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Collective creativity: strategies for catalyzing interdisciplinary research

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Abstract

Fostering interdisciplinary collaboration is critical for addressing complex research problems. At the earliest stages of research ideation and mobilization, we need to create environments that cultivate collective creativity, curiosity and decision making among those with diverse expertise. The fields of design and design thinking offer excellent tools and approaches for promoting rich conversations while simultaneously navigating ambiguity. Here we describe how design strategies can support team science, specifically as loosely formed groups collaboratively brainstorm around intractable problems.

Keywords Science communication: theory and models

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Interdisciplinary collaboration is widely considered essential for driving innovation and addressing complex scientific problems. In academia, we are finding that the biggest societal challenges, whether defined by funding agencies, the university, or researchers themselves, require an incredibly wide-range of expertise to uncover original and impactful solutions. Indeed, team-based research is increasing across fields [Wuchty, Jones and Uzzi, 2007], which may be due in part to problems today being more ill-defined, technically challenging, and most suitable to solutions that require disciplinary diversity [Bennett and Gadlin, 2012].

At the Michigan Institute for Clinical & Health Research (MICHR), the University of Michigan's Clinical and Translational Science Award hub, efforts have focused on supporting research teams as they pursue large, team-based grants that will provide the needed funding to tackle big problems. There are often years of advanced planning required to create a competitive large-scale grant submission, and there is a need to create momentum at the earliest stages of research ideation. To address this, MICHR has recently developed and implemented facilitated brainstorming sessions in which interdisciplinary groups, often comprised of biomedical researchers, engineers, artists, and architects, among others, can ideate

and mobilize around intractable problems. Often, these sessions serve as 'Day 1' for collaborative thinking, and it is common that participants have never met before. As such, we are challenged to foster environments in which participants can collectively and deeply explore potential opportunities in the absence of knowledge regarding the expertise and experiences of others in the room. To address this, we posit that the fields of design and design thinking offer excellent tools for unleashing the inherent creativity and curiosity within researchers. Designers relish the lack of predetermined outcomes and have developed frameworks to meaningfully engage with ambiguity and bring increasing iterations of clarity to a fuzzy problem space. While providing models for generating varied choices, design also incorporates structures for collective decision making [Boland and Collopy, 2004]. As such, designers have evolved from being creators of things to being catalyzers of people.

It is precisely this insight that can help us use relevant, embodied routines of designers to help foster collective creativity, while simultaneously driving a horizontal distribution of responsibility among interdisciplinary researchers. Embedding a design attitude in research fosters an acceptance of, and comfort with, a problem solving process that remains liquid and open [Boland and Collopy, 2004]. In this way, we can build a sequence of engaging and purposeful activities that advance interdisciplinary conversations and research agendas. Some of the ways in which we overlay the foundations of team science with elements of design in our interdisciplinary research support programming, and specifically in a series of brainstorming sessions, include:

Understanding 'user' needs. A key trait of human-centered design is the ability to develop deep empathy for the people we are designing for [IDEO, 2011]. Before designing a brainstorming session for a group, we need to understand their perspectives, needs and desired outcomes. We purposely use the word 'group' at this stage because the participants in our brainstorming sessions will not be cohered enough to identify as a team. There is often one or more faculty - designated by us as the 'champions' — who are leading the interdisciplinary effort and will be the point persons for providing key information and feedback throughout the design process. Initial meetings with faculty champions will focus on discussing immediate and long-term research goals, composition of the research group, and desired outcomes at the conclusion of one or more brainstorming sessions. In general, understanding where the group is now and where they want to go will inform which structured activities will elicit the right information from participants.

Amplifying diversity. Different perspectives are needed to solve tricky problems in a holistic way. We work closely with faculty champions to ensure diverse disciplinary expertise is represented during a brainstorming session. In order to amplify the voices of all participants, our session activities are designed to appeal to both introverts and extroverts, and they allow participants to build on each other's ideas, resulting in potential solutions that will truly challenge the status quo.

Context setting. The idea of creating a meaningful space that participants enter in order to explore possible permutations and combinations is foundational to game theory. This idea has found its way into the world of design [Gray, Brown and Macanufo, 2010]. For brainstorming sessions to be fruitful, participants must understand why the problem under consideration is important, why the faculty

champions are seeking their expertise, and the long-term goal(s) of the effort. Appropriate framing of these issues is key and will ultimately have a huge impact on what is achieved by the end of the session(s). Context setting begins prior to the group convening, and we have used tools such as journey mapping, empathy mapping and show and tell activities to articulate research problems, such as a patient's experience with a disease, so that all participants have foundational knowledge. We are very explicit at the beginning of a brainstorming session about what we want to achieve in both the short- and long-term, and each prompt we use to elicit information throughout the session has been carefully crafted to drive towards those goals.

Making things visual. While highlighting the importance of diagrammatic reasoning in problem solving, Herbert Simon and colleagues noted that sketches and visuals had a "low search and recognition cost" [Qin and Simon, 1992]. Visual artifacts are carriers of meaning; they make information explicit, tangible, portable and persistent [Gray, Brown and Macanufo, 2010], thus allowing participants to engage with the situation at hand. We promote visual thinking in our brainstorming sessions as a great way to invite collaboration, to help get people on the same page and to clarify thinking. Tools we use include sticky notes for capturing, sharing, linking and reorganizing research ideas. We use sticky dots for prioritizing ideas, and participants are given trading cards with their pictures and names that are used when mapping themselves to research ideas. Open walls are ideal for displaying these visuals and for sparking conversations among participants as they actively engage with the tangible artifacts.

Divergence and convergence. While primarily associated with creating varied solutions, Herbert A Simon in *The Sciences of the Artificial*, a pivotal book on management, describes design as the science of decision making [Simon, 1969]. In practice, design process typically involves repeated loops of divergent and convergent thinking, terms coined by Joy Paul Guilford [Guilford, 1967]. In our sessions, we ask participants to think very expansively about possible solutions to a problem (divergent thinking). The accompanying activities they engage in are designed to foster creativity, exploration, and originality. In convergent thinking, we help participants to reflect on the many different ideas generated and to begin prioritizing the best potential solutions. Depending on the complexity of user needs, we may create a series of convergent and divergent activity loops that create momentum in the ideation process.

Horizontal distribution of responsibility. Design processes that encourage low vertical management structures allow for a horizontal distribution of responsibility, enabling greater inclusion and bubbling of local knowledge in the service of a common goal. Although we have faculty champions who are leaders of the broad research effort, our collective creativity activities foster sharing of ideas across all participants. Indeed, activities are structured in such as a way that resulting ideas are separated from the person, and methods for prioritization capture input from all participants. Such structure empowers everyone to be part of the process and helps them begin to feel ownership over the collective decisions.

Bias towards action. In a rapidly changing world, workgroups don't have time to react to developments; members need to increase decision-making velocity, taking actions quickly and learning from each one [Hagel III et al., 2018]. It is thus crucial

that the momentum and excitement created through collective design activities is maintained once this time together ends. As such, towards the conclusion of a session, we have participants engage in activities that will determine actionable next steps and commit them to assuming responsibility for specific tasks with deadlines. Using a show, don't tell mentality, session facilitators are the first to identify and take responsibility for certain assignments; this typically elicits others in the group to do the same, ensuring progress and collaborative activity will be sustained.

Design and design thinking methods have been used successfully to advance research and health care in numerous settings. Design experts and companies, including IDEO, have long used, and advocated for, applying these approaches to solve complex health problems and ignite collaborative ideation in research [Bernstein, 2011; Brown, 2008; Brown and Wyatt, 2010; Simons, Gupta and Buchanan, 2011]. While the methods vary, design thinking approaches have been adopted to understand numerous health conditions [Altman, Huang and Breland, 2018], and a scoping review by Bazzano et al. [Bazzano et al., 2017] highlight the various health-related contexts in which design thinking has been leveraged. For our own work in advancing interdisciplinary research, we have drawn much inspiration from the strategies outlined in *Gamestorming* [Gray, Brown and Macanufo, 2010], *The Surprising Power of Liberating Structures* [Lipmanowicz and McCandless, 2013] and *Make Space: How to Set the Stage for Creative Collaboration* [Doorley and Witthoft, 2012]. While the ideas on this topic are predominant, the knowledge to translate these theories to research development and its eventual impact are less forthcoming. Moving forward, we are working to refine the process of enabling and managing collective and participatory interdisciplinary research and to critically evaluate the impact that human-centered design can bring to fostering interdisciplinary conversations and advancing research agendas.

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