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SPECIAL ISSUE
Science communication in unexpected places

PRACTICE INSIGHTS

From the laboratory to the kitchen table? An insight into theory-based game development practices for science communication

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Abstract

This practice report aims to outline the idea of science communication as a multidimensional practice that extends beyond the transmission of scientific facts to include the tacit, cultural, and experiential dimensions of science—with a focus on 'the university' as an embodiment of the culture of science. Drawing on the idea of 'kitchen table science communication', we present a board game designed to foster critical engagement with the implicit norms and structures of academic life among students, their families, and broader publics. Emphasizing science as a complex, adaptive, and culturally situated endeavor, the game serves both as an educational tool and as a medium for participatory meaning-making. Through iterative development and ethnographic testing across diverse academic and informal settings, we explore how playful, narrative-driven formats can open epistemic spaces and promote a more intuitive, affective, and accessible understanding of science. Our findings suggest that games—by embracing abstraction, indeterminacy, and co-creation—offer unique affordances for cultivating science literacy as lived experience rather than codified knowledge.

Keywords

Public understanding of science and technology; Visual communication; Science and media

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1 ▪ Science communication as communication of scientific culture

Science communication cannot be limited to conveying an isolated scientific phenomenon or finding; it must also encompass examining the broader 'environment' of science from a meta-perspective [Bucchi & Trench, 2021]. Following this idea, we conceptualize science communication not merely as the dissemination of scientific knowledge but as an exploration of the culture of science [Priest, 2013; Davies & Horst, 2016] and of the scientific endeavor itself. "[H]ighlighting the process of science over its product" [Schipani, 2024] is an increasingly relevant approach considering the consensus that science must become more comprehensible to the general public [Ellenbogen, 2013].

This observation becomes particularly evident in our teaching practice at universities and similar institutions of higher education. Through our experience, we have identified a striking pattern: many students possess, at best, only a superficial understanding of what science entails. Science, as we have come to realize, is often perceived as something distant, inaccessible, and abstract. Despite standing in front of individuals who are, at least nominally, members of the academic community, we found that students did not perceive themselves as active participants in the system; rather, they felt subjected to it — alienated rather than integrated [Hascher & Hadjar, 2018].

Moreover, our findings indicate that this sense of detachment is particularly pronounced among students whose parents did not pursue higher education or whose families were socialized within non-Western academic environments [Franceschelli et al., 2016]. This leads to a key question: How can students be supported in engaging with the university as an inclusive and intelligible space, where they can play with the "everyday rules of the game" rather than perceiving it as a distant or exclusionary institution?

Therefore, our contribution does not aim to encompass all aspects of science communication from a generalist perspective. Instead, our emphasis lies on the conceptualization, development, and critical examination of a format modeled on the structure of a central institution within the academic system: the university. Regarding our own academic background, particular attention is directed toward a prototypical university in Germany.

In this practice insight, we aim to explore whether the specified objectives can be achieved through the medium of a board game. More specifically, we focus on the initial phase of iterative design and prototyping, during which the game was conceptualized and developed as a co-creation in collaboration with students, and subsequently tested in a range of spatial settings. Accordingly, we are guided by the following research question: How can a playful format for science communication be developed and tested in an iterative and co-creative manner? As this initial question establishes the conceptual and practical foundations for all subsequent developments, it is essential to outline our theoretical framework in the following section.

2 ▪ From theory to game development: preliminary considerations

2.1 ▪ *Multifaceted knowledge*

Because the scientific system (and the university as one of its academic embodiments) constitutes a multifaceted, intricately interconnected network, it cannot be adequately communicated through a single linear narrative [Ladyman et al., 2013]. Kerr's notion of the "multiversity" portrays 'the university' as "a whole series of communities and activities held together by a common name, a common governing board, and related purposes" [Kerr, 1963], underscoring that it is not a monolithic entity. Similarly, universities are labeled "complex, adaptive systems" [Rouse, 2016] populated by independent stakeholders whose interactions are often unpredictable — a characterization, that may also apply to the scientific enterprise in general [Hüther & Kosmützky, 2023]. In this context, universities are also portrayed as "organized anarchies" [Hüther & Kosmützky, 2023] in which knowledge and practice emerge from dynamic interactions across countless subfields and social contexts, where the actors continually influence one another and adapt to environmental changes in non-linear and non-conscious fashion [Hüther & Kosmützky, 2023]. While the university cannot represent the entirety of the scientific system, the microcosm of a 'multiversity' does convey the degree of complexity inherent in the culture of science, which must always be understood within its social and organizational context [Davies & Horst, 2016; Ellenbogen, 2013].

Although the objective of a board game may be to simulate real-world phenomena, the translation of reality into a game inherently involves abstraction [Caillois, 2001]. In this process, the complexity of the real world is distilled into tangible concepts and game mechanics, often by metaphors and analogies. This abstraction is intrinsically linked to simplification, leading to a reduction in the level of detail with which the real world is represented. Consequently, this creates what can be termed 'gaps of indeterminacy', a concept that was originally derived from literary theory [Iser, 1974] but has also been successfully adapted in media theory [Ryan, 2015]. Unlike the experience of reading a book, where individuals typically fill these indeterminate gaps in an isolated manner, in (board-)gaming these gaps are collaboratively filled through performative actions, such as discourse, interaction and negotiation by the players. Thus, the board game not only opens 'unexpected places' for science communication in a physical sense — such as when the game is played at informal locations — but also in an epistemic sense in general. The game therefore creates a framework for 'spaces of possibility' [Cohen, 2023] where a common understanding of science can develop.

In the context of science communication transitioning from rather linear models to more holistic cultural approaches [Davies et al., 2019; Blue, 2019], we want to reemphasize that 'successful' (science) communication will always be "more [...] than the transfer of knowledge" [Davies & Horst, 2016]. Since the communication of science "has gone through its own process of shifting from a focus on preserving and transmitting knowledge to considering a broader social and societal context" [Ellenbogen, 2013], conveying a 'feeling' for science, that is, fostering a subjective and individual understanding of scientific processes [Schipani, 2024] and cultures [Kreutzer, 2025; Roth, 2023; Davies & Horst, 2016; Priest, 2014] should also be embraced as a communicative goal [Woolnough, 2001]. This implies that our communicative objective is not to impart explicit knowledge to the recipients, but rather to convey a notion or an 'implicit mutual understanding' of science. Our

hypothesis is that a "public understanding of science" [Ellenbogen, 2013] — or in our case, rather a 'public understanding of the university' — cannot be achieved solely through factual knowledge. Instead, it emerges more as intuition of the *culture of science* [Davies & Horst, 2016; Priest, 2013] "as part of a collective meaning-making process within the broader web of culture" [Davies et al., 2019; Smith & Garramon Merkle, 2020].

To address this requirement, our contribution centers on the development and evaluation of a board game that relates to what has been conceptualized as the "third mode" of science communication. This mode is defined as "knowledge building" through a cross-disciplinary approach that "draw[s] from the sciences, the social sciences, and the arts to construct new knowledge that has elements from all contributing disciplines" [Stocklmayer & Rennie, 2017]. We therefore contend that a medium that is both "active and participatory" [Rowan, 2012] following a "joyously interdisciplinary" [Trench, 2023] approach, provides the optimal channel for communicating such an understanding of science. Whether this approach is effective will be evaluated primarily based on feedback from the widest possible range of test participants; that is, the requirement of a "joyously interdisciplinary" format is deemed fulfilled to the extent that an increasing number of participants with diverse prior knowledge and academic backgrounds perceive the game as entertaining.

2.2 ▪ *Target group(s)*

While the intended target audience for our endeavor is highly diverse, it can be broadly categorized into two subgroups. First and foremost, we aim to develop an educational medium for undergraduate students, creating an implicit space in which so-called 'stupid questions' can be freely asked without fear of judgment. Notably, the students' field of study is not a decisive factor in its applicability; therefore, the format needs to be agnostic regarding the specific characteristics of particular academic disciplines.

Second, the format is intended for a range of use cases, including use as an instructional resource in secondary education, equipping students on the verge of graduation with insights into their prospective academic journey. It seeks to convey not only the practicalities of studying at a university but also to provide an experiential sense of what it *feels* like to be a student at a German university, what it feels like to be a student at a German university, which is often accompanied by moving to a new town and, in particular, by a vastly increased degree of autonomy, including finding accommodation, managing daily life, and planning one's own study schedule. Regarding our target audience, we have deliberately chosen the university as both the spatial and narrative setting, since it provides a familiar embodiment of academia to capture the practices of teaching science, doing science as well as communicating science and is, at least conceptually, accessible and familiar to all target groups.

2.3 ▪ *A serious game for teaching contexts: practical integration & visual design*

Since one of the primary use cases for the developed game 'Campus Chronicles' is its application in undergraduate education, the game must be playable in an ad hoc manner; its mechanics, narrative, and fundamental principles should be immediately comprehensible to players without requiring extensive reading of game instructions beforehand. Furthermore, in alignment with principles of accessibility and open knowledge dissemination [Miao et al., 2016], the game has been deliberately developed as an open educational resource [Silveira,

2016] and is intended to be shared free of charge. To ensure compliance with open-access licensing we intentionally refrained from incorporating third-party materials such as stock images or other external content (see Figure 1).

Figure 1. Examples of the game's cards with hand-drawn illustrations. The current version of the game includes 20 distinct challenges and approximately 90 different hand cards.

For the visual design of the game, we wanted to ensure that the game can be played spontaneously without extensive explanations, therefore, its visual design must be immediately familiar to players. Studies have shown that individuals unfamiliar with a particular interface tend to prefer representations that mimic the look and feel of real-world objects [Cho et al., 2015; Urbano et al., 2022]. Considering our diverse target audience and the necessity for the game to be easily understood, we chose a visual language inspired by skeuomorphism [Kim & Lee, 2020] to mitigate the indeterminacies by creating an explicit design language as visual counterbalance (see Figure 2).

3 ▪ Game development and testing

3.1 ▪ *Co-creation*

Building on the observation outlined above that the university functions as a multifaceted system, this premise served as the guiding brief for the entire project and positioned a board game as an appropriate medium for communicating the intricacies of "academic formation" [Spoerhase, 2015]. Based on this brief, we recruited a project group of 30 students who assumed the role of (co-)creators. Over a six-month period, their task was to develop a board game that approached this guiding question pragmatically by recounting the game's narrative

Figure 2. The game's board depicting different spaces of a university.

from a student perspective. That is, rather than asking what constitutes a university, the game was intended to articulate what it means to be a student, including everyday routines, structural challenges, and the informal knowledge that circulates within university life.

From the outset, the students were positioned not as respondents but as creative authors of both content and form. Co-creation took place in a dedicated (maker)space that enabled hands-on work, rapid prototyping, and the exchange of ideas in an atmosphere oriented toward experimentation. The physical setup thus functioned not only as a workplace but also as a methodological tool that supported iterative co-creation [Ruf et al., 2025]. Throughout the process, instructors provided non-invasive facilitation: instead of directing specific outcomes, they offered gentle guidance that kept the project aligned with its conceptual goals while preserving student autonomy. This facilitative stance was intended to protect creative flow and reinforce students' ownership of the game.

To make effective use of participants' diverse skills, the group organized itself into three subgroups with clearly defined responsibilities. These task teams focused separately on game mechanics, visual and material design, and narrative structure including game instructions. This division of labor enabled deeper focus within each area and allowed students to contribute according to individual strengths and preferences. At the same time, all subtasks ultimately had to be integrated into a coherent whole; accordingly, the effectiveness of this structure depended on continuous cross-group exchange. For this reason, development was conducted entirely on location. We deliberately avoided virtual meetings and instead worked in a shared physical space large enough to allow subgroups to separate when needed yet open enough to support spontaneous discussion. Ideas, knowledge, and decisions circulated through face-to-face conversations or by addressing the room as a whole, ensuring that mechanics, narrative, and design evolved coherently. This

largely self-governed process was documented using non-invasive ethnographic methods so that observation and recording would not interrupt students' momentum. Specifically, we employed photo ethnography [Wright, 2018], participant observation, and thick description [Geertz, 1973] to capture play scenes and narrative space maps to document the development on location by visualizing movement flows through the physical workspace via sketches (see Figure 3) and combined these with notes on observed interaction paradigms and gestures [Ruf & Sieß, 2022; Ruf et al., 2025]. This documentation proved valuable not only for recording key design decisions, emerging problems, and the rationale behind subsequent revisions, but also for tracing the social dynamics of an ongoing co-creative process.

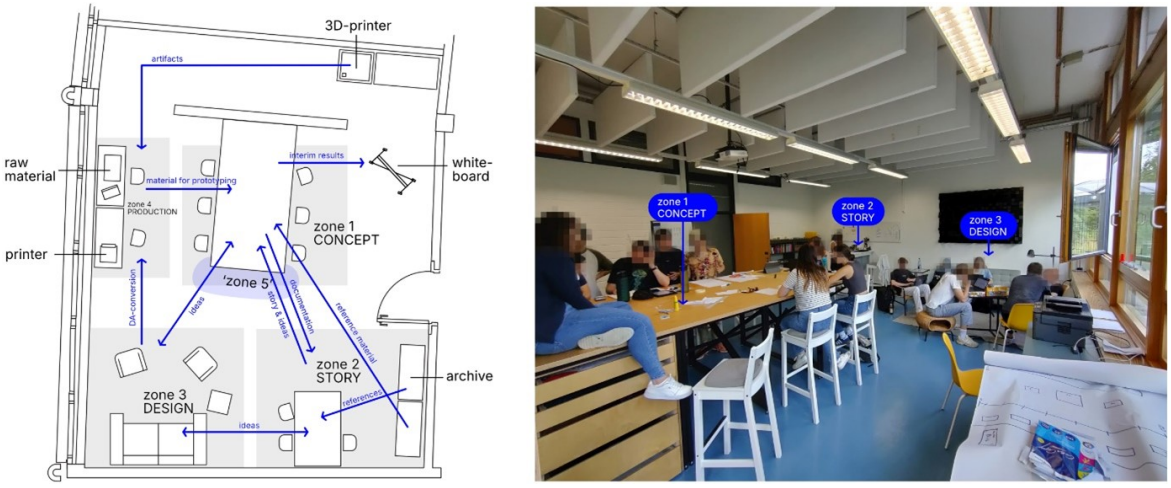

Figure 3. Development and game testing in the lab: Example of a flow map (left) that we used as ethnographic tool to visualize and document the exchange of information and self-governance during development in the (co-)creation space (right).

3.2 ▪ *Game tests*

After verifying that the game and its mechanics functioned as intended, we considered it essential to conduct further tests in varied scenarios and with diverse audiences. Accordingly, the game was presented to an international group of doctoral and postdoctoral researchers in a workshop at the University of Witten/Herdecke (Germany) with six participants. This session was documented using audio ethnography [Makagon & Neumann, 2009] via two microphones and a field recorder. Although the audio recordings yielded highly detailed insights into the workshop, we refrained from using this method in subsequent tests because the visible presence of recording devices and the necessity for explicit prior consent impeded the flow of play and heightened participants' awareness of being tested. Because the game is particularly suited for university open days, we were able to conduct two further sessions with students from a German secondary school (21 participants, aged 16–18) and a vocational college (17 participants, aged 17–19). These contexts also enabled a systematic examination of how these comparatively hard-to-reach target groups — characterized by demographic homogeneity and, in part, minor legal status — interacted with the game. We used semi-structured group interviews [Brinkmann & Kvale, 2018], complemented by object elicitation [Harrison et al., 2025]. As these playtests occurred within official school events, at least two custodial authorities in the form of supervising teachers were present throughout,

Figure 4. Some impressions from the various testing and feedback sessions: University of York (top left) with game design professionals, University of Witten/Herdecke (top right) with postgraduate researchers, Bonn-Rhine-Sieg University with high school students (bottom left) and finally in Hannover with science communication professionals (bottom right).

making additional parental or guardian consent unnecessary. Across all tests, anonymity was maintained by refraining from recording any personal information.

In addition, the game was presented at an academic conference followed by a workshop at the University of York (U.K.). The conference setting provided an opportunity to collect feedback from 21 participants who were professionally engaged with games as a medium for science communication (see Figure 4). A second presentation in a purely academic context took place at a symposium of science communication researchers in Hannover, Germany. There, the game was exhibited to approximately 60 participants, who were invited to comment on missing aspects of university life represented in the game and on the visual design of the game materials.

3.3 ▪ *The 'whiteboard method', field notes, and guiding questions*

During all external playtests, we deliberately avoided questionnaires to make the most efficient use of the limited time available with student participants — especially in settings where the game constituted only one station during a university visit — and to prevent disruptions to gameplay. Instead, we emphasized open brainstorming during sessions, inviting participants to communicate ideas, associations, and critiques ad hoc.

Rather than continuing to use audio ethnography, which we had implemented in the first external test, we adopted the approach of Sandelli and Cunningham [2019] that utilizes a whiteboard as a key tool for collecting feedback. For this approach to be effective, it was essential that participants maintained an overview of the issues under discussion, enabling them to build on earlier insights. Accordingly, feedback was documented in ways that were always visible to everyone, either on a whiteboard or via Post-its. To accommodate different personality types, contributions could take multiple forms: a participant might articulate an idea verbally to the group, discuss it openly, and then have it recorded on the board by the facilitator; alternatively, participants could write ideas directly onto the board without further explanation, after which the facilitator moderated a group discussion. To provide a minimal structure for these sessions, the facilitator used guiding questions [Brinkmann & Kvale, 2018] to sustain conversation (see Supplementary Material). After each session, the whiteboard or Post-it outcomes were preserved and augmented with facilitator field notes.

3.4 ▪ *Analyzing feedback*

The resulting data was analyzed after each playtest using a mixed-methods approach [LeCompte & Schensul, 2013]. First, all aspects collected on whiteboards, pinboards, or Post-its were documented in a research journal. These entries were then expanded with detailed annotations and categorized using a fixed, deliberately simple coding scheme which allowed us to sort the gathered qualitative data into categories such as visual game design, game mechanics, game content, meta-knowledge (about the university/culture of science), ideas for extension, demand for improvement, unanticipated discussion, etc. Because many ideas could be integrated into the game during an ongoing design process, this procedure supported an iterative development cycle; thus, the research journal documents not only ideation but also the game's evolving design trajectory (see Figure 5). However, the primary purpose of maintaining this research journal is to derive concrete findings by combining observational notes with labels and photographs from the test scenes.

3.5 ▪ *Findings*

When asked what game mechanic was valued most, a majority of players (∼68%) reported that they appreciated the game's design, which consistently required interaction from all participants, even when it was not their turn. We observed that the opportunity to collectively discuss and critically engage with the depicted scenarios, events, and challenges was widely used.

On the one hand approximately 80% of players highlighted their appreciation for the game's subtle humor and occasional insider jokes, stating that these elements made them feel understood in relation to their own lived experiences. On the other hand, the dark humor that some cards featured was perceived as focusing too much on negative aspects of academia by two test persons. Additionally, the high level of detail and craftsmanship in the game's visual design and materials was well received by all players, with praise given to the game pieces, the customized drawings and the game board.

We observed that ∼10% of players reacted sensitively to the metaphors used in the game. A specific critique was directed at the event fields on the game plan, which were designed as manhole covers — an element that, according to a consensus among players, carried

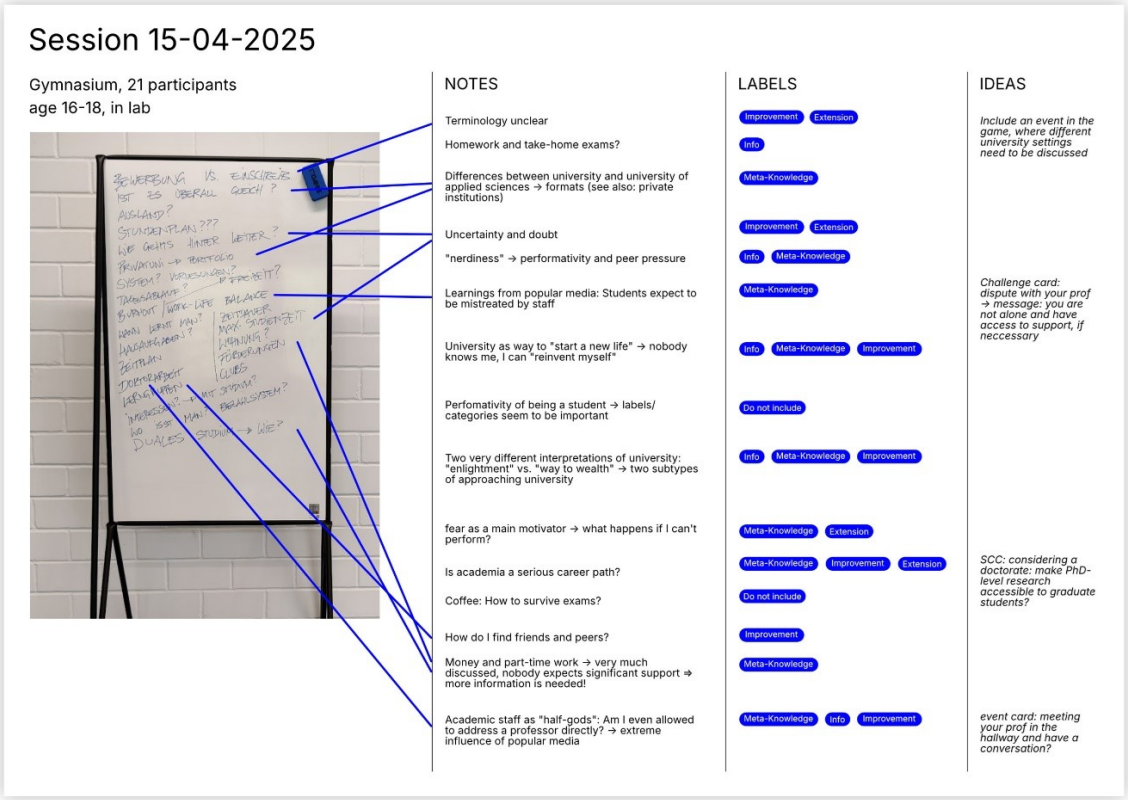

Figure 5. Example page from the research journal. Recorded aspects from the whiteboard served as guidelines for notes, which were tagged and then translated into concrete ideas for the next iteration of the game (full disclosure: the text was translated from German to English).

predominantly negative associations. Furthermore, ∼23% of players expressed a desire to create their own game cards, reinforcing the idea that students not only wished to gain a deeper understanding of the university system themselves but also wanted to share *their* tacit knowledge with their family and friends — through the framework of the game, yet in a way that reflected their own perspective.

All playtests indicated that, through discussion and gameplay, it was not only possible to articulate numerous assumptions and implicit understandings about the university and academia but enabled the participants to learn about aspects that had previously been unknown. When asked which aspect of the game they valued most, approximately 35% of the playtesters reported that they particularly enjoyed the safe space it provided for asking 'stupid questions' and ∼91% of players appreciated that crucial information was not disseminated as an 'information dump' but was rather constructed through the virtue of interaction with the game and the players. We also observed that ∼62% of participants expressed that the conversations within the game helped them to understand university life better.

Takeaways and critical assessment. While prior research has captured important aspects of game design as a format for science communication [Illingworth & Wake, 2019, 2021; Stachyra & Roughley, 2023], we aim to extend these insights by addressing the intersection of game development and testing.

Create a development cycle that facilitates iterative design and feedback loops. Game development that treats a narrative not simply as a thematic layer, but also as a central communicative aesthetic experience for the players, is challenging. For this reason, the game was developed through a continuous iterative process, involving numerous revisions, prototypes, and playtests. This approach allowed us to consistently gather feedback from players and integrate their insights into the game. We found that isolated development, without this constant exchange, would not have been feasible.

(First) impressions matter. During the feedback sessions, participants repeatedly highlighted the strength of the game's visual design. Although the game progressed through multiple stages of development, we consistently prioritized ensuring that the components conveyed a strong and coherent initial impression, irrespective of whether an early prototype or a more advanced version of the game was being tested. Players noted that they felt genuinely appreciated because they experienced what felt like an 'authentic' board game and not a mere prototype. This first impression is critical, as it frames players' attitudes toward the game. As one tester noted: "The more sophisticated the design, the more willing I am to engage with the game and to invest my own time and passion in providing in-depth feedback. If you [as authors] put passion in, I will also be passionate." Consequently, it is advisable to introduce a compelling (i.e. both intelligible and aesthetically appealing) design early in the development process and to revise these design decisions throughout the feedback and testing cycles.

The message takes precedence over the 'correct' way of gaming. We significantly underestimated the extent to which the game serves as a catalyst for discussions and conversations, which, in practice, considerably extend our projected playtime of approximately 90 minutes. Fundamentally, we view this as a net positive development, as it is particularly within these discussions where science communication takes place and individual knowledge is created. This finding highlights the advantages of the physical game [Illingworth & Wake, 2021] over its digital counterpart, as its tangible components foster the 'head, heart, and hands model' [Singleton, 2015] of learning on the one hand and serve as tools for both visual and object elicitation [Harrison et al., 2025; Pauwels, 2020] on the other.

Think of your game as a 'framework' for discussion. In the playtests we observed that our assumption that the game could provide a setting for asking so-called 'stupid questions' proved to be correct. Due to its collaborative elements, players had to strategically engage with their peers by asking about the academic concepts represented on their hand cards, within the framing of collaboration for a common goal. As a result, the game environment functioned as a kind of "safe space" [Illingworth & Wake, 2019; Gieryn, 2018] that "suspends [...] hierarchies of knowledge" [Illingworth & Wake, 2021], in which such questions and discussions could take place without the "perceived risk of making a fool of oneself by saying something wrong or naïve" [Macknight et al., 2024].

Be open to 'adapt, improvise and overcome'. Adapting the game for international audiences remains a challenge. While textual elements on the game board and cards can be easily translated, some of the academic phenomena represented in the game are specific to European/German universities. Other elements might encounter cultural barriers (e.g., the event card depicting a 'student party'), which could hinder accessibility in different educational or cultural contexts. However, after presenting the game in several settings that were unfamiliar with the German academic culture, we found that this issue was not

perceived as particularly problematic by the players. On the contrary, the differences in fact facilitated fruitful discussions, since they provided opportunities for players to better understand their own academic systems by reflecting on the contrasts and similarities.

Minimize your influence as authors. As already outlined: the university as an embodiment of the culture of science features a multifaceted structure that cannot be conveyed through linear media but needs to be constructed by the players themselves [Davies et al., 2019; Smith & Garramon Merkle, 2020]. Accordingly, we observed that entirely new knowledge was introduced into the discussion through the process of playing that we, as the authors, had never anticipated. In this sense, the game develops a certain 'autonomy,' which certainly carries the risk of inaccurate information, but also has the potential to unlock significant creative possibilities. All in all we consider this a net positive development, as it shifts some interpretative authority away from the game's creators while granting players greater agency over the medium. In this way, players actively take ownership of the game as *their* game. It is a well-recognized principle that the act of explaining a concept constitutes a learning process in itself, as articulating knowledge enhances one's own understanding [Williams et al., 2010]. By transforming players into storytellers, the game turns them into 'organic disseminators': they externalize scientific knowledge to others and, through storytelling, concretize, internalize, and reflect on this tacit knowledge.

Find non-invasive and undogmatic ways for gathering feedback. Given that game development is an inherently iterative and dynamic process, we found that ethnographic methods offered a particularly effective approach for capturing its evolving nature. Their flexibility and adaptability made them well-suited to document design iterations and to gather player feedback in real time, thereby supporting continuous improvisation and revision throughout the development cycle. Furthermore, it is essential to implement research methods that do not disrupt the flow of gameplay, particularly on location. It is critical that participants do not feel they are being observed — both because this would alter their behavior [Oswald et al., 2014] and because it would undermine the very notion of a "safe space" [Gieryn, 2018] created by the game. Here, ethnography offers qualitative techniques — namely, participant observation [Geertz, 1974] and discreet field-journal notes — that enable the documentation of gaming experiences without generating a research-like atmosphere.

4 ▪ Conclusion

In sum, our practice report demonstrates how a theory-informed, co-created board game can make the culture of science — embodied here by the university — tangible, discussable, and shareable beyond traditional classroom or outreach formats. By framing science communication as a matter of lived experience rather than mere knowledge transmission, the game opens 'spaces of possibility' [Cohen, 2023] in which tacit norms, structural challenges, and everyday routines of academic life can be explored collaboratively. Iterative development, ethnographic observation, and diverse playtests reveal that players particularly value the safe space for 'stupid questions', the invitation to co-author content, and the game's capacity to trigger critical yet playful conversations. At the same time, questions of cultural transferability and accuracy point to the need for ongoing adaptation. We therefore propose such formats as productive laboratories for future research on participatory, culturally situated science communication.

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