# DESIGN FOR IMPACT: THE STATISTICAL COLLABORATOR'S WORKFLOW

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by

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ABSTRACT

Design For Impact: The Statistical Collaborator’s Workflow

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Statisticians and data scientists have traditionally been positioned as technical experts within interdisciplinary collaboration. With the advent of artificial intelligence, there is a growing opportunity and need for statisticians to play more central, strategic roles in business. Existing frameworks, such as ASCCR (Vance & Smith, 2019), support this goal but were not specifically designed around data-driven impact. This paper proposes an enhancement of the ASCCR framework that builds impact-enabling steps into the statistical collaborator's workflow. Specifically, we introduce a newly developed tool that scaffolds impact planning, execution, and communication. The artifact, called the Design For Impact Tool, was formatively evaluated by 20 experts from industry and academia and 39 students in statistical collaboration courses. Participants generally perceived the model as relevant and the artifact as useful, while identifying a need for clearer implementation guidance and greater flexibility across collaborative contexts. By making impact an explicit component of collaborative practice, this paper seeks to strengthen statisticians' ability to translate evidence into action and achieve meaningful, real-world outcomes.

Keywords: statistical consulting, impact, communication, interdisciplinary collaboration

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# Chapter 1

# INTRODUCTION

## 1.1. Motivation and Contribution

The current economic landscape can be characterized by a hyperfocus on data-driven decision-making and the implementation of artificial intelligence (AI) (Alaimo & Kallinikos, 2021; Enholm et al., 2022). Generative and advanced machine learning tools have demonstrated the ability to solve challenging problems and unlock new scientific frontiers (e.g., computational prediction of protein structures awarded the 2024 Nobel Prize in Chemistry). Statisticians and data scientists have the opportunity to, in part, be arbiters of the data and information systems that support these new technologies. Specifically, we believe statisticians' experience in modeling, probability and estimation theory, and quantitative reasoning can help accelerate AI-driven growth in both the public and private sectors. Plus, as barriers to programming and routine analysis are lowered by AI-powered tools, we find it increasingly important that practitioners position themselves as strategic collaborators and decision-makers as means for maintaining professional longevity in the free market. Industry leaders agree that communication and collaboration are essential to the rebuilding of statistics in the age of AI (Donoho et al., 2026). And curricular guidelines recommend project-based, communication-heavy coursework (GAISE, 2016) that frames statistics as a process of gleaning insight for the purpose of evidence-based decision-making (GAISE, 2026). This motivates our development of an end-to-end, collaborative scaffold that helps statisticians maximize and communicate the impact of their interdisciplinary collaborations.

To maximize their impact, statisticians could start by borrowing the problem-solving and communication frameworks that already exist in business-oriented disciplines. A great example is the Minto Pyramid

which introduces logic into the communication and disaggregation of complex problems (Minto, 1996). The pyramid consists of three tiers: one main idea, three supporting arguments, and three supporting statistics for each argument. Evidently, statistics is a key component of a widely used consulting framework, but statisticians are rarely the ones in the communication or decision-making roles. Another example: the Situation, Complication, Resolution (SCR) framework developed by McKinsey & Company which supports clear and succinct communication. We think simple frameworks like these have the potential to afford statisticians more credibility and influence with institutional leaders. The ability to translate complex findings into an actionable narrative may very well be the differentiator between a statistician that is offered a strategic role at their institution and the statistician whose work becomes fully automated. The tool we present in this paper builds on the kind of structured problem-solving and communication that is exemplified by the Minto Pyramid and SCR. We created a physical scaffold, built specifically for statisticians, that promotes impactful behaviors throughout a collaborative engagement. Our tool is meant to position statisticians with more influence, visibility, and longevity than the traditional data analyst.

Other frameworks, such as ASCCR (i.e., Attitude, Structure, Content, Communication, and Relationship; Vance & Smith, 2019) and its contained items (e.g., $Q_1Q_2Q_3$; Vance et al., 2026), are tailored to statisticians and promote the features of great collaboration, but they were not specifically built to maximize impact. Our work adds impact-centric elements to the three stages of a traditional statistical engagement, building on ASCCR and $Q_1Q_2Q_3$, but drawing more attention to stakeholders and decision translation. This paper introduces the Design For Impact process model, a prescriptive guide for impact-centric collaboration, and the corresponding Design For Impact Tool, a physical, fillable artifact that supports implementation of the process model. Our choice to define a conceptual process and then

operationalize that process into a physical artifact is rooted in the literature on implementation and design science.

### 1.2. Implementation and Design Science

Distinguishing between implementation items (i.e., theories, models, and frameworks) is one part of implementation science, for which many scholars have proposed taxonomies and definitions. This paper will rely on Nilsen's classification approach which mainly considers how implementation items are developed and how they are intended to be used when classifying them as theories, models, or frameworks. Under his taxonomy, we consider Design For Impact a process model, as it provides a prescriptive, structured, and sequential guide for impact-centric collaboration. We think of ASCCR and $Q_1Q_2Q_3$ as being most similar to determinant frameworks as they seek to understand or explain implementation outcomes, though a precise classification of ASCCR and $Q_1Q_2Q_3$ is less pertinent to this research. Ultimately, disciplines that create their own implementation items share a common goal that rises above the context of their domain: knowledge translation, exchange, transfer, and integration (Nilsen, 2020). In simple terms, we seek to formalize the best practices that experts in the field have developed throughout their career. This provides those earlier in their career with consolidated guidance about how experienced practitioners maximize impact in their collaborative engagements, thereby reducing the learning curve and enhancing performance.

An adjacent discipline to implementation science is design science which "seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts" (Hevner et al., 2004, p. 75). Under this definition, our tool can be considered the resultant artifact of the Design For Impact process model. Mental models are helpful but leave much to interpretation and may not

translate as cleanly to real-world projects as a physical artifact could. Artifacts should be rooted in existing theory as well as the experience, creativity, and intuition of the researchers (Hevner et al., 2004). Early versions of the Design For Impact Tool relied both on the literature, which we will discuss in later sections, and the judgments and hypotheses of our research team. What constitutes the scientific rigor of an artifact is the extent to which it reflects existing research and the extent to which the initial artifact was evaluated and revised using robust methods. Since our tool is meant to serve a pedagogical purpose, we should study its use in the classroom and account for the perspectives of instructors and students. Since our tool is meant to also be used by practicing statisticians, we should consult these practitioners on the relevance, utility, and clarity of the tool. Later in this paper, we will touch on other stakeholders of our tool, like clients themselves, and opportunities to expand the scope of validation in future studies.

To summarize, *Design For Impact* refers to our process model motivated by implementation science. The *Design For Impact Tool,* motivated by design science, is the physical, fillable artifact that operationalizes the model. We use the word *artifact* when discussing the output of design science and the word *tool* when discussing its use by practitioners, but we consider these terms generally synonymous.

To provide precedent for our formative evaluation approach, Hevner et al. assert that the “evaluation of a new artifact given organizational context affords the opportunity to apply empirical and qualitative methods” (2004, p. 77). This is to capture the complex interaction between the artifact and the various stakeholders who are exposed to it (i.e., the consultant, the client, and third-parties). This explains our use of personal interviews, qualitative coding, and thematic analysis as our primary methodological approach. Then, using the build-and-evaluate loop, we adjust the artifact according to feedback from multiple stakeholder groups and an improved understanding of the problem (Markus et al., 2002; Hevner

et al., 2004). Aside from the methodological foundation for the evaluation and revision process, Design For Impact also builds on several existing frameworks like ASCCR and $Q_1Q_2Q_3$.

### 1.3. Foundational Frameworks

Within each of the ASCCR components, Vance and Smith provide a sub-framework, tool, or model that helps practitioners implement effective collaborative behaviors. The tool proposed in this paper builds on $Q_1Q_2Q_3$ (i.e., Qualitative, Quantitative, Qualitative), which is contained in the Content component of ASCCR. $Q_1Q_2Q_3$ reflects the organic lifecycle of a statistical engagement and, for our purposes, can be summarized as the following stages that one would undergo during a traditional consultative process: learning the context of the domain ($Q_1$), applying an appropriate analytical method ($Q_2$), and assessing the results to answer the research question ($Q_3$). The artifact we propose in this paper is meant to give more direction on context-gathering in $Q_1$, encourage greater intentionality on selecting an analytical approach in $Q_2$, and structure $Q_3$ with more decision- and action-oriented communication principles. We believe these contributions holistically enhance every component of ASCCR, even though $Q_1Q_2Q_3$ lives only in the Content component. For example, a statistician who seeks to understand the domain, the domain problem, and its stakes will simultaneously strengthen their relationship with the client. Further, a statistician who delivers a concise narrative about their impact on the domain problem during a close-out meeting would be strengthening their communication with the client. The Design For Impact Tool helps practitioners do both.

Other scholars have investigated how statistical collaborators work with domain experts in terms of common content and process grounds. Mao et al. offer better practices for interdisciplinary scientific collaboration by qualitatively analyzing common successes and pain points, that is, where most teams

that involve both statistical experts and non-statistical experts tend to excel or get stuck. “Most informants reported that the major challenge in their collaboration was establishing… common ground at the beginning of the project and maintaining it throughout the process” (Mao et al., 2019, p. 12). This excerpt demonstrates a common bottleneck in interdisciplinary collaboration: the formulation of research questions and common conceptual ground at the project inception. Additionally, “scientific research questions keep evolving quickly… [and] such evolution of questions breaks the initial common ground and requires dynamically building new common ground” (Mao et al., 2019, p. 13). Design For Impact seeks to align interdisciplinary teams earlier and deeper, such that they can adapt to evolving research questions when the team makes new discoveries or shifts their priorities.

Similarly, Sahneh et al. (2021) offer human-centric guidelines for effective collaboration in data science such as thoroughly communicating the project plan. In part, we can accomplish this by setting clear project goals, establishing roles and responsibilities, and communicating authorship expectations (Sahneh et al., 2021). Assuming that not all statisticians are setting clear project goals and discussing roles and responsibilities with their clients, we should support these behaviors by building them into the statistical collaborator’s workflow and the training material that we deliver to early-career statisticians. We believe statistical practitioners should embrace and facilitate these goal-setting and partnership conversations to amplify their impact, so we integrated them into Design For Impact.

Some frameworks that exist outside of statistics and data science offer collaboration, communication, and decision scaffolding that we carried into Design For Impact. Two helpful examples are the ICE and SMART goal-setting frameworks (Ellis & Brown, 2017; Doran, 1981). ICE (Impact, Confidence, and Ease) helps teams decide what actions or interventions to pursue by evaluating them for potential impact, the confidence that such impact can be attained, and the ease by which it can be attained. SMART (Specific,

Measurable, Assignable, Realistic, and Time-related) helps teams set effective goals and, particularly, ones that can be measured by some predetermined metric. Other frameworks like PIE (Plan, Implementation, and Evaluation) support the underlying structure that our tool relies on (Laurian et al., 2007) in a way that is similar to $Q_1Q_2Q_3$. Instead of asking statisticians to memorize and weave disparate frameworks into their professional workflow, Design For Impact incorporates elements from all three.

### 1.4. Design For Impact

We hypothesize that statisticians can maximize and communicate the impact of their work by aligning deeply with the domain expert(s) in $Q_1$, intentionally selecting an analysis pathway in $Q_2$, and translating the results to be decision-ready in $Q_3$. Our process model is guided by these three principles: alignment ($Q_1$), intentionality ($Q_2$), and translation ($Q_3$). We operationalize these principles with five artifactual components: Vision, Impact, Partnership, Analysis Pathway, and Narrative – the Design For Impact Tool represents them as five fillable sections (Figure 1). In methods, we will describe more support from the literature for these five components and clarify what kind of information they are each meant to elicit. Figure 1 shows the earlier version of the Design For Impact Tool, initially called the "Designed For Impact Tool," and this was the version shown to our study participants. In many ways, Design For Impact represents a self-contained theory of change (Taplin et al., 2013) for every engagement that it is applied to. It elicits the why, how, and so-what of every data-driven, collaborative effort, and it makes this information common knowledge amongst all team members.

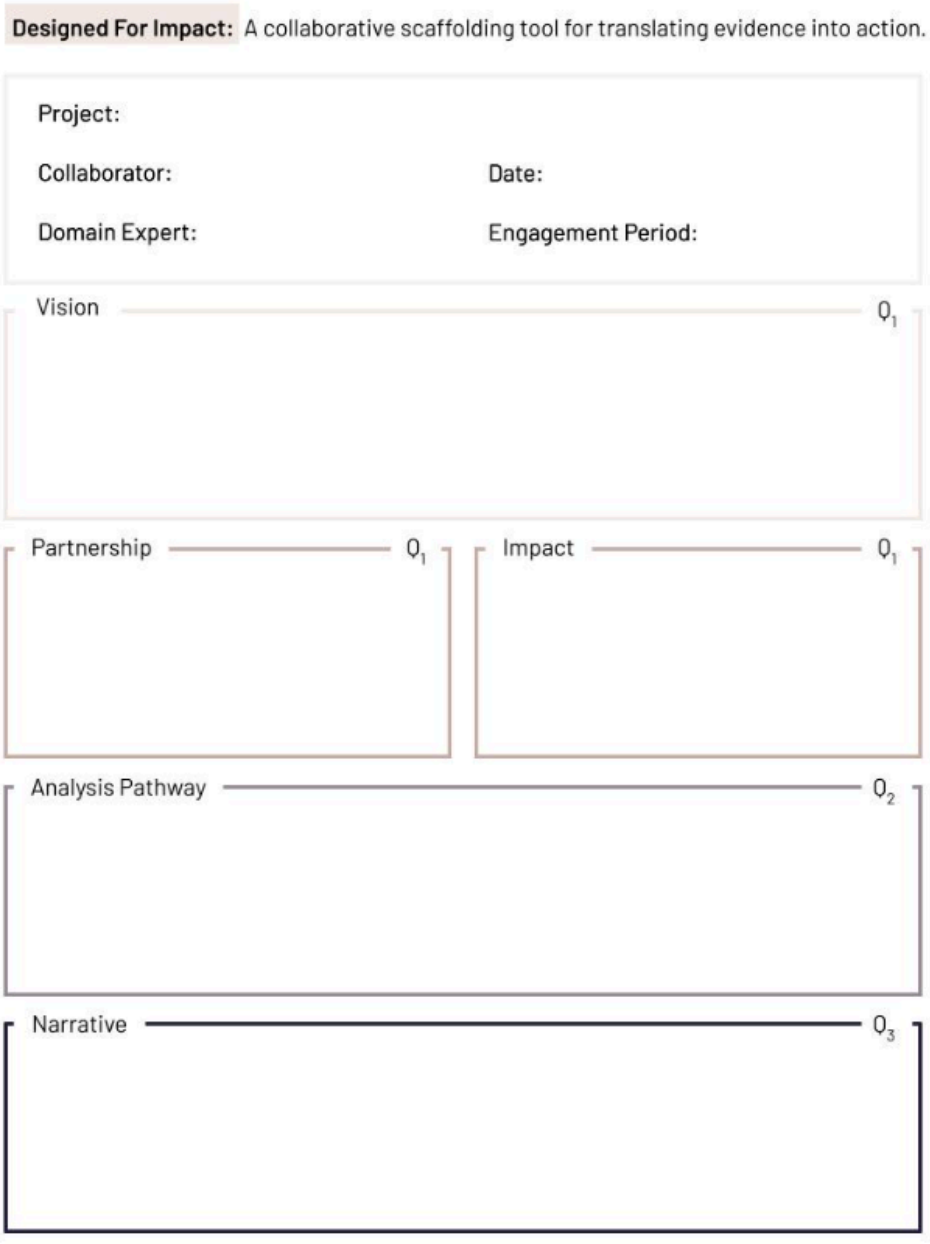



Figure 1. Original blank Designed For Impact Tool presented to study participants.

### 1.5. Constructs of Interest

Our hypothesis that Vision, Impact, Partnership, Analysis Pathway, and Narrative are core tenets of impact-centric statistical collaboration needed to be assessed against a set of constructs. We decided to consult prospective users and measure the extent to which they perceive the artifact as *relevant* (i.e., process model is consistent with real-world, statistical practice), *useful* (i.e., enhances statistical, interdisciplinary collaboration), and *clear* (i.e., understandable by prospective users and ready to integrate into a collaborative workflow). These three constructs serve as the foundation for the surveys and interviews we conducted with prospective users. The most consolidated version of our research question was then: What modifications or additions to the Design For Impact process model, artifact, or implementation guidance would improve its perceived relevance, clarity, or utility?

### 1.6. Objectives

This research intends to (1) motivate the development of a tool that helps statisticians and data scientists maximize and communicate the impact of their interdisciplinary collaborations, (2) propose an impact-centric process model and accompanying artifact as a practical solution, and (3) formatively evaluate the relevance, clarity, and utility of the process model and artifact. We ask questions like: In what ways does the Design For Impact process model reflect the best practices of impactful statistical collaboration? How is the Design For Impact Tool a helpful and intuitive manifestation of these best practices? How can we improve the Design For Impact Tool to accomplish these goals and reduce implementation barriers?

# Chapter 2

# METHODS

## 2.1. Development of the Artifact

The Design For Impact Tool underwent four iterations before it was presented to the study participants. Early versions of the tool were markedly different, placing greater emphasis on the prospective and retrospective evaluation of impact (Appendix A). We were initially interested in quantifying and comparing “potential impact” against “realized impact” to obtain some kind of capitalization metric for each statistical engagement. Although this approach certainly warrants future research, we found that it complicated the tool and was misaligned with our project goals.

Participants were provided with a blank version of the Design For Impact Tool (Figure 1) and an instructional document (i.e., the Implementation Guide) containing a one-line description and 1-3 example prompts for each component of the tool (Figure 2). The next few sections will describe some of the empirical support for each of the five components, but our selection of these components was also driven by our own hypotheses about impact-centric statistical collaboration.

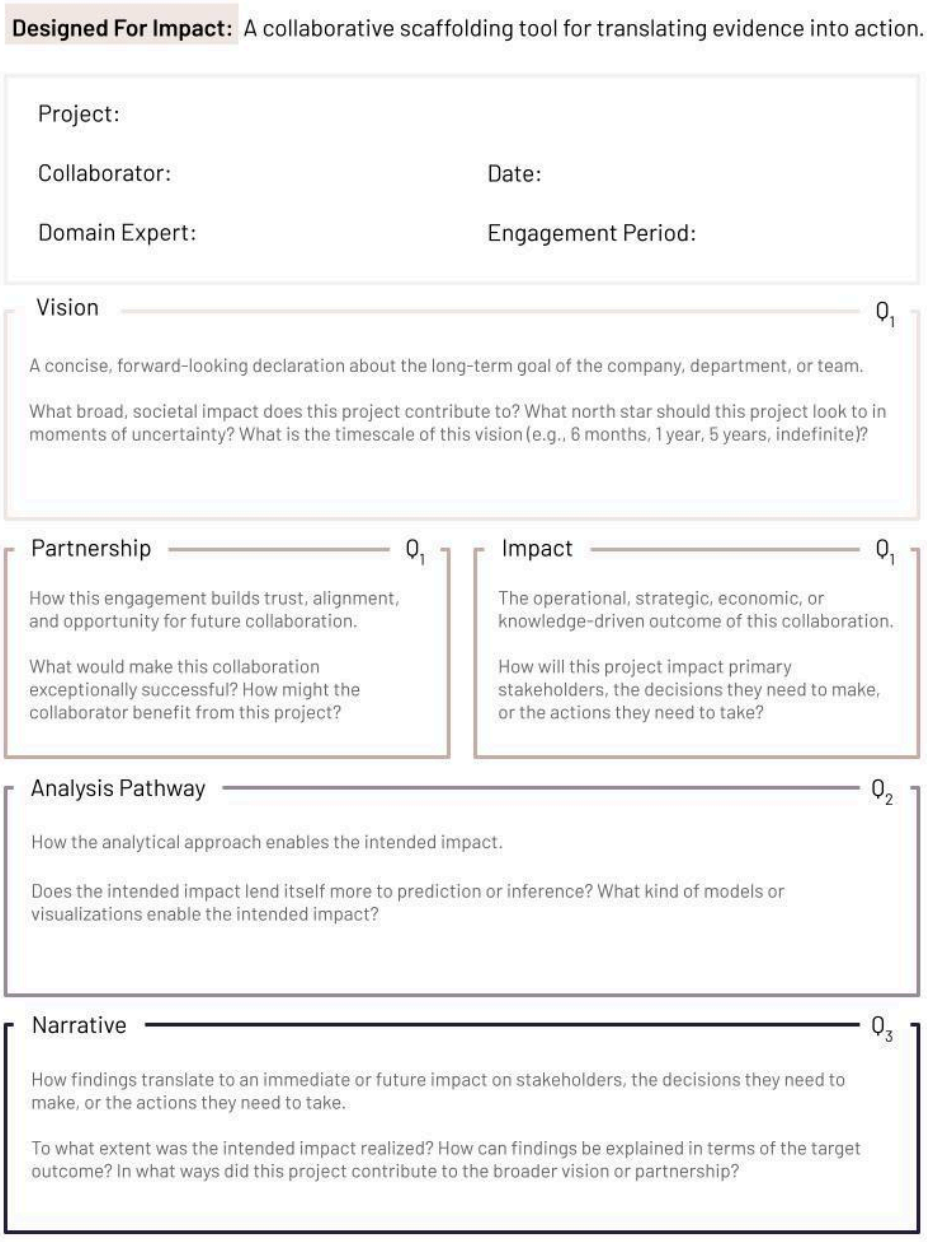



Figure 2. Original Designed For Impact Implementation Guide presented to study participants.

## 2.2. $Q_1$: Vision, Impact, and Partnership

For years, vision and mission statements have proliferated across global enterprise. The literature suggests that having an organizational "North Star" helps leaders gain the support of followers and affects the perception and reputation of companies (Berson et al., 2015; Spear, 2017). While vision statements are more frequently discussed in the C-suite, we believe statistical practitioners could contribute more deeply if they were aware of the broader goals that their projects were positioned in. This might be the predetermined vision of the client's company, division, or academic institution, or it might, instead, be a larger-scale project that the statistical engagement plays a supporting role in.

Consider this scenario: a statistician is commissioned to analyze click-through and conversion on recently deployed digital advertisements. The practitioner could simply deliver this report to the client containing the requested metrics and trends. However, using Design For Impact, this practitioner asks about the key message of the campaign and what purpose it serves for the company. The client says that the Chief Marketing Officer wants customers to know that their widgets are highly durable. These digital advertisements are meant to position the company as a luxury brand with premium products, built with premium materials. Although this level of information is not often discussed among technical team members, it serves several purposes for our statistical practitioner – it sparks a conversation about measuring customer perception *in addition* to quantitative engagement (i.e., click-through and conversion), it builds a relationship with the client through a "great question" (Vance, Trumble et al., 2022), and it tells the statistical practitioner how to deliver a final report that is deeply embedded in the interests of senior leadership. The vision statement in this fictitious example might sound like, "We sell the most premium and durable widgets on the market." Other examples of Vision statements include, "Advance our understanding of the environmental-behavior gap to design better interventions," or

"Prevent any San Diegan from ever going hungry," or "Promote industry-best customer relationships built on timely and personalized technological support." The Vision statement captures the long-term goal that the statistical collaboration seeks to advance. To get closer to attaining their vision, though, a team must first identify some kind of actionable impact.

To maximize impact, we think stakeholders need to be at the forefront of statistical collaboration conversations, and this belief is supported by research in both industry and academia. In public health research, there is a body of work around community-based participatory research: an approach that integrates community stakeholders into the scientific discovery process. In business, researchers like Hristov and Appolloni have investigated the effect of incorporating stakeholders' perspectives into organizational strategy (2021). While it is natural for statisticians to focus on the research question, we also want to normalize discussion about key stakeholders, that is, who we want to impact. Even if the goal of a statistical engagement is to contribute to a body of scientific knowledge, the statistician might consider who the researchers are that will utilize this information and how they will use it (e.g., to recommend treatments, to inform future research, etc.). Ultimately, we want statisticians to name a "who," that goes beyond their immediate collaborator. Having these discussions will help the statistical practitioner choose an Analysis Pathway ($Q_2$) that enables the intended impact ($Q_1$). It will also help them translate their statistical findings into a meaningful and interpretable narrative ($Q_3$). A common mistake that statistical practitioners make is identifying the *client* as being the key stakeholder. This is sometimes the case, but we encourage statisticians to think more broadly.

Reconsider the marketing example: the statistician may be engaged by a member of the marketing team but, using Design For Impact, they elicit information about who needs evidence to make a decision – the answer is the CMO and the decision is how to prepare next quarter's campaign. One might also consider

the *customers* as key stakeholders – they decide whether or not to click the advertisement and buy the widget. This helps us understand why click-through matters and what our analysis will change for the marketing team and for the customer. In this case, the Impact statement might sound like, “Help the CMO allocate ad-spend across customer segments to maximize total conversion.” The Impact component is a helpful place to record a key performance indicator, if applicable, but should ultimately include the relevant stakeholder and an evidence-based decision or action. Knowing who needs information and for what purpose is essential for statisticians who want to be positioned as strategic partners and not calculators. Other examples of Impact statements include, “Food bank director needs a forecast for next month’s demand to decide the necessity of borrowing from partner banks,” or “Customer success representatives need to know where users encounter the greatest service delay to improve retention,” or “Fundraising staff need to know how donors are responding to email messaging to craft next month's request.” More critical information comes when the statistician asks about expectations, roles and responsibilities, and general partnership rules.

The collaboration expectation gap (CEG) describes the goal congruence between collaborative partners (DeCampos et al., 2022). Greater transparency about how partnering firms seek to benefit from collaboration is valuable for attaining desired outcomes (DeCampos et al., 2022). In simple terms, making “what’s in it for me” and “what’s in it for you” common knowledge in a professional collaboration improves team performance. We also believe the statistical practitioner should take interest in exceeding the expectations of the client. The design process (Simon, 1996), often called design thinking, encourages problem-solvers to engage in empathy for the client as the first step to creating an effective solution – this builds context and connection. Asking the client to reflect on what would make the collaboration exceptionally successful helps the statistical practitioner (1) manage

expectations if the client's greatest desires are far from feasible and (2) prioritize their attention to matters that are of particular importance to the client. Partnership conversations also ensure that the statistician is adequately recognized and compensated for their contributions, and this includes time spent on analyses that were not retained as the final solution.

Considering the marketing example, the statistician learned that the CMO intends to use click-through data about the current campaign to inform next quarter's campaign – our analysis only matters, then, if it is delivered prior to the production or launch deadline for the next campaign. Timing is a consequential component of the stakeholder's definition of "success," and Design For Impact facilitates this conversation from the very beginning of the engagement. The Partnership statement for this example could be "Deliver results within two weeks before the next campaign planning cycle begins." Other Partnership examples include, "Team will pursue publication and all collaborators will receive co-authorship," or "Eric will connect Heather with his contact from the grant issuer, and a complete methodology is needed by the end of the month," or "Jett will present the results at next month's board meeting with visualizations that use the company color palette." Partnership is the last component of $Q_1$ which creates robust alignment between collaborators.

### 2.3. Robust Alignment

$Q_1$ conversations should be given enough time and preparation that the statistical practitioner and client achieve shared understanding on the Vision, Impact, and Partnership. This will serve as the team's "basis for action" throughout the project (Vance, Alzen et al., 2022, p. 54). In theory, a physical artifact that is shared between collaborators will improve the congruence of the goals and expectations of each party by clearly and formally disclosing that information. Even as the scope or analysis pathway evolves, $Q_1$

information remains mostly constant, and teams always have their vision statement as a collective North Star.

Ultimately, a key contribution of the Design For Impact Tool is to provide a checklist that helps statistical practitioners get aligned more quickly and more deeply with the client than they would without Design For Impact. Prompting these conversations may come intuitively to some practitioners, but not so much for others, especially those in their early career. Positioning the statistician as less of a number cruncher and more as a strategic partner is described by Vance and Love as "progress[ing] along the path from consulting to collaboration to leadership" (Vance, Alzen et al., 2022, p.54; Love et al., 2017). To us, statistical *consulting* can feel episodic and ephemeral. Statistical *collaboration* feels more sustained and impactful on a collective mission. And statistical *leadership* represents the end-to-end problem-solving process: the statistician orchestrates collection and organization of the data, then decides how it is analyzed and interpreted, and, finally, uses the information to make an evidence-based decision. Connecting the analysis to $Q_1$ information is critical for maximizing impact, and this brings us to $Q_2$.

### 2.4. $Q_2$: Analysis Pathway

We believe the selection of an analysis pathway is an important move for the potential impact of a project, and that conversations about Vision, Impact, and Partnership should inform that decision. The Analysis Pathway component is not meant to contain any results; rather, it prompts the statistician to consider how their analytical approach will enable the intended impact identified in $Q_1$ and how the values, needs, and preferences of the client shape the way that the statistician will approach the analysis. We find that, in some cases, one highly effective data visualization is a sufficient client deliverable. Sometimes the client seeks to understand relationships between variables and, other times,

they only wish to maximize or minimize a particular metric. Clients may intuit these preferences without using the terms inference or prediction. It remains the statistician's responsibility to conduct an analysis that is relevant and appropriate in complexity, and this step in Design For Impact is meant to elicit that information.

The Design For Impact Tool encourages the statistician to be more intentional about the nature and delivery of analysis. We selected the term "Analysis Pathway" since consultative engagements often involve several dead-ending paths. Early in the engagement, we may decide with the client to pursue one Analysis Pathway but realize later, due to insufficient resources, a change in scope, or lack of statistical significance, that another investigation will be necessary. The Design For Impact Tool helps document that process, making the statistician's effort evident, even when the final analysis reflects a narrow view of the full scope of work.

In the marketing example, the statistician might decide to fit a logistic model for each advertisement and estimate the likelihood of conversion across regional customer segments. They selected this analytical approach because the CMO may decide to change the targeted demographic parameters for next quarter's campaign based on this information. The statistical practitioner shared this proposed Analysis Pathway with their colleague from marketing, and they agreed that it was aligned with the CMO's goals. Perhaps, the statistical practitioner produces a logistic curve, with predictions colored by customer segment, visually displaying which segments have higher conversion probabilities. This visualization is, then, optimized for the key stakeholder and their evidence-based decision. The Analysis Pathway might then sound like, "Fit logistic models that predict conversion by customer demo, and generate two logistic curves colored by customer demo to inform ad-spend allocations." Other Analysis Pathway examples include, "Build a relational database to connect food supply and demand data to support deficit

projections," or "Test two donation messages with comparable groups of website visitors then compare donation rates and amounts to decide next message," or "Visualize customer experience surveys with diverging bar charts to identify key pain points that the software team can address." Once the statistical practitioner has executed the planned analysis, they will need to distill their findings and consider their audience before disseminating. This step is supported by $Q_3$ on the Design For Impact Tool.

### 2.5. $Q_3$: Narrative

We believe one of the central roles of a statistician on an interdisciplinary team is to translate data-derived insight into something interpretable for their audience. This is among the final steps to achieving impact as a statistical practitioner. There has been much greater attention in recent years to the idea of storytelling with data (e.g., Knaflic, 2015). Ren et al. assert that "storytelling will make data more engaging and memorable… [and] offers an equal chance for everyone to gain insights from the data because of its effective information-transmission abilities" (2023, p. 2). The practitioner bears the responsibility of curating their message in a way that is both empirically accurate and relevant to the client. In fact, the practitioner may write three to four narrative statements for the same analysis, each curated to a different viewer and their decision or action. This invites more nuance: the Narrative could be prescriptive and predictive (e.g., "We recommend allocating 45% of total ad spend on the west coast demographic and predict a 4 percentage point increase in overall conversion"), the Narrative could be descriptive (e.g., "We identified the west coast demographic as having 3.2 times higher odds of conversion compared to the east coast demographic"), the Narrative could also be retroactive and relate to the statistician's value-add (e.g., "We identified a customer demographic with higher odds of conversion, the CMO shifted ad-spend, and this resulted in $86,000 in additional revenue"). The exact nature of the Narrative will depend on the project context, but can generally be constructed with

knowledge of the stakeholder and Impact that was identified in $Q_1$ and the audience of that particular Narrative statement. This completes our fictitious marketing example, and the complete work-through can be seen in Figure 3. We also included a fully worked example for a fictitious project in academia so that readers can discern how the contents of each component may vary depending on the working environment (Figure 4). Later, we argue that Design For Impact remains relevant and adaptable across most subdomains of statistics and data science.

To address a couple caveats, the Narrative should not overstate confidence – it should be firmly grounded in the strength of evidence and generalizability of the analysis. Additionally, the statistical practitioner still had impact if their evidence led to a decision but not an action. Inaction on behalf of the stakeholder is still a choice that the statistician informed, and that choice, perhaps, will lead to other evidence-based decisions or a strategic hold-out. With a fully constructed Design For Impact Tool and each of the five components explained, we will now discuss the study design.

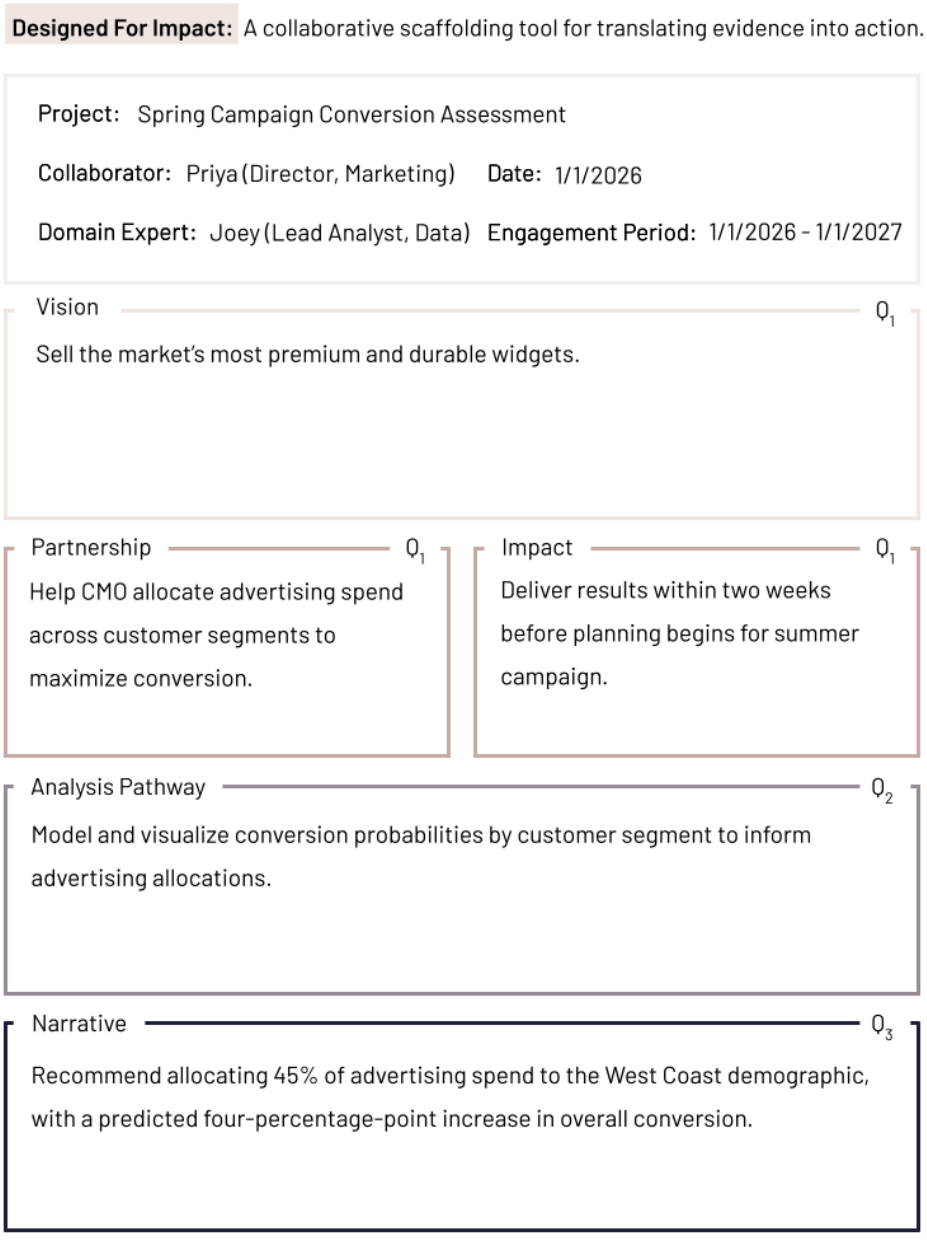



Figure 3. Full industry example using original Designed For Impact Tool.

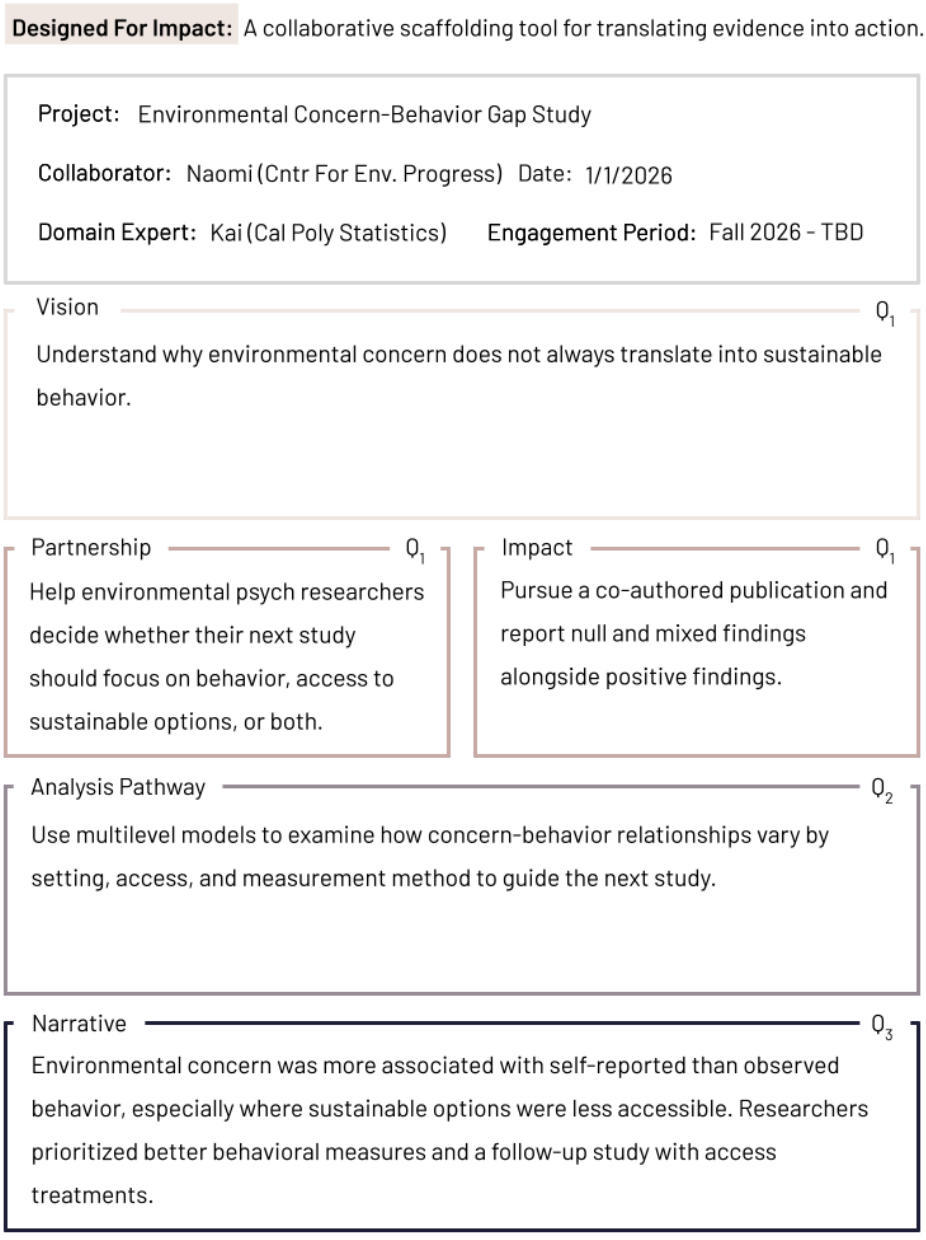



Figure 4. Full academia example using original Designed For Impact Tool.

## 2.6. Study Design

Since the design process (Markus et al., 2002) encourages consultation from stakeholders, our first step was to determine which groups would provide feedback on the artifact. A primary purpose of this work was to develop a model that captured the core tenets of impact-centric statistical consulting, and a secondary purpose was to develop an artifact that operationalizes the model. With this in mind, we decided that students and practitioners would serve as the target audience for this research. Students and practitioners from academia would help us understand the clarity and pedagogical value of Design For Impact. Practitioners from both industry and academia are best positioned to give feedback on relevance, and both groups (i.e., students and practitioners) could speak directly to general, perceived utility. Thus, we carried out a mixed-methods, formative assessment with these groups to assess the relevance, clarity, and utility of the Design For Impact process model and tool. Their qualitative feedback was the primary medium for motivating revisions to the model or tool, and Likert items helped us contextualize and triangulate themes from the open-ended feedback.

## 2.7. Participants

The students who participated in this research were actively enrolled in project-based statistical collaboration courses. Of the 44 students across two classes and two institutions (i.e., California Polytechnic State University, San Luis Obispo (Cal Poly), and University of Colorado Boulder), 39 agreed to participate. Only Cal Poly students (n = 30) were assigned a new client following a lecture about Design For Impact and were, therefore, the only students administered an adoption post-survey. The students at University of Colorado Boulder did not engage with a new client following their Design For Impact lecture and were not administered this survey. Both classes used a similar curriculum and

consisted of mostly senior undergraduates or graduate students, though demographic information was not collected for students.

We identified two practitioners from our professional networks to pilot the study materials. One was administered a practitioner survey for which the data were excluded from analysis, and the other provided unguided, general feedback on the Design For Impact Tool. We made minor adjustments to the survey and tool prior to moving forward with the full practitioner interviews. We compiled a roster of 40 practitioners, also from our professional networks. All practitioners had a background in statistics, interdisciplinary collaboration, or both.

### 2.8. Instruments and Procedures

There were three survey instruments used in this study. The first was a brief pre-survey administered to all participating students (n = 39). The second was a brief post-survey, completed by a majority subset of the participating students (i.e., Cal Poly only; n = 30). The third was a longer-form survey and script, administered as a semi-structured, computer-aided personal interview (CAPI) to all participating practitioners (n = 20). We wrote each survey to contain questions about participants' perceived relevance, clarity, utility, and intended adoption of the artifact. Both students and practitioners were prompted with open-ended questions about perceived strengths, weaknesses, and suggestions to improve the tool (Appendix B, Appendix C, Appendix D).

Preceding the pre-survey, we delivered a 45-minute lecture to students about impact-centric collaboration and the Design For Impact Tool. This presentation was meant to briefly motivate the development of the tool, show its foundation in ASCCR and $Q_1Q_2Q_3$, and instruct students how to use the tool. Following the lecture, students were invited to participate in the online, anonymous survey. They

were allotted 10-15 minutes of class time but were not required to participate and did not receive an incentive for participating. Students from Cal Poly were invited to take the post-survey four weeks after the lecture and were also allotted class time. The post-survey asked students about the extent to which they voluntarily applied the tool in their latest client engagement and why.

For the practitioners, we conducted one-on-one, 30-minute, recorded interviews on Zoom, administering the online survey. Each practitioner was provided with the tool and informational resources beforehand (i.e., the Implementation Guide and an informational website). We also offered a brief, verbal overview of the tool to the practitioners prior to beginning the survey. Practitioners did not receive an incentive for participating. Prior to the interview, some practitioners applied the tool to an active or recent statistical engagement, but most reported drawing on their experience more broadly when responding to the prompts. The interviewer occasionally asked clarifying or follow-up questions on the practitioners' verbal responses, and some interviews marginally exceeded 30 minutes.

This research was approved by the Institutional Review Boards of California Polytechnic State University, San Luis Obispo (2026-081-CP), and University of Colorado Boulder (26-0160). The data we collected concern human subjects and will therefore remain protected and publicly unavailable.

### 2.9. Data Preparation

To prepare the data for analysis, we combined the student survey data from both institutions (i.e., manually with Excel) and generated transcripts of the practitioner interviews (i.e., with automated software in the Microsoft 365 video player). While reviewing the recorded interviews, we manually disaggregated the practitioners' transcripts into excerpts. We kept multiple sentences that were within the same line of reasoning together to maintain interpretability. That is, some excerpts consisted of 1-2

sentences while others were 5-6 sentences or greater. We then used R (R Core Team, 2026) to parse the practitioner excerpts from a word processor format to CSV and built a practitioner corpus, where each row represented one excerpt, then underwent a similar process to generate a student corpus. Since the students were not interviewed, their excerpts consisted only of their typed responses to the open-ended questions from the pre- and post-surveys. We then used R to combine the student and practitioner corpora into a general corpus to use for coding. Data preparation and visualization were conducted in R (R Core Team, 2026), and some code was written or debugged by GPT-5.3-Codex or GPT-5.6-Sol. The R code used to clean the data and generate the figures in this paper can be accessed at the linked repository [https://github.com/jettpalmer/design-for-impact-thesis-code].

### 2.10. Qualitative Analysis

We began by drafting an a priori analysis pathway memo, containing the general qualitative approach that would be used to analyze the data collected in this study (Appendix E). We then reviewed all student and practitioner excerpts and annotated them with descriptive impressions and keywords. We synthesized these observations in analytic memos (Appendix F, Appendix G) and grouped similar annotations into preliminary codes. We developed a codebook with explicit inclusion criteria for each code and applied it to the general corpus, adding additional codes when we encountered excerpts that did not fit cleanly into the existing criteria. The initial codebook contained 14 codes, and the final codebook contained 17 (Table 1). We assigned each excerpt at least one qualitative code; excerpts that reflected two codes were assigned primary and secondary codes. Since this analysis was conducted by one researcher, interrater reliability was not assessed. Since we had video recordings for only the practitioners, we conducted the coding process in Excel, tagging each excerpt in a Code column, as opposed to using a video-based qualitative coding software (e.g., NVivo). Codes were used to query

excerpts and generate broader themes rather than to quantify and compare frequencies. Our focus on patterned meaning rather than frequency was consistent with a thematic approach as opposed to a content analysis in qualitative methodology (Vaismoradi et al., 2013).

Table 1. Qualitative codebook and criteria used to classify participant excerpts. Note: Codes marked with an asterisk were added during the coding process.

| **Code** | **Criteria (i.e., apply when excerpt discusses...)** |
|---|---|
| Structure and Scaffolding | Organizing thoughts, providing a clear sequence, breaking down a project, serving as a checklist, or preventing important considerations from being overlooked. |
| Alignment and Expectations | Establishing shared goals, clarifying what the domain expert wants, defining responsibilities, setting expectations, building trust, or ensuring collaborators are “on the same page.” |
| Impact Orientation | Centering stakeholders, decisions, actions, outcomes, broader goals, real-world relevance, or the “so what?” |
| Translation and Narrative | Communicating technical work accessibly, tailoring outputs to an audience, storytelling, visualization, narrative statements, or connecting findings to domain meaning. |
| Collaborator Role and Value | Positioning the statistician as a partner, advisor, leader, or team member rather than a number-cruncher; recognition, authorship, or articulation of the statistician’s value-add. |
| Documentation, Accountability, and Reflection | Recording agreements, maintaining project memory, managing scope, documenting effort or impact, checking whether goals were achieved, or supporting retrospective reflection. |
| Pedagogical Value | Teaching students or early-career practitioners, reducing the learning curve, making implicit consulting knowledge visible, or supporting novice development. |
| Formalization vs Redundancy | The tool formalizes practices the respondent already performs, captures professional instincts, adds little new content, or may become unnecessary after the process is internalized. |

| Code | Criteria (i.e., apply when excerpt discusses...) |
|---|---|
| Component Clarity | Confusion about the meaning or boundaries of Vision, Impact, Partnership, Analysis Pathway, or Narrative; overlapping concepts; unclear terminology; uncertainty about stakeholders or expected content. |
| Implementation Clarity | Uncertainty about when, how, by whom, or with whom the tool should be completed; whether it is an intake form, worksheet, mental model, or living document; requests for worked examples. |
| Flexibility and Iteration | Revising the tool, returning to earlier decisions, project pivots, re-scoping, changing goals, off-ramps, check-ins, cyclical work, version history, or concerns that the framework is too linear. |
| Applicability | Whether the tool fits particular industries, academic versus industry work, short versus long engagements, dyads versus teams, embedded versus one-off work, or simple versus complex projects. |
| Feasibility and Burden | Time constraints, extra work, administrative friction, paperwork, lack of opportunity, group logistics, or insufficient benefit relative to the effort required. |
| Adoption Mode and Intent | Full use, partial use, use as a mental model, selective use of concepts, integration into another framework, intention to use, reluctance, forgetting, or abandonment. |
| General Clarity* | The tool, process model, instructions, presentation, or individual components being clear, understandable, straightforward, or easy to follow. |
| Concision* | The tool being brief, simple, compact, concise, easy to start using, or requiring little initial effort to understand or adopt. |
| Feature Request* | A proposed addition, removal, reorganization, wording change, format change, or new functionality for the tool. |

### 2.11. Quantitative Analysis

We summarized responses to each Likert item as counts across the ordered response categories, and did not calculate any scores or averages. We supported qualitative findings by displaying relevant Likert distributions as diverging bar charts. We used these data to assess the strength of agreement with individual statements about perceived relevance, clarity, and utility, and to identify where response patterns may complicate themes from participants' open-ended feedback. For example, two items might draw broad agreement (i.e., slightly agree, agree, or strongly agree across all participants) while reflecting different signal strength (i.e., the proportion of respondents who strongly agreed) – this helps us capture information about aggregate sentiment which might not have otherwise emerged in the qualitative themes. The qualitative analysis, however, remained the primary basis for interpreting feedback and revising the model and tool.

Chapter 3

# RESULTS

## 3.1. Data Overview

Most students elected to participate in the study (n = 39/44), and half of the practitioners from the initial roster either did not respond or declined to participate (n = 20/40) (Table 2). Our practitioner sample was predominantly academic (14/20) and highly experienced, with 12/20 reporting more than 20 years of experience in interdisciplinary collaboration (Table 3). The general corpus contained 359 rows, composed of either transcribed excerpts from the practitioner interviews or typed comments from the student surveys. Combining the student and practitioner excerpts into one corpus allowed us to code the data efficiently and prepare for thematic analysis.

Table 2. Recruitment and participation rates by participant group.

| **Participant Group** | **Contacted** | **Participated** | **Participation Rate** |
|---|---|---|---|
| Cal Poly Students | 35 | 30 | 85.7% |
| CU Boulder Students | 9 | 9 | 100.0% |
| **All Students** | **44** | **39** | **88.6%** |
| Practitioners | 40 | 20 | 50.0% |

Table 3. Practitioner characteristics by professional setting and years of interdisciplinary collaboration experience.

| Variable | Category | Number of Practitioners | Percentage of Sample |
|---|---|---|---|
| Primary Professional Setting | Academia | 14 | 70.0% |
| | Industry | 4 | 20.0% |
| | Hybrid/Joint Appointment | 2 | 10.0% |
| Years of Experience | 0-5 | 3 | 15.0% |
| | 6-10 | 4 | 20.0% |
| | 11-20 | 1 | 5.0% |
| | 20+ | 12 | 60.0% |

### 3.2. Themes

To translate this feedback into revisions for the process model and tool, we grouped the 17 codes into broader themes. The codes do not necessarily belong to a single theme, nor are the themes mutually exclusive and collectively exhaustive. The themes we identified (Table 4) will be discussed more extensively later, but the grouping was mainly characteristic of whether the code was generally positive, negative, or mixed, and whether the code was referencing the process model, artifact, or our delivery of the materials (e.g., instructional materials). For example, if the code captured negative feedback about the clarity of the Analysis Pathway construct, this might corroborate a broader theme about implementation clarity as a key barrier and prompt a revision to the Analysis Pathway construct or how we present it. The actual themes are more nuanced than what we describe in this particular example, but this illustrates the empirical lineage of the changes we made to the Design For Impact process model and tool. Excerpts coded as a “Feature Request” were considered in the revision process but were not

assigned to a particular theme. Table 5 illustrates this process that started with a participant excerpt and ended with a functional implication to our model, tool, or supplementary materials. As we discuss the themes in the following sections, some practitioner Likert items are shown visually or included in-text. A summary of student Likert items can be found in Appendix H.

Table 4. Qualitative themes, descriptions, and corresponding codes. Note: Codes may correspond to more than one theme; themes are not mutually exclusive or collectively exhaustive.

| **Theme** | **Brief Description** | **Relevant Codes** |
|---|---|---|
| The model provides helpful structure for impact-centric collaboration. | Organizing collaborative work around shared goals and expectations, real-world relevance, accessible communication, and a clear understanding of the statistical collaborator's role and value. | Structure and Scaffolding; Alignment and Expectations; Impact Orientation; Translation and Narrative; Collaborator Role and Value. |
| The tool formalizes valuable practice. | Making collaborative practices visible and repeatable through documentation, accountability, and reflection; supporting novice development while capturing experienced practitioners' existing professional instincts. | Documentation, Accountability, and Reflection; Pedagogical Value; Formalization vs Redundancy; General Clarity; Concision. |
| The tool requires clearer implementation guidance. | Uncertainty about the meaning and boundaries of core constructs and about when, how, by whom, or with whom the tool should be completed; requests for clearer examples. | Component Clarity; Implementation Clarity. |
| Extent of adoption is mediated by collaboration characteristics. | Differences in full, partial, selective, integrated, or intended use based on the tool's fit across working contexts, flexibility over time, and burden relative to expected value. | Flexibility and Iteration; Applicability; Feasibility and Burden; Adoption Mode and Intent. |

Table 5. Illustrative analytic lineage from participant excerpts to Design For Impact revisions.

| Participant Excerpt | Annotation | Code | Theme | Resulting Revision |
|---|---|---|---|---|
| "I was a little confused about identifying stakeholders beyond the [domain expert]." | Confused; stakeholders; impact component | Component Clarity; Implementation Clarity | The tool requires clearer implementation guidance. | Update the Implementation Guide to more effectively guide the user at identifying stakeholders. |

### 3.3. Finding 1: The Model Provides Helpful Structure For Impact-Centric Collaboration

Students found the Design For Impact Tool helpful for organizing their thoughts and breaking down a complex project into more actionable, statistical steps. One student described it as providing "clear, organized structure for [understanding] the project's arc." This structure helped students think through an appropriate Analysis Pathway and prepare deliverables or client presentations. Both students and practitioners described the tool as being similar to a checklist. Suppose the Design For Impact process model captures the core tenets of impactful statistical collaboration. Then, having those ideas aggregated in one place helps ensure that they are not overlooked during the course of a statistical engagement. This interpretation was reflected in the close-ended responses: 19 of 20 practitioners agreed (i.e., slightly agree, agree, or strongly agree) that the "Design For Impact Tool prompts discussions that might otherwise be overlooked in typical consulting engagements" (Figure 5). One practitioner with over 20 years of experience made this comparison explicitly: "I think the structure is what's most helpful – it's kind of like a checklist. Having something to refer back to helps ensure you aren't leaving out any critical steps."

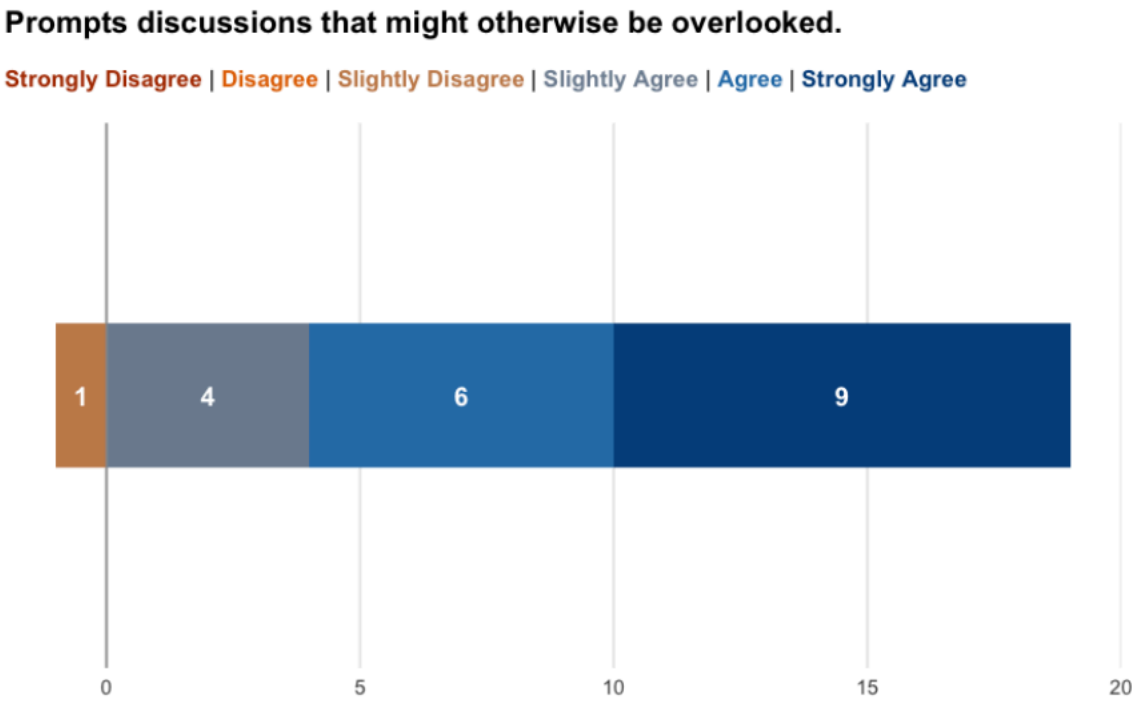



Figure 5. Practitioner responses regarding whether the Design For Impact Tool prompts discussions that might otherwise be overlooked in typical consulting engagements.

We saw a high degree of receptivity toward our focus on broad project context, stakeholders, and decision-making. Students and practitioners expressed interest in learning a new domain deeply through a better understanding of the "why" (i.e., Vision), the "who" (i.e., key stakeholders), and the "what" (i.e., the decisions those stakeholders need to make). These ideas seemed to connect statisticians more closely to the purpose of the collaboration. As one student explained, "clearly establishing things like Vision and Partnership ensure you are actually making an important contribution to the project and that your analysis choices align with the [domain expert's] broader goals." Although much of this information is gathered at the beginning of a collaboration, participants recognized its relevance throughout the project lifecycle, especially when communicating results. One practitioner described this as "one of the

biggest learning [opportunities] for statisticians," noting that the tool could help practitioners "start out the project thinking from the [stakeholder] perspective, [allowing them to] look back and describe findings in that context." Partnership conversations about each party's expectations, needs, constraints, and incentives further support goal congruence between statisticians and domain experts. Several practitioners thought these conversations positioned statisticians as truer partners rather than mere number crunchers. In discussing the Partnership component, one emphasized that the statistician is not "just a p-value generator" but "part of the team," and they should be treated accordingly. Other excerpts related to the perceived relevance of the process model are included in Table 6. Similarly, 19 of 20 practitioners agreed on some level (i.e., slightly agree, agree, or strongly agree) that using a formal impact evaluation tool strengthens statisticians' roles as collaborators and advisors (Figure 6).

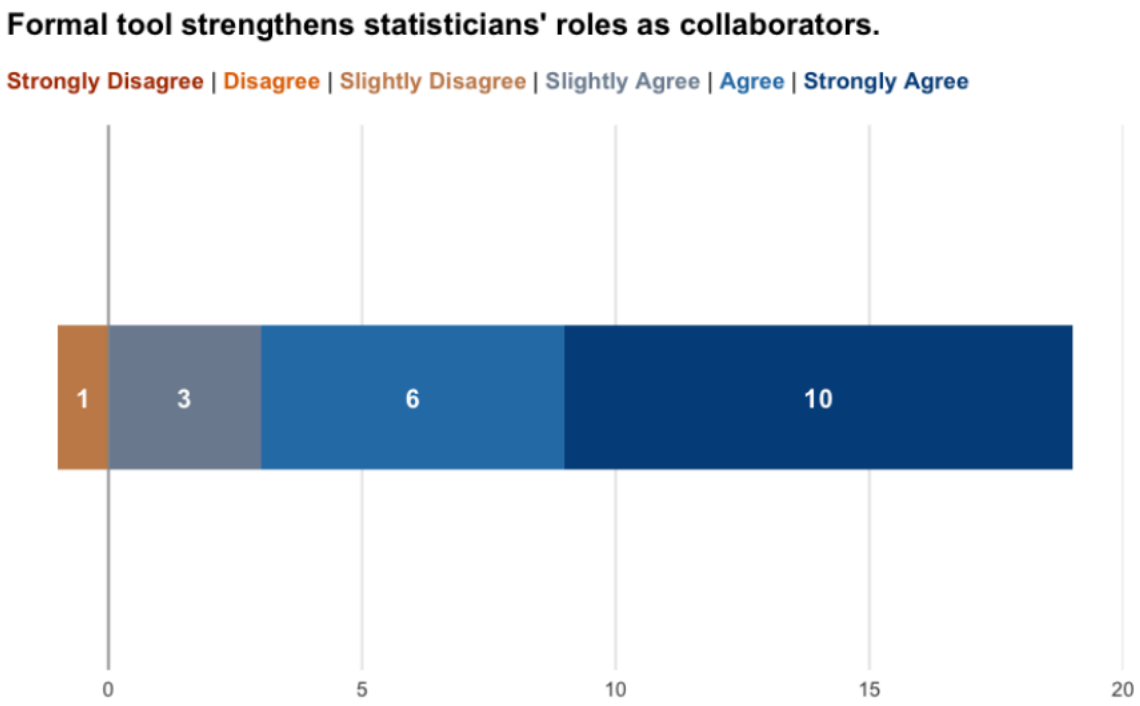



Figure 6. Practitioner responses regarding whether a formal impact evaluation tool strengthens statisticians' roles as collaborators and advisors.

Table 6. Selected participant excerpts illustrating the structural and impact-oriented value of Design For Impact. Note: Some excerpts are lightly edited for readability.

| **Participant** | **Excerpt** |
|---|---|
| Student | "I think it gives me a clear, organized structure for [understanding] the project's arc." |
| Student | "Clearly establishing things like Vision and Partnership ensure you are actually making an important contribution to the project and that your analysis choices align with the [domain expert's] broader goals." |
| Practitioner | "I think the structure is what's most helpful – it's kind of like a checklist.… Having something to refer back to helps ensure you aren't leaving out any critical steps." |
| Practitioner | "One of the biggest learning [opportunities] for statisticians is being able to translate statistical methods into real-world impact or domain-specific impact... This helps statisticians start out the project thinking from the [stakeholder] perspective, [allowing them to] look back and describe findings in that context." |

| Participant | Excerpt |
|---|---|
| Practitioner | “This document outlines the fact that the statistician [is] not just the p-value generator; they’re part of the team, and they should be treated as such.… A statistician is a collaborator, not just a service [provider] for the project.” |
| Practitioner | “Really thinking through these questions together with the client is valuable. And I think the togetherness is really important – involving the client and emphasizing the collaboration aspect. It’s not just that we are helping and consulting; now we are collaborating.” |

### 3.4. Finding 2: The Tool Formalizes Valuable Practice

Practitioners consistently agreed that the Design For Impact process model and tool reflected the best practices in statistical consulting and collaboration. Many described Design For Impact as a formalization of instincts they had developed through years of experience. One practitioner explained this belief: “These [ideas] unfold naturally in good collaboration” and the tool is “a way of formalizing [them].” Another practitioner made a similar comment: that much of effective consulting practice is learned over time and Design For Impact allows novices to “borrow from known experience rather than learn it from [the ground up].” For many practitioners, this formalization made the Design For Impact Tool especially valuable as a pedagogical aid for students and junior team members. Participants frequently cited the conciseness and general clarity of the tool as strengths for teaching and learning. For example, when discussing teaching applications, one practitioner noted that experienced consultants may already address the five components of Design For Impact implicitly, but that the tool “pulls out the key [ideas]... communicat[ing] a lot of information pretty quickly and concisely.” The close-ended responses reinforced both interpretations. 19 of 20 practitioners agreed that the Design For Impact Tool aligns with how impact naturally unfolds in consulting projects (Figure 7), and all 20 agreed on some level (i.e., slightly

agree, agree, or strongly agree) that they would consider using it to teach students or junior consultants (Figure 8).

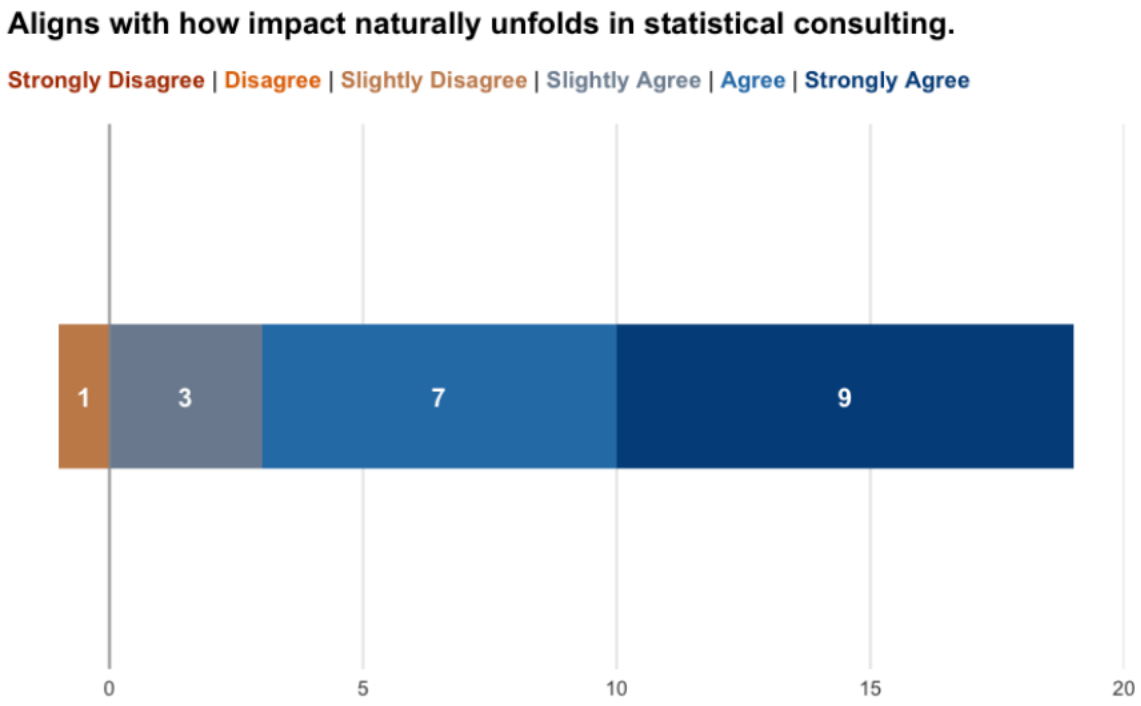



Figure 7. Practitioner responses regarding whether Design For Impact aligns with how impact naturally unfolds in statistical consulting.

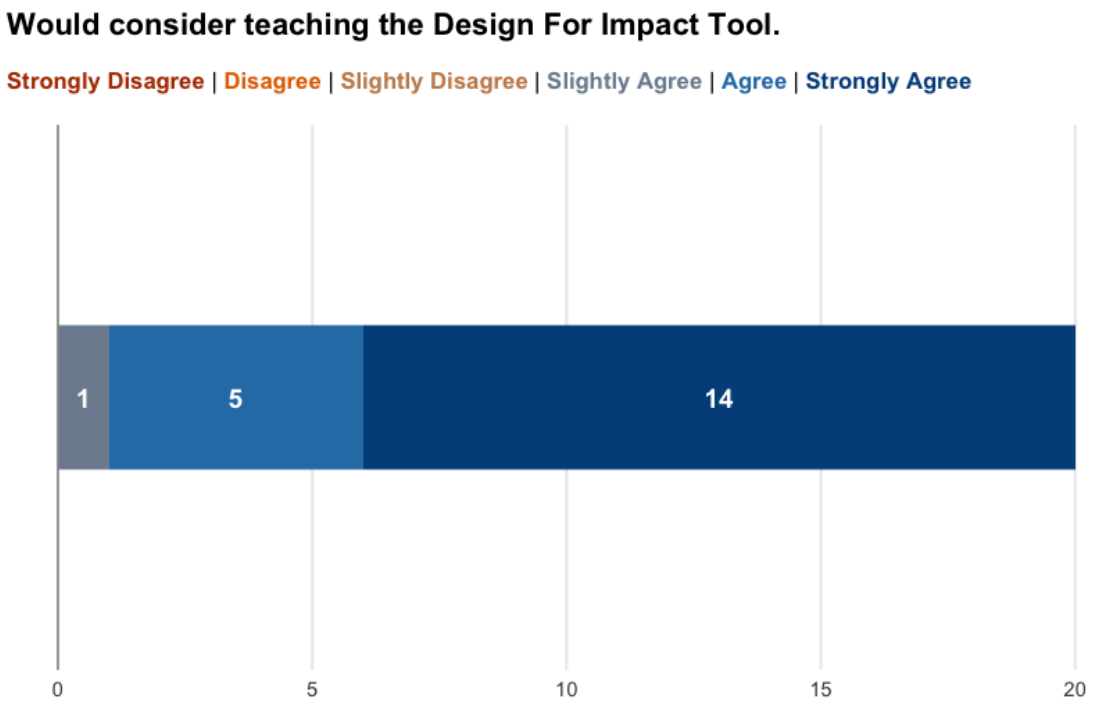



Figure 8. Practitioner responses regarding willingness to use the Design For Impact Tool to teach students or junior consultants.

For some experienced practitioners, the contents of the Design For Impact Tool were already embedded in their statistical practice. Our model formalizes, rather than replaces, existing practice, and several participants characterized the value-add as being the aggregation of these ideas, not so much the components being novel themselves. Responses were mixed when we asked practitioners whether the tool contained new ideas that they intended to integrate into their workflow: 14 of 20 agreed (i.e., slightly agree, agree, or strongly agree), while six disagreed (i.e., slightly disagree, disagree, or strongly disagree) (Figure 9). Some worried that the artifact would introduce unnecessary administrative burden while others found documentation to be a strength, noting that the tool could "solidify what [the statistician and client] have spoken about that you don't normally record in a face-to-face meeting." The

tool provides “something to return to if disagreements arise and would help statisticians track the impact of their work.” These remarks and others that speak to the functional utility of the Design For Impact Tool are included in Table 7. Other practitioners emphasized that a physical record is especially helpful when the scope of a project changes. Thus, even when the model lacked perceived novelty to seasoned practitioners, formalizing these practices in a shared artifact introduced potential benefits for accountability, scope management, and project reflection.

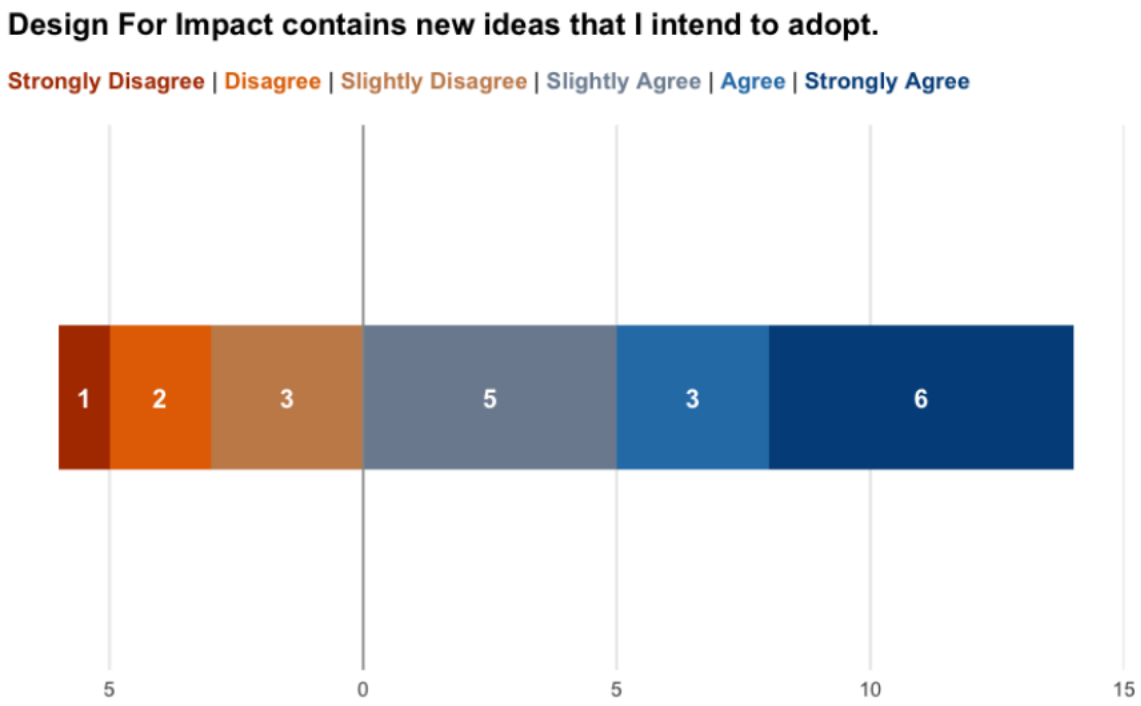



Figure 9. Practitioner responses regarding whether Design For Impact contains new ideas they intend to adopt.

Interestingly, some practitioners who disagreed that the tool prompted otherwise overlooked discussions or introduced new ideas still agreed that they would consider using the Design For Impact Tool to teach students or junior consultants. This suggests that experienced practitioners may already

incorporate the principles of Design For Impact into their workflow but still recognize the value of formalizing those principles for less experienced statisticians.

Table 7. Selected participant excerpts illustrating how Design For Impact formalizes valuable collaborative practices. Note: Some excerpts are lightly edited for readability.

| **Participant** | **Excerpt** |
|---|---|
| Practitioner | “It’s actually pretty consistent with things that I do already... The basic pieces are there for sure. I think it’s pretty consistent with the kinds of things that have helped make me successful.” |
| Practitioner | “These [ideas] unfold naturally in a good collaboration, and it’s just a way of formalizing [them], which I think is good... For undergraduates who are new to this, formalizing these things is a good thing.” |
| Practitioner | “A lot of [consulting practice] you build over time... This helps formalize it. [It’s good] if you can borrow from known experiences rather than learn it [from the ground up].” |
| Practitioner | “It can be really useful for teaching, particularly for my consulting students... It communicates a lot of information pretty quickly and concisely.” |
| Practitioner | “It’s a structured way of doing something that some people might be doing naturally already, but others might not be – and for [those people], that structure might be more beneficial.” |
| Practitioner | “[The tool] helps to solidify what [you and the domain expert] have spoken about that you normally don’t record in a face-to-face meeting.” |
| Practitioner | “Overall, it is helpful, but it could be a burden – not exactly a burden, but extra work that people may not really see as beneficial.” |

### 3.5. Finding 3: The Tool Requires Clearer Implementation Guidance

Practitioners requested substantially more guidance on how to implement the Design For Impact Tool throughout the lifecycle of a project – that is, when to introduce it, when to return to it, and how to revise it as the scope of a project shifts. One practitioner captured this concern directly: “I’m not sure how I would fill it out… I would need to see a few examples of it for the lifetime of a project.” Another

practitioner wondered “at what stage” the tool should be introduced and “at what point it would be good to bring it back into the picture.” Students also sought greater clarity, although their feedback more often concerned the content of the components than how to embed the tool into an established workflow. Students were most uncertain about “identifying stakeholders beyond the [domain expert],” what belonged in the Analysis Pathway component, and how broad or specific the Narrative component should be. Both students and practitioners consistently asked for more concrete examples. One student wrote, “I would love to see a full example,” including an example of a “great” Narrative, while another wanted examples of how the tool would be implemented in an initial meeting with a domain expert. Practitioners made comparable requests for worked examples and case studies that demonstrate how the artifact evolves alongside a project over time. This feedback is consistent with the idea that “learning occurs as novices observe [the] application of tools and practices by more expert members of the community and then are supported to independently apply the same tools and practice” (Alzen et al., 2026, p. 307). Notably, these requests were more nuanced than a general lack of comprehension. All 20 practitioners agreed to some degree (i.e., slightly agree, agree, or strongly agree) that the overall purpose of the tool was clear, and all 39 students agreed on some level that they understood how to use the tool. The open-ended responses, though, reflect the aforementioned implementation uncertainty.

This finding was especially consequential for our build-evaluate-revise loop because it represented the largest concentration of constructive feedback we received, while also pointing toward improvements in how we *present* and *deliver* Design For Impact as opposed to changing the process model or artifact themselves. One practitioner suggested our documentation be thoroughly expanded while noting that the physical artifact addressed the critical ideas. Accordingly, the next iteration should provide more worked examples, more thoughtful guidance for identifying stakeholders, and greater clarity on how to

connect that information to the $Q_2$ and $Q_3$ components. Open-ended feedback about implementation clarity, including and in supplement to those referenced in this section, are included in Table 8.

Table 8. Selected participant excerpts illustrating the need for clearer implementation guidance. Note: Some excerpts are lightly edited for readability.

| **Participant** | **Excerpt** |
|---|---|
| Student | "I would have loved to see a full example... Seeing a 'great' final Narrative would have been helpful." |
| Student | "I liked the section about different ways of adopting [Design For Impact], but I think I would benefit from examples of how this tool would be implemented in an initial meeting with a [domain expert]." |
| Student | "I was a little confused about identifying stakeholders beyond the [domain expert]." |
| Student | "The Analysis Pathway is the only box that is a bit unclear to me. I'm unsure what to write and how technical to be." |
| Student | "The Narrative aspect toward the end was the most confusing. I'm confused about how broad or how specific this one- to two-sentence Narrative should be." |
| Practitioner | "I'm not sure how I would fill it out – when I would fill it out, [or] the timing of it. I'm guessing that it would be some kind of living document... I would need to see a few examples of it for the lifetime of a project: how it was used and how it was filled out." |
| Practitioner | "At what stage would I use this?... At what point [would it be] good to bring [this] back into the picture?... Maybe [provide] some guidance on, in successful projects, at what points in the project this has been used." |
| Practitioner | "I would appreciate a little more structure or direction. I don't know if that is specifically an expansion of the how-to guide or more case studies.… I still felt that I would like a little more direction in terms of the best way to use it." |

### 3.6. Finding 4: The Extent of Adoption is Mediated by Collaboration Characteristics

Practitioners generally viewed Design For Impact as representing a useful collaborative workflow, but best practices are only valuable to the extent that they can be feasibly implemented. Participants identified several characteristics of statistical collaboration that mediate the perceived applicability of

Design For Impact, including project length and scale, team composition, professional setting, and type of analysis. In the post-survey, one student explained that although the ideas were "super helpful in producing more applicable and impactful analyses," the "short nature of the meeting [with the client]" and the need to coordinate with a team of peers meant that they "didn't feel like [they] had enough time to use the tool effectively." Across student responses, time constraints were the most frequently cited barrier to using the artifact in full. 22 of 30 post-survey respondents reported partial use, two reported using the tool in its entirety, and six reported no use (Figure 10). Practitioners raised similar concerns about shorter or more limited engagements. One participant considered situations where the client is seeking brief statistical advice, such as power calculations, arguing that "you'd have to… make sure that it's a proper collaboration, not just a brief consultation, to make this worthwhile."

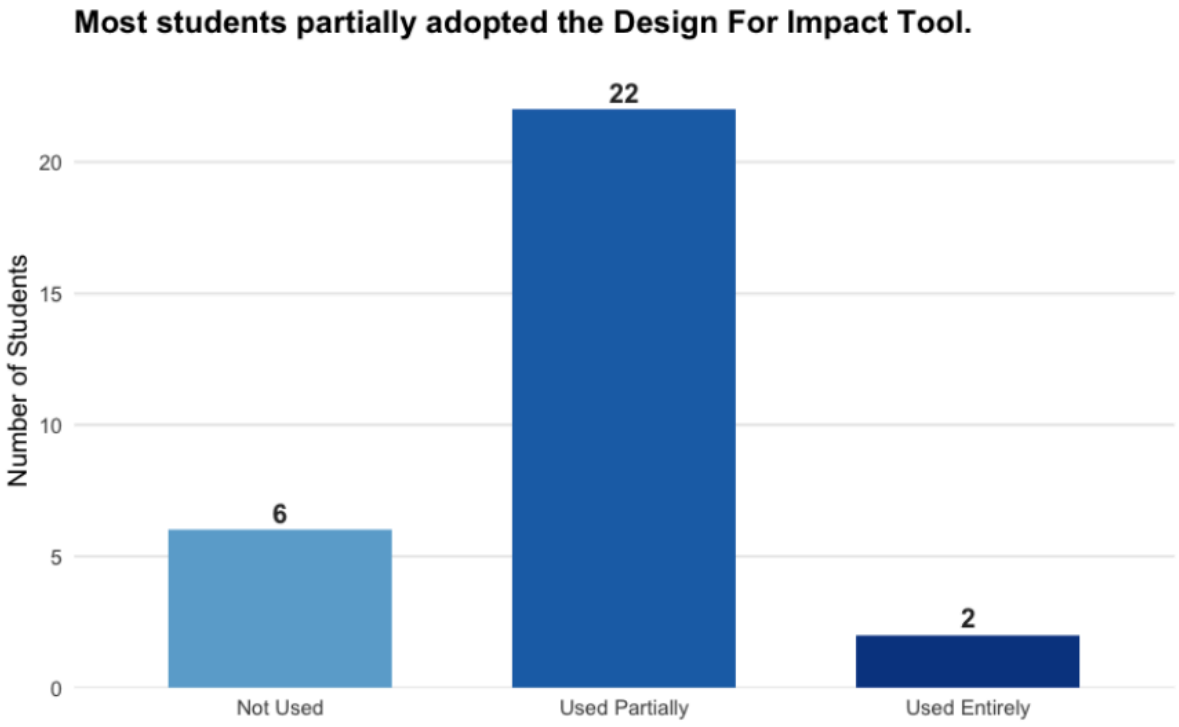



Figure 10. Extent of Design For Impact Tool adoption among student post-survey respondents.

The Design For Impact process model and artifact were developed largely with dyadic collaborations in mind (i.e., one statistical practitioner working with one non-statistical domain expert), but several practitioners described multidisciplinary teams in which statistical expertise is distributed less cleanly. Similarly, some participants questioned whether the model would transfer equally across different kinds of statistical work, including one practitioner from industry who believed the tool fit "really well for new product development" but less effectively for "existing product improvement" in data science. Several practitioners conveyed that projects are often non-linear, with frequently shifting priorities and scope. As a result, the concerns about administrative burden resurfaced when considering the intent to adopt. One practitioner suggested that completing and updating the tool "at all points in the study" would require participants to deliberately budget additional time. These uncertainties suggest that adoption depends not only on whether the practitioners value the process model and its principles but also on whether it is feasible to use for projects of different shapes and sizes. Table 9 contains additional feedback from students and practitioners about perceived barriers or contingencies for applying Design For Impact. Later, we will address many of these constraints and propose solutions that retain Design For Impact.

Table 9. Selected participant excerpts illustrating how collaboration characteristics mediate adoption of Design For Impact. Note: Some excerpts are lightly edited for readability.

| **Participant** | **Excerpt** |
|---|---|
| Student | "The main reason I didn't use the tool itself was issues of timing. I thought the ideas behind the tool were super helpful in producing more applicable and impactful analyses and deliverables... However, [given] the short nature of the meeting, we didn't feel like we had enough time to use the tool effectively." |
| Student | "Some concepts of this tool are easily applicable, while the full tool requires more effort." |

| Participant | Excerpt |
|---|---|
| Practitioner | “For shorter-term projects, this feels less valuable because I’m not diving as deep with the researcher. In these cases, the exact Analysis Pathway isn’t as important to nail down. The Partnership component is important – I could do a better job talking about these things early on and outlining roles.” |
| Practitioner | “Some projects are really long; some are really short... Sometimes our engagement is very quick and [involves] looking over results, and sometimes we are there from the design [stage]... Some of the impacts are really hard to evaluate when it’s just a quick project.” |
| Practitioner | “Often, I’m working with multiple areas of domain expertise... I would have to shoehorn some of the teams into either ‘statistics’ or ‘not,’ which doesn’t work... if you have multidisciplinary people or informatics people on your team. That would limit its broad applicability in teams.” |
| Practitioner | “A lot of the projects that we collaborate on don’t fit this model, primarily because of almost a debugging aspect of the job. This fits really well for new product development, but... existing product improvement, edge-case detection, [and] edge-case protection are projects that we collaborate on, and I don’t know if this fits very well in those.” |
| Practitioner | “The scope can change along the way... If [the initial questions] don’t turn up anything, then the team…[asks], ‘How about we look at it this way?’ It becomes this cyclical thing where you’re producing work, they’re reviewing work, and that iterates until there’s something ‘useful.’” |
| Practitioner | “To sit and think about it and actually fill it out is going to take time... [The Analysis Pathway] could change through the course of the project, so you have to come back and keep updating it. Then the Narrative…[requires] reflection after the study. At all points in the study, it’s going to need extra time, so you need to think about that in your planning.” |

### 3.7. Resulting Revisions

These findings lead us to some modifications to the process model and tool but mainly how we present them or, more specifically, to our supplementary materials. A complete list of revisions with brief justification can be found in Table 10. Since a large majority of constructive feedback pertained to implementation and component clarity, we applied most revisions to the Implementation Guide, not the

tool template. The revised Design For Impact Tool (Figure 11) and Implementation Guide (Figure 12) are included below. We encourage readers to revisit Figures 1 and 2, the original Designed For Impact Tool and Implementation Guide, if they wish to compare them visually.

Table 10. Revisions to the Design For Impact process model, artifact, and implementation guidance.

| **Process Model, Artifact, or Implementation Guidance** | **Action** | **Explanation/Justification** |
|---|---|---|
| Process model | Rename the process model from Designed For Impact to Design For Impact. | Though participants did not request this change, the revised name better reflects the process model's emphasis on planning and intentionality. |
| Artifact | Adopt a blue-toned color palette. | Although participants did not comment on color, we found that the two lightest colors in the original palette were difficult to distinguish when printed. The revised palette improves contrast, while its light-to-dark progression visually reinforces the movement from a high-level Vision to a concrete, evidence-based Narrative. |
| Artifact | Revise the artifact subtitle. | The new subtitle states the tool's overarching purpose more directly and aligns it with the impact-centered language used throughout the process model and manuscript. |
| Artifact | Revise the header fields to include Project, Collaborators, and Engagement Period. | Several participants felt that role labels drawn from the $Q_1Q_2Q_3$ or ASCCR literature could limit the tool's clarity and flexibility, particularly for collaborations involving more than one domain expert or client. Using the broader label "Collaborators" accommodates varied team structures, while Engagement Period keeps the temporal boundaries of the work visible. Light gray rules more clearly associate each label with its entry space. |
| Artifact | Add a Version field to the header. | Participants emphasized that statistical engagements often involve rescoping, analytical dead-ends, and changing priorities. Versioning allows users to preserve a record of earlier pathways while clearly identifying the current iteration of the tool. |

| Process Model, Artifact, or Implementation Guidance | Action | Explanation/Justification |
|---|---|---|
| Implementation guidance | Distinguish “Capture,” “Consider,” and “Iterate” guidance. | Students and practitioners requested clearer guidance on how to complete the tool. These labels distinguish what belongs in each component from questions that can elicit that information and, for Analysis Pathway, explain how to proceed when the planned approach changes. |
| Implementation guidance | Clarify the scope of Vision. | Practitioners found the original framing potentially too high-level for many engagements. The revision positions Vision as a longer-term goal that the collaboration helps advance, such as an organizational objective or larger project, without implying that the statistical work must achieve that vision on its own. |
| Implementation guidance | Reframe Impact around stakeholders and enabled decisions or actions. | Participant feedback suggested that Impact could be interpreted too broadly or centered on the immediate client. The revision instead foregrounds the people that the evidence will ultimately serve and what it will enable them to decide or do, more clearly distinguishing Impact from Vision. |
| Implementation guidance | Reframe Partnership around reciprocal motivations and expectations. | Some practitioners were hesitant to characterize trust as established at the beginning of an engagement. The revision focuses on the motivations, contributions, and expectations that collaborators can discuss early and through which trust, alignment, and future collaboration may develop. |
| Implementation guidance | Clarify Analysis Pathway as an iterative plan for gathering evidence. | Participants wanted a clearer distinction between the analytical plan and the results it eventually produces. The revision anchors the pathway in stakeholder needs, broadens the possible approach beyond modeling, and explicitly explains how to document and revise an unsuccessful pathway. |

| Process Model, Artifact, or Implementation Guidance | Action | Explanation/Justification |
|---|---|---|
| Implementation guidance | Reframe Narrative as a concise, audience-centered account of the analysis's contribution. | Participants requested more concrete guidance about what the Narrative should contain. The revision emphasizes the central takeaway, intended audience, and decision or action enabled, helping users connect the analysis back to $Q_1$ rather than simply summarizing technical results. |

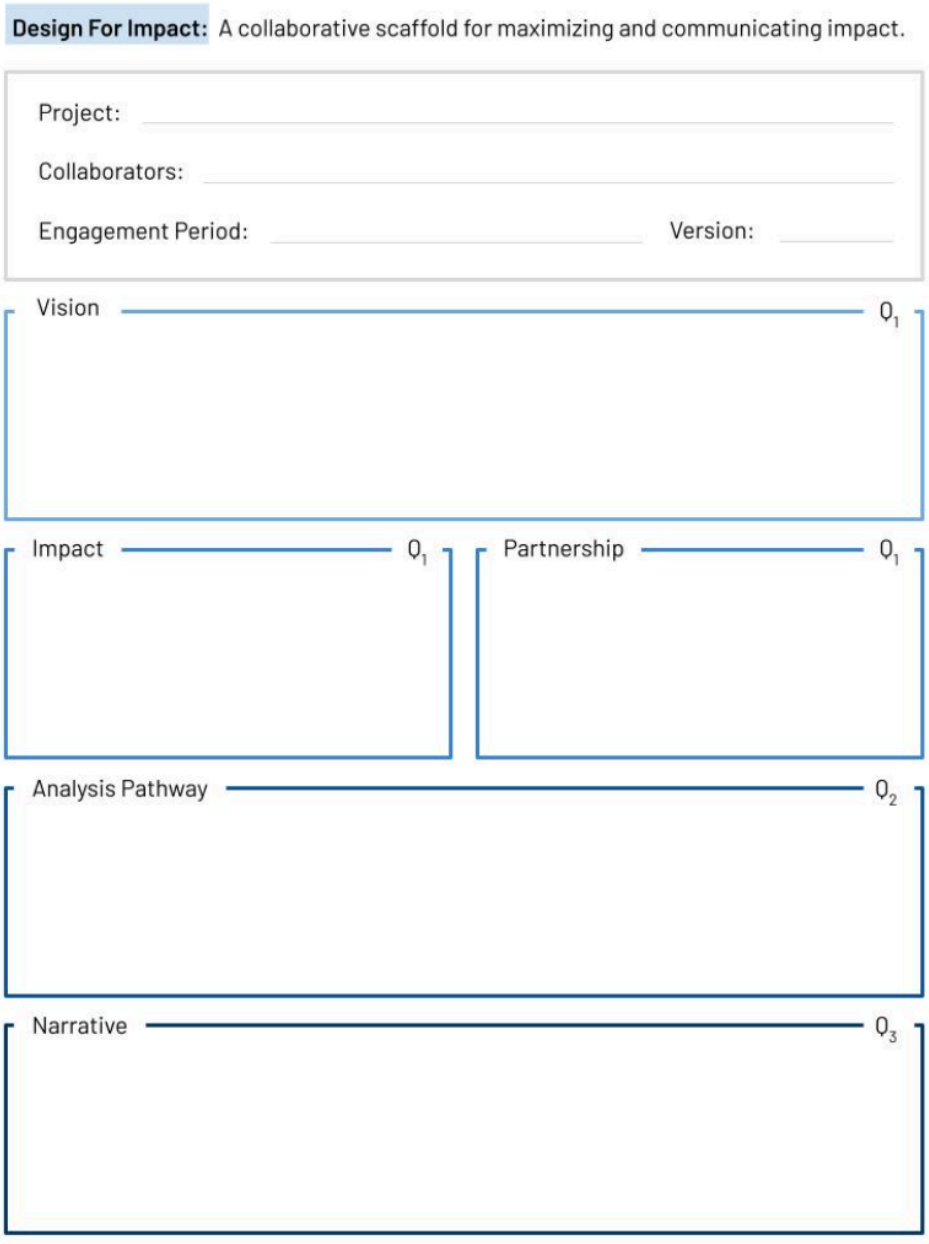



Figure 11. Revised Design For Impact Tool template. Download a PDF on our website [https://jettpalmer.github.io/design-for-impact/].

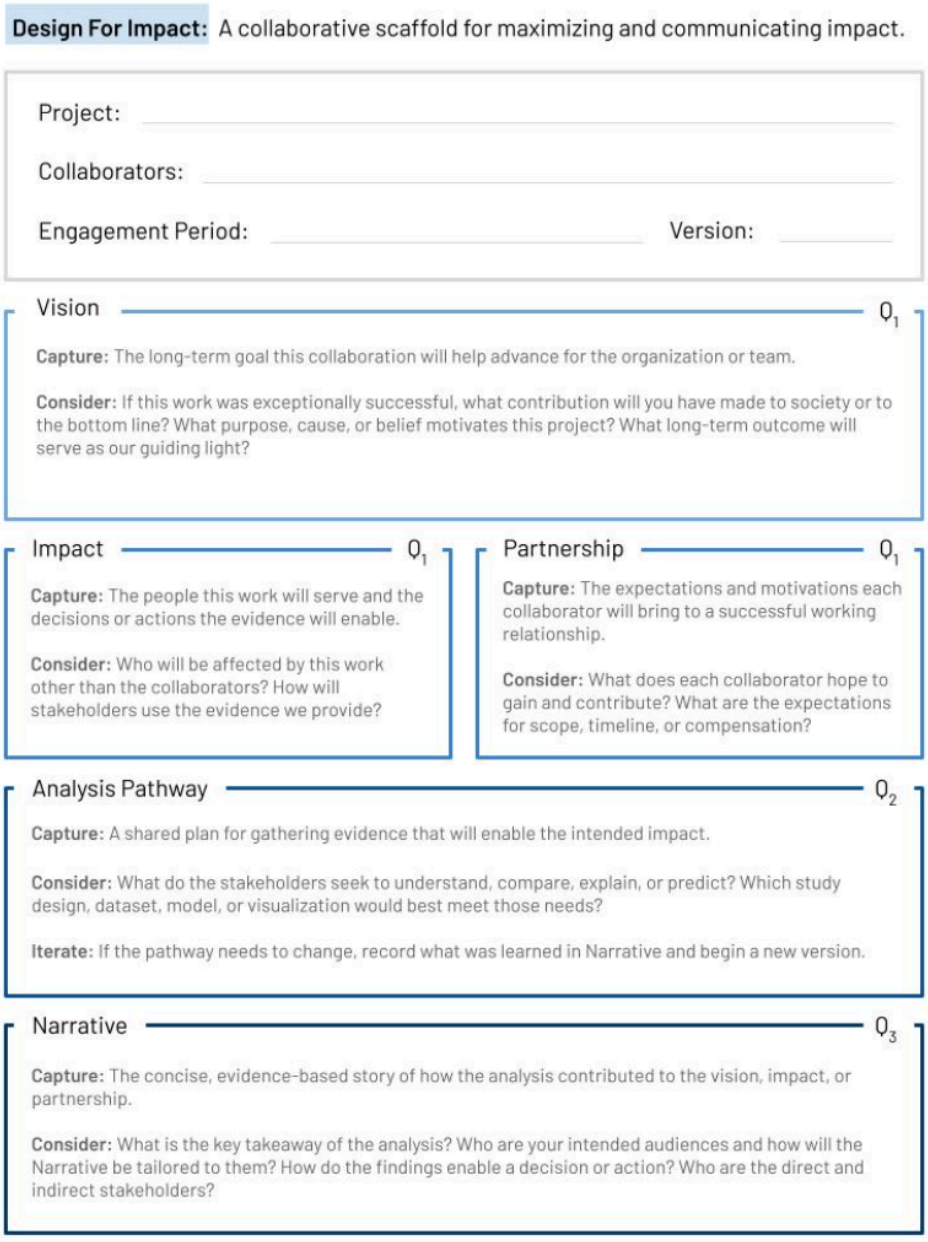



Figure 12. Revised Design For Impact Tool Implementation Guide. Download a PDF on our website [https://jettpalmer.github.io/design-for-impact/].

# Chapter 4

# DISCUSSION

## 4.1. General Interpretation

We found that the Design For Impact process model and tool received generally favorable feedback. Most of our practitioners collectively agreed that the Design For Impact process model effectively represented the best practices for impactful statistical collaboration. Participants perceived the structure and material as helpful for maximizing and communicating the impact of their engagements. This was especially true for those early in their career with less established workflows, pointing to a promising degree of relevance for students and practitioners. Participants also perceived the conciseness and layout of the artifact as being a key strength – the tool served as a helpful medium for aligning expectations with domain experts and connecting their analyses to the intended impact. This supported the utility construct, and future work should investigate tangible outcomes of implementing Design For Impact that move beyond the positive perception that our participants expressed.

While students found that the general purpose of the Design For Impact process model was clear, they asked for more guidance on what information each of the five components should capture. This was different from practitioners who seemed to be more inclined to customize the contents of each component according to their needs and experiences. However, practitioners sought more direction on how to implement the tool, that is, how to build it into an established workflow and navigate its use as a shared artifact with the client. Implementation was especially blurry to practitioners in cases where there might be changes to the project scope or priorities. Naturally, students lack exposure to the nonlinearity of real-world consulting, and did not raise this as a concern. In this sense, the clarity

construct split into more nuanced parts depending on whether feedback was coming from a student or practitioner but, either way, it prompted several revisions to our Implementation Guide. Some of the questions and concerns from our participants, such as those regarding changes to scope, will be addressed in the next section.

### 4.2. Addressing Participant Questions and Concerns

While the empirical foundation of this work treats our process model and artifact as hypotheses and relies on participants to formatively test them, we emphasize that a substantial portion of constructive feedback was less about the process model or tool themselves and more about how we presented them. In this section, we offer a response to some of the key questions and concerns from the participants. The primary questions and concerns pertained to (1) brief or limited collaborative engagements, (2) multidisciplinary teams, (3) changes to project scope, (4) relevance in certain subdisciplines, and (5) administrative burden or disruption to existing workflows.

A statistical practitioner's investment into the long-term goals of their collaborators is naturally more warranted for long-term engagements. With that said, even very short projects, like power calculations, move through all of the stages of $Q_1Q_2Q_3$. These projects will still have some broader goal, hinge on partnership expectations, require analytical choices, and result in findings that are relevant to the client. Perhaps, in short-term engagements, the decision-maker tends to also be the immediate collaborator, whereas this happens less with long-term projects. In the power example, the collaborator might need the statistical practitioner’s help to decide how large her sample size should be. But we still encourage the statistical practitioner to ask the client who benefits from their research. If the researcher is conducting clinical trials for a drug, while the decision-maker is the researcher herself, the statistician can formulate a better impact narrative if they know who is set to benefit from the drug. This is one way

that Design For Impact might look different between long- and short-term engagements, but we do generally see the same workflow and impact-centric opportunities in both cases – the projects simply function on a different timeline which usually means the magnitude of the impact will differ, too.

While we created Design For Impact with dyadic collaborations in mind, we quickly realized that teams are most often larger and have members with a variety of quantitative backgrounds. After removing the "statistical collaborator" and "domain expert" verbiage from the header of the tool, we find that Design For Impact remains applicable to larger and statistically diverse teams. And these are especially ideal cases for Design For Impact to exist as a shared artifact – this way, all members of the team can contribute to some part of the tool depending on their strengths. For example, an informatician might advise on the Analysis Pathway, and a communications expert could help craft the Narrative statement(s), while the statistician remains the facilitator of Design For Impact, contributing their expertise on, say, particular sampling methodologies or the communication of uncertainty.

Practitioners collectively agreed that projects rarely go according to the initial plan. The original Design For Impact Tool insinuated that a project explores just one Analysis Pathway whereas, in reality, practitioners usually try several before they land on the final approach, gleaning insight that is useful to the client. This prompted our addition of a versioning field in the header of the Design For Impact Tool. Now, we encourage statistical practitioners to archive older versions of the tool when certain Analysis Pathways do not work out, still including a Narrative statement about why that path was discontinued and how it informed a decision to try another approach. We have included an example below that utilizes the versioning mechanism (Figures 13-16). Design For Impact now acts as a paper trail which, when followed, tells us about tried and failed analyses, changes to scope and expectations, and collects even more evidence of impact throughout the lifecycle of an interdisciplinary engagement. And for

practitioners who are not using a professional-grade statement of work or similar contractual agreement, the Design For Impact Tool could act as a lightweight substitute, still capturing plans and expectations of the client, and helping early-career practitioners mitigate scope creep or compensation challenges.

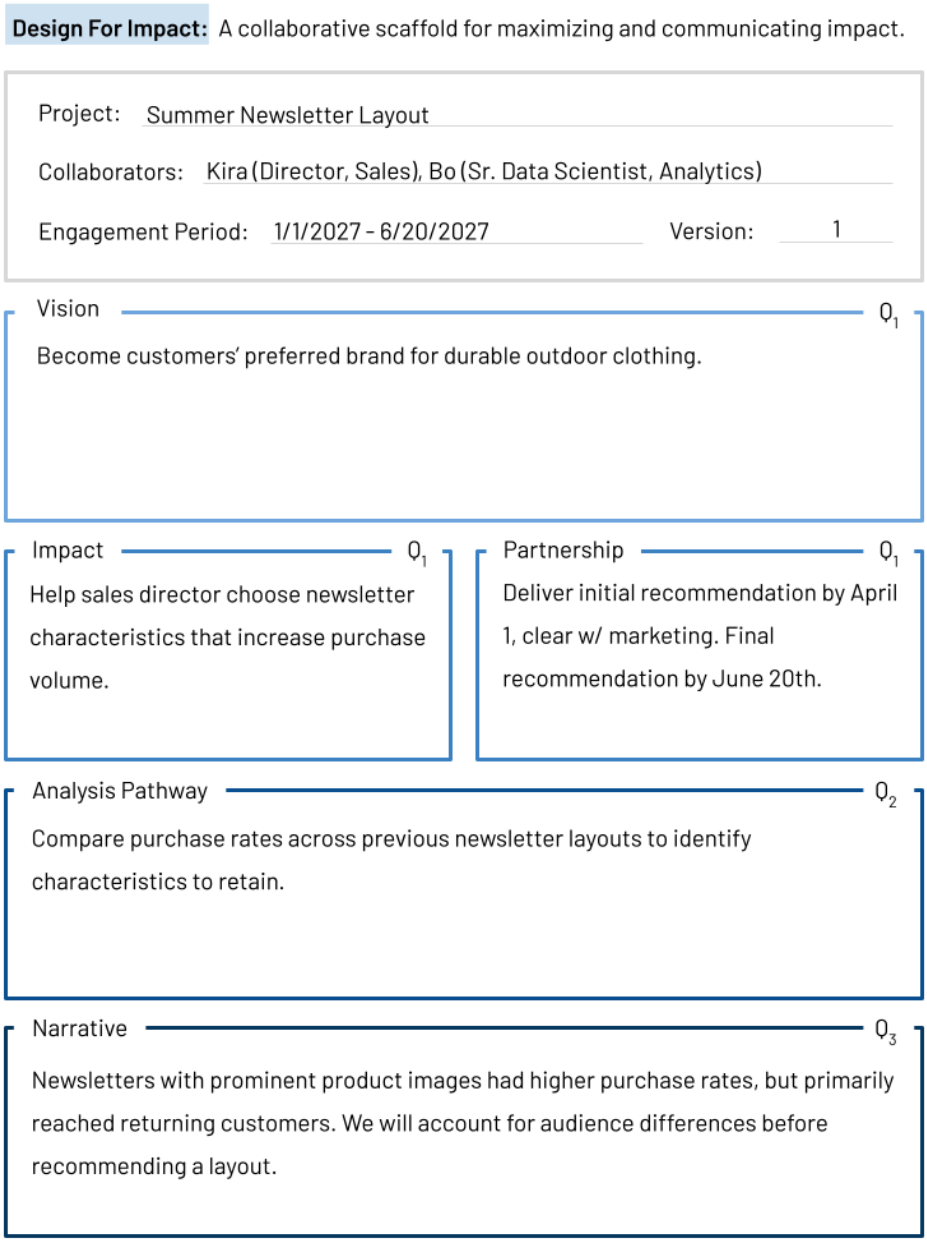



Figure 13. Full versioning example using new Design For Impact Tool (version one).

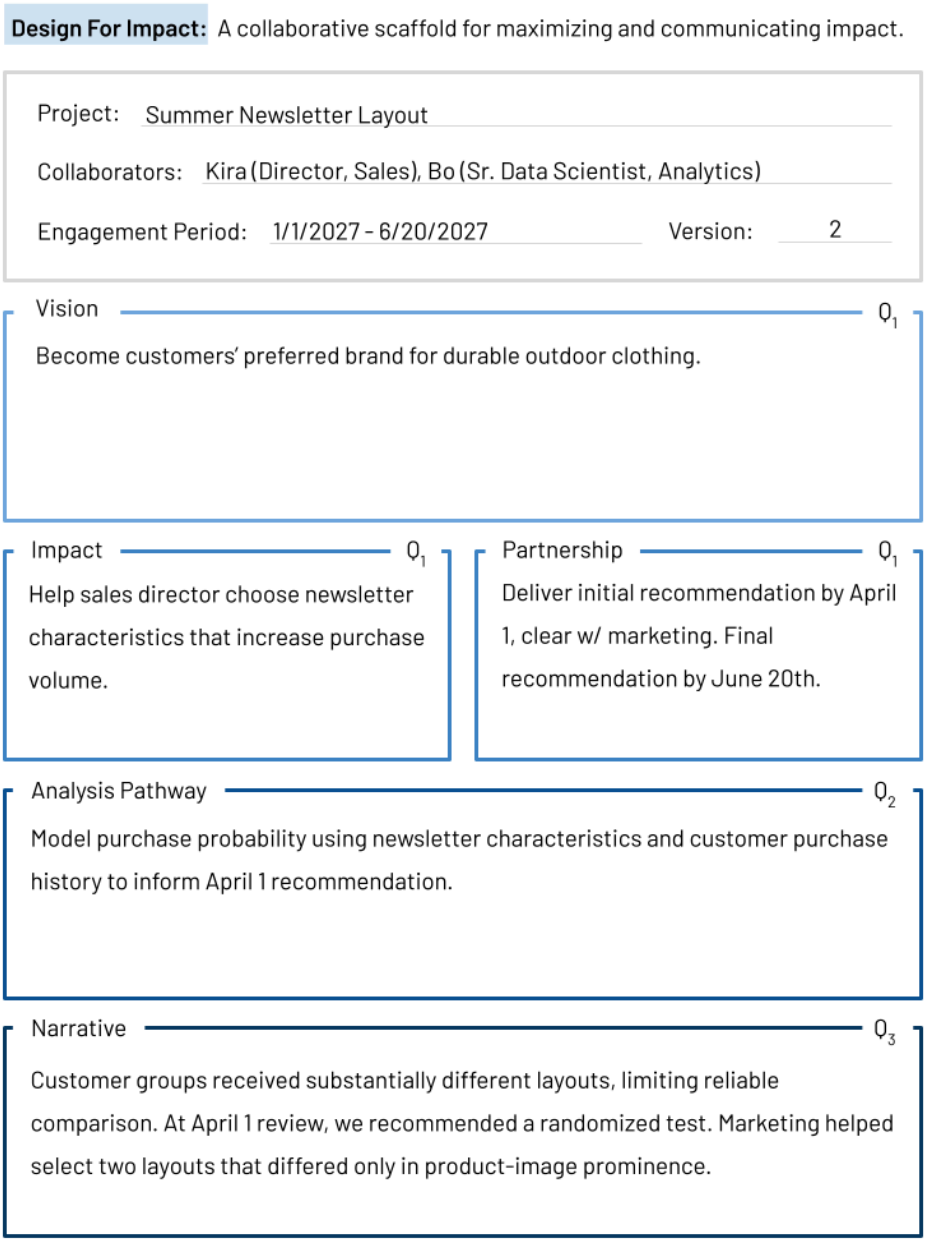



Figure 14. Full versioning example using new Design For Impact Tool (version two).

**Design For Impact:** A collaborative scaffold for maximizing and communicating impact.

Project: Summer Newsletter Layout

Collaborators: Kira (Director, Sales), Bo (Sr. Data Scientist, Analytics)

Engagement Period: 1/1/2027 - 6/20/2027 Version: 3

**Vision** $Q_1$

Become customers' preferred brand for durable outdoor clothing.

**Impact** $Q_1$

Help sales director choose newsletter characteristics that increase purchase volume.

**Partnership** $Q_1$

Deliver initial recommendation by April 1, clear w/ marketing. Final recommendation by June 20th.

**Analysis Pathway** $Q_2$

Randomly assign customers to the two layouts and compare purchase rates to help the sales director select an image treatment.

**Narrative** $Q_3$

Early results were too imprecise to distinguish a worthwhile improvement from little or no benefit. Marketing and sales agreed to continue testing across additional newsletter sends before choosing a layout.

Figure 15. Full versioning example using new Design For Impact Tool (version three).

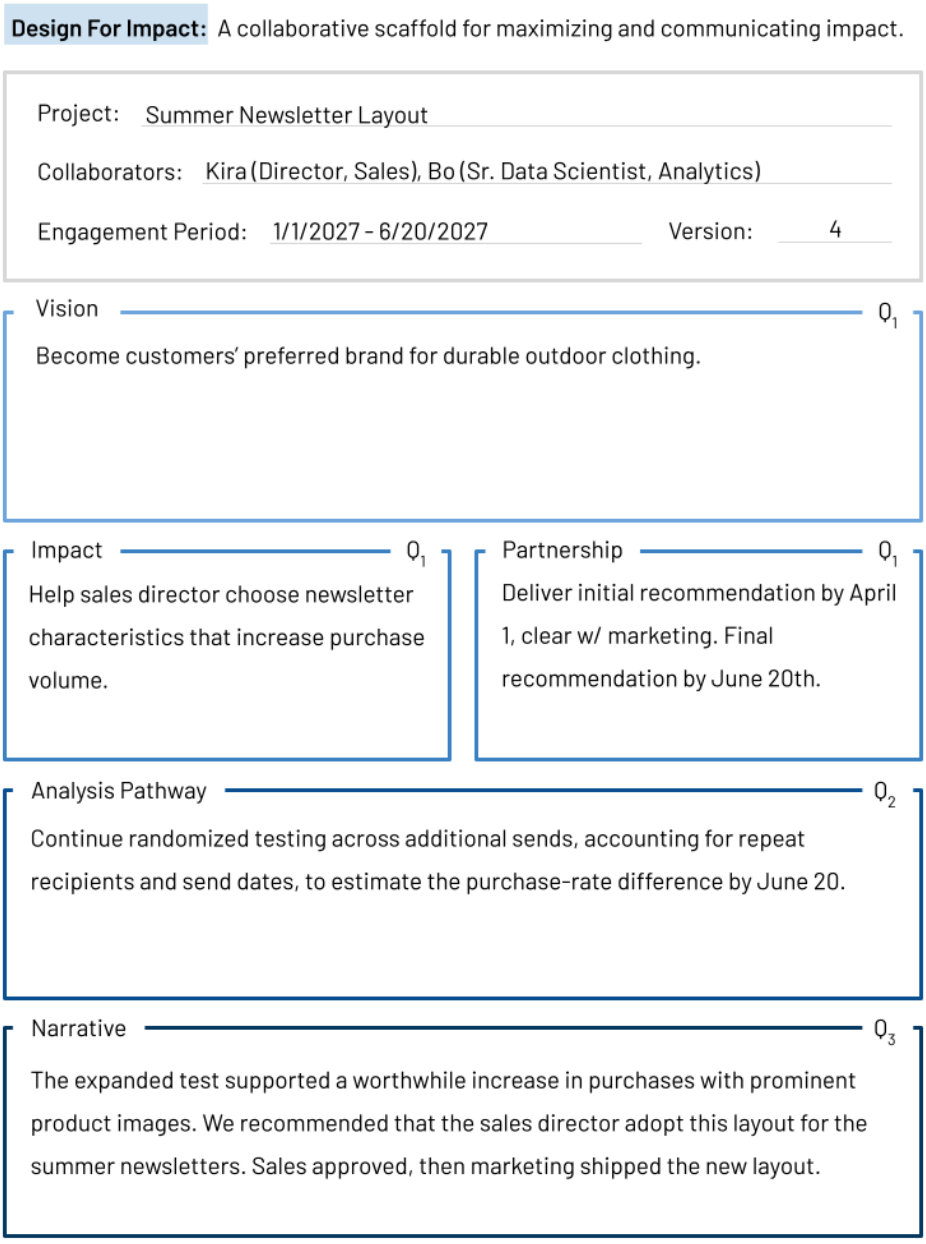



Figure 16. Full versioning example using new Design For Impact Tool (version four).

For some subdisciplines of statistics including but not limited to, custom software development, business intelligence and dashboards, and data architecting, Design For Impact may not extend as cleanly at first glance. Some practitioners showed apprehension to adopt Design For Impact in similar settings, but we think it is worth examining where impact-oriented behaviors can still be integrated into one's workflow. Suppose a colleague submits a ticket because a business intelligence dashboard shows outdated figures. By asking how lag affects the colleague's work, the statistical practitioner learns that their colleague needs the latest data to submit a report each Friday at the end of their work day. Rather than scheduling queries every ten minutes, the practitioner decides to add a "Get Latest Insights" button that refreshes the data when needed. By understanding the colleague's underlying need and relating it to an action or decision, the statistical practitioner finds a solution that helps the colleague send accurate reports without the cost of constant queries. Across all subdisciplines, we invite statistical practitioners to introduce new prompts, beyond those that we included in the Implementation Guide, that are better suited to their domain and still elicit the information meant to be captured by the Design For Impact Tool.

While it may be true that Design For Impact consumes time to implement, we think the gains in impact, the quality and relevance of the analysis, the relationship with the collaborators, the reflection of one's own contribution to the big picture, and so forth, are well worth the additional time spent on Design For Impact. Apprehension to employ Design For Impact due to time and administrative burden may be a manifestation of hyperbolic discounting (i.e., the practitioner may be valuing their present time more than their future time). Based on practitioner feedback, we believe Design For Impact may reduce cases where a secondary or tertiary analysis is conducted due to a misalignment with the client's needs. As another example, clients sometimes make requests that are outside of the practitioner's intended

commitment or compensation, and spending some time on Design For Impact at the beginning of a collaboration not only prompts conversations about scope and expectations but also documents that information in a shared artifact.

While not a concern of practitioners in this study, we wanted to address a potential misconception that an effective Narrative requires a significant p-value. When the Analysis Pathway involves inferential procedures, the users of the Design For Impact Tool should consider ways in which the collaboration will have impact even if it does not cross some inferential threshold. For example, a non-significant p-value may prompt pharmaceutical researchers to draw new hypotheses about the effect size of a drug or help the senior scientist know when to explore other projects that have demonstrated more preliminary efficacy. The very idea that some analysis pathways lead to dead-ends is what motivated the addition of version control to the Design For Impact Tool, as was earlier discussed. Collaborators may be interested in launching an adjacent investigation, perhaps involving a different methodology or set of variables, but we believe they should document the resolution of one approach and allow it to become part of the broader statistical story. As aforementioned, we encourage users of the Design For Impact Tool to write a Narrative for unsuccessful analysis pathways, adjust components of the tool according to the new approach, increment the version of the tool, and then store the original.

There was one more area of disagreement among practitioners related to a question about whether the Design For Impact Tool appropriately balances structure with flexibility. There were three individuals who disagreed to some extent but, judging from those practitioners' open-ended comments, we think their concerns were adequately addressed by the revisions. Two disagreed with this item because they found Design For Impact to be too linear and unable to accommodate changes in scope, and we can see how this folds into the earlier discussion. The third practitioner believed there was too much flexibility and

specifically asked for more elaborate implementation guidance on our website. Our new website is entirely redesigned, offering extensive educational material both for those looking to try the Design For Impact Tool themselves and for those interested in teaching it.

### 4.3. More on Implementation

Being in an exploratory stage of their career, students and junior practitioners are learning their preferred approach to statistical collaboration. While their workflows are still immature, we encourage students to use the Design For Impact Tool as a shared, physical artifact. In the Implementation Guide, we provide sample questions that help students capture the information that we intend to elicit with each component of the tool. Asking and considering these questions could support preparation and facilitation of a client kick-off meeting. The Analysis Pathway component will provide the student an opportunity after the kick-off meeting to reflect on whether their chosen methodological approach is aligned with what they documented in $Q_1$. It functions as a mid-project pulse-check for both the statistician and their collaborators, prompting students to share their analysis plan with the collaborators and invite feedback. Once they land on an analysis pathway, iterate until the analysis goals are met, and interpret their findings, students can draft a Narrative statement and include it in the client deliverables. This forces the students to spend time distilling their findings as they relate to the stakeholders identified in $Q_1$, as well as the decisions or actions the evidence will support. Design For Impact stays with students and junior practitioners all throughout their statistical collaboration, encouraging effective behaviors, and helping them maximize and communicate their impact.

Implementation for experienced practitioners could look almost identical to the implementation process for students – after all, not all practitioners move through these impact-oriented steps naturally, and our

scaffold could help them do that. The key difference is that experienced practitioners may already have a standard approach to their statistical collaborations. We invite seasoned practitioners to weave Design For Impact into their existing workflow in any of the following ways: (1) asking more vision and impact-centric questions during a scoping meeting, (2) including the Design For Impact Tool in their statement of work (e.g., as a cover page), (3) using the Design For Impact Tool as a versioning mechanism for documenting tried-and-failed analysis pathways, and (4) considering the $Q_1$ components to prepare a one- to two-sentence impact narrative ahead of a close-out meeting. We believe adopting Design For Impact in any capacity has the potential to strengthen practitioners' partnership with their collaborators through deeper alignment with their expectations and needs.

We recognize that for both students and practitioners there will be cases where introducing the Design For Impact Tool as a shared artifact with collaborators will not be feasible. For example, consider a situation where a junior statistical practitioner is not afforded time on the conversational floor during client meetings. In cases like these, we invite practitioners to implement Design For Impact to the greatest extent possible. Perhaps, the practitioner uses Design For Impact to structure their personal meeting notes, attempting to capture $Q_1$ information during the scoping meeting, following up with the client via email to confirm accuracy, then incorporating that information in $Q_2$ and $Q_3$. This way, the junior practitioner still applies the Design For Impact process model without introducing a shared artifact to collaborators.

While this research does not supply a detailed pedagogical approach, we hope that this paper provides instructors and supervisors with some helpful context for teaching Design For Impact to their learners. More works associated with Design For Impact, including a forthcoming publication and short course, will focus more on education, supplying readers with detailed implementation and instructional

materials. Minimally, we suggest providing learners with a blank version of the tool, the Implementation Guide, and a filled example. These items and additional materials can be found at our website [jettpalmer.github.io/design-for-impact].

### 4.4. Future Work

Firstly, we hope this work serves as precedent for more scientific development and evaluation of collaboration and communication frameworks in technical fields. We, along with many of our peers, believe that the field of statistics and data science will continue to become more interdisciplinary, with a greater number of disciplines relying on those with data-centric competencies to help solve their toughest business and scientific problems. We believe statistical practitioners should pursue more decision-oriented roles – where the knowledge of statistics is an impact-driver and value-creator, not an obligatory procedural step, and our quantitative reasoning is leveraged for long-term strategic operations. Our development and lightweight assessment of a previously intuited, but now specified process, shows our colleagues that the “way we do work” may be worth generalizing to improve collaborative practice, support early-career practitioners, and strengthen our profession over time.

Specific to the Design For Impact process model and tool, future research may treat Design For Impact as an intervention, comparing realized impact against unstructured or alternatively structured workflows. One would likely select an impact metric, which may depend on the discipline under which Design For Impact is being assessed, then compare performance of the Design For Impact teams against the controls. For example, a researcher could investigate whether Design For Impact leads to discernibly greater annual contract value on sales teams that employ statistical practitioners. As a teaching tool, future research may seek to implement Design For Impact in a statistical collaboration course or a

statistical consulting practicum and compare educational outcomes against similar classes that were not supplied the process model and tool. When considering the extensibility of Design For Impact, we think other technical disciplines that move through a similar workflow as the one defined by $Q_1Q_2Q_3$ could benefit from an adapted version of the Design For Impact Tool. Future work could explore this application of Design For Impact in other technical consulting fields like engineering. And finally, although we built Design For Impact to be facilitated by the statistical collaborator, their interdisciplinary counterpart may also be affected by the tool, and future research could seek to understand the clients' perceptions of the tool's efficacy as a collaborative scaffold.

### 4.5. Limitations

Our surveys and interviews were not administered to a random sample of students or practitioners but, rather, convenience samples from our professional networks or our course enrollments. The practitioner sample was predominantly academic, and future research should solicit more industry perspectives. Our results were not used for statistical inference, and responses are only intended to represent the perspectives of our participants. We consider this work a qualitative pilot for more robust assessments of the Design For Impact process model and tool. We also recognize features of our research methodology that may have affected the quality of the data. For instance, students may have conflated their judgment about Design For Impact with their judgment of our lecture on the material. As an illustration, if we inadequately explained the Vision component to students, they may have indicated on their survey that the Vision component was less clear. Discussion about this study limitation did prompt us to consider that the efficacy of the tool seemed dependent on both the artifact itself and the users' understanding of how to implement it. Thus, when we evaluated the feedback and made revisions, we carefully considered whether the feedback was with regard to the process model, the artifact, or our verbal and

written communication on how to apply them in supplementary formats. Almost all data in this study reflected participant perception, not experience applying the tool. We also recognize that the five students and 20 practitioners who declined to participate may have been qualitatively different from those who participated. Of the practitioners who did participate, it would be reasonable to assume that some felt pressured to validate Design For Impact as a result of social desirability bias since they were non-anonymous, interfacing directly with the researchers, and were professionally connected to one or more of us. Since we were responsible for creating the tool, writing the surveys, instructing the students, conducting the interviews, processing and coding the data, and generating themes, we recognize the risk of confirmation bias and emphasize the limited generalizability of our findings.

# Chapter 5

# CONCLUSION

Design For Impact is a newly developed process model and accompanying artifact (i.e., the Design For Impact Tool) that aims to help statisticians maximize and communicate the impact of their interdisciplinary collaborations. With new opportunities to automate or augment routine statistical tasks, statisticians in industry and academia should position themselves as data-driven strategists and decision-makers. We presented some existing literature that informed the five components of Design For Impact, as well as our methodological approach for collecting formative feedback, rooted in implementation and design science. We demonstrated how Design For Impact is positioned within broader statistical frameworks like ASCCR and $Q_1Q_2Q_3$, and how our tool is supported and inspired by impact- and communication-oriented frameworks such as ICE, PIE, and SCR. Our approach to collecting formative feedback involved prospective users, including practitioners from industry and academia, as well as students across two institutions in statistical collaboration courses. A qualitative analysis generated these key takeaways: participants perceived the process model as relevant and the tool as useful, while calling for clearer implementation guidance. The constructive feedback that we received from participants motivated revisions to the process model, the tool, and how we presented this information to our audiences in supplementary materials. We encourage readers to apply and teach Design For Impact, as well as conduct more robust comparisons of realized impact attributable to our process model and tool. We believe the five components from the Design For Impact Tool prompt deep alignment, analytical intentionality, and thoughtful translation – the tenets of statistical collaboration that translate data into real-world impact, serving both the domain itself and our profession.

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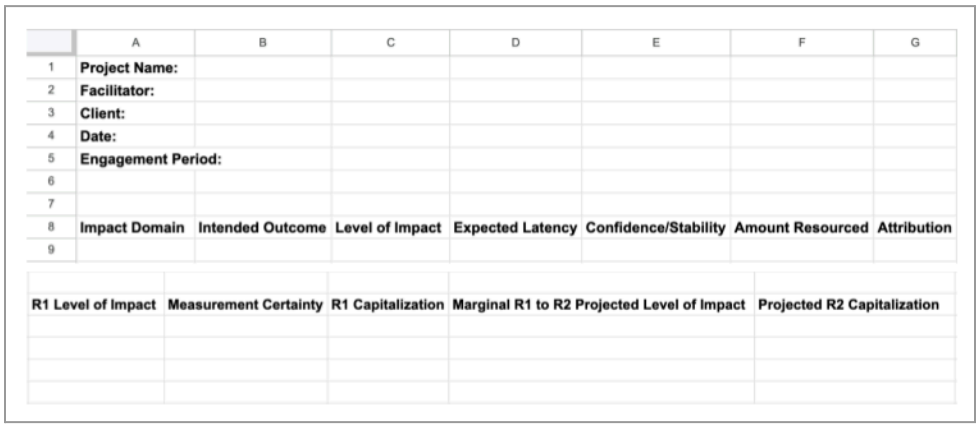
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APPENDICES

Appendix A

DESIGN FOR IMPACT TOOL: DISCARDED VERSIONS



| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | **Project Name:** | | | | | | |
| 2 | **Facilitator:** | | | | | | |
| 3 | **Client:** | | | | | | |
| 4 | **Date:** | | | | | | |
| 5 | **Engagement Period:** | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | **Impact Domain** | **Intended Outcome** | **Level of Impact** | **Expected Latency** | **Confidence/Stability** | **Amount Resourced** | **Attribution** |
| 9 | | | | | | | |

| R1 Level of Impact | Measurement Certainty | R1 Capitalization | Marginal R1 to R2 Projected Level of Impact | Projected R2 Capitalization |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Figure A.1. First discarded version of the Design For Impact Tool.

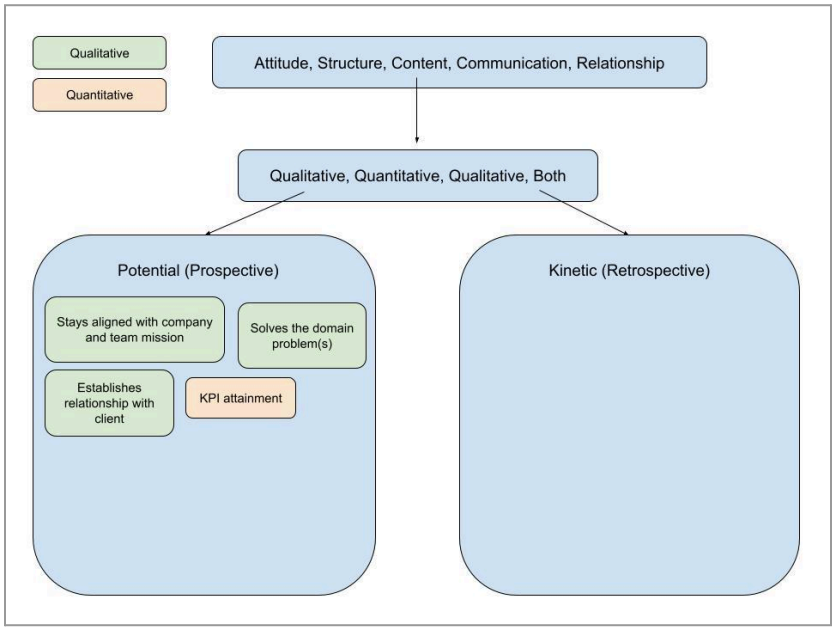



Figure A.2. Second discarded version of the Design For Impact Tool.

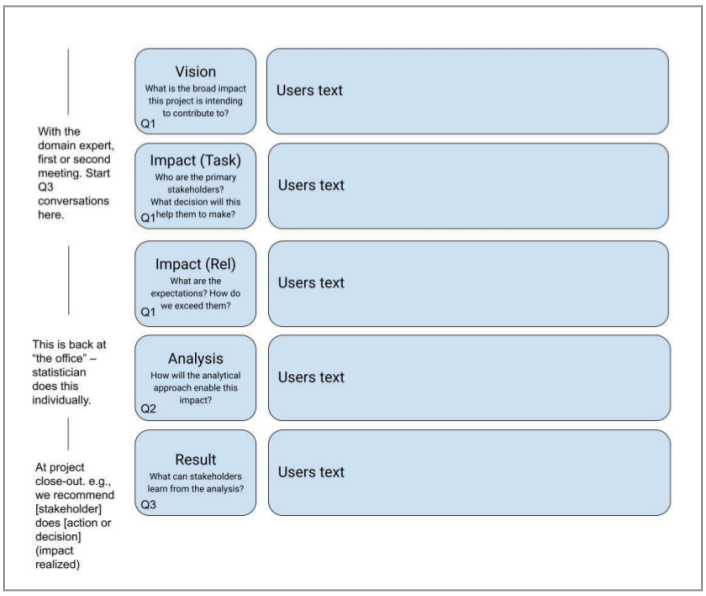



Figure A.3. Third discarded version of the Design For Impact Tool.

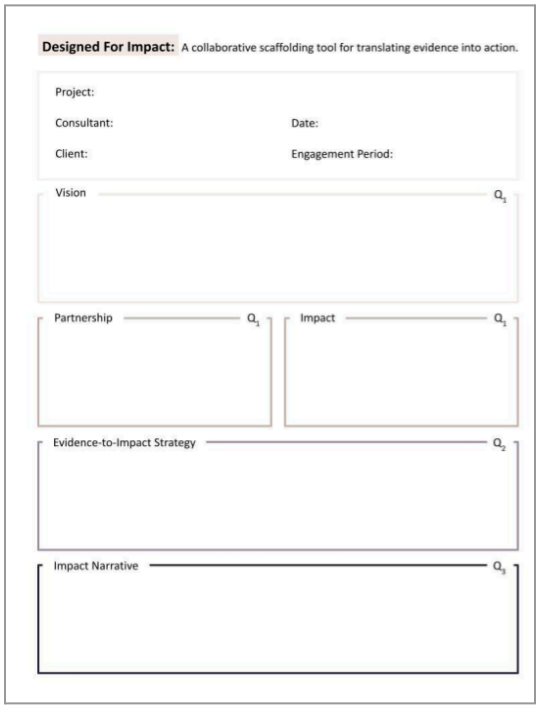



Figure A.4. Fourth discarded version of the Design For Impact Tool.

Appendix B

SURVEY INSTRUMENT: STUDENT-PRE

For items 1-9, participants were asked to rate their level of agreement on a scale from 1-6 (1 = Strongly Disagree, 6 = Strongly Agree).

1. Impact planning seems like an important part of statistical collaboration.
2. Impact evaluation seems like an important part of statistical collaboration.
3. Future students of this class should be taught about impact planning and evaluation.
4. Future students of this class should be taught how to use the Designed for Impact Tool.
5. I understand how to use the Designed for Impact Tool.
6. The design of the DIT is intuitive and easy to understand.
7. The Designed for Impact Tool seems impractical for use in statistical consulting.
8. Overall, the Designed for Impact Tool seems useful for statistical consulting practice.
9. I intend to use the Designed for Impact Tool for future projects.

For items 10-13, participants were provided free-response fields.

10. What did you find most helpful about the Designed for Impact Tool?
11. What aspect of the Designed for Impact Tool was most confusing or unclear?
12. What questions, comments, or suggestions do you have about the Designed for Impact Tool?
13. Is there anything else you would like to mention?

Appendix C

SURVEY INSTRUMENT: STUDENT-POST

Since learning about the Designed for Impact Tool (DIT), have you applied the tool in your work as a statistical collaborator?

1. I haven't used the tool.
2. I have used the tool to some extent.
3. I have used the tool in its entirety.

IF “I haven’t used the tool”:

1. What is the primary reason(s) that you haven't used the tool?
2. How likely are you to use the tool on a future project?
    a. Very Unlikely
    b. Unlikely
    c. Unsure
    d. Likely
    e. Very Likely

IF “I have used the tool to some extent”:

1. What is the primary reason(s) that you have used ideas from the tool, but not the tool itself?
2. How likely are you to use the tool on a future project?
    a. Very Unlikely
    b. Unlikely
    c. Unsure
    d. Likely

e. Very Likely

IF “I have used the tool in its entirety”:

1. What was the most effective/relevant feature of the tool when you applied it?
2. What was the least effective/relevant feature of the tool when you applied it?
3. How likely are you to use the tool on a future project?
    a. Very Unlikely
    b. Unlikely
    c. Unsure
    d. Likely
    e. Very Likely

Appendix D

SURVEY INSTRUMENT: PRACTITIONER

1. Do you primarily work in industry, academia, or hold a hybrid/joint appointment?
    a. Industry
    b. Academia
    c. Hybrid/Joint Appointment
2. How many years of experience do you have in statistical consulting or interdisciplinary collaboration?
    a. 0-5
    b. 6-10
    c. 11-20
    d. 20+
3. Briefly describe the project you are considering for this interview.
    a. Note: Most participants said they would draw on their experiences more broadly.

For items 4-15, participants were asked to rate their level of agreement on a scale from 1-6 (1 = Strongly Disagree, 6 = Strongly Agree). They were invited to provide an optional explanation for their response to any of the items.

4. The overall purpose of the Designed for Impact Tool is clear.
5. The distinction between prospective impact planning and retrospective impact evaluation is meaningful.
6. The DIT appropriately balances structure with flexibility.

7. The concepts introduced in the DIT align with how impact naturally unfolds in consulting projects.
8. The tool would be feasible to use within realistic project constraints (time, scope, access).
9. This tool seems broadly applicable across domains and industries that utilize statistical consulting.
10. The DIT prompts discussions that might otherwise be overlooked in typical consulting engagements.
11. Using a formal impact evaluation tool strengthens the role of statisticians as collaborators and advisors.
12. Overall, the Designed for Impact Tool is useful for statistical consulting practice.
13. I would consider recommending this tool to other statistical practitioners.
14. I would consider using the DIT to teach students or junior consultants about impact planning and retrospective impact evaluation.
15. There are new ideas from the DIT that I intend to integrate into my existing consulting or collaborative workflow.

For items 16-21, participants were asked to provide open-ended responses.

16. What are the top two strongest aspects of the Designed for Impact Tool?
17. What aspect of the tool feels most unclear, impractical, or misaligned with real consulting practice?
18. What aspects of this tool reflect the unique contributions statisticians bring to interdisciplinary teams?
19. If you were revising this tool, what are two changes or additions that you would make?

20. How do you foresee this tool improving the impact of your work or collaborations?

21. Is there anything else you would like to share that we haven't discussed?

Appendix E

ANALYTIC MEMO: ANALYSIS PATHWAY

This memo is meant to *informally* and *briefly* discuss the questions of interest for our qualitative analysis of student and practitioner feedback. We will also share a general approach for incorporating information from the Likert items also administered to students and practitioners.

## Key Question

Our qualitative analysis can be most broadly summarized with one question: What modifications or additions, to the model, artifact, or delivery will improve its relevance, clarity, or utility?

Evidently, there are three levels to this investigative prompt which tell us:

1. Whether the qualitative insight is suggesting a *modification* or *addition* to the existing materials;
2. Whether the qualitative insight is suggesting a change to the *process model*, the *artifact*, or the *delivery*;
3. Whether the qualitative insight is regarding *relevance*, *clarity*, or *utility*.

## Process Model, Artifact, and Delivery

There are three primary and overlapping contributions of this research. The first is the collection or curation of key components that we think contribute to impactful interdisciplinary statistical collaboration. These were chosen both deductively (i.e., by recommendations in the literature) and inductively (i.e., by way of the researchers' judgment). This collection of components is merely a hypothesis for defining an effective, impactful collaborative process. Thus, the feedback we receive from students and practitioners about the components themselves (e.g., "the vision and impact components

don't feel distinct enough"), would represent qualitative insight regarding the *process model*. The second contribution of this research is the artifact that accompanies and operationalizes the process model. This is the physical, printable tool that should help prospective users implement our five components into their collaborative workflow. The third contribution of this research is our *delivery* of the process model and the artifact. Here, we would consider the kinds of materials that we use to present this work (e.g., website, instructional videos, worked-through examples), the kind of messaging we use and audiences we target (e.g., students versus practitioners, industry versus academia), among other considerations about dissemination.

### Relevance, Clarity, and Utility

These represent our primary constructs of interest. In this study, relevance means the perceived importance and alignment of the ideas we present with real-world interdisciplinary, statistical collaboration. Clarity means that the user understands the intended purpose of the process model and tool and how to apply them. Utility is the extent to which the framework and tool are helpful to their users for maximizing and communicating impact in interdisciplinary, statistical collaboration.

There are subsidiary constructs that we are also interested in. For example, we would like to collect preliminary data on the adoption or intent to adopt the framework and tool. A robust understanding of the adoption and efficacy of the tool is beyond the scope of this study. However, we *can* ask questions about, say, the practitioners' intent to adopt the framework and the way in which they do so. And for students, we can coordinate instruction of the framework so as to coincide with a class consulting engagement, then ask about the extent to which they used the tool. Both of which we did in this study. These are not definitive methods for understanding adoption of the tool but could still generate some

insight. We are also interested in the functional and aesthetic design of the tool. For example, whether students and practitioners liked the layout, colors, etc., but these findings can reasonably be folded into *clarity* or specified under the *delivery* of the framework and tool.

### Theming

Our intent for the qualitative approach of this research is to collect all open-ended feedback from study participants, sort and group quotes, and generate themes that challenge or support our process model for impact-centric statistical collaboration. The exact approach will be detailed in the methodology of the paper, but this process will consist of multiple stages starting with preliminary analytic memos for the student and practitioner data in parallel. We will then parse the open-ended feedback into relevant quotes by splicing or disaggregating them. Then, we will group similar quotes together and generate themes, discussing what additions or modifications those themes suggest to the process model, artifact, or delivery, with respect to our constructs of interest. This process is meant to be highly descriptive, staying close to the respondent's original feedback and avoiding extrapolation or generalization. While commonalities within the feedback will emerge as the most critical changes to our process model, artifact, and delivery, we will also be responsive to one-off comments that we judge as particularly insightful or relevant.

### Likert Items

We plan to use the Likert items in two primary ways. The first is to visualize the overarching sentiment of the respondents – diverging bar charts are helpful for seeing the “mass” of agreement and disagreement

to our collection of questions about relevance, clarity, and utility. The second is to corroborate or challenge the qualitative findings to triangulate themes and strengthen or weaken the case for a particular addition or modification to our process model, artifact, or delivery. To reiterate, the *way* that we built the framework and artifact, and the way that we disseminated and communicated it, represents an amalgamation of hypotheses, formed deductively and inductively, about how to do impact-centric collaboration in statistics. These hypotheses are what we seek to validate or invalidate with feedback from prospective users (i.e., students and practitioners) without generalizing beyond our participants.

Appendix F

ANALYTIC MEMO: STUDENT DATA

This memo is meant to informally document my initial impressions of the feedback from our student participants.

Structure

There seems to be broad appreciation for the structure that the framework and tool afford them. They report the tool helping with orientation to new projects and domains and with clarifying thoughts to communicate with the domain expert. These kinds of remarks often contained words like “structure,” “organize,” “flow,” “breaks down,” etc.

Overlap

Students seemed disconcerted and confused about whether components like Vision, Impact, and Partnership were supposed to overlap. The distinction between each wasn’t clear or, perhaps, meaningful.

Clarity

The elements of the framework and tool that were most unclear to students were Impact and Narrative. Students had trouble identifying the “end-user” stakeholders for Impact and knowing what kind and length of information was expected for the Narrative section. Generally, the students seemed to want more guidance on how to fill out each box and, perhaps, some robust examples for each box would have been helpful.

### Implementation

The students expressed a clear appreciation for the ideas captured by the tool (i.e., the framework aspect), but less of an inclination to apply these ideas using the artifact. They cited a sort of "administrative" burden or time constraint associated with filling out the artifact, especially for short-term engagements. When issuing positive remarks they used phrases like "big picture" and "domain expert alignment;" when making constructive comments they used phrases like "mental model" and "only some of the concepts." Most of these remarks came from the student post survey, after they had an opportunity to apply the tool. By far, the most cited barrier for adopting the tool was time constraint, which I think is mostly a product of their specific class project and environment.

### Alignment

Many students appreciated that the tool helps with client alignment. When discussing this, they made comments like, "reflecting on what the domain expert wants," "staying on the same track," and "getting an overall picture [of the domain]."

### Likert

Almost all students agreed to some degree that impact planning and assessment is important, as well that future students of statistical consulting courses should be taught these concepts (38/39). Almost all students expressed understanding, perceived practicality, perceived utility, and intent to adopt. Despite still being positive, clarity and intent to adopt had the weakest signal (i.e., highest proportion of slightly agrees). Most students (22/30) used the tool to some extent and, of those, most said that they were likely to use the tool on a future project.

Appendix G

ANALYTIC MEMO: PRACTITIONER DATA

This memo is meant to informally document my initial impressions of the feedback from our practitioner participants.

Expanding the role of statistical collaborators

Many practitioners expressed a belief that statistical collaborators are ready and able to contribute more comprehensively to their interdisciplinary engagements (i.e., planning, decision-making, etc.). They said the tool was effective at positioning the technical practitioner this way – inviting the client to engage the practitioner in broader discussions than merely number-crunching. Several said that documentation of the statistician's effort and translated impact would be helpful for justifying their role on the team in terms of value-add and even for personal record-keeping of one's own impact.

Relevance and formalizing instincts

The majority of respondents said that the ideas captured by the framework and tool are consistent with either their current practice or what they believe to be the "ideal" practice. That is, our work is formalizing and capturing the natural instincts of seasoned practitioners in terms of deeper and impactful engagement with interdisciplinary domain problems. Even for the practitioners who showed apprehension to adopt the tool themselves, often citing that they already implement all of what the tool offers, almost all were very keen on using the framework and tool to teach early-career statisticians and data scientists. Several alluded that the tool would help reduce the learning curve to becoming a valuable collaborator. Almost all cited the tool's conciseness as being its greatest strength – capturing core tenets of effective collaboration while keeping to one page.

Rigidity and re-scoping

One of the most common complaints or confusions among practitioners was how this tool adapts to project re-scoping, pivoting, and analytical dead-ends. They expressed a desire for the tool to be more flexible to iteration – this might come in the form of a digital version that's easier to edit, or more conversation and focus around pivot points and "off-ramps" during the impact planning stage, or building in check-in points throughout the life cycle of the project to update the tool.

Expectations, alignment, and integration with the scope of work

The most favorable aspect of the framework and tool among practitioners was its ability to facilitate alignment with the client and set expectations about the contributions of the statistician or data scientist. On the former, the tool instigates deeper conversations about the domain and the broader project or mission that their collaboration exists within – practitioners believe this would help avoid mishaps and misunderstandings later by clarifying the needs of the client early in the collaboration (i.e., in terms of deliverables, timeline, resources, or even graphical styles). On the latter, the practitioner appreciated that the tool served as documentation and record-keeping that would keep the statistician on track with the task as well as manage scope-creep from the client. This could be a concise cover page to a longer scope of work (a.k.a., statement of work, contracts with CROs, etc.) or serve as a brief, more friendly SOW for academic or early-career practitioners.

Nature of engagement and implementation clarity

A slightly less common but present theme was that the tool felt limited in applicability. They expressed that the tool seemed most designed for longer-term engagements that are conducted in dyads (i.e.,

statistician and domain expert). In actuality, many practitioners work in teams, not dyads, with individuals who have some degree of statistical expertise. Some worried there wouldn't be sufficient time to fully implement the tool in many of these engagements. Given these constraints, most practitioners expressed a need for robust, worked-through examples, and much more clarity on how the tool is used throughout the life cycle of a project (i.e., when it's introduced, returned to, how it's iterated, how it worked with teams, how it works with different lengths of engagements, etc.).

Likert

Overall sentiment was positive across all items. The highest scoring items (i.e., receiving a large proportion of strongly agrees) were "would consider using Designed For Impact Tool to teach" and "using a formal impact tool strengthens the role of statisticians." This suggests that practitioners are interested primarily in using the tool to teach which is consistent with practitioners' frequent mention that our tool seems most effective for early-career practitioners. It also seems that the practitioners we interviewed are supportive of the use of an artifact despite frequently citing the likely administrative burden of implementing the artifact. Perhaps they're recognizing the role of hyperbolic discounting – the tool might steal some time at the beginning of an engagement but recover even more time from being lost later in the engagement. The lowest scored items were, "new ideas from the Designed For Impact Tool that I intend to integrate in my workflow" and "would recommend this tool to other practitioners." I realize now that the former is double-barreled. In conversation/explanation, most practitioners objected to the "new ideas" part, citing their extensive experience, but not the "intent to integrate" part. Both of these items were in the adoption category.

Appendix H

STUDENT LIKERT ITEM SUMMARY

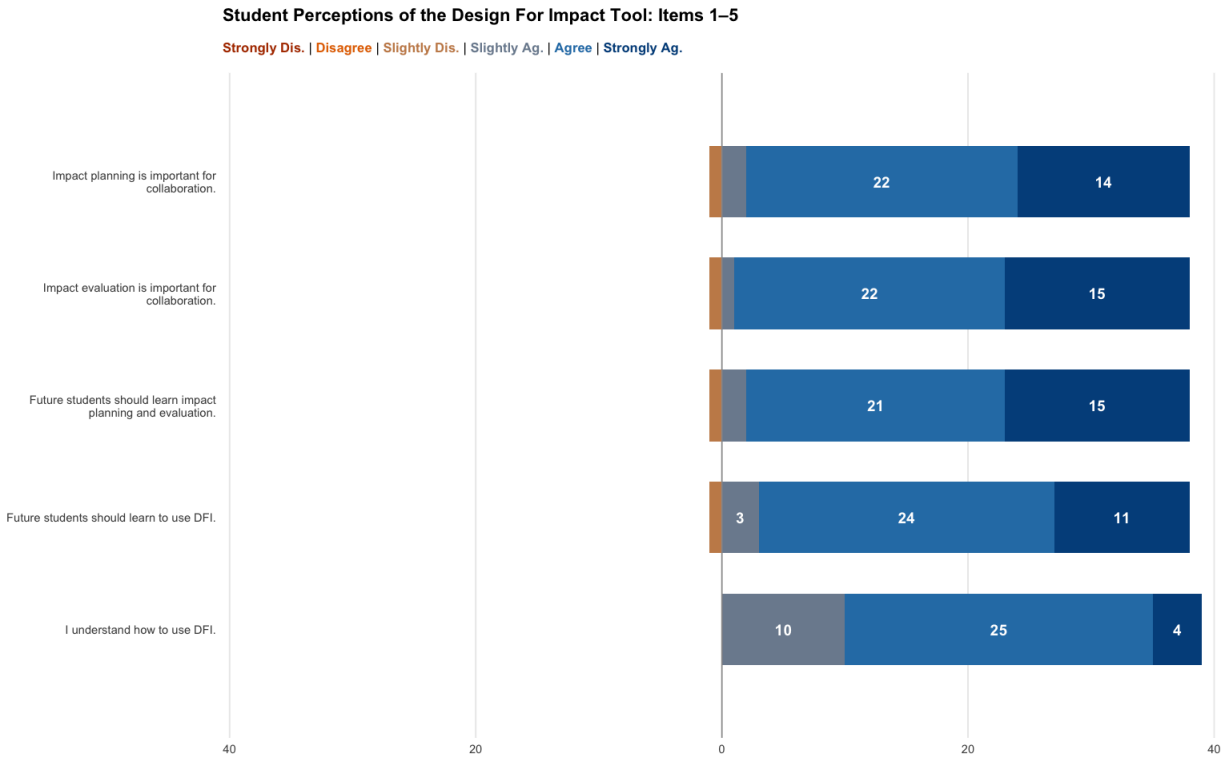



Figure H.1. Likert items 1-5 from the student pre-survey. Note: The full questions can be found in Appendix B, items 1-5, shown top to bottom in Figure A.5.

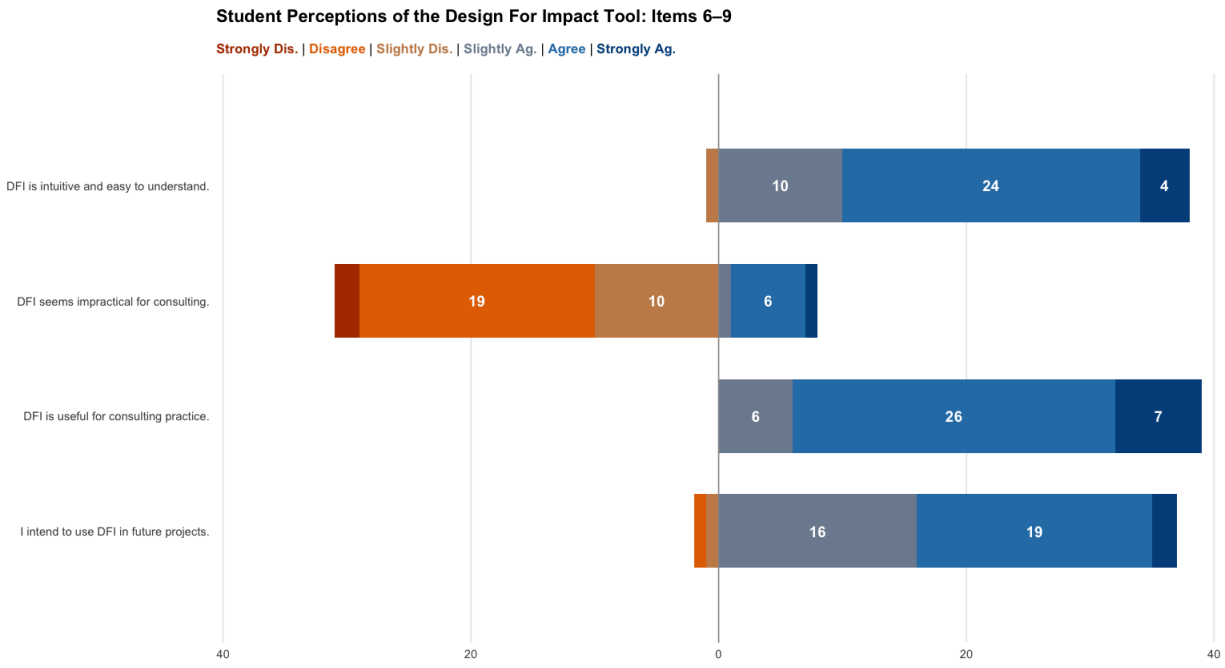



Figure H.2. Likert items 6-9 from the student pre-survey. Note: The full questions can be found in Appendix B, items 6-9, shown top to bottom in Figure A.6.

Interpretation

Students expressed the strongest agreement on the importance of impact planning and evaluation, rather than on the tool itself. Of the 39 respondents, 15 strongly agreed that impact evaluation is important for collaboration and that future students should learn impact planning and evaluation, while 14 strongly agreed that impact planning is important. By comparison, 11 strongly agreed that future students should learn to use the Design For Impact tool. These responses suggest that students were particularly receptive to the underlying principles of Design For Impact, even beyond the use of the physical tool.

Responses concerning the tool's usability and future adoption were generally favorable but less emphatic. Only four students strongly agreed that the tool was intuitive or that they understood how to use it, and just two strongly agreed that they intended to use it in future projects. Similarly, although 31 students disagreed to some degree that the tool seemed impractical for consulting, only two strongly disagreed. It’s possible that the eight students who agreed with this prompt did not notice its reverse-coded nature. These responses suggest that students recognized the value of Design For Impact while showing more reservation for its practical application and continued use.