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IA2: Observing a PUSAKA collaboration meeting: SABAR and $K_1K_2K_3$
Due: Two days after observing the meeting: 17 Februari

1. Observe a PUSAKA collaboration meeting (in class).
2. Complete the write-up as instructed below. Post on LMS as an individual IA2 document with this pattern of filename: IA2.First.Last.pdf (or doc or whatever filetype) or you can use your student ID.

PUSAKA collaboration meeting report
Collaborators:
    Assoc. Prof. Dr. Eric Alan Vance
    Laily Nissa Atul Mualifah, S.Si., M.Si.
Domain Expert:
    Name: Yessie Widya Sari, M. Si
    Background: Physics Professor
Date: 15 February 2024

K_1: Kualitatif
    Summarize the domain expert's problem and/or question. How were the data collected? Be sure to write what their overall research goal(s) are and how they will use the answers to their research questions (i.e., what is their intended outcome of the research). Also, be sure to write down what their specific scientific questions are. If the statistical collaborators did not ask the domain expert about their goals and scientific questions, you must ask so that you can fulfill this assignment.
    Answer
    The domain expert, Bu Yessie, aims to develop a cancer-killing material from chlorophyll extracted from microalgae. The material should actively react under specific radiation. Her overall research goal is finding the optimal method to extract maximum chlorophyll yields from the microalgae.
    Previous research showed alcohol-based extraction yields 2-4x higher chlorophyll than water-based methods. However, alcohol extraction requires additional purification steps that increase costs. Therefore, Bu Yessie wants to optimize a simpler microwave-assisted water extraction approach.
    The specific scientific questions are:
1. Which extraction method parameters (solvent, microwave time, power) will maximize chlorophyll yields given limited samples?
2. How do microwave power and time influence yields for water-based extraction?

    To answer these, Bu Yessie will design extraction experiments varying solvent (water vs alcohol), microwave power (low, medium, high), and time (short, medium, long). The resulting chlorophyll will be measured using a UV-Vis spectrophotometer. The maximum number of algae samples is 20 due to limited availability.

By optimizing the extraction, Bu Yessie can obtain enough high-purity chlorophyll to create the cancer-reactive material. This material can then undergo stability testing to determine its ability to selectively kill cancer cells when exposed to specific radiation.

K$_2$: Kuantitatif

Summarize the statistical collaborators' quantitative contribution/advice, if any. Did the domain expert understand the statistics? If the statistical collaborators you observed did not get this far with the project, describe what you think might be appropriate for K$_2$.

Answer

The statistical collaborators advised using a factorial experiment design with two factors - microwave radiation power (3 levels: low, medium, high) and time (3 levels: short, medium, long). This would result in 12 total experiments: 6 for the aqueous extraction method and 6 for the alcohol-based method.

By testing all combinations of the factors and levels, the domain expert can efficiently map how the extraction yield responds to changes in power and time. The results can uncover interactions between the two factors as well. This data can then be used to statistically model the response surface and identify the optimal settings that maximize chlorophyll extraction.

The domain expert appeared to understand the rationale for the suggested factorial design. The approach aligns with her goal of finding the best microwave-based extraction technique within the constraints of the limited sample size. While the collaborators did not prescribe the definitive methods yet, they equipped the domain expert with a practical experimental framework to systematically gather informative data.

In summary, the statistical contribution involved outlining an efficient, structured experiment plan that meets the domain expert's needs. The factorial design will produce enough data points to model the relationship between power, time, and extraction yield. This will guide determination of optimal settings while using the samples judiciously. I believe this quantitative advice provides critical direction for the domain expert to progress toward answering her research questions.

K$_3$: Kualitatif

Did the contribution/advice/solution answer the researchers' questions? Will it help the domain expert achieve his or her overall research goal(s)? Are there any practical constraints limiting the effectiveness of the proposed K$_2$ statistical solution? What is the answer to the research question(s)? If the statistical collaborators you observed did not get this far with the project, describe what the domain expert said he/she would use the results for. Also, include your prediction for what may happen for K$_3$.

Answer

The proposed statistical design did not explicitly answer the researcher's questions, but it clearly helped guide the domain expert in deciding the next steps to take. The limited availability of chemicals may constrain the effectiveness of the research, however the statistical approach can minimize risks and uncertainties. After conducting the suggested twelve experiments, I expect the collaborators to

have a clearer understanding of the results and concepts, which will inform decisions on further ways to maximize the yields.

While the optimal methods are still unknown, the discussion enabled the domain expert to outline an initial experimental plan to efficiently test the different conditions. The factorial design will uncover interactions between the radiation time and power on the extraction across the two solvent bases. By mapping the response surface, the collaborators can determine the settings that maximize chlorophyll yields. This achieves the domain expert's aim of finding an improved microwave-based extraction technique.

Despite not yet achieving the definitive answer, this statistical collaboration has provided critical guidance for making progress toward the research goals. The domain expert now has an actionable approach to collect informative data. I predict the results will provide key insights to optimize the extraction, though additional work may be needed to translate findings into practical applications.

SABAR

Apply the SABAR checklist to the meeting (in the Readings #2). How well did the PUSAKA collaborators satisfy the items? Which were opportunities for improvement?

Answer

1. **Siapkan**
   The students did not have advance notice of Bu Yessie's research problem, so they were not fully prepared with background knowledge coming into the meeting. Having some information beforehand could have allowed them to ask more informed questions and spend less time grasping the fundamentals.

2. **Awali**
   The introduction and opening of the collaboration was very efficient. The collaborators clearly set expectations on meeting duration, goals, and their willingness to help achieve research objectives. The rapport building between collaborators and domain expert was excellent.

3. **Bekerja**
   Despite asking about research goals, there were still misunderstandings between the parties. This could be attributed to the novel, technical nature of the research or language barriers. Conducting the discussion in Bahasa Indonesia may have allowed deeper exploration and ideas from the students.

4. **Akhiri**
   Due to time limits, the meeting had to end promptly. However, the collaborators actively took notes and summarized key points on the board throughout, which the domain expert seemed very satisfied with. Closing on a positive note with visible progress made the domain expert feel her time was well spent.

5. **Renungkan**
   The collaborators asked detailed, thoughtful questions to unpack the research questions and goals. Applying the SABAR structure drove an organized,

productive session. For the students, it provided valuable experience interacting with domain experts in a systematic way.

In summary, the introduction and closing were smoothly executed, but the middle work phase faced some language and knowledge gaps. With more preparation and conducting discussions in Bahasa Indonesia, the collaborators can have even more productive exchanges to provide greater value to domain experts.

Reflection

What do you think went well in the meeting? What do you think could have been improved? What might you have done differently had you been a statistical collaborator on the project? What is your overall impression of observing the very first PUSAKA collaboration meeting?

Answer

Overall, the first PUSAKA collaboration meeting was efficient and structured. The strengths included good rapport building, clearly outlining the goals and expectations, and actively capturing notes to summarize key discussion points.

Some aspects that could be improved:
- Having some background information on the research problem ahead of time would have allowed the collaborators to spend less time grasping the fundamentals and instead ask more insightful questions.
- Getting more details upfront on the specific data and units would have oriented the collaborators earlier.
- Explicitly asking about the domain expert's hoped-for outcomes and expected deliverables from the collaboration would have helped align expectations and priorities from the start.

If I were a collaborator, I may have probed more about the data collection methods, units of measurement, and desired outputs early on to accelerate shared understanding. I also would have summarized the options discussed and defined clear next steps before closing.

Overall, it was an impressive first meeting - the structure and rapport building created a solid foundation. For future sessions, upfront preparation and alignment on goals/outcomes could make the discussions even more targeted and valuable. This experience demonstrated how statistical collaborations can be enormously impactful when done thoughtfully.

Learning Objectives for this assignment include:
- Familiarizing oneself with the format of PUSAKA collaboration meetings
- Understanding project report format
- Applying $K_1K_2K_3$
- Applying SABAR
- Reflecting on statistical collaboration in practice