A FRAMEWORK FOR TEACHING AND LEARNING COLLABORATION IN STATISTICS AND DATA SCIENCE: HOW WELL CAN IT WORK IN INDONESIA?

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By learning collaboration skills, statisticians and data scientists can more effectively collaborate with others who possess the skills they may lack. We describe the ASCCR framework, which was developed in the United States for teaching and learning collaboration skills. We hypothesize which aspects of this framework are universal and which are culturally dependent. We provide an example of our initial attempt to translate the Structure component of ASCCR into the Indonesian language and culture. The new acronym of SABAR can help Indonesian students learn, remember, and use specific skills for structuring, organizing, and conducting collaboration meetings. How to effectively teach collaboration skills to Indonesian students in statistics and data science will require more work and is the subject of future research.

1. INTRODUCTION

The most important problems are not statistical problems; rather, the most important problems are real world problems in which statistics (and data science) may be the key to discovering the solution (Awe & Vance, 2014). By learning collaboration skills, statisticians and data scientists can collaborate with others who have skills they lack and are needed for their projects. For example, statisticians and data scientists can collaborate with experts in other domains (whom we call domain experts) to provide needed expertise on how the data were collected, what questions should be asked and answered of the data, and how the results can be transformed into action for the benefit of society (Olubusoye et al., 2021; Vance & Love, 2021).

The need for learning and teaching interdisciplinary collaboration skills in higher education and in the workforce raises several questions, among them: What skills should be taught? And how should universities teach them?

A group of statistical consultants, collaborators, and educators proposed that students learn collaboration skills by engaging in collaborative projects with real domain experts (LeBlanc et al., 2022). One way to ensure a steady supply of real collaboration projects appropriate for student learning is to create a consulting center or statistics and data science collaboration laboratory. Vance and Pruitt (2022) describe the ideas underpinning these centers or "stat labs" and Vance et al. (2022) describe the growing network of 35 of these stat labs in developing countries in the LISA 2020 Global Network. One of our future goals is to create such a center or lab at IPB University in Bogor, Indonesia to become a hub for a network of interdisciplinary statistics and data science collaboration centers throughout Indonesia and part of the LISA 2020 Global Network.

Vance (2015) describes the virtuous cycle of creating and sustaining academic statistical consulting and collaboration centers. In his model, successful centers begin with educating and training statistics students to become effective interdisciplinary collaborators. That education and training is based on a strong foundation of statistical theory and methods and then provides students with opportunities to practice and reflect upon collaboration skills in the classroom, thus helping students move along the path from statistical consultant to collaborator to a leader (Love et al., 2017).

Vance and Smith (2019) developed the ASCCR framework for collaboration to answer the question: What collaboration skills should be taught? We propose that the components of ASCCR are just as relevant for educating students in Indonesia as they are in the United States where the framework was initially developed. Collaboration has a strong foundation in Indonesia, as the concept of Gotong Royong or "mutual cooperation" is still embedded in daily life, especially in Indonesian villages. However, this foundation is threatened by an emphasis at universities on competition that teaches students they must do everything on their own. Because a student's native culture and the culture of their academic environment play a significant role in the effectiveness of teaching and their learning, we are working to translate aspects of the ASCCR framework into the Indonesian language and modify how we teach it to adapt to Indonesian culture.

In Section 2 of this paper, we describe the ASCCR framework and hypothesize which aspects of the framework are universal and which are culturally dependent. In Section 3, we provide a case study of our initial attempt to translate the Structure component of ASCCR into the Indonesian language. Our new acronym to help students learn, remember, and use these collaboration skills for structuring meetings uses the Indonesian language to generate a more culturally appropriate teaching method for Indonesian students and educators. We conclude this paper in Section 4 by outlining future work and inviting potential collaborators to help with this project of translating and adapting the ASCCR framework for collaboration into Indonesian language and culture.

2. THE ASCCR FRAMEWORK FOR COLLABORATION: WHICH ASPECTS ARE UNIVERSAL AND WHICH ARE CULTURALLY DEPENDENT?

The ASCCR framework for collaboration (Vance & Smith, 2019) is comprised of five components: Attitudes that facilitate or detract from collaboration, a Structure for collaboration meetings, the Content or workflow of a collaboration project that emphasizes the qualitative aspects of statistics and data science work at the beginning and the end of the project, Communication skills to enable collaboration, and Relationships between the domain experts and the statisticians or data scientists. Below we will briefly describe each of these five components and discuss which aspects of them appear to have universal applicability and salience across cultures and which may need to be modified to better resonate with the Indonesian language and culture.

2.1 Attitude

In our experience, attitudes are very important for collaboration. Some attitudes we have observed or experienced ourselves detract from collaboration; others facilitate collaboration. When it comes to teaching and assessing collaboration, we do not differentiate strongly between attitudes and skills, because in practice these cannot be distinguished. Therefore, we believe that attitudes are skills and can be learned by all statisticians and data scientists from beginning students to advanced practitioners to improve their collaborations.

Vance and Smith (2019) found that dividing the universe of potential attitudes that statisticians, data scientists, and the domain experts with whom they collaborate into three categories was a useful strategy for teaching interdisciplinary collaboration. Their categories are Me, You, and We, and they apply to the attitudes of the statisticians and data scientists. They have not yet formally explored the attitudes of domain experts.

Me attitudes are attitudes the statistician or data scientist has about herself. For example, having the attitude that collaborations with domain experts are important and that collaboration skills can be learned is a Me attitude that we believe facilitates collaboration. Another effective attitude is that each collaboration project is an opportunity for the statistician/data scientist to apply their expertise and to learn more, both about the domain and about new statistics and data science methods. An example of an attitude that detracts from collaboration is that the statistician must know everything about statistics and cannot say, “I don’t know but I will find out” to the domain expert.

You attitudes are attitudes the statistician or data scientist has about the domain expert. An effective attitude is, “The domain expert is an expert in their field who knows more about their problem and possibly their data than anyone else.” In our experience, this attitude reminds the statistician or data scientist to probe the domain expert to try to learn more about the origin of the data and the nuances of the research questions. An example of an ineffective attitude is that the domain expert knows nothing about statistics and needs to be taught the basics of data science. Such an attitude does not serve as a very strong foundation for collaboration.

We attitudes are attitudes the statistician or data scientist has about the collaboration team. For example, the attitude that together the statistician and the domain expert can accomplish more than either could alone is an attitude that sets into motion a strong collaboration.

Our hypothesis is that the component of Attitude is highly relevant for teaching and learning interdisciplinary collaboration in Indonesia. This component of Attitude may be the one most affected by the prevailing culture. Further study is required to better understand which specific attitudes Indonesian statistics and data science students currently have, and which attitudes may be the most important for improving collaboration outcomes.

2.2 Structure

The ASCCR framework uses the POWER structure developed by Zahn (2019) to teach a process for organizing and conducting effective collaboration meetings. POWER is an acronym to help students remember and implement five stages of a collaboration meeting: Prepare-Open-Work-End-Reflect. Vance and Smith (2019) concluded that, in the complex dance of a meeting, this structure facilitates effective and efficient meetings, reduces the cognitive load of the participants, and supports effective collaboration. Alzen et al. (2023) further describe details of the POWER structure and use it to determine how well beginning students conduct collaboration meetings compared to an experienced statistics and data science collaborator. We will briefly summarize this structure below.

The first stage of POWER is Prepare, in which the statistician or data scientist should review any materials sent by the domain expert; ready oneself mentally, physically, and emotionally for the upcoming meeting; and develop an initial plan for the meeting.

The second stage is to Open the meeting with a greeting, a conversation about how much time is available for the meeting (Vance, Alzen, et al., 2022), what the domain expert would like to accomplish during today's meeting (i.e., their short-term objectives), what the statistician or data scientist's objectives are for the meeting, whether both parties are willing and able to discuss these objectives during the current meeting (perhaps another meeting should be scheduled to discuss a specific topic), and what the domain expert's overall timeline is for their project.

The statistician/data scientist transitions into the Work stage of the meeting by creating shared understanding of the domain expert's overall research, business, or policy questions and why these are important to them. The remainder of the work stage consists of the statistician/data scientist and the domain expert working collaboratively to address their objectives for the meeting.

The statistician/data scientist Ends the meeting by summarizing the key decisions made, the actions she and the domain expert will take, what the outcomes were for the meeting objectives, what the plan is to complete any objectives left incomplete, and what the next steps in communication will be—including when the next meeting will occur or when they will decide if and when to have another meeting. All of these items should be orally discussed and also written down and sent to the domain expert to create shared understanding of what the outcomes of the meeting were and what the next steps will be.

Finally, the statistician/data scientist Reflects on what went well during the meeting, what could be improved, and what she will do differently next time. Ideally, this reflection includes the domain expert, who has valuable insight into what worked well and what could be improved. One aspect of reflection that is important for students to understand is that the process of reflection will help them improve their collaboration skills. The meeting that just ended will not be the last collaboration meeting in their career. By reflecting on each meeting and using each meeting as an opportunity to learn and improve, students' collaboration skills can grow remarkably quickly.

Our hypothesis about the relevance of Structure in Indonesian culture is that some structure, even a flexible one, is important and will improve the quality of collaborations. The five-stage structure of POWER also resonates with Indonesian culture because it is essentially a beginning-middle-end structure, which seems to be universally applicable. However, the acronym of POWER has connotations, even in English, of a hierarchy in collaborations that is not useful. The statistician/data scientist does not have power over the domain expert, and vice versa. This structure is very powerful and can help a statistician/data scientist organize and conduct a very collaborative meeting. How specifically to structure meetings is likely to be culturally dependent, especially on the way to best have a conversation about the time available for the meeting and what the expectations are for both domain expert and statistician/data scientist. In Section 3 we provide an initial attempt to translate the Structure component of the ASCCR framework into Indonesian language and culture.

2.3 Content or Workflow

The key feature that distinguishes the Content or workflow of collaboration projects within the ASCCR framework from other popular workflows or data science lifecycles , including the PPDAC (Problem, Plan, Data, Analysis, Conclusions) (Wild & Pfannkuch, 1999), is its explicit emphasis on the qualitative aspects of statistics and data science projects.

Briefly, the content of every statistics and data science project has three interrelated parts that roughly correspond to the beginning, middle, and end of the project. Every project begins with

Qualitative (Q_1) aspects, such as what the research/business/policy question is, what data are available, why and how the data were collected, and how the final results of the project may be used for action to benefit society. After understanding these qualitative issues, the statistician or data scientist can proceed to Quantitatively (Q_2) model and analyze the data. Then to complete the project, the statistician/data scientist must translate the quantitative results into useful answers to the initial research/business/policy questions, develop recommendations, and outline the next steps for action to benefit society. This ending part of the project is Qualitative (Q_3). Hence, the content or workflow of every statistics or data science project begins with Qualitative (Q_1), proceeds to Quantitative (Q_2), and finishes with Qualitative (Q_3).

We concatenate this process to $Q_1Q_2Q_3$ and describe it in more detail in Trumble et al. (2022). An analogy we developed for Indonesian students is that $Q_1Q_2Q_3$ is like the three statistical quartiles of a dataset: Q_1 (the 25th percentile) is near the beginning, Q_2 (the 50th percentile) is in the middle, and Q_3 (the 75th percentile) is near the end.

Our hypothesis is that a focus on qualitative issues of statistics and data science projects will be just as important in Indonesia as in the United States because the basic content of a project does not change much between cultures. The best way to teach this workflow to Indonesian students must incorporate aspects of the local culture and may need to be translated into the Indonesian language.

2.4 Communication

We believe that effective Communication creates shared understanding throughout a statistics or data science collaboration. The ASCCR framework can be used to teach students how to ask great questions; listen, paraphrase, and summarize the answers; and explain statistics and data science to non-statistical domain experts.

Briefly, a great question is one that provides the statistician or data scientist information she needs to make a deep contribution to the domain and also strengthens the relationship with the domain expert. Vance et al. (2022) describes strategies for asking great questions.

In our experience, communication is important for every collaboration no matter what field or culture the participants come from. In other words, communication skills are collaboration skills in every culture; the need for communication in collaborations is universal. However, the details of how a question should be asked or an answer paraphrased might differ from country to country. What the best communication strategies are for Indonesian statistics and data science students is a topic of ongoing study.

2.5 Relationship

Throughout the world, strong Relationships are key to effective collaborations. Strong relationships can facilitate collaborations and make positive outcomes more likely. But beyond this, Vance (2020) proposed that creating a strong relationship with the domain expert should be one of the terminal goals of every collaboration project. In other words, creating a strong relationship with the domain expert should be a goal in and of itself for every collaboration.

In our experience, establishing trust between all parties in a collaboration is a crucial step in creating strong relationships. Other aspects that may help strengthen relationships include fostering loyalty, regard, and interdependence (Covey, 1989); demonstrating knowledge and competence; identifying mutual goals; and creating shared understanding (Vance, Alzen, et al., 2022).

We hypothesize that Relationship is a universally important concept for collaborations, and how to create and strengthen them most effectively may depend on culture.

3. CASE STUDY: FROM POWER TO SABAR TO STRUCTURE MEETINGS IN INDONESIA

Our initial attempts to translate the ASCCR framework for collaboration into Indonesian language and culture started with the Structure component of organizing and conducting collaboration meetings. Because POWER is an acronym in English that could imply a power differential between parties in a collaboration, we decided to translate the POWER structure into the Indonesian language.

Our result was SABAR, which means “be patient” in Indonesian and resonates with everyday issues in Indonesian life and social interactions. *Sabar* is used to describe a person who can face challenges without becoming angry, desperate, or upset. The acronym SABAR is comprised of five

verbs to remind statistics and data science collaborators what they should do in the five stages of every collaboration meeting. Figure 1 shows the translation of POWER to SABAR.

Prepare	**S**iapkan
Open	**A**wali
Work	**B**ekerja
End	**A**khiri
Reflect	**R**enungkan

FIGURE 1. The POWER structure is translated into the Indonesian language SABAR structure, which means "be patient".

The first stage of SABAR is Siapkan ("prepare"), in which the statistician or data scientist prepares herself for a successful meeting. Some work is required to become ready for a collaboration meeting, and this stage of Siapkan will teach Indonesian students what they should focus on before every meeting.

The second stage of SABAR is Awali ("start"). This is the beginning or start to the meeting. Beginning the meeting by creating shared understanding of what each party hopes to accomplish during the meeting and how much time they can devote to accomplishing their objectives will start the statistician or data scientist on the path to a successful meeting.

The statistician/data scientist will Bekerja ("work") on the agreed-upon wants, goals, and objectives for the meeting. Working collaboratively to create shared understanding will help the statistician/data scientist make a deep contribution to the project and help to strengthen the relationship with the domain expert.

The fourth stage of SABAR is Akhiri ("end"). This is the end or finish to the meeting. Summarizing the decisions made and the next step action items will solidify the progress made during the meeting and facilitates successful collaboration outcomes.

The final stage of SABAR is Renungkan ("reflect"), in which the statistician/data scientist thinks about or ponders what went well and what could be improved. Reflecting on the meeting they just had will help the statistician/data scientist use that experience to improve their collaboration skills.

The five stages of SABAR immediately parallel the five stages of POWER. Within the SABAR structure there are opportunities to add elements specific to Indonesian culture to make it into an effective tool for teaching and learning how to organize and conduct collaboration meetings. Additionally, one advantage of this new acronym is that the meaning of SABAR is to "be patient," which will remind the statistician/data scientist not to rush through the stages of a collaboration meeting, to take the time necessary to establish shared understanding with the domain expert, and to handle any challenges of the collaboration with equanimity.

4. CONCLUSIONS

In this paper, we introduce aspects of the ASCCR framework for collaboration to an international audience and describe our initial attempts to adapt this framework to educate and train Indonesian statisticians and data scientists. Based on our initial work, we have concluded that the dominant culture in statistics and data science collaboration is that of the fields of statistics and data science themselves. The local culture or country of origin of the domain expert or statistician/data scientist is less important than the universal norms of statistics and data science. Therefore, we conclude that the five components of ASCCR (Attitude, Structure, Content, Communication, and Relationship) are just as relevant for educating students in Indonesia as they are in the United States and other countries where ASCCR is used to educate and train collaborative statisticians and data scientists.

A first step in this process is the novel acronym SABAR, which is a training tool to help Indonesian statisticians and data scientists structure, organize, and conduct interdisciplinary collaboration meetings. This adaptation of the POWER structure of Zahn (2019) is likely to be better suited for the context and language of Indonesia.

How to effectively teach collaboration skills to Indonesian students in statistics and data science will require more work and is the subject of future research. As this is a work in progress, we invite Indonesian statistics and other statistics and data science educators around the world to collaborate with us to translate and adapt ASCCR into Indonesian language and culture. Our goal in doing so is to develop a locally relevant model for teaching and learning statistics and data science collaboration in Indonesia to help build and bolster Indonesia's culture of data-driven inquiry.

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REFERENCES

Alzen, J. L., Trumble, I. M., Cho, K. J., & Vance, E. A. (2023). Training Interdisciplinary Data Science Collaborators: A Comparative Case Study. Journal of Statistics and Data Science Education, 0(0), 1–10. https://doi.org/10.1080/26939169.2023.2191666

Awe, O. O., & Vance, E. A. (2014). Statistics education, collaborative research, and LISA 2020: A view from Nigeria. Proceedings of the Ninth International Conference on Teaching Statistics (ICOTS9, July, 2014), Flagstaff, Arizona, USA.

Covey, S. R. (1989). The Seven Habits of Highly Effective People: Restoring the Character Ethic. Simon and Schuster.

LeBlanc, M., Rueegg, C. S., Bekiroğlu, N., Esterhuizen, T. M., Fagerland, M. W., Falk, R. S., Frøslie, K. F., Graf, E., Heinze, G., Held, U., Holst, R., Lange, T., Mazumdar, M., Myrberg, I. H., Posch, M., Sergeant, J. C., Vach, W., Vance, E. A., Weedon-Fekjær, H., & Zucknick, M. (2022). Statistical advising: Professional development opportunities for the biostatistician. Statistics in Medicine, 41(5), 847–859. https://doi.org/10.1002/sim.9290

Love, K., Vance, E. A., Harrell, F. E., Johnson, D. E., Kutner, M. H., Snee, R. D., & Zahn, D. (2017). Developing a Career in the Practice of Statistics: The Mentor's Perspective. The American Statistician, 71(1), 38–46. https://doi.org/10.1080/00031305.2016.1255257

Olubusoye, O. E., Akintande, O. J., & Vance, E. A. (2021). Transforming Evidence to Action: The Case of Election Participation in Nigeria. CHANCE, 34(3), 13–23. https://doi.org/10.1080/09332480.2021.1979807

Trumble, I. M., Alzen, J. L., House, L. L., & Vance, E. A. (2022). The Content of Statistics and Data Science Collaborations: The QQQ Framework (arXiv:2209.04887). arXiv. https://doi.org/10.48550/arXiv.2209.04887

Vance, E. A. (2015). Recent Developments and Their Implications for the Future of Academic Statistical Consulting Centers. The American Statistician, 69(2), 127–137. https://doi.org/10.1080/00031305.2015.1033990

Vance, E. A. (2020). Goals for Statistics and Data Science Collaborations. JSM Proceedings, 2198–2209. https://par.nsf.gov/servlets/purl/10227760

Vance, E. A., Alzen, J. L., & Smith, H. S. (2022). Creating Shared Understanding in Statistics and Data Science Collaborations. Journal of Statistics and Data Science Education, 30(1), 54–64. https://doi.org/10.1080/26939169.2022.2035286

Vance, E. A., & Love, K. (2021). Building Statistics and Data Science Capacity for Development. CHANCE. https://doi.org/10.1080/09332480.2021.1979810

Vance, E. A., Love, K., Awe, O. O., & Pruitt, T. R. (2022). LISA 2020: Promoting Statistical Practice and Collaboration in Developing Countries. In Promoting Statistical Practice and Collaboration in Developing Countries (pp. 27–46). Chapman and Hall/CRC. https://doi.org/10.1201/9781003261148-3

Vance, E. A., & Pruitt, T. R. (2022). Statistics and Data Science Collaboration Laboratories: Engines for Development. In Promoting Statistical Practice and Collaboration in Developing Countries (pp. 3–26). Chapman and Hall/CRC. https://doi.org/10.1201/9781003261148-2

Vance, E. A., & Smith, H. S. (2019). The ASCCR Frame for Learning Essential Collaboration Skills. Journal of Statistics Education, 27(3), 265–274. https://doi.org/10.1080/10691898.2019.1687370

Vance, E. A., Trumble, I. M., Alzen, J. L., & Smith, H. S. (2022). Asking Great Questions. Stat, e471. https://doi.org/10.1002/sta4.471

Wild, C. J., & Pfannkuch, M. (1999). Statistical Thinking in Empirical Enquiry. International Statistical Review, 67(3), 223–248. https://iase-web.org/documents/intstatreview/99.Wild.Pfannkuch.pdf

Zahn, D. (2019). Stumbling Blocks to Stepping Stones. iUniverse. https://www.iuniverse.com/Bookstore/BookDetail.aspx?BookId=SKU-000966452