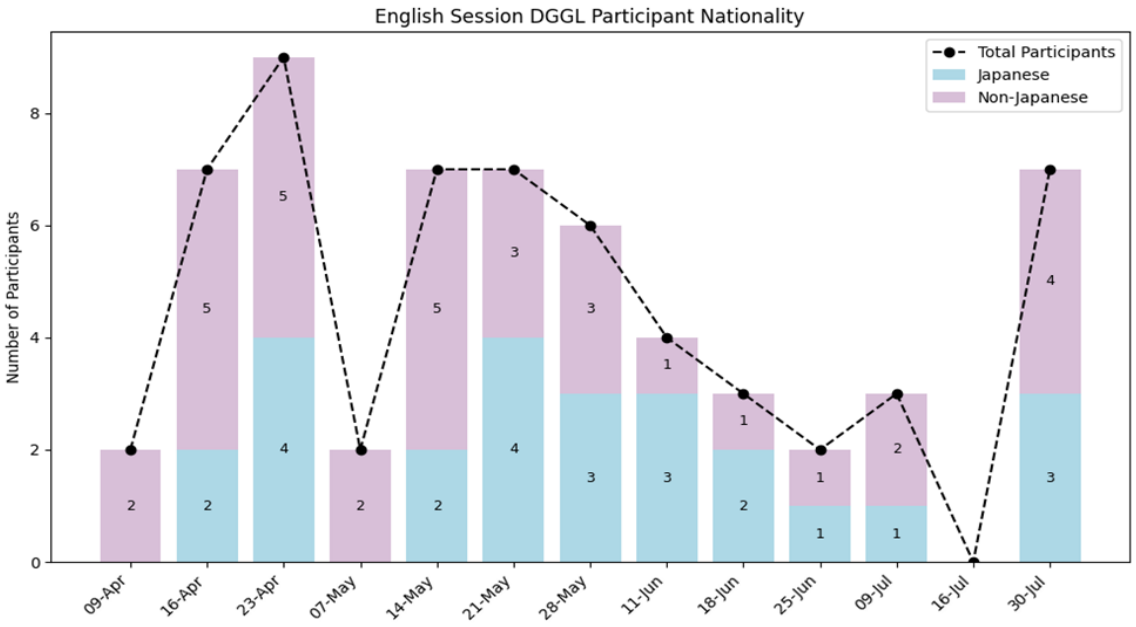


Figure 1 Number of Participants (Japanese and Non-Japanese)

Figure 2 displays the disciplinary distribution of participants. Materials Science (MS) students constituted the largest group (42.4%), followed by Knowledge Science (KS) students (40.7%) and Information Science (IS) students (16.9%). This balanced disciplinary mix reflects DGGL's interdisciplinary mission, bringing together students from different academic backgrounds to

practice communication and collaboration. Overall, these metrics highlight DGGL's effectiveness in cultivating an inclusive, multicultural, and interdisciplinary environment that supports iterative training in science communication.

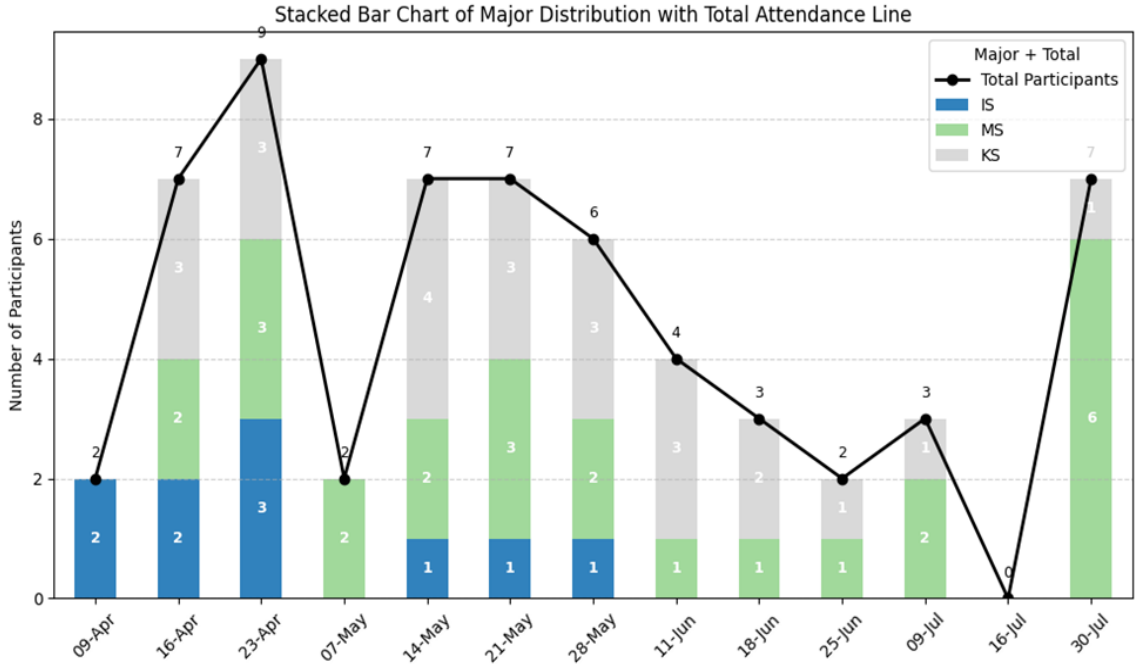


Figure 2 Number of Participants (Japanese and Non-Japanese)

Figure 3 illustrates the number of returning participants. A total of 39 students attended multiple sessions, averaging three repeat participants per meeting. This pattern suggests that DGGL successfully fostered sustained engagement and continuity of learning among its participants.

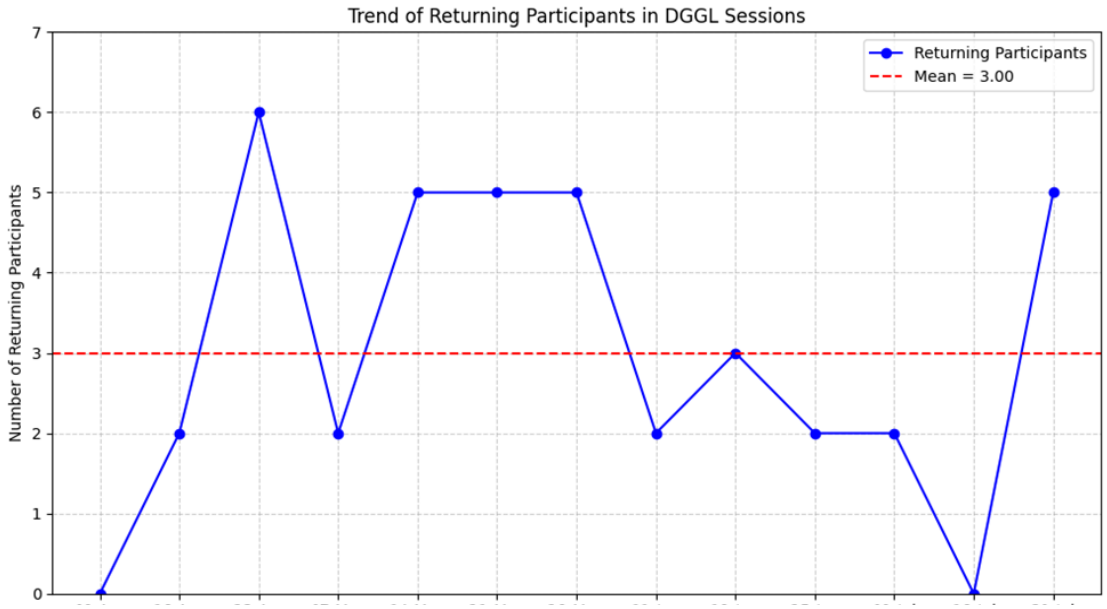


Figure 3 Number of Returning Students

2.2 Program Activities

DGGL was originally launched in April 2022 as a weekly one-hour session. In January 2025, it was piloted as a platform for science communication (SC) training, and from April 2025 onward it was fully implemented, with systematic data collection and a standardized session format.

Each session followed a consistent flow:

- Briefing (2–3 minutes): The faculty facilitator outlined the session's purpose and its connection to SC and RRI.
- Small-group work (assistant-facilitated): Students were divided into groups of 2–3, with an assistant assigned to each group.
    - Students began with a 60-second explanation of their research, explicitly stating their discipline.
    - Peers then asked clarification questions, helping to identify assumptions and jargon.
    - Students were given about four minutes to elaborate on their research questions, methodology, and anticipated societal relevance, with encouragement to use action verbs and avoid overreliance on technical terms.
- Plenary discussion (≈10 minutes): The full group reconvened to reflect on difficulties, share strategies, and identify effective approaches to communicating research.

Over time, a range of instructional techniques was integrated, including one-sentence summaries, metaphor-based exercises (e.g., the "vase" metaphor), poster presentations, and structured peer feedback. Since June 2025, one session per month has been conducted in English to address the linguistic challenges faced by non-native speakers.

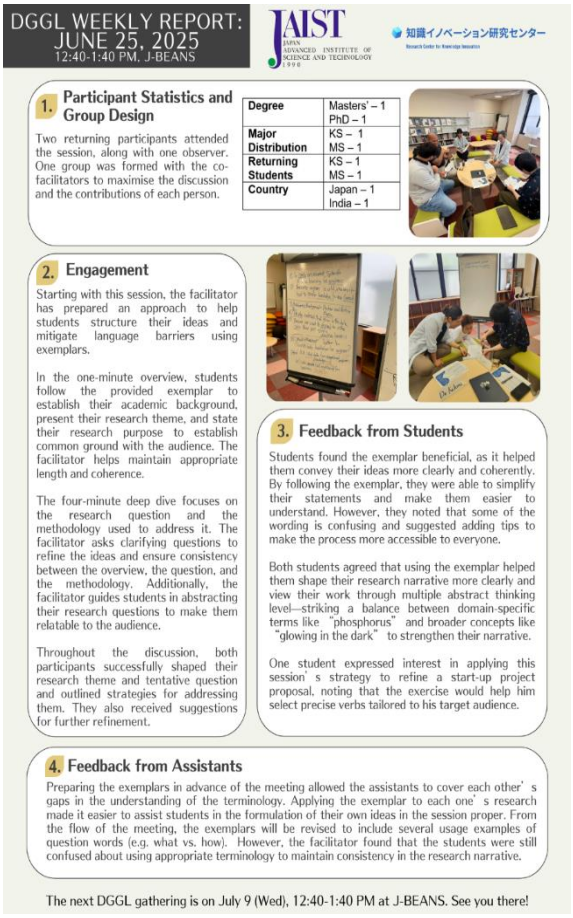
2.3 Weekly Report

A distinctive feature of DGGL is its Weekly Report, produced primarily by the student assistants in collaboration with the faculty facilitator. Figure 5 provides an example from the July 9, 2025 session. These reports went beyond simple record-keeping, serving as analytic documentation to capture communication dynamics and inform program development.

The Weekly Reports followed a standardized structure:

1. Participation snapshot: Number of participants, disciplinary background, nationalities, and repeat attendance (aggregate data only).
2. Engagement log: A factual description of the day's activities, documenting what was done in each session.
3. Feedback from students: Summarized from comments and reflections shared during the final plenary discussion, where participants identified difficulties and suggested strategies for improvement.
4. Feedback from assistants: Based on observations during facilitation, as well as post-session debrief meetings among the two assistants and the faculty facilitator. These reflections highlighted what worked, what did not, and how students' communication abilities were developing over time.

All Weekly Reports and activity records have been published on the KI Center website, ensuring transparency and enabling wider use of the program materials. For this report, these documents serve as the primary qualitative data, complementing the quantitative indicators summarized in Section 2.1. The analysis places particular emphasis on miscommunication, not as a failure but as an entry point for developing effective science communication practices.


DGGL WEEKLY REPORT: JUNE 25, 2025
12:40-1:40 PM, J-BEANS

JAIST JAPAN ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY 1990

知識イノベーション研究センター

1. Participant Statistics and Group Design

Two returning participants attended the session, along with one observer. One group was formed with the co-facilitators to maximise the discussion and the contributions of each person.

Degree	Masters' – 1 PhD – 1
Major Distribution	KS – 1 MS – 1
Returning Students	KS – 1 MS – 1
Country	Japan – 1 India – 1

2. Engagement

Starting with this session, the facilitator has prepared an approach to help students structure their ideas and mitigate language barriers using exemplars.

In the one-minute overview, students follow the provided exemplar to establish their academic background, present their research theme, and state their research purpose to establish common ground with the audience. The facilitator helps maintain appropriate length and coherence.

The four-minute deep dive focuses on the research question and the methodology used to address it. The facilitator asks clarifying questions to refine the ideas and ensure consistency between the overview, the question, and the methodology. Additionally, the facilitator guides students in abstracting their research questions to make them relatable to the audience.

Throughout the discussion, both participants successfully shaped their research theme and tentative question and outlined strategies for addressing them. They also received suggestions for further refinement.

3. Feedback from Students

Students found the exemplar beneficial, as it helped them convey their ideas more clearly and coherently. By following the exemplar, they were able to simplify their statements and make them easier to understand. However, they noted that some of the wording is confusing and suggested adding tips to make the process more accessible to everyone.

Both students agreed that using the exemplar helped them shape their research narrative more clearly and view their work through multiple abstract thinking level—striking a balance between domain-specific terms like "phosphorus" and broader concepts like "glowing in the dark" to strengthen their narrative.

One student expressed interest in applying this session's strategy to refine a start-up project proposal, noting that the exercise would help him select precise verbs tailored to his target audience.

4. Feedback from Assistants

Preparing the exemplars in advance of the meeting allowed the assistants to cover each other's gaps in the understanding of the terminology. Applying the exemplar to each one's research made it easier to assist students in the formulation of their own ideas in the session proper. From the flow of the meeting, the exemplars will be revised to include several usage examples of question words (e.g. what vs. how). However, the facilitator found that the students were still confused about using appropriate terminology to maintain consistency in the research narrative.

The next DGGL gathering is on July 9 (Wed), 12:40-1:40 PM at J-BEANS. See you there!

Figure 5 Weekly Report on July 9, 2025

3. Observed Communication and Miscommunication Patterns

The compiled DGGL reports provide case illustrations of how graduate students encountered challenges in communicating their research across disciplinary and cultural boundaries. This section highlights the main patterns of communication breakdowns observed in practice,

which later informed the development of targeted training methods.

3.1 Technical Jargon and Complexity as "Noise."

DGGL session reports consistently documented students' difficulties in explaining research to peers from different disciplines, with technical jargon and overly complex presentations acting as barriers to understanding. In Shannon and Weaver's (1949) Transmission Model of Communication, these barriers can be understood as "noise" in the communication channel that disrupts effective message decoding. Participants frequently identified this issue in feedback sessions, emphasizing that simplifying terminology, employing analogies, or visualizing complex concepts improved audience engagement and accessibility.

3.2 Cultural and Language Barriers

Cultural and language barriers were frequently reported in DGGL sessions, as students sometimes struggled to express nuanced scientific ideas in English or Japanese, or to follow cultural references unfamiliar to them. At first glance, these difficulties might seem like a drawback. However, in practice, they became valuable learning opportunities. Students were encouraged to reflect on how diverse audiences might interpret their words and to adjust their explanations accordingly—for example, by avoiding culture-specific terms or by framing ideas in more universally accessible ways. This process illustrates the essence of RRI's *anticipation* principle: not only predicting potential misunderstandings in advance but also proactively designing communication strategies that minimize them(Stilgoe et al., 2013).

3.3 Frame Misalignment

Activities such as one-sentence research summaries exposed "frame misalignment" (Goffman, 1974; Lakoff, 2010), where students initially presented their work in narrowly technical frames. Peer review and facilitator-led questioning helped participants reframe their research narratives to emphasize relevance to societal challenges such as sustainability, healthcare, or disaster resilience. This reframing process illustrates how DGGL uses communication breakdowns to build reflexivity, encouraging students to critically evaluate their assumptions and the accessibility of their narratives.

4. Science Communication Training Methods Developed in DGGL

In response to these challenges, the facilitator and student assistants collaboratively developed a set of structured training methods to support more effective science communication. Figures 6 and 7 provide examples of the instructional templates and mind maps used in practice. These methods were designed not only to address immediate communication difficulties but also to help students recognize the assumptions underlying their explanations and connect their research to broader societal contexts.

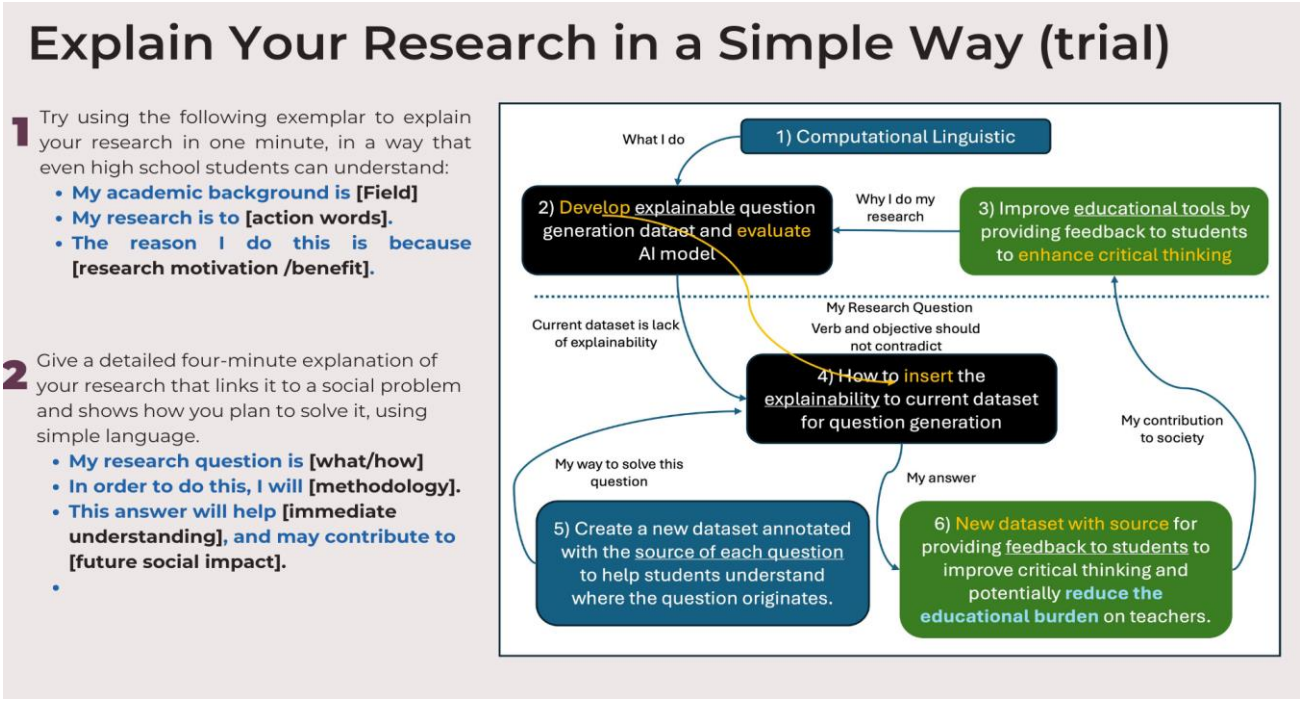


Figure 6 Example of the Instructional Templates and Mind Map

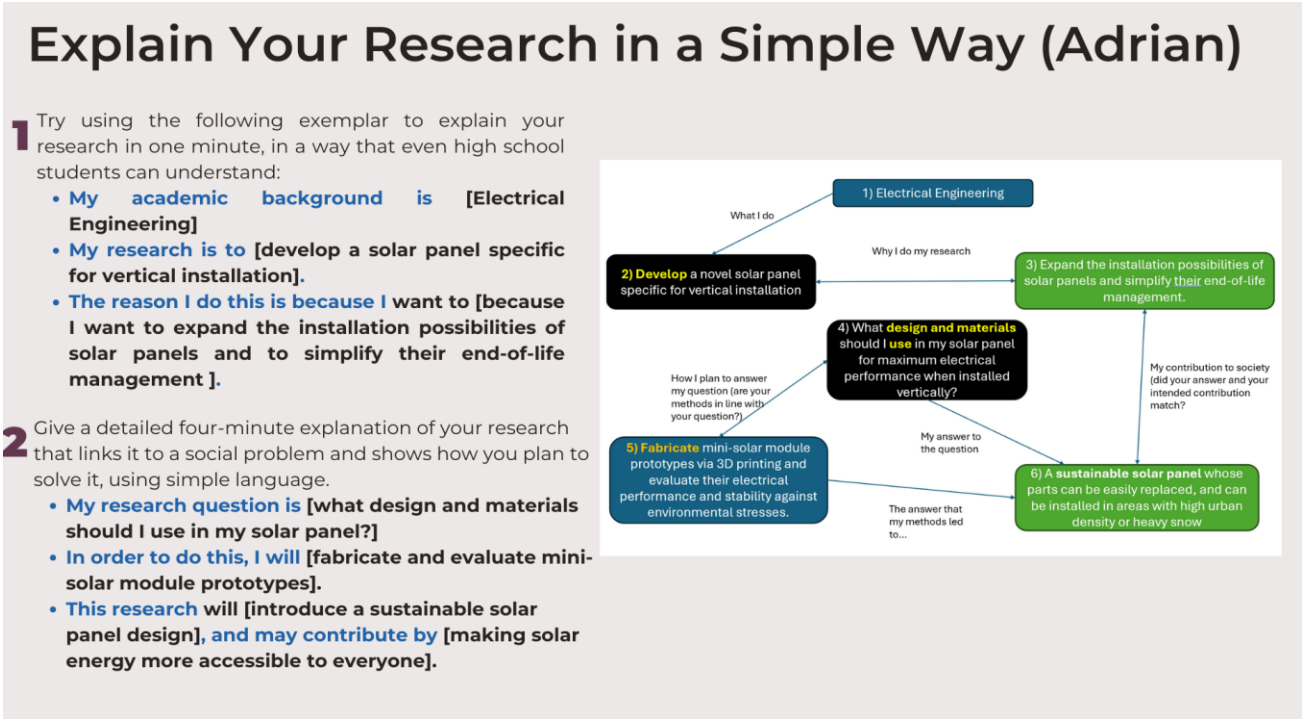


Figure 7 Example of the Instructional Templates and Mind Map

The approach began by asking students to explain their research in one minute, covering their academic background, research topic, and significance. This was followed by a four-minute explanation, in which students elaborated on their research questions, methodology, and broader societal impact.

During the one-minute explanation, students often faced two challenges: either relying on overly specific examples or, conversely, using language so abstract that the essence of their research was unclear. Over time, it also became evident that disciplinary assumptions—what students took as "common knowledge"—varied significantly, becoming a frequent source of miscommunication. To mitigate this, students were asked to state their research discipline explicitly at the outset. This small adjustment helped listeners situate the explanation and reduced misunderstandings.

Students were also encouraged to describe their work using action verbs, which made explanations more concrete and accessible. This was particularly helpful for Japanese-speaking participants, who reported that it clarified what they were actually doing in their research. Additionally, in line with RRI's emphasis on social relevance, students were prompted to explain why their research matters—its potential societal benefits and impact. Combining these three elements (discipline, what they do, and why it matters) consistently produced explanations that were easier for peers across fields to understand.

In the subsequent four-minute segment, students presented their research question and methodology. While this part was generally manageable, articulating the societal impact proved more difficult. To support this, assistants prepared mind maps and example sentences (see Figures 6 and 7), which helped students translate abstract impacts into concrete, discipline-specific narratives. This exercise also encouraged the use of logical reasoning, critical thinking, abstraction, and reflective analysis. By framing their explanations in this way, students not only clarified what their research could and could not accomplish but also practiced linking their work to broader social challenges.

5. Pedagogical Insights: Linking Findings to RRI Dimensions

Before linking DGGL practices directly, it is useful to recall the four dimensions of Responsible Research and Innovation (RRI) (Stilgoe et al., 2013):

- Anticipation: exploring possible impacts and misunderstandings in advance, and preparing strategies to address them.
- Inclusion: engaging diverse perspectives and making research processes more participatory.
- Reflexivity: critically examining one's own assumptions, values, and motivations as a researcher.

- Responsiveness: adapting research and communication in light of new insights, societal needs, or stakeholder concerns.

DGGL's activities illustrate these dimensions in practice. Miscommunication episodes prompted reflexivity, as students recognized the limits of their own framing. The program's multicultural and interdisciplinary environment fostered inclusion, requiring students to listen and adapt to multiple perspectives. Exercises such as one-sentence summaries and poster sessions encouraged both anticipation of audience needs and responsiveness to real-time feedback. In this way, DGGL demonstrates how RRI principles can be embedded into graduate education through structured, reflective practice.

5.1 Reflexivity through Miscommunication

DGGL activities such as the "Why I do my research" exercise highlighted how miscommunication can act as a mirror for students' own assumptions. When their explanations failed to land with peers, students were prompted to reflect: *Am I relying too much on jargon? Am I assuming background knowledge that others may not have?* These moments encouraged critical self-examination of both their research and their role as scientists, directly operationalizing the reflexivity principle of RRI.

5.2 Inclusion and Diversity as Communication Drivers

DGGL consistently brought together students from diverse cultural, disciplinary, and linguistic backgrounds. While this diversity sometimes created confusion—for example, when different disciplines used the same word in different ways—it also fostered empathy and audience awareness. Students learned to listen carefully, acknowledge multiple perspectives, and adjust their language to ensure inclusivity. In this way, DGGL turned diversity into a training ground for inclusion, one of RRI's key dimensions.

5.3 Anticipation and Responsiveness in Practice

Exercises such as one-sentence summaries, elevator pitches, and poster presentations simulated real-world scenarios where scientists must engage with various stakeholders. Students had to anticipate audience needs and prepare clear explanations, but they also had to respond in real time to unexpected questions or feedback. This dual practice—preparing in advance and adapting on the spot—aligns closely with the responsiveness principle of RRI, while reinforcing anticipation as a forward-looking skill.

5.4 Miscommunication as a Learning Tool

DGGL reframes miscommunication as a pedagogical resource rather than a communication failure, supported by a combination of structured feedback loops, reflective practice, and

intentional diversity in group design. From a theoretical perspective, communication challenges observed in DGGL sessions concretely demonstrate foundational principles: Shannon and Weaver's "noise," Grice's cooperative principles, and frame alignment theory all provide lenses for understanding why communication breaks down and how it can be repaired.

Practically, these insights strengthen DGGL's position as a "living laboratory" for science communication, equipping future researchers with strategies to:

- Simplify complex content while retaining accuracy,
- Anticipate diverse audience perspectives,
- Respond to societal concerns with empathy and evidence, and
- Effectively articulate the societal relevance of their research.

This report shows that DGGL's deliberate use of miscommunication episodes as catalysts for learning reflects a robust, evidence-based model for embedding RRI principles into higher education.

6. Conclusion

Today's global society faces complex challenges—such as climate change, pandemics, and social inequality—for which there are no ready-made solutions. In this context, individuals who complete higher education are increasingly expected to take initiative, collaborating across disciplinary and cultural boundaries. Graduate students in master's and doctoral programs, who are developing advanced expertise, must therefore cultivate the ability to communicate science effectively as an essential skill.

The DGGL program can be positioned as one response to this societal need. By reframing miscommunication not as failure but as a learning resource, DGGL equips graduate students with a set of transferable skills: science communication, logical reasoning, critical thinking, abstract conceptualization, reflexivity, and empathy. These capabilities are essential for future leaders to bridge the gap between specialized knowledge and societal challenges.

The findings of this report suggest that DGGL functions as a living laboratory for embedding RRI principles in graduate education. By creating an inclusive, interdisciplinary, and

multicultural environment, the program demonstrates how training in science communication can foster broader competencies that are vital for RRI. Moving forward, the DGGL model offers a scalable approach for higher education institutions seeking to cultivate researchers who can anticipate societal needs, engage diverse communities, and contribute meaningfully to addressing global challenges.

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Notes

This report was drafted by Surawat Pothong based on group discussions. Adrian Augusto M. Sumalde provided comments and language editing. The manuscript was revised and finalized by Kotona Motoyama. The manuscript was revised and finalized by Kotona Motoyama. The overall project and report were supervised by Kunio Shirahada.