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ORIGINAL ARTICLE

How Expert Consultation Affects Creativity: The Role of Expert Input in Early-Stage Innovation

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ABSTRACT

Whether contact with domain experts enhances or constrains creativity at the start of innovation projects is widely debated. Guidance in many innovation programmes advises teams to avoid experts during initial ideation to limit anchoring and conformity, yet empirical evidence at the team level is limited. This exploratory study investigates how early exposure to experts influences idea generation in multidisciplinary teams participating in the CERN IdeaSquare Summer School. Drawing on qualitative reflections from 15 of 25 participants, the study examines how expert guidance affected the novelty, feasibility, and evolution of team ideas. Findings suggest that expert input can both enhance creativity, by providing technical knowledge that clarifies opportunities and constraints, and introduce bias by anchoring ideas to familiar solutions. Teams with diverse disciplinary backgrounds appeared better able to integrate expert insights without losing originality, suggesting that team composition moderates the impact of early guidance. Although limited by sample size, the findings provide preliminary insights into designing collaborative ideation processes and inform future research on optimizing expert engagement in early-stage innovation.

Keywords: Creativity, Expert Consultation, Multidisciplinary Teams, Innovation, Ideation, Cognitive Bias.

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INTRODUCTION

Innovating requires balancing imaginative thinking with practical guidance. A key debate concerns whether, in creative team projects, teams should consult experts early to enhance feasibility or delay contact to avoid anchoring and conformity. Some innovation programs encourage early expert engagement to reduce uncertainty, while others caution that it may constrain divergent thinking. Psychological research suggests that early exposure to information can unconsciously shape later judgments and responses (Horner & Henson, 2008). Similarly, in idea generation, advice from an expert may influence which ideas emerge and create a reference point that biases judgments toward the first suggestion (Myers, 2023).

This study focuses on creativity at the team level, investigating how teams generate novel and useful ideas while interacting with experts. Most research examines how internal team dynamics creativity but less is known about how guidance from external experts shapes idea generation early in the innovation process. This gap is significant because early expert input can either enhance or constrain creativity: relevant technical knowledge may support feasible, innovative solutions, but it may also anchor thinking and limit divergent ideation. Understanding how early expert guidance shapes creativity can offer practical insights for designing collaborative innovation processes that maximize both novelty and feasibility. This study addresses the following question: *How does consultation with technical experts at the beginning of a project shape creative idea generation in multidisciplinary teams?*

This question is examined in the context of the CERN IdeaSquare Summer School (CISS), where student teams from diverse disciplines are tasked with developing novel applications of deep technologies for real-world problems. The CISS setting is particularly suitable for this study because it provides a structured, multidisciplinary innovation ecosystem in which teams are encouraged to consult technical experts for guidance, validation, or advice on feasible applications. The combination of diverse team composition and access to early expert input allows investigation of how early-stage consultation shapes creative idea generation in a realistic yet analysable setting. To examine how early-expert exposure affects creativity within teams, we surveyed 25 CISS participants, 15 of whom responded. Given the small sample size, this study is treated as exploratory, aiming to provide preliminary insights to

guide future research on the role of expert consultation in early ideation.

THEORETICAL BACKGROUND

Team creativity refers to the collective capacity of a group to generate ideas that are both novel (original and new) and useful (feasible and valuable in practice) (Amabile, 1988; van Knippenberg, 2017). Unlike individual creativity, which arises from a single person's cognitive processes, team creativity emerges from interactions among members, the integration of diverse knowledge, and the negotiation of ideas. A key cognitive process supporting creativity is *divergent thinking*, the ability to explore multiple alternatives rather than fixating on a single solution. Multidisciplinary teams, by integrating varied disciplinary perspectives and skills, can expand the range of possible solutions and enhance collective creative performance. (Anderson et al., 2014).

A critical question in innovation practice concerns the timing of expert input with experts. In the CISS environment, *experts* are defined as domain-specific physicists and technical specialists who possess deep knowledge of specific technologies (which may or may not be the primary technology a specific CISS group is exploring), and are recognized as reliable sources of knowledge or skill whose judgment is accorded authority and status by peers and the public (Ericsson, 2006). Then, *expert input* refers to the technical guidance, validation, or prescriptive advice these specialists provide regarding the feasibility and potential applications of the said technologies, realizing a technical knowledge transfer in the innovation ecosystem (Mieg, 2001).

Some innovation programs like CISS may discourage approaching technical experts early in the innovation process. This could be due to psychological studies on priming and anchoring, showing that earlier experiences influence later thoughts and judgments. Priming occurs when encountering a suggestion or piece of information shapes how individuals respond to subsequent stimuli (Horner & Henson, 2008). Similarly, anchoring occurs when the first value or idea received becomes a starting point, especially considering the power asymmetry between experts and student teams. Opinions from experts may be perceived as more authoritative and indicative as "useful" starting points, especially if they remain too close to the prescribed technical specifications of a given technology (Myers, 2023). Thus, team members without domain knowledge may evaluate new ideas relative to the expert's initial opinion rather than considering a wider range of possibilities, which could explain why certain innovation programs discourage early exposure to expert input.

Another possible reason for delaying early-stage expert consultation could be to prevent *functional fixedness* from individual members and relevant technical experts who possess domain technical knowledge. *Functional fixedness* is a mental block in which experience with the usual function of an object makes it harder to imagine alternative uses (Newell et al., 1972; Gick et al., 1983). Creativity researchers have found that designers often replicate elements of examples they have seen even when they are asked to create something different (Jansson & Smith, 1991; Smith et al., 1993). This tendency shows that individual members with technical knowledge, and even experts, are not immune to cognitive bias as their familiarity may limit the generation of innovative solutions. Consequently, when consulting technical experts, individual team members with technical domain knowledge may unconsciously gravitate toward familiar ideas, potentially overlooking other possibilities.

While the research literature seems to suggest against early-stage expert consultation, research on cognitive fixation during the ideation process offers ways to reduce the limitations of anchoring and functional fixedness in team members, both with and without technical domain knowledge. One study found that switching between tasks helped people think of more ideas and refine them because it interrupts fixed patterns of thought (Lu, Akinola & Mason, 2017). These tasks can involve alternating between divergent thinking, in which many ideas are generated, and convergent thinking, in which ideas are refined. Successful teams use both forms of thinking to develop ideas that are new and useful (Amabile, 1988; Gilson et al., 2019), and the way team members interact and combine different perspectives is crucial (Anderson et al., 2014).

Taken together, these psychological principles suggest that early consultation with experts can shape creativity in complex ways. On the one hand, expert feedback can provide essential technical understanding that supports convergent thinking and helps teams refine ideas early in the innovation process. On the other hand, expert input may predispose teams toward particular directions, narrowing their creative search space.

Empirical research on these dynamics at the team level, particularly in real-world innovation settings, remains limited. This study contributes to the theoretical conversation on Innovation Education and team dynamics by examining how cognitive mechanisms such as anchoring and functional fixedness may interact with a team's disciplinary composition to either support or constrain creative idea generation. By integrating these previously fragmented perspectives, the study highlights the importance of understanding the conditions under which expert guidance may enhance or limit creativity. This theoretical framing provides the motivation for future research on how multidisciplinary teams can effectively engage with expert input during early-stage ideation.

METHOD & ANALYSIS

Building on the theoretical expectation that early expert input can shape creative cognition through mechanisms such as anchoring, functional fixedness, this study adopts an exploratory qualitative design. The aim is not to test causal effects or quantify relationships, but to analytically examine *how* different forms of expert consultation are experienced by teams and *how* these experiences relate to perceived creativity during early-stage ideation. Given the focus on processes and meanings rather than outcomes, a qualitative approach is well suited to capturing participants' reflections on expert interactions and the evolution of their ideas. Accordingly, the analysis is oriented toward identifying recurring patterns in *perceived modes of expert interaction* and their cognitive and creative consequences, rather than toward classifying experts themselves or evaluating objective creative performance.

The analysis draws on survey responses from 15 of the 25 participants in the CERN IdeaSquare Summer School (CISS). Participants represented diverse disciplinary backgrounds, including engineering, physics, computer science, and social sciences, and were organized into six multidisciplinary teams of four to five members. All teams worked on early-stage innovation projects to develop novel applications for assigned advanced technologies, with structured opportunities to consult technical experts during the program. While the limited sample size constrains generalizability and precludes robust quantitative analysis, it is appropriate for an exploratory study aimed at developing analytically grounded insights into expert–team interactions. Findings are therefore interpreted as preliminary patterns that can inform future, more systematic investigations rather than as generalizable effects.

Data Collection & Survey Design

A survey was developed to capture participants' reflective accounts of expert interactions and idea development (see Appendix). The survey focused on two core dimensions of team creativity: novelty (originality of ideas) and feasibility (technical and practical viability). To explore the research hypothesis, the survey was structured around three guiding questions:

1. Did participants adopt recommendations from experts when iterating their technology applications?
2. Did access to expert knowledge facilitate or hinder their ability to think outside the box?
3. How did participants evaluate their initial exposure to expert information and the perceived quality of their ideas at the outset of the project?

To address these prompts, the survey was organized into two main sections: (1) *Idea Development Tracking & Expert Exposure*, and (2) *Idea Story & Expert Interaction* (see Appendix for survey structure).

In the first section, participants documented the evolution of their ideas at key turning points: beginning of the project, after individual research, after brainstorming, after meeting with experts, and at the end of the project. At each stage, they rated both the quality of their ideas and level of expert exposure on a continuous scale from 0 to 1. An idea quality rating of 0 indicated low novelty or feasibility, while a score of 1 represented a highly novel and strongly feasible idea. Similarly, an exposure score of 0 denoted no expert contact, and 1 indicated extensive engagement at that stage. These scales were not used for statistical analysis but served as self-reflective indicators, helping participants think about their own creative progression and the perceived influence of expert input.

In addition to numerical ratings, participants answered open-ended questions about whether experts recommended specific application areas, whether such recommendations influenced their decisions, and how expert consultation affected their technical understanding and creative thinking. Creativity was assessed through participants' reflections on whether their ideas became more original and applicable following expert consultation.

The second section invited participants to narrate the *story* of their idea development, including sources of inspiration and the role of expert interactions in shaping their final application. Open-ended questions encouraged reflection on how expert feedback influenced both the originality and feasibility of their ideas. Recognizing that individual experiences may vary and cannot be fully captured through predefined questions, this section emphasized open narrative responses, enabling the identification of recurring patterns, challenges, and potential biases in how expert input affected creativity.

The analysis of these responses aimed to clarify whether extensive exposure to experts leads to a bias toward familiar ideas, potentially reducing novelty, or whether it encourages divergent thinking. If the latter occurs, it can be further examined whether this effect stems from the participants' increased technical knowledge, and whether this knowledge accumulation within teams outweighs the risk of bias from expert influence.

Data Analysis

A thematic analysis of participants' open-ended survey responses was conducted, following the approach of Braun & Clarke (2006). Responses were read multiple times and analysed by two of the study authors, who were also participants in the CERN IdeaSquare Summer School. Their familiarity with the context enabled deeper insight into the ideation processes, while also introducing the possibility of insider bias. To minimize this, the

authors approached the analysis reflexively, documenting assumptions and interpretations, and grounding emerging patterns in the participants' responses.

The analysis proceeded in four stages:

1) Initial Coding: Narrative responses were subjected to inductive first-cycle coding. Segments referring to expert interaction, idea development, or cognitive effects were assigned descriptive codes, capturing both interactional and cognitive aspects of expert consultation. Examples of codes included *expert validation*, *clarification of technical constraints*, *feasibility-oriented refinement*, *anchoring to expert suggestions*, *fixation on familiar applications*, *knowledge-driven creativity*, *divergent exploration*, and *convergent narrowing*. Coding was conducted without predefined categories, allowing both theoretically anticipated mechanisms (e.g., anchoring, functional fixedness) and emergent patterns to surface from participants' descriptions.

2) Identification of Expert Interaction Modes: Codes from the first-cycle thematic analysis were examined for recurring configurations across participants. This process led to the identification of three analytically distinct *modes of expert interaction*, understood as patterns in how expert input was perceived and integrated by teams rather than as stable expert types: *validation-oriented input*, in which experts primarily confirmed the feasibility, relevance, or technical soundness of ideas already under consideration, with contributing codes including *expert validation*, *feasibility-oriented refinement*, and *clarification of constraints*; *knowledge-enabling input*, in which experts provided technical explanations, contextual background, or insights into system limitations, with relevant codes including *knowledge-driven creativity*, *clarification of technical constraints*, and *divergent exploration*; and *directive or prescriptive expert input*, in which experts suggested specific application areas, use cases, or solution pathways, with associated codes including *anchoring to expert suggestions*, *fixation on familiar applications*, and *prescriptive advice*.

Classification was based on participants' narratives rather than objective expert traits, and patterns were observed across teams rather than tied to specific expert backgrounds, seniority, or interaction styles. While some participants noted differences depending on the expert's familiarity with the field or style of explanation, these factors were not systematically captured; therefore, the modes represent perceived patterns of expert input consistently reported by multiple participants, making them analytically grounded while remaining exploratory.

3) Theme development: Codes and expert input modes were grouped into broader themes capturing the perceived effects of expert consultation on creativity. The main themes were *validation and feasibility*, capturing how expert input helped clarify constraints and opportunities; *knowledge-driven creativity*, highlighting instances where technical insights enabled novel applications; *bias and fixation*, describing situations where expert guidance shaped the direction of ideation and potentially limited exploration; and *team composition effects*, reflecting variations in how teams integrated expert input based on prior technical knowledge or disciplinary diversity.

These themes integrated both cognitive mechanisms (e.g., anchoring, fixedness) and social dynamics (e.g., reliance on authority, division of expertise within teams).

4) Interpretation and Cross-Team Analysis: Themes were examined across teams and linked back to the three guiding survey questions outlined earlier in the Method & Analysis section. Anonymized participant quotes and illustrative examples were used to demonstrate how different modes of expert interaction related to perceived changes in novelty, feasibility, and creative direction. Descriptive self-ratings of idea quality and expert exposure were used to contextualize narrative accounts, supporting interpretation of perceived idea trajectories without serving as independent analytical variables.

RESULTS & DISCUSSION

Adoption of Expert Recommendations

Survey responses indicate that early-stage consultation with experts influenced the generation of creative applications in several ways. Participants who met with experts at the beginning of the project reported that guidance clarified technological possibilities and constraints, helping them refine initial ideas and produce proposals that were both coherent and feasible, while improving the quality. One participant noted, *"Knowing the context in which it was used helped a lot. Hearing firsthand about the problems and why previous solutions failed was very useful,"* suggesting that early consultation provided a reference point that shaped the direction of idea development. Reflective self-ratings indicated that most participants perceived an improvement in idea quality following expert consultation, particularly with respect to feasibility and clarity. Importantly, most participants did not report feeling constrained by the expert input, indicating that early guidance did not necessarily result in fixation.

At the same time, some participants described focusing primarily on application areas recommended by experts, even when other possibilities existed. As one participant explained, *"We tended to focus on the areas the expert mentioned, even though other options were possible."* This may reflect a potential anchoring effect, where initial expert input influences the team's creative thinking and could limit exploration of unconventional ideas.

Participants' responses also suggested that the anchoring effect may vary depending on the nature of the guidance and the team's prior knowledge. If the input

provided a broad overview and general context without delving into potential uses or applications, it would not necessarily hinder creativity or divergent thinking. Conversely, when guidance was more directive or focused on specific applications, teams appeared more likely to be influenced by the expert's bias, which might result in fixation on a single solution and limit "out of the box" ideas. When participants perceived expert input as a foundation for understanding the context, validating potential applications, or inspiring new ideas, it appeared to support both divergent and convergent thinking, leading to proposals that were both innovative and feasible. While these patterns are consistent with theoretical expectations regarding functional fixedness and anchoring, the underlying cognitive mechanisms were not directly observed and therefore remain interpretive.

Impact on Divergent Thinking and Creativity

Participants also described variation in how early expert consultation affected divergent thinking. Teams with limited technical knowledge often reported that minimal expert guidance allowed them to generate more imaginative and unconventional ideas, drawing on personal experiences or interdisciplinary perspectives. Participants suggested that insufficient technical understanding sometimes led to frustration or a focus on ideas perceived as immediately feasible, which they felt could limit more exploratory ideation; in this sense, early-stage contact with experts was described as providing a useful foundation for subsequent creative work. Reflective ratings supported these narratives by indicating perceived increases in idea quality across project stages, particularly following phases involving expert consultation and focused refinement. Conversely, early expert input sometimes encouraged teams to balance originality with feasibility, resulting in ideas that were both innovative and implementable. This indicates that early consultation can support convergent thinking without necessarily suppressing divergent thinking, depending on prior knowledge and team composition.

Influence of Team Composition and Prior Knowledge

The effect of early consultation also seemed to vary across teams. Teams composed of both technical and non-technical members often described integrating expert guidance while maintaining a sense of originality, viewing expert input as a starting point rather than a limiting influence. In contrast, teams composed primarily of novices sometimes described relying more heavily on expert suggestions, which they perceived as constraining their creative exploration. These observations are consistent with prior work by Smith et al. (1993), which shows that existing knowledge and prior experiences can shape the generation of new ideas, including the incorporation of features from existing solutions. However, the specific ways in which team composition drives these outcomes remain tentative. Nevertheless, team composition emerges as a potentially important factor that may moderate how early expert guidance influences creativity, warranting further investigation in future studies.

Overall, early-stage consultation with experts influenced creative idea generation in complex. It provided knowledge that improved the feasibility, clarity and quality of ideas, while also introducing the potential for cognitive bias toward certain solutions. Reflective ratings highlighted that perceived idea quality tended to increase across project stages, especially when teams balanced expert guidance with independent exploration. The effect on creativity appeared to depend on how teams balanced expert guidance with independent exploration: when balanced, early consultation enhanced both novelty and feasibility; when over-relied upon, it constrained the range of creative possibilities. Team composition and prior knowledge appear to shape these dynamics, suggesting that multidisciplinary teams may be better positioned to leverage expert input without losing originality.

It is important to acknowledge the limitations of this study. The small, context-specific sample and reliance on qualitative self-reports limit the generalizability of the findings, and potential response bias may exist, with more reflective or engaged participants possibly overrepresented. While these factors constrain broad applicability, the exploratory qualitative approach emphasizes depth of understanding over representativeness. Additionally, the data do not provide definitive evidence regarding causal mechanisms or systematic effects of expert input on creativity, because the study relied on self-reports and did not directly observe team interactions or manipulate the timing or content of expert input. While the study offers preliminary insights into how participants perceived early expert consultation, it cannot definitively quantify the relationship between expert exposure and idea novelty or feasibility, nor determine whether the potential biases introduced by expert guidance outweigh its benefits. Future studies employing larger samples and complementary quantitative or longitudinal qualitative methods would be necessary to rigorously assess these relationships.

CONCLUSIONS

This study examined how early-stage consultation with technical experts affects creative idea generation in multidisciplinary student teams at the CERN IdeaSquare Summer School. Findings indicate that expert input can both enhance and constrain creativity. On one hand, it clarifies technical possibilities, improves feasibility, and helps teams refine ideas, supporting convergent thinking. On the other hand, expert recommendations may create

anchoring effects or functional fixedness, particularly for teams with limited technical knowledge, potentially narrowing divergent exploration.

The impact of expert guidance seemed to be strongly shaped by team composition and prior knowledge. Mixed teams of technical and non-technical members integrated expert insights while maintaining originality, whereas novice-heavy teams sometimes over-relied on experts, limiting the breadth of ideas. This suggests that the benefits of early consultation depend not only on when teams engage with experts but also on how guidance is used in the context of diverse perspectives.

Overall, early expert consultation could serve as a valuable tool for fostering both novel and feasible ideas, especially when balanced with independent exploration. These findings have practical implications for designing collaborative innovation programs: structuring expert interactions to provide contextual knowledge and validation, rather than prescriptive solutions, may help maximize creative potential while minimizing bias.

Given the exploratory nature and small sample size of this study, the results should be interpreted as preliminary, and further research with larger samples and combined qualitative–quantitative approaches would be needed to more rigorously evaluate the conditions under which expert guidance optimally supports team creativity.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest. All authors participated in the CERN IdeaSquare Summer School 2025 as students from different disciplinary backgrounds. The study was designed, conducted, and analysed by the authors based on survey responses and reflections from other participants, and not on their own experiences. The authors received no financial compensation, institutional advantage, or professional benefit related to the outcomes of this research.

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APPENDIX

Survey Questionnaire:

Instructions: Please answer the following questions honestly. Your responses are anonymous. At various turning points in your process, indicate how good your current idea is and how much expert exposure you had up to that point.

Section 1: Idea Development Tracking & Expert Exposure

Exposure: At turning points in your process, give how good your current idea is (scale 0–1) and how much expert exposure you had (scale 0–1).
Example (for reference, our own group's process):
Beginning: 0 idea, 0 exposure
After individual research: 0 idea, 0.1 exposure
After brainstorming: 0.1 idea, 0.1 exposure
After meeting expert: 0.9 idea, 1 exposure
End: 1 idea, 1 exposure

Your response:

Beginning: ___ idea, ___ exposure
After individual research: ___ idea, ___ exposure
After brainstorming: ___ idea, ___ exposure
After meeting expert: ___ idea, ___ exposure
End: ___ idea, ___ exposure

Did experts in the field recommend certain industries in which your application could be used?
[Open-ended]
Did you use that field?
[Open-ended]
How much did interviewing experts further your knowledge on your technology?
[Open-ended / scale 0–1 if desired]
Did you feel you got "thinking inside the box" because of the knowledge you possessed?
[Open-ended / scale 0–1 if desired]

Section 2: Idea Story & Expert Interaction

The story about how you got the idea (from the beginning, inspiration, etc.):
[Open-ended]
Did you present any of your ideas to an expert? If so, how did that affect your end product?
[Open-ended]
Is there anything else you would like to add? [Open-ended]

Section 3: Contact Information (Optional)

Email (for raffle, if applicable):
[Open-ended]