STUDY PROTOCOL

Evaluation of the Effectiveness of the Genomics & Science DOJO 3.0 Learning Method in Improving Research Skills and Scientific Writing among Researchers in Indonesia: A Randomized Controlled Trial

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EXECUTIVE SUMMARY

Background

Despite progress in research output, Indonesia continues to face challenges in research quality and methodological rigor. Evidence indicates that many studies conducted by Indonesian researchers do not consistently meet international standards, largely due to gaps in research competence and training (Widyahening et al., 2014). Given that human resources account for a substantial proportion of research capacity, strengthening individual researcher skills is critical to improving scientific output and impact (Putera et al., 2022). The Genomics and Science DOJO, an experiential learning initiative, shows promise in improving research outputs but lacks formal evaluation. This study addresses that gap using a randomized controlled trial (RCT) to compare the effectiveness of the DOJO approach against non-DOJO learning methods.

Rationale

Experiential learning offers a robust framework for strengthening research capacity by emphasizing active engagement, reflection, and the practical application of knowledge (Fry, Ketteridge & Marshall, 2009; Kolb & Kolb, 2009). Evidence consistently shows that this approach leads to improved learning outcomes, including enhanced critical thinking, analytical reasoning, problem-solving skills, and knowledge retention, competencies essential for high-quality scientific research (Ahmed, 2025; Heng and Jin, 2025 Dianita, 2023; Burch et al., 2019;). Its effectiveness is further reinforced through collaborative learning and peer interaction, which foster deeper cognitive engagement and build confidence in applying complex skills.

Despite its proven benefits, there remains limited rigorous evaluation of structured experiential learning models within the context of research capacity strengthening, particularly in integrated competencies such as critical thinking, scientific communication, and professional empowerment. This gap is especially evident in emerging interdisciplinary fields such as genomics and data-driven biomedical research.

To address this, the Genomics and Science DOJO 3.0 program adopts an experiential, immersive “DOJO” model that integrates technical training, mentorship, and structured scientific debate through the Shinjitsu methodology. Building on prior iterations that demonstrated promising outcomes in manuscript production and collaboration, DOJO 3.0 introduces a more rigorous evaluation framework and enhanced program components. This study employs a randomized controlled trial (RCT) design to generate robust evidence on the effectiveness of the DOJO learning method compared to non-DOJO learning methods.

Objective

a. Primary Objective

The primary objective of this study is to rigorously evaluate the effectiveness of the DOJO 3.0 learning methodology in enhancing research skills and scientific writing, including but not limited to critical thinking and data analysis ability, knowledge acquisition across key learning modules (e.g., Mixed-model Bioinformatics, Data Dive and Analysis, etc), and scientific manuscript quality and progress toward publication compared to the non-DOJO learning method

These outcomes will be measured using standardized assessment tools, including case studies, scoring rubrics, and validated questionnaires (multiple-choice questions) administered via the Knowledge Gateway. Outcomes will be evaluated as the change in scores from baseline (pre-intervention) to endline (post-intervention).

The primary analysis will estimate the intention-to-treat effect by comparing the mean change in each outcome between the intervention and control groups.

b. Secondary Objective

The secondary objectives of this study are to:
1. Compare participants' experiences and perceptions of the learning process and quality of teaching between the intervention (DOJO) and control groups;

2. Assess participant engagement, performance, and learning behaviors throughout the program.

Feedback forms will capture participants' overall impressions of the program and their evaluation of teaching quality across facilitators (sensei). Observational data will be systematically quantified to assess participants' performance, activeness, and engagement during program activities (e.g., frequency and quality of questions or contributions, and participation across learning sessions). Selected engagement and behavioral measures will also be tracked throughout the program where applicable.

Methods

This study employs a randomized controlled trial (RCT) design to evaluate the causal impact of the Genomics and Science DOJO 3.0 learning methodology compared to a conventional (non-DOJO) approach. Participants are randomly assigned to intervention or control groups, with stratified randomization based on baseline test scores and research stage to ensure group comparability. Both groups receive identical content, duration, instructors, and assessment tools, with the only difference being the learning methodology.

Data are collected at multiple time points, including baseline, during intervention (daily pre-post tests and process monitoring), and endline. Key outcomes include critical thinking, knowledge

improvement, data analysis skills, personal empowerment, manuscript quality, publication outcomes, and teaching quality. Quantitative analyses will be conducted using statistical methods such as (Analysis of Covariance) ANCOVA to assess between-group differences while adjusting for baseline values.

Participants

Participants are teams of early- to mid-stage researchers on genomics, biomedical sciences, public health and related fields recruited from across Indonesia. Eligibility is determined through a multi-stage screening process, including administrative checks, blinded concept note evaluation, and team capability assessment. Inclusion requires full participation commitment, completion of screening stages, and submission of required documents.

Sample Size

The study includes a total of 48 teams (96 individuals), with each team consisting of two participants. Teams are evenly allocated into two study arms: 24 teams in the intervention group and 24 teams in the control group.

Follow Up

Participants are followed throughout the intervention period and for up to 9 months post-program to monitor research outputs, particularly manuscript development and publication progress. Data collection includes baseline and endline assessments, continuous monitoring during the program, and periodic follow-up of publication outcomes.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

1.1 Background

1.1.1 SUMMIT's Background

For over 25 years, the Summit Institute for Development (SUMMIT) has engaged communities to enhance public health. SID is also a founding partner of the Open Smart Register Platform (OpenSRP), which is currently used in 17 countries and recognized by the WHO as one of the top 10 innovations in global healthcare. Recently, using Fast Healthcare Interoperability Resources (FHIR), SID developed a team-based care model in four districts in Indonesia (with plans to expand to ten districts by 2027), covering 10 million people.

SUMMIT has long been recognized as a leading research institute, with a strong track record in improving healthcare and human development through rigorous, high-impact research. Building on this foundation, SUMMIT has actively supported Indonesian researchers by collaboratively developing the DOJO learning methodology with its co-founders. This approach is designed to strengthen capacity through structures, experiential learning training that enhances scientific rigor, critical thinking and publication outcomes.

1.1.2 Problem Statement (Indonesia Context)

Strengthening human resource capacity in biomedical and genomic research is a fundamental prerequisite for establishing an evidence-based and sustainable health system. In Indonesia, despite both the number of researchers and overall research output have increased, available evidence suggests that adherence to international standards of methodological rigor and reporting quality remains limited among studies conducted by Indonesian researchers (Widyahening et al., 2014). Research competence and training have been identified as significant determinants of research performance, with competence representing the most substantial contributing factor (Wasfi et al., 2020).

Furthermore, emphasized in prior research citing the Head of the Indonesia's National Research and Innovation Agency, human resources, particularly researchers, account for approximately seventy percent of the capital required for research implementation, while the remainder comprises infrastructure, equipment, and financial support (Putera et al., 2022). This highlights the significant importance of empowering Indonesian researcher capacity in determining the quality and output of the research, including scientific and writing skills through structured interactive and experiential learning methods and capacity building interventions.

The Genomics and Science DOJO is a flagship initiative of SUMMIT designed to accelerate the production of high-quality outputs in research publications. It adopts a structured experiential learning method that has successfully supported ten research publications in high impact journals such as The

Lancet, Epigenetics, Scientific Reports, Frontiers in Nutrition and so on. However, the DOJO method has not yet been systematically evaluated for its effectiveness in improving these scientific outputs. Therefore, this study employs a randomized controlled trial (RCT) design to assess its impact by comparing outcomes between participants exposed to the DOJO approach and those receiving a non-DOJO learning method.

1.1.3 Literature Review

Experiential learning is an educational approach grounded in the idea that knowledge is constructed through the transformation of experience, rather than passive absorption of information. It emphasizes active engagement, reflection, and the application of knowledge in real or simulated contexts, allowing learners to integrate theory with practice (Fry, Ketteridge & Marshall). This cyclical learning process has been widely applied in higher education and professional training to enhance deeper understanding and skill acquisition.

A growing body of empirical evidence demonstrates that experiential learning leads to superior learning outcomes compared to traditional didactic methods, including improved engagement, comprehension, and knowledge retention (Roland, 2017). Importantly, beyond foundational knowledge acquisition, experiential learning also contributes to the development of higher-order cognitive skills such as critical thinking, strengthened analytical reasoning, and problem-solving abilities (Dianita and Tiarani, 2023). These competencies are significantly recognised as essential for scientific practice and research productivity.

Beyond individual ability, the effectiveness of experiential learning appears to be mediated by increased cognitive engagement and social interaction within learning environments. Recent studies among university students indicates that peer interaction and collaborative learning significantly improve critical thinking through reflective engagement and active knowledge improvement, while also empowering students' confidence in applying these skills (Ahmed, 2025). These highlights the importance of social interaction elements within experiential learning environments in strengthening analytical skills.

In addition to cognitive outcomes, experiential learning approaches have been shown strongly related with increased self-confidence and learning empowerment. Pedagogical approaches such as project-based learning and mentorship have demonstrated effectiveness in enhancing self-confidence among learners in their ability to apply knowledge into practice, while also improving resilience and critical thinking to solve complex problems (Heng and Jin, 2025). Self-confidence in turns contributes to a person's ability to construct logical arguments, effectively organize their thoughts, and conduct feedback-based revision (Robillos & Thongpai, 2022). Hence, it highlights that empowerment is not merely an outcome of experiential learning but a key mediating factor in the development of higher-order thinking skills.

Despite growing evidence, there remains limited evaluation of structured and experiential studies within the context of research capacity strengthening. Furthermore, existing studies often focus on isolated learning outcomes rather than integrated competencies such as critical thinking, data analysis, scientific writing and communication, and professional empowerment. This represents a critical gap in the literature, especially in emerging interdisciplinary fields such as genomics and data-driven

biomedical research. To address this gap, this study employs a randomized controlled trial (RCT) design to evaluate the effectiveness of the Genomics and Science DOJO 3.0 program in improving participants' competencies.

1.2 Intervention Description: Genomics and Science DOJO

The **Genomics and Science DOJO** is a flagship initiative designed to accelerate the production of high-quality outputs in genomic and biomedical sciences in Indonesia. The program is therefore developed as an experiential learning–based capacity-building model that integrates technical training, intensive mentorship, critical discussion, and structured scientific debate through the *Shinjitsu* methodology. It adopts an intensive and immersive learning approach inspired by the concept of a "DOJO," a dedicated environment for disciplined practice, continuous self-improvement, and the pursuit of mastery. Within this framework, participants are positioned as active agents in the learning process, engaging directly in hands-on data analysis, scientific writing, and the constructive evaluation and testing of scientific arguments.

By combining the structured, collaborative ethos of the DOJO with the principle of *Shinjitsu*, the pursuit of truth, the program fosters critical thinking, intellectual rigor, and openness to challenge. It also seeks to address entrenched hierarchical norms in scientific practice by promoting merit-based discourse and transparent argumentation. Through this integrated approach, the initiative aims to strengthen national research capacity, enhance the quality of scientific communication, and improve the translation of research evidence into policy and practice within the health sector.

The DOJO model is co-developed and implemented through a collaboration between Summit Institute for Development, Oxford University Clinical Research Unit, Genomik Solidaritas Indonesia, with contributions from collaborators in Brazil and an Academic from the University of Indonesia. The initiative is supported by the British Embassy Jakarta.

1.2.1 DOJO 1.0 and DOJO 2.0: Lesson Learned

Based on the implementation of DOJO 1.0 and DOJO 2.0 (January 2024 to June 2025), the program has trained more than 150 scientists and produced over 30 manuscripts, including 10 that have been accepted and published, while the others are still under review. Participants also contributed to various international conference presentations, with a total of six teams taking part. These achievements demonstrate the program's role in fostering critical thinking, scientific writing, and interdisciplinary collaboration.

Key lessons from the previous phase highlight the importance of sustained post-training support, particularly for manuscript development and publication follow-up, as well as the need for a standardized and measurable evaluation framework to assess participant progress and program effectiveness. The DOJO model has also demonstrated adaptability beyond the health sector, with successful implementation in innovation and education initiatives, indicating its scalability across disciplines. These findings form the basis for the design of DOJO 3.0.

1.2.3 DOJO 3.0: Proposed Intervention

The key characteristic of the DOJO approach lies in the Shinjitsu methodology, which integrates structured debate, confrontational argumentation, and real-time intellectual challenge as core mechanisms to stimulate critical thinking. In Shinjitsu classroom activities, participants engage in live discussions during content delivery, while the instructor (Sensei) actively prompts, questions, and challenges participants throughout the session. This enhancement aims to enable a more rigorous evaluation of the effectiveness of the DOJO learning approach while also supporting continuous improvement and long-term sustainability.

The program will be implemented through structured components by continuing several activities such as *Wounded Healer, Ninja Run, and Shinjitsu Tournament*. *Wounded Healer* is based on the principles of active psychology and leverages direct and interactive experiences. In this session, participants actively share challenges encountered in a supportive environment, thereby fostering confidence and psychological safety. This is followed by *Ninja Run*, where participants train their critical thinking and decision-making skills under constrained conditions. Subsequently, participants engage in a structured *Shinjitsu Tournament*, in which they not only present their arguments but also defend and critically challenge them in a confrontational yet structured setting.

1.3 Non-Intevention Description: Non-DOJO

To compare the impact of the DOJO intervention, the control group will follow a structured standard learning approach that is conceptually adapted from the teaching and learning methods used in the MSc in Health Service Improvement and Evaluation (HSIE) at the University of Oxford. The non-DOJO activities represent an interpretation of this program's approach, selected for adaptation due to its compatibility with the DOJO program. These activities are designed to deliver the same content, learning objectives, and level of exposure as the intervention group, while using pedagogical methods distinct from the DOJO approach.

In the *Shinjitsu class*, the material will be delivered in a fully didactic, one-way format, limiting participant interaction to brief, moderator-led question-and-answer sessions. The *Wounded Healer* session will be conducted as a seminar focused on individual reflection rather than interactive sharing, resulting in a more passive reflective experience without the experiential and positive psychology components present in the DOJO intervention. For *Ninja Run*, participants will not be placed in a competitive environment but will instead be given time to complete tasks at their own pace without time pressure, thereby not experiencing the same level of cognitive demand as working under constraints. Last activity, the *Shinjitsu Tournament* will be conducted in a similar setting with the intervention group.

1.4 Research Objectives

c. Primary Objective

The primary objective of this study is to rigorously evaluate the effectiveness of the Dojo 3.0 methodology in enhancing scientific skills and outputs, including but not limited to critical thinking and data analysis ability, knowledge acquisition across key learning modules (e.g., Mixed-model Bioinformatics, Data Dive and Analysis, etc), and scientific manuscript quality and progress toward publication.

These outcomes will be measured using standardized assessment tools, including case studies, scoring rubrics, and validated questionnaires (multiple-choice questions) administered via the Knowledge Gateway. Outcomes will be evaluated as the change in scores from baseline (pre-intervention) to endline (post-intervention).

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Feedback forms will capture participants' overall impressions of the program and their evaluation of teaching quality across facilitators (sensei). Observational data will be systematically quantified to assess participants' performance, activeness, and engagement during program activities (e.g., frequency and quality of questions or contributions, and participation across learning sessions). Selected engagement and behavioral measures will also be tracked throughout the program where applicable.

1.5 Significance of the Research

Research on structured, digital, and immersive learning interventions such as *Genomics and Science DOJO 3.0* has important implications for multiple stakeholders in strengthening program implementation and informing evidence-based policy recommendations. Findings from this Randomized Controlled Trial (RCT) will support improvements in the design, implementation, and scalability of research capacity-building interventions aimed at enhancing bioinformatics technical skills, critical thinking, and scientific writing among researchers in Indonesia.

1.5.1 Researchers/Participants

The expected benefits include:

- Technical Capacity Development: Participants will receive intensive training in bioinformatics, genomics, and data analysis through curated learning materials.
- Enhanced Critical Thinking Skills: Through the Shinjitsu methodology (structured scientific debate), participants will strengthen their logical reasoning and scientific argumentation skills.
- Improved Scientific Writing Quality: The program supports participants in improving the quality of their research manuscripts, increasing their readiness for publication in reputable journals.
- Professional Empowerment: Participants will gain increased confidence in managing research projects and engaging within the global scientific ecosystem.
- Scientific Networking: Opportunities to build connections with fellow researchers and expert mentors (Sensei) in relevant fields.

1.5.2 Participants' Affiliated Institutions

The expected benefits include improved standards of research quality and publication outputs among participating staff. Additionally, knowledge and skills acquired through the program are expected to be disseminated within institutions, facilitating peer-to-peer learning and broader capacity strengthening.

1.5.3 National Stakeholders in Health and Genomics

The study is expected to contribute to strengthening national capacity in genomic data analysis, which is critical for enhancing health system resilience and advancing precision medicine in Indonesia.

1.5.4 Funders/Sponsors

The study will provide robust, evidence-based insights into the effectiveness of the technical assistance program, supporting efforts to strengthen scientific collaboration between the United Kingdom and Indonesia.

CHAPTER 2

RESEARCH METHODOLOGY

2.1 Conceptual Framework

This study is based on the premise that differences in learning methodology influence the development of participants' research capacity in biomedical and genomics fields. The Genomics & Science DOJO 3.0 compares two approaches: the DOJO method, which emphasizes interactive and experiential, high-engagement, and pressure-based learning, and the Non-DOJO method, which applies a more structured and less interactive learning approach.

Both groups receive identical learning materials, duration, assessment tools, and instructors, ensuring that the only systematic difference lies in the learning methodology. The intervention is expected to influence key outcome domains, including knowledge improvement, critical thinking, data analysis skills, personal empowerment, manuscript quality, and quality of teaching.

The conceptual relationship underlying this study can be defined as:

Learning Method → Learning Process & Engagement → Capacity Outcomes

In addition to quantitative outcome measurement, participant experience data will be collected using a structured Google forms survey. The survey will capture participants' perceptions and experiences throughout the program. Responses will be collected at the end of the intervention to ensure a complete reflection of the entire learning experience. This data will be used to support interpretation of differences in learning processes between the two approaches.

2.2 Research Design

This study employs a Randomized Controlled Trial (RCT) design to evaluate the causal impact of the Genomics and Science DOJO 3.0 learning methodology (Cartwright, 2010; Braga et al., 2025). The study is primarily quantitative, aiming to assess the effectiveness of the DOJO intervention by comparing changes in key capacity indicators, including critical thinking, knowledge improvement, data analysis, personal empowerment, manuscript quality, and quality of teaching, between the intervention group (DOJO) and the control group (Non-DOJO). The RCT design enables causal inference by randomly assigning participants into two study arms, allowing differences in outcomes to be attributed specifically to the DOJO methodology.

Participants are assigned into:

- **Intervention group (DOJO)**
- **Control group (Non-DOJO)**

The design allows for two main types of comparison:

- **Within-group analysis**: measuring pre–post changes in each group
- **Between-group analysis**: comparing differences in improvement (gain scores) between DOJO and Non-DOJO groups

To ensure internal validity, key elements of the learning environment are held constant across both groups, including learning materials, duration of exposure, assessment tools, eligibility criteria, and the pool of sensei delivering the sessions. The only systematic difference lies in the mode of intervention delivery, where the DOJO group receives a more interactive, high-engagement, and experiential learning approach, while the control group follows a more structured, less interactive format.

2.2.1 Participant Flow & Study Design (RCT Framework)

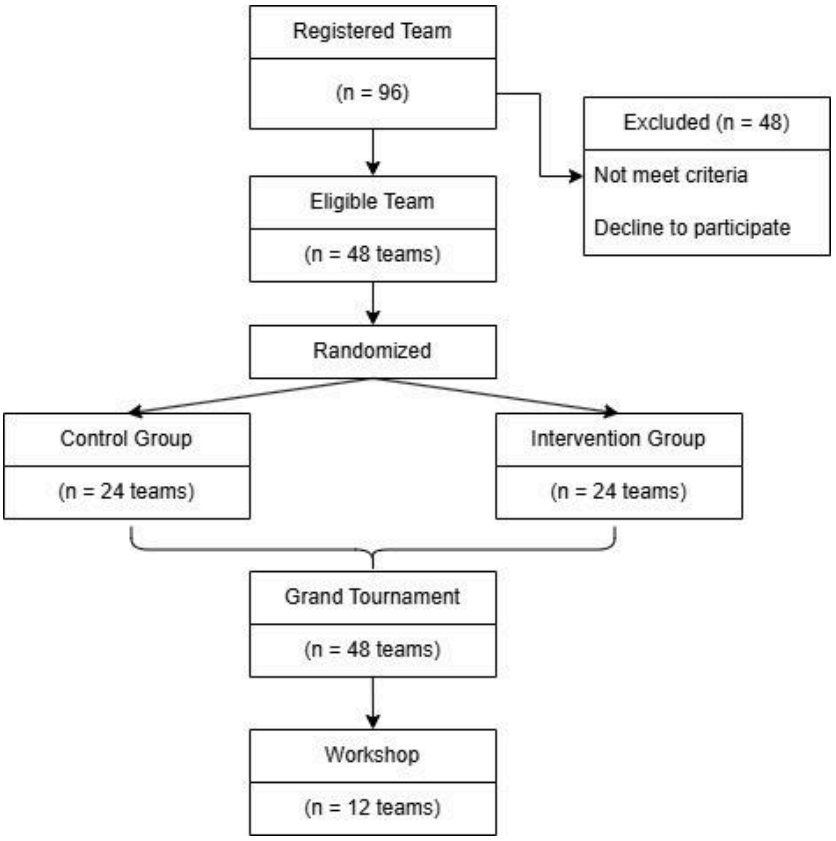


Figure 1. Consort Flow Diagram

Given the relatively small sample size, participants were allocated into study groups based on baseline test results and research stage to enhance comparability. Participant allocation followed a stratified randomization approach. Participants were first grouped according to their baseline test results then categorized into predefined strata using established thresholds to ensure a comparable distribution of research stage across study arms. These groups were subsequently randomized into intervention and control arms across two cycles. Baseline equivalence between groups was then verified using statistical tests (Chi-square and t-test), confirming no significant differences between groups prior to the intervention (Chicco et al., 2025).

The participant flow follows a structured RCT framework. Participants will register and undergo eligibility screening, resulting in 48 eligible teams. These teams will then be randomly assigned to two parallel study arms: 24 teams in the intervention group and 24 teams in the control group. Each

arm will be supported by an equivalent number of Sensei, judges, and organizing staff. The intervention and control groups will be hosted in separate venues but conducted concurrently to minimize the risk of contamination between participants.

All teams will participate in the *Shinjitsu Tournament* as part of the selection process. Of the 48 participating teams, the top 25% based on performance will be selected to proceed to the final workshop stage.

Although this study primarily adopts a quantitative approach, a limited qualitative component is included to complement the interpretation of findings, such as open-ended questionnaires and observations notes. These data are used to contextualize the quantitative results, particularly in understanding the learning processes and differences in outcomes between the study groups.

2.3 Study Location and Duration

2.3.1 Study Location

The study will be conducted in Jakarta, Indonesia, across two separate venues to minimize contamination between participants, and will include participants from across the country. After eligibility screening, the sample consists of 48 teams, with each team comprising two participants, resulting in a total of 96 individuals.

2.3.2 Study Duration

This study will be conducted over approximately 15 months, including a preparation phase starting in December 2025. The preparation phase begins with staggered registration periods: Batch 1 from 6–27 February 2026, Batch 2 from 2–14 March 2026, and Batch 3 from 5–15 May 2026. The program activities will commence in early June. The workshop and dissemination event will be held at the end of June, marking the completion of the program.

Following the workshop, monitoring will continue for 9 months to track each team's manuscript development and publication progress. Monitoring will be conducted biweekly by the study team through structured progress updates, collected via email and online messaging platforms.

Each update will capture key indicators, including manuscript submission status, progress in the peer review process (e.g., under review, revision requested, resubmission), changes in target journals, and overall progression toward publication. All data will be systematically recorded in a centralized tracking system (e.g., Google Sheets) to ensure consistency and enable longitudinal analysis.

2.4 Intervention Arms and Sample Size

The intervention will be evaluated to assess its impact and its role in achieving the program objectives. RCT has a high level of validity due to their complex, detailed, and structured implementation, as well as the involvement of a sufficiently large population (Krauss, 2021). One of the key strengths of RCT is the ability to provide robust evidence of causal relationships, as well as insights for program implementation (Braga et al., 2018; Farrokhyar et al., 2010).

Activities for the control group (conventional standard) refer to the learning methods used in the MSc in Health Service Improvement and Evaluation (HSIE), University of Oxford, which include a combination of lectures, class discussions, group projects, and workshops (MSc in Health Service Improvement and Evaluation).

The difference between the control method (conventional learning approach) and the intervention method (DOJO) is presented in the table below. The description of the control method is a conceptual adaptation by the research team based on commonly used conventional approaches in health education, including those reflected in programmes such as the MSc in Health Service Improvement and Evaluation (HSIE), University of Oxford. This comparative framework reflects the research team's interpretation of these approaches, developed to enable a structured analytical comparison between the two methods within the context of this study.

Table 1. Methodology Comparison between Control and Intervention

Dimension	DOJO Method (Intervention)	Conventional Standard (Control)
Pedagogical Philosophy	Experiential capacity-building grounded in the Shinjitsu methodology, where learning occurs through critique, debate, practice by doing, and intellectual confrontation.	Conventional pedagogy centered on instruction and guided application, where learnings occur through lectures, workshops, and structured exercises.
Interaction & Learning Dynamics	Highly interactive and challenge-driven. Participants actively critique, debate, and defend ideas; peer interaction is intentionally adversarial yet collaborative.	Though experiential at the technical level, learning is primarily instructor-guided and collaborative, with teamwork projects but no structured requirement for adversarial peer critique or debate.
Role of Hierarchy	Hierarchy minimized; participants are encouraged to question and contradict peers and more senior participants to strengthen reasoning.	Structured academic hierarchy with defined roles (lecturer, tutor, supervisor, student).

Learning Activities	Debate-style critique sessions, challenge-framed exercises, intensive peer review, and reflective sessions such as "Wounded Healer" to build agency and personal empowerment.	Lectures, workshops, small-group discussions/FGD, teamwork projects, writing retreats, and conference-style presentations.
Feedback & Support Structure	Peer-driven critique cycles with facilitators guiding intellectual confrontation and reasoning refinement (sparring)	Formal academic supervision through advisors, tutors, and dissertation supervisors providing structured feedback.

This study is designed to ensure strong internal validity by keeping key components consistent between the intervention and control groups (Akobeng, 2008). The standardized components include:

- Identical topics and presentation slides
- Assessment rules (using the same measurement tools, categories, and timing)
- Duration and exposure window
- Eligibility criteria
- The sensei delivers the sessions (with rotation across venues to minimize instructor effects).

As such, the only systematic difference between the two groups lies in the learning methodology.

2.4.1 Intervention Group (DOJO Approach)

The intervention group receives the Genomics and Science DOJO 3.0 methodology, which emphasizes an experiential, high-engagement, and performance-driven learning approach. While all learning objectives and materials are equivalent to the control group, the delivery is intentionally designed to be interactive, dynamic, and cognitively demanding. A defining characteristic of the DOJO approach lies in the *Shinjitsu* methodology, which integrates structured debate, confrontational argumentation, and real-time intellectual challenge as core mechanisms to stimulate critical thinking. Participants are continuously placed in situations that require them to defend ideas, question assumptions, and respond under pressure, creating an environment that is both rigorous and highly immersive.

In the *Shinjitsu class*, participants engage in real-time discussions during material delivery, with the sensei actively prompting, questioning, and challenging participants throughout the session. This is followed by structured practice sessions and immediate, tailored feedback, allowing participants to iteratively refine their understanding. The *Wounded Healer* session represents another defining component of the DOJO methodology, grounded in principles of positive psychology. It is conducted as an experiential and highly interactive reflection, where participants actively share personal challenges in a guided and psychologically safe environment, fostering self-confidence, psychological safety, and peer-supported growth.

Applied components such as *Ninja Obstacles* require participants to directly execute tasks using the same datasets or materials, producing tangible outputs such as data analyses, revised manuscripts, or methodological critiques. This "learning by doing" approach is further intensified in the *Ninja Run*, where participants complete a series of challenges under strict time constraints in a competitive setting, requiring rapid thinking, synthesis, and prioritization under pressure. The presence of time pressure is a deliberate design element, intended to train participants' ability to think critically and make decisions in constrained, high-stakes conditions.

In the *Shinjitsu Tournament*, participants engage in structured debate, requiring them not only to present ideas but also to defend and critique arguments in real time within a confrontational yet structured setting. Across all activities, the DOJO approach is intentionally playful, immersive, and highly engaging, while simultaneously incorporating pressure, debate, and continuous intellectual challenge as core learning mechanisms. Despite these differences in delivery, all activities are aligned with the same learning objectives and assessment criteria as the control group, ensuring comparability within the RCT framework.

2.4.2 Control Group (Standard / Non-DOJO)

The control group follows a standard, structured learning approach designed to deliver the same content, learning objectives, and exposure as the intervention group, but through less interactive and lower-intensity modalities. This ensures that any observed differences in outcomes can be attributed to the mode of delivery rather than differences in content or learning opportunities.

In the *Shinjitsu class*, material is delivered primarily through one-way lectures, with limited participant interaction during the session. Unlike the DOJO approach, there is no structured debate or confrontational exchange; engagement is restricted to short, moderated Q&A segments, and participants are not placed in situations that require real-time argumentation or defense of ideas. Feedback during mentoring sessions is provided in a general, non-individualized manner. The *Wounded Healer* session, while maintaining the same objective of supporting self-reflection, is implemented in a seminar-style format grounded in individual reflection rather than interactive sharing. Participants engage through personal note-taking without verbal exchange, peer interaction, or guided feedback, resulting in a more passive reflective experience without the experiential and positive psychology-driven engagement present in the DOJO group.

For applied learning components such as *Ninja Obstacles*, participants engage with the same materials and problems as the intervention group, but through facilitated discussion rather than direct task execution. Instead of producing outputs, participants articulate their reasoning and approaches conceptually. Similarly, in the *Ninja Run*, participants are given the same set of challenges but complete them in a self-paced, non-competitive environment without time pressure, structured enforcement, or performance-based urgency. As such, participants are not exposed to the same level of cognitive demand associated with working under constraints. While the preceding learning activities differ between groups, the Shinjitsu Tournament will be conducted in the same manner for both the control and intervention groups.

Overall, the control condition maintains equivalence in content, duration, and assessment, while differing primarily in the absence of debate, time pressure, immersive engagement, and experiential learning dynamics that characterize the DOJO methodology. This design ensures that the comparison between groups isolates the effect of these defining DOJO elements as the key intervention variable.

2.4.3 Randomization and Allocation

Participants will be assigned to study arms using stratified randomization with baseline test scores and research stage used as stratification variables to ensure balanced group composition. The final allocation into control and intervention groups across both cycles will be executed using a SAS 9.4 script, ensuring unbiased assignment. The steps for the randomization process are as follows :

A. <u>Cleaning and Encoding</u>

The randomization process will begin with data cleaning and encoding to prepare key stratification variables. First, each participant will be assigned based on their **baseline test** score, and coded values based on their **research stage**, ensuring these characteristics are evenly distributed across the RCT groups.

For the **baseline test,** score will be assessed to reflect participant current level of knowledge and skills within a group. While for the **research stage**, participants will be categorized based on their current progress in the research pipeline. These encoded variables are then used as the basis for stratified randomization to ensure balanced group composition across both baseline test results and research stage.

B. <u>Randomization</u>

Baseline measurements will be collected prior to the start of any intervention activities, before treatment exposure, to capture participants' initial capabilities without contamination.

The randomization process into clusters will be conducted after assessing the baseline test results and stratified by research stage that has been encoded. This study will conduct a randomized assignment using a script in SAS 9.4, followed by a stratification approach to define balanced strata.

Participants were first organized into two study arms: Intervention and Control. Within this structure, randomization will be performed in a stratified manner. Participants' baseline test scores will be categorized, and stratified randomization will be conducted based on baseline results, with additional stratification by participants' research stage. Baseline score categories will be defined using the median, top quartile, and bottom quartile. These categories will not be numerically encoded, but instead reported as score ranges. Participants in higher research stages (Stage 4–5) are randomly assigned across the four classes, followed by Stage 3 participants, and then early-stage participants, ensuring proportional representation within each class.

Importantly, the stratification framework (i.e., how participants were grouped by baseline test results and research stage) was first established to define balanced strata, and assignment into

classes will be fully randomized using a SAS 9.4 script. This ensures that allocation bias is minimized while still maintaining balance across key variables.

Program impact is evaluated at two levels: **first,** overall impact is assessed through baseline-to-endline comparisons between control and intervention groups; and **second,** session-level learning gains are measured within-session pre–post assessments for each module, allowing for identification of specific components driving observed effects.

2.4.4 Inclusion and Exclusion Criteria

Inclusion Criteria:

- Registered participants of Genomics & Science DOJO 3.0
- Teams consisting of two members
- Submission of research concept note
- Completion of screening and assessment stages (administratively and substantially through blind concept note screening and team's curriculum vitae)
- Willingness and commitment to participate in the full program will be ensured through a structured confirmation process.
- In addition, participants will be required to review, sign, and submit a commitment letter outlining the full schedule, expectations for attendance, and participation requirements.
- Information regarding program schedule and participation expectations will be communicated at multiple stages, including during registration, program launch, and post-selection, to ensure participants are fully informed prior to confirming their participation.
- Involvement/ attendance of the first author

Exclusion Criteria:

- Incomplete registration or documentation
- Failure to meet team composition requirements
- Withdrawal before intervention
- Incomplete baseline data

2.4.5 Sample Size

The sample consists of all eligible participants who pass the screening and assessment process. A total of 48 teams are included and distributed across intervention and control groups within two implementation cycles, and group balance is ensured through stratified randomization.

2.5 Study Procedures

2.5.1 Sensei and Communication

Prior to study implementation, all senseis/mentors involved in the program will attend a briefing session to discuss the materials, align perspectives, and standardize delivery methods for both the

intervention and control groups. This is intended to ensure that materials are delivered fairly across groups, with consistent levels of engagement and enthusiasm, thereby minimizing potential bias.

The control and intervention groups will be conducted simultaneously at two separate venues located in Jakarta: Venue A and Venue B. The same senseis will deliver the materials in both locations, following staggered schedules between Venue A (control) and Venue B (intervention), while ensuring that the content delivered each day remains consistent. Senseis will move between venues to deliver the same materials, but with different instructional approaches corresponding to the control and intervention conditions.

2.5.2 Subject Screening and Enrollment

The subject screening and enrollment process is conducted through a structured, multi-stage evaluation to ensure that all selected participants meet the eligibility criteria and demonstrate sufficient research potential. The process consists of three sequential stages: administrative screening, concept note evaluation, and team capability assessment. Each stage is designed to assess different aspects of participant eligibility and quality, ensuring a comprehensive and fair selection process.

Stage 1: Administrative Screening

The initial screening is conducted by the committee to verify basic eligibility requirements. This stage ensures that all applicants meet the minimum criteria before proceeding to substantive evaluation. The assessment includes:

- Minimum educational qualification (at least a bachelor's degree)
- Team composition (each team must consist of two members)
- Submission of required documents (CVs of both team members)
- English proficiency evidence (English test score)
- Completion of the required concept note outline

Only applicants who fulfill all administrative requirements proceed to the next stage.

Stage 2: Concept Note Scoring (Blind Review)

The second stage evaluates the quality and substance of the submitted research concept note. This assessment is conducted by the sensei using a blind review mechanism, where evaluators assess the concept note independently without access to team identity or background information. This approach is implemented to ensure objectivity and eliminate potential bias related to participants' profiles.

The evaluation process follows a standardized workflow:

- Sensei access assigned concept notes through a centralized tracking sheet
- Each concept note is reviewed and scored using the Dojo 3.0 Concept Notes Score Form
- Scores are recorded based on the concept note ID (without revealing team identity)

- Progress is monitored through the tracking system to ensure completion

This stage focuses solely on the intellectual merit, clarity, and feasibility of the proposed research idea.

Each team's concept note has been anonymized and assigned a code (e.g., D0001, D0002, and so on) to ensure a blind assessment process. This prevents assessors from knowing which team they are evaluating, thereby minimizing bias. The spreadsheet is also used to track each assessor's progress, ensuring that all participants receive an equal number of evaluations from the assessors.

The concept note outline is adapted from a standard scientific manuscript structure (IMRaD: Introduction, Methods, Results, and Discussion), with reference to the Project and Research Proposal from Harvard Medical School Harvard Medical School, n.d.). The structure is not reproduced verbatim, but adapted at the outline level to fit the objectives and context of the DOJO program.

The accompanying scoring rubric (Table 2) was developed based on the evaluation framework used in the previous iteration of the program and subsequently refined for reuse. It was further adjusted to align with the updated concept note outline, ensuring consistency between assessment criteria and the expected structure of submissions as defined in the aforementioned template.

Table 2. Scoring Rubric for Concept Note

Component	Indicators Assessed	0 – Not Met	1 – Poor	2 – Fair	3 – Good	4 – Very Good	5 – Excellent
Relevance to Theme	Alignment with Genomics, Medicine, Biomedicine, Biology, or Public Health (human-related research)	Not relevant at all	Very minimal relevance	Limited relevance; weak connection	Moderately relevant	Clearly relevant and well aligned	Highly relevant and strongly aligned with DOJO objectives
Title & Status	Accuracy, clarity, and realism of title and research status	No title/status provided	Unclear or misleading title; no clear status	Overly broad title; vague status	Clear and relevant title and status	Precise title; consistent status	Highly precise title; fully consistent and realistic status
Research Questions & Objectives	Clarity, specificity, feasibility, alignment	None provided	Unclear or not researchable	Broad or partially aligned	Clear but broad or not fully measurable	Focused and aligned	Precise, measurable, and fully aligned
Background & Rationale	Problem definition, research gap, justification	None provided	Unclear problem; no justification	Vague problem; unclear gap	Clear problem; basic justification	Clear gap and strong justification	Explicit gap and compelling justification

Methods & Analysis	Design, methods, and statistical analysis clarity and alignment	None provided	Inappropriate or unclear methods	Poorly explained methods	Clear design and basic analysis	Well-described and aligned methods	Rigorous, detailed, and analytically strong
Data Sources & Readiness	Data appropriateness, accessibility, and feasibility	None identified	Inaccessible or inappropriate data	Feasibility uncertain	Appropriate and feasible	Accessible and ready	Fully appropriate, accessible, and well-prepared data
Feasibility of Implementation	Timeline, resources, risks, and execution plan	No feasibility plan	Unrealistic plan	Weak justification	Reasonable feasibility	Clear and realistic plan	Highly feasible with strong risk mitigation
Expected Results	Clarity and logical alignment with objectives	None stated	Unclear or irrelevant results	Weak linkage to design	Clear expected results	Well-linked and logical results	Highly precise and analytically grounded results
Innovation & Originality	Novelty and originality of research	No innovation	Minimal innovation	Some novelty	Moderately innovative	Clearly innovative	Highly innovative / potentially groundbreaking
Long-term Impact	Sustainability and potential impact of research	No impact identified	Very limited impact	Limited impact	Reasonable impact	Significant and clear impact	Strong, strategic, and sustainable impact
Quality of Writing	Clarity, grammar, structure, and academic quality	Incomprehensible	Very poor writing	Several errors	Clear with minor errors	Well structured	Exceptionally clear and academically strong

Stage 3: Team Capability Scoring (Blind Review)

The third stage assesses the capability of each team, including their academic background, expertise, and prior research or writing experience. This evaluation is conducted separately from the concept note assessment using a shuffled review system, where team CVs are distributed independently from their corresponding concept notes.

The evaluation process includes:

- Accessing team CVs through a separate tracking sheet

- Reviewing team profiles and supporting documents
- Scoring using the Dojo 3.0 Team Capability Score Form based on Team ID
- Recording completion status within the tracking system

All sensei are required to complete both concept note and team capability assessments for all teams. The use of blinded and shuffled identifiers ensures that evaluations remain independent and unbiased across both dimensions.

For the team capability scoring, each team is also assigned a separate code (e.g., T0001, T0002), distinct from the concept note codes. This ensures that the evaluation of the concept note is conducted independently from the assessment of the team's CV, maintaining a blinded process and minimizing bias.

Final Selection and Enrollment Criteria
Following the completion of all evaluation stages, scores from both components are combined using a weighted system:

- Concept note score: **70%**
- Team capability score: **30%**

Teams are considered eligible for enrollment if they meet the following criteria:

- Achieve a minimum total score of **≥ 3.0**
- Receive a **majority "yes" recommendation** from the sensei evaluators

Only teams that satisfy both the quantitative threshold and the qualitative recommendation criteria are selected to proceed to the study and formally enrolled as participants in the RCT.

2.5.3 Data Management

2.5.3.1 Data Collection

Data collection will be conducted at multiple time points throughout the study, including baseline (pre-intervention), during the intervention, and post-intervention, using both quantitative and qualitative approaches.

1. Baseline Data (Pre-Intervention)

At baseline, participant characteristics, including concept notes, will be collected during registration for background profiling and screening purposes. Participants will complete a structured questionnaire

capturing demographic and baseline information, including personal background, education, professional experience, institutional affiliation, English proficiency, research experience, and research stage.

Furthermore, participants will complete a baseline (pre-intervention) assessment to measure initial knowledge, analytical skills, and scientific communication abilities. Baseline data will be collected 2–3 days prior to the intervention via SUMMIT's Knowledge Gateway platform to describe participant characteristics and ensure comparability between study groups at study entry.

a. Critical Thinking

Data will be collected using a structured instrument consisting of two components:
a) a knowledge assessment; and
b) a skills-based assessment.

The knowledge component consists of 6–8 open-ended questions designed to evaluate understanding of critical thinking concepts. The skills component involves a one-page writing task in which participants provide a critique of a case study in the form of a manuscript peer review.

b. Knowledge Improvement

This variable is measured quantitatively using Multiple Choice Questions (MCQs) administered through an online platform (Google form) as pre-tests and post-tests. The pre-test is conducted at the beginning of each session, and the post-test at the end of the same session. Assessment of skill improvement is conducted for each delivered module, consisting of nine modules in total.

c. Data Analysis

Data will be collected using an instrument consisting of two components:
a) a knowledge assessment and
b) a skills-based assessment.

The knowledge component includes 6–8 open-ended questions related to the fundamental concepts of data analysis. The skills component involves a case-based task in which participants analyze a dataset based on six structured instructions and submit their results through an online form.

d. Personal Empowerment

This data is collected using a validated personal empowerment questionnaire that was previously used in the DOJO implementation to assess participants' self-confidence and understanding of program-related skills. The data are collected at two time points: pre-intervention (before the Online Shinjitsu Class) and post-intervention (after the Shinjitsu Tournament).

In addition, participant engagement indicators, including the level of interaction, are observed by assessors and operationalized into quantitative data using structured rating scales and behavioral frequency measures. These data are collected throughout the program implementation.

e. Manuscript Quality

Data for manuscript quality will be collected directly from participants on pre-determined time to accurately assess quality improvement. Data, namely manuscript, will be collected during Pre-DOJO or before the Shinjitsu online class, and post-DOJO or one week after the Minicamp ends. The collected manuscript will be blinded and distributed to the evaluator.

2. Intervention Monitoring and Ongoing Assessment

During the intervention, multiple data sources will be collected including observation notes and standardized rubric-based assessments. These data are used to monitor participant engagement, learning processes, and performance throughout the program. Practical activities such as the Ninja Run are also used as assessment instruments to evaluate applied skills, during which senseis and committee members can observe participants' engagement, motivation, activeness, and scientific communication skills. Additionally**,** we will also conduct daily pre- and post-tests to evaluate and measure changes in participants' understanding and knowledge of the materials delivered each day. These data will also be used in the assessment to further identify which materials or activities of the Dojo methodology yield significant results

3. Post-Intervention (Endline Data)

At the end of the intervention, endline assessments will be conducted using the same instruments as the baseline to measure changes in participant capacity across the entirety of the program. Knowledge post-tests will be administered at the end of each session, while final assessments for skills and personal empowerment will be conducted after the completion of the program *(Shinjitsu Tournament)*.

In addition, post-intervention outcomes will be monitored, including manuscript quality, publication outputs, and teaching quality evaluations. Post-DOJO manuscripts will be collected one week after the minicamp, anonymized, and assessed using the same criteria as the baseline to determine improvements in manuscript quality.

a. Publication of Participants

Data on participants' publication progress will be collected through direct follow-up and recorded in a centralized tracking system. Information will be documented in a shared spreadsheet, including manuscript start date, submission dates, acceptance dates, and publication dates. The study team will request updates on publication progress at two-week intervals.

Journal quality data will be obtained from indexing databases (e.g., Scopus or Web of Science) to determine journal quartile rankings (Q1–Q4).

b. Quality of Teaching

Data will be collected once at the end of the program using an online form comprising two components: (1) overall teaching quality at the program level, where participants rate the overall quality of teaching across the program; and (2) Sensei-specific teaching quality at the individual level, where participants indicate the Sensei they interacted with and evaluate their performance. Both components will be assessed using the same core criteria.

4. Informed Consent and Enrollment

The study team will distribute an RSVP link to collect participants' information, including informed consent and a letter of commitment. Participants who agree to take part in the study will be required to sign both documents and upload the completed forms through the provided link.

2.5.3.2 Data Processing

All collected data will undergo data cleaning, coding, and anonymization procedures. Data cleaning will include checks for completeness, consistency, missing values, and duplication. Incomplete or invalid responses will be handled according to predefined criteria.

Data from multiple sources, such as assessment instruments, LMS logs, and publication tracking records, will be integrated into a unified database for analysis. Variables will be coded and transformed as needed; for example, multiple-choice responses will be assigned numerical scores, rubric-based assessments will be standardized, and composite indices (such as self-empowerment indices and improvement scores) will be computed.

Each participant will be assigned a unique identifier to ensure data confidentiality. All personally identifiable information will be removed or replaced with these identifiers, so that only anonymized data are used in the analysis process.

Statistical analyses will be conducted using SAS version 9.4 and R programming software.

2.6 Data Analysis

Data analysis will be conducted by the designated data analysis team at the Summit Institute of Development in accordance with the predefined statistical analysis plan. All analyses will utilize appropriate statistical software and adhere to applicable data protection standards and research ethics.

The analysis will focus on variables collected directly from participants, including individual characteristics, critical thinking ability, knowledge improvement, data analysis skills, personal empowerment, manuscript quality, participant publications, and teaching quality. The analysis process will employ statistical software such as R and SAS 9.4, selected for their flexibility and capability in

handling complex data, as well as their compliance with statistical analysis standards in social and humanities research.

Study Variables and Measurement

Table 3. Study Variables and Measurement

Variable Details	Method	Tools	Unit Analysis	Rubric Scoring
Critical Thinking	Quantitative	Pre- and Post-Test of Case-based task	Individual	Holistic Critical Thinking Scoring Rubric (Facione & Facione, 2009).
Knowledge Improvement	Quantitative	Pre- and Post-Test from whole material	Individual	Test Scoring based on the questions and key answers provided by each sensei, and is administered by the committee/ study team via knowledge gateway
Data Analysis	Quantitative	Pre- and Post-Test case-based data analysis assessment	Group	Scoring metric of data analysis prepared by Sensei
Personal Empowerment	Quantitative	Pre- and post- self assessment, along with quantifying participants' performance and behaviour (activeness, comments and questions being asked)	Individual	1. Improved understanding & insights 2. Quality of arguments in debate 3. Practical Skills 4. Empowerment 5. Personal ranking

Manuscript Quality	Quantitative	Evaluator Scoring	Group	1. Novelty 2. Methodological rigor 3. Clarity of writing 4. Significance 5. Suitability of Journal
Publication of Participants	Holistic Approach (Combination of Objective Timeline Metrics + Journal Quality Assessment)	Timeline and Journal quality tracking	Group	1. Publication Timeline 2. Quality of Journal 3. Holistic approach 4. Comparison between control and intervention group
Quality of Teaching	Quantitative	Participants Feedback via Google Form	Individual	

1. Critical Thinking

   Participants' critical thinking abilities will be assessed based on individual capacity to analyze and identify problems, interpret information, evaluate reasoning, and construct coherent, well-justified arguments. Critical thinking abilities will be measured from the combination of a free-text pre- and post-test, *Ninja Run* activity, and performance in *Shinjitsu Tournament.* The primary metric is the mean change score in endline scores between intervention and control groups, estimated using analysis of covariance (ANCOVA) with baseline scores as covariate.

2. Knowledge Improvement

   Participants' knowledge improvement will be assessed by comparing their individual understanding of the materials delivered each day. Improvement of knowledge will be measured using multiple-choice questions (MCQs). Scores will be calculated as the percentage of correct answers (%) for each team participant. The primary metric is the adjusted mean difference in endline MCQ scores between intervention and control groups, estimated using ANCOVA with baseline MCQ scores as covariate.

3. Data Analysis

   Data analysis skills will be assessed at the team level, focusing on participants' ability to interpret data, apply basic quantitative analysis, draw evidence-based conclusions, and communicate key findings. The skills component will be evaluated using a scoring rubric that is generated by an expert to objectively score the assignment with scores ranging from 1 to 5. In each score, a detailed description is provided to ensure standardisation when the scoring rubric is used to quantify team performance.

   To assess improvement over time, a mean change score will be calculated at the team level by comparing pre- and post-intervention scores. The primary metric will be the mean change scores, which will be compared between intervention and control groups to evaluate the effect of the program.

4. Personal Empowerment

   Personal empowerment will be assessed based on participants' confidence and sense of agency in engaging with and completing program-related tasks. Scores from the Dojo-specific validated questionnaire will be calculated separately at pre- and post-assessment. Pre-to-post changes will be standardized (z-scores) to enable comparability across instruments with different scoring scales. Standardized scores from both measures will then be equally weighted and combined to generate a composite Personal Empowerment Index. Changes in the Personal Empowerment Index are compared between control and intervention groups to assess program impact.

5. Manuscript Quality

   The improvement in manuscript quality submitted by the team participants, comparing before and after to DOJO activity. Manuscript quality will be evaluated using the DOJO evaluator scoring system applied in previous iterations of the program. The primary outcome will be the mean change in manuscript quality score, calculated as the difference between post- and pre-intervention scores at the team level. This change score will be used to assess improvements in manuscript quality resulting from the DOJO intervention.

6. Publication of Participants

   This variable will be assessed based on efficiency and quality of participants' manuscript publications, including submission timelines, publication speed, and journal impact. Impact on publication outcomes will be measured using a composite scoring approach. The

Submission-to-Publication Interval Score was measured as time-to-publication (publication lag), a commonly used metric in research dissemination studies (Bjork and Solomon, 2013). The score will be calculated based on the number of months between manuscript submission and publication, with shorter intervals receiving higher scores (≤3 months = 4; ≤5 months = 3; ≤7 months = 2; ≤9 months = 1; not published = 0). Journal quality will be assessed using SCImago/Journal Citation Reports quartile classifications, which are widely used bibliometric indicators of journal prestige, with scores assigned as follows: Q1 = 3, Q2 = 2, Q3 = 1, and Q4 or unindexed journals = 0 (Gonzalez-Pereira et al., 2010).

A Holistic Publication Effectiveness Score will be calculated as a composite measure to summarize overall publication performance. It is derived by averaging two pre-specified components: the Submission Timeliness Score (time from submission to publication) and the Journal Quality Score (based on predefined journal quality classification).

Formula: Publication Effectiveness Score = (Submission Timeliness Score + Journal Quality Score) / 2

This composite measure is used for analytical purposes to enable a simplified comparison of publication outcomes between groups, and is not an externally validated instrument

For analysis, scores will be aggregated and compared between intervention and control groups to evaluate differences in submission speed, journal quality, and overall publication effectiveness.

7. Quality of Teaching

   This variable measures participants' perceptions of how effective the teaching was, both overall and at the Sensei level (clarity, structure, engagement, and learning support). Average scores (1-5 scales) are calculated for overall teaching quality and per Sensi, then aggregated for comparison between intervention and control groups.

2.6.1 Descriptive Analysis

Descriptive analysis will be conducted to summarise participants' baseline characteristics and study variables, including the baseline score of each participant before intervention begins. Continuous variables will be presented as means and standard deviations (or median and ranges, as appropriate), while categorical variables will be summarized using frequencies and percentages. Descriptive statistics will be used to report baseline characteristics, as well as pre- and post-intervention scores for all outcome measures.

2.6.2 Inferential Analysis

Inferential analysis will be conducted to evaluate the effect of the intervention on study outcomes, following the intention-to-treat (ITT) principle, whereby all participants will be analysed according to their assigned groups regardless of adherence. All statistical tests will be two-tailed, with a significance level of $p < 0.05$, and 95% confidence intervals will be reported.

For continuous outcomes measured at baseline and post-intervention or endline (e.g., critical thinking, knowledge improvement, data analysis skills, personal empowerment, and manuscript quality), the primary analysis will be conducted using analysis of covariance (ANCOVA) to compare post-intervention scores between groups while adjusting for baseline values of the respective outcome variables. In addition, repeated-measures ANCOVA will be implemented, where appropriate, to assess within-participant changes over time and differences between groups. This approach offers a more precise estimation of the intervention effect by accounting for potential differences in baseline.

For supportive analyses, descriptive statistics (means and standard deviations) will be presented to summarise baseline, endline, and change scores within each group to support interpretation of outcome trends.

Categorical outcomes (publication status, paper completion, or workshop completion) will be analysed using chi-square tests or Fisher's exact tests, as appropriate, and may additionally be examined using logistic regression models. Ordinal outcomes (e.g., journal quartile rankings and Likert-scale teaching quality scores) will be analysed using non-parametric methods, the Mann-Whitney U test.

Time-related outcomes, such as time to publication (measured as days to publication), will be explored using survival analysis techniques, such as Kaplan-Meier Survival analysis.

All analyses will account for baseline participant characteristics, including stratification variables such as research stage and educational background, to improve comparability between groups and reduce potential confounding.

2.7 Ethics Consideration

This study has been designed to adhere to the ethical principles of research involving human subjects, including respecting the rights, dignity, and welfare of participants. Prior to implementation, the study will obtain approval from the Ethics Committee of the Faculty of Medicine and Science University of Mataram to ensure that all aspects of the research comply with applicable ethical standards.

2.7.1 Informed Consent

Each selected participant will be provided with comprehensive information about the study's objectives, benefits, potential risk and procedures. This information will be delivered in both written and verbal forms in a plain language that is easy to understand. Participants will be asked to review and sign an informed consent form before participating in the study, indicating that they have understood and voluntarily agreed to participate in the study.

2.7.2 Confidentiality and Privacy

Participants' personal data will be kept confidential using a coding system to protect their identities. Only the principal investigator and authorized team members will have access to the data, which will be stored in a secure system. Research findings will be presented in aggregate form without disclosing individual information. All study data, including electronic records and paper documents, will be stored in a secure and confidential environment from collection through archiving, ensuring protection against unauthorized access, use, or disclosure in compliance with all ethical, legal, and regulatory requirements. Data security will be maintained through controlled-access data centers. All digital data will be encrypted, with user access restricted through role-based permissions, authentication, and detailed access logs. Participant information will be anonymized and de-identified using unique study codes, and any data shared externally will exclude direct identifiers, subject to Principal Investigator approval. Physical documents and storage media will be kept in locked facilities accessible only to authorized staff, with secure disposal procedures for materials no longer required. Data retention timelines will be defined to determine appropriate long-term storage or destruction of study materials.

2.7.3 Participant Safety

This study is designed to minimize the risks that participants may face. Before implementation, all procedures will be reviewed to ensure that any potential risks to participants are kept within acceptable limits. In the event of side effects or unexpected issues, the research team will be prepared to provide the necessary assistance and referrals.

2.7.4 Voluntary Participation

Participation in this study is voluntary. Participants have the right to refuse to participate or withdraw from the study at any time without any negative consequences.

Participation in the Genomics and Science DOJO 3.0 program and the associated research study is voluntary. Participants are free to choose whether to apply, join, or withdraw from the program and/or study at any time.

For participants who choose to join the program, continued participation is based on a prior commitment to attend scheduled activities, which is confirmed through an RSVP process and a signed commitment letter. This letter clearly outlines all program dates, activities, and attendance expectations.

Failure to meet agreed program participation requirements may result in program-related consequences as specified in the participation agreement. These requirements apply to program participation only and are separate from voluntary participation in the research study.

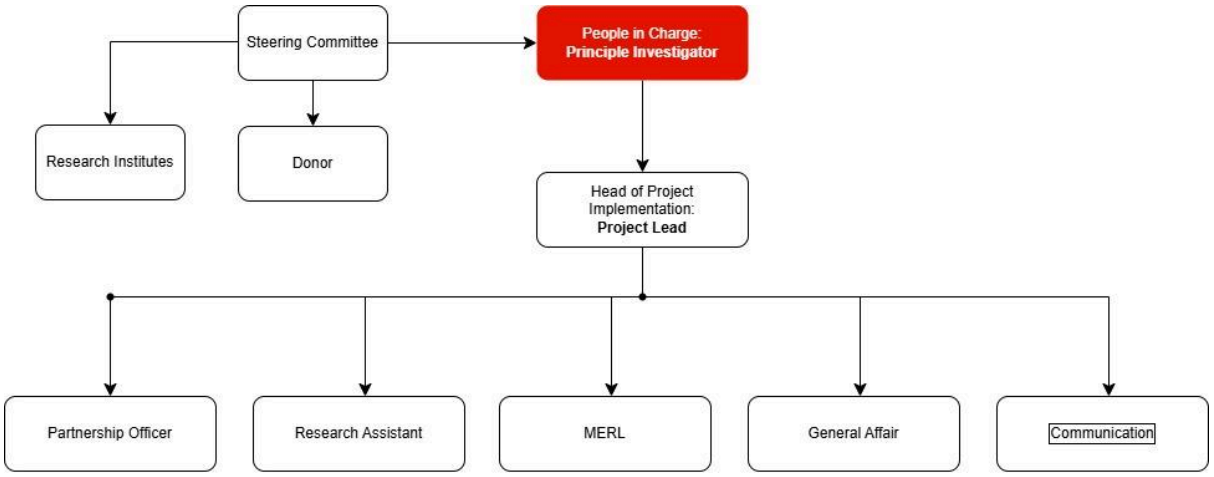
2.7.5 Transparency and Accountability

This study will be conducted with full transparency, and the results will be reported honestly and made accessible to relevant stakeholders. The procedures will comply with national and international research ethics guidelines, including the Declaration of Helsinki. By applying these principles, the study is expected to maintain scientific integrity while protecting the rights and welfare of the participants. Permissions in each region will also be processed according to the applicable licensing procedures. This study complies with the Personal Data Protection Act No. 27 of 2022 in the Health Sector to protect patients' personal data.

CHAPTER III

IMPLEMENTATION PROGRAM

3.1 Research Committee Structure



In this research, the SUMMIT team has established a close collaboration with the Steering Committee. This collaboration is crucial to ensure the sustainability of the implemented programs. Through the synergy between SUMMIT and the steering committee, the program can be implemented more effectively and target the intended objectives. Additionally. the support from the Donors and research institutions strengthen the

The SUMMIT Team

a. Principal Investigator (PI)

- Focuses on the scientific and academic aspects of the research, directing and designing the study;
- Responsible for research design, methodology, and scientific validity;
- Makes key research decisions;
- Leads a team of scientists and researchers;
- Oversees the use of research data;
- Responsible for reporting research findings to sponsors or scientific journals.

b. Project Lead

- Focuses on project management and operational execution;
- Supporting for research design, methodology, and scientific validity
- Responsible for daily management, timelines, and project target achievements;
- Manages the budget within the project's scope;
- Coordinates the team to ensure the project runs as planned and on schedule;
- Reports project progress to partners and management.

c. Research Assistant

- Assists in technical and administrative research tasks;
- Person in charge for DOJO events implementation
- Collects data, conducts experiments, analyzes preliminary results, and supports research administration;
- Works under the supervision of the Project Lead (PL);
- Reports work results to the Project Lead (PL).

d. Partnership

- Identify and develop strategic partnerships
- Manage partnership outreach, engagement, and relationship building with key stakeholders
- Lead partnership negotiations and formalization processes, including MoUs and collaboration agreements.
- Coordinate external partners and collaborators to support project implementation and activities
- Maintain sustainable partner engagement and communication

e. MERL

- Prepares required documents for ethical registration and clinical trial registration of the study
- Design and support data collection
-
- Oversees data quality and ethical research practices
- Identifies implementation challenges and recommends adjustments
- Documents lessons learned and best practices
- Works under the supervision of the Project Lead
- Reports work results to the Project Lead

f. General Affair

General Affairs play a crucial role in managing logistics and operations to ensure smooth research implementation. They ensure that facility, equipment, transportation, and administrative needs are well met.

g. Communications

- Manage study-related media communications, including press releases and media inquiries
- Develop and maintain official social media content aligned with approved messaging
- Document all media and social media outputs related to the study

h. Data Analyst

Data analyst focuses on data processing and analysis, ensuring that the research generates accurate, data-driven insights. At the beginning of the study, the data analyst assists in determining sample size calculations and cluster randomization. The data analyst also selects the best analysis methods and presents data visualizations.

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