

Deal Me In: A Card Game for Aligning Assessments in Project-Based Learning and Human-Centered Engineering Courses

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Abstract

This Design Methods, Frameworks, & Mindsets paper presented a design-based faculty development innovation. It uses a playful, gamified approach to strengthen faculty assessment literacy and collaboration in project-based learning environments, grounded in the realities of human-centered engineering education. Project-based learning courses are now central to many engineering programs because they engage students in authentic, open-ended problems that resemble professional practice. Yet faculty routinely struggle to align assessment practices with these experiences, particularly when evaluating outcomes that are qualitative, integrative, or developmental, such as reflection, collaboration, adaptability, and lifelong learning. As programs increasingly adopt human-centered and context-rich design approaches, this misalignment between learning goals and assessment practices becomes more visible and more consequential. This paper reports on the design, use, and exploratory evaluation of the Lifelong Learning Challenge Game, a card-based assessment design activity developed within a human-centered engineering department during an accreditation review cycle. The game asks faculty to combine three elements, engineering contexts, student learning outcomes, and assessment strategies, and to use these combinations as prompts for assessment design conversations. For example, a participant might pair a community-based redesign project with an outcome focused on adaptability and propose a short reflection video that captures how teams navigated changing client needs. By externalizing assessment ideas and making trade-offs visible, the game supports shared sensemaking around what counts as credible evidence of learning without prescribing specific instruments or rubrics.

The game was implemented in two settings: a faculty development workshop and a series of program-level assessment meetings. In workshops, faculty from multiple engineering and design disciplines played in small groups using prompts that intentionally lowered the stakes, such as “Come up with the worst idea” or “Design something you could use tomorrow.” These prompts encouraged divergent thinking and helped participants move beyond compliance-oriented views of assessment. In the program context, gameplay supported alignment between course-level activities and program-level outcomes by surfacing both strong sources of evidence and gaps in existing assessment plans. Analysis of observations, gameplay artifacts, and faculty reflections suggests that the card game format fosters collaboration and shared language among faculty who often work in isolation on assessment tasks. Participants consistently generated assessment ideas that emphasized learning processes more so than final products, particularly for human-centered and lifelong learning outcomes. Gameplay also revealed blind spots in existing practices.

By combining serious purpose with playful interaction, the Lifelong Learning Challenge Game reframes assessment alignment as a collaborative design activity instead of a bureaucratic requirement. The paper concludes by discussing implications for design education, faculty development, and program-level assessment, as well as directions for adapting the game to additional outcomes such as teamwork, ethics, and communication.

Keywords: assessment, faculty development, human-centered design engineering, project-based learning, gamification

Introduction

Project-based learning has become a defining feature of contemporary engineering education. Across institutions and disciplines, courses are increasingly organized around authentic problems, real stakeholders, open-ended constraints, and iterative development. These environments are widely valued because they more closely resemble professional engineering practice, where problems are rarely well defined and solutions evolve through interaction with context, people, and systems [1, 2]. In design-focused and human-centered engineering courses, students are expected not only to produce technical artifacts, but also to navigate ambiguity, collaborate across perspectives, and make decisions that involve social, ethical, and contextual trade-offs. Despite this shift in pedagogy, assessment practices have been slower to adapt. Faculty routinely report difficulty aligning assessment with the kinds of learning that project-based courses are intended to support, particularly when outcomes are qualitative, integrative, or developmental [3]. Reflection, adaptability, collaboration, and lifelong learning are frequently named as core goals, yet they remain challenging to assess in ways that feel authentic, feasible, and fair. Traditional approaches often emphasize end-of-project deliverables or narrowly scoped rubrics, which can capture what students produced, but not how they learned, adapted, or made decisions along the way [4].

This misalignment has practical consequences for both faculty and students. Assessment design is often undertaken in isolation, shaped by prior experience, inherited materials, or accreditation templates often without a shared understanding of learning goals [5]. During accreditation cycles, assessment work can become especially strained, with faculty efforts framed primarily as documentation and not opportunities for reflection and improvement [6]. When assessment feels disconnected from teaching practice, it risks reinforcing compliance-driven behaviors, encouraging students to optimize for grades rather than engage deeply with uncertainty, iteration, and reflection [3]. These challenges are amplified in human-centered engineering contexts, where courses grounded in empathy, stakeholder engagement, and contextual awareness intentionally foreground process over product. Students may revise problem definitions mid-project, abandon technically elegant solutions in response to user needs, or negotiate conflicting values among stakeholders. These moments are often where the most significant learning occurs, yet they are difficult to capture using conventional assessment approaches [7]. Faculty frequently recognize the importance of these experiences but struggle to articulate what counts as credible evidence and how that evidence should be gathered and interpreted across teams and courses.

A growing body of work argues that assessment should be treated as a design activity [8]. Like engineering design, assessment involves working within constraints, balancing competing priorities, iterating on ideas, and making judgments under uncertainty. From this perspective, assessment is less about selecting the “right” instrument and more about designing evidence that meaningfully reflects learning in context. However, most faculty development around assessment emphasizes frameworks, matrices, and alignment tables. While useful, these tools often feel abstract and disconnected from instructors’ lived teaching contexts, particularly in project-based environments where learning unfolds unevenly and evidence is distributed across

time and artifacts [5]. What is often missing are design-oriented tools that support exploration, conversation, and shared sensemaking around assessment choices.

The work presented in this paper responds to that gap. We introduce the Lifelong Learning Challenge Game as a playful, structured approach to supporting faculty in aligning assessment practices with project-based and human-centered learning goals. The game creates a shared design space in which faculty can explore possibilities, surface assumptions, and learn from one another. By positioning assessment as a collaborative design problem, the game aligns with approaches familiar to engineering educators and reframes assessment work as a social, creative activity rather than an individual or bureaucratic task.

Background

This work sits at the intersection of project-based learning, human-centered engineering, faculty assessment practice, and playful approaches to professional learning. This section focuses on literature that helps explain why assessment alignment is challenging in design-oriented contexts and why faculty development tools grounded in design and play may be productive responses.

Assessment in Project-Based Learning

Project-based learning (PBL) has been widely adopted in engineering education because it supports deeper engagement with complex problems, integration of knowledge across domains, and development of professional skills [1]. In PBL environments, learning unfolds through cycles of inquiry, experimentation, failure, and revision, often in collaboration with others. These characteristics align well with professional practice, but they complicate assessment. Evidence of learning is distributed across time, teams, and artifacts, rather than concentrated in a single product or exam [2].

Prior research consistently highlights tension between the goals of PBL and common assessment practices. While instructors value outcomes such as problem framing, collaboration, and self-directed learning, they often rely on assessment approaches that emphasize final deliverables or individual performance [3]. As a result, assessments may underrepresent the learning processes that PBL is intended to support. This mismatch can shape student behavior, encouraging surface-level completion rather than sustained engagement with uncertainty and iteration. Researchers have proposed a range of strategies for assessing PBL, including portfolios, peer assessment, reflective writing, and milestone reviews [4]. These approaches can make learning processes more visible, but they place significant demands on faculty judgment and instructional time. Without shared language or support, faculty may struggle to implement these strategies consistently or to interpret evidence in ways that inform program-level decisions.

Human-Centered Engineering and Evidence of Learning

Human-centered engineering extends the challenges of PBL assessment by explicitly foregrounding context, empathy, and stakeholder engagement. In these courses, students are expected to consider social, cultural, and ethical dimensions alongside technical performance. Learning often involves reframing problems, negotiating competing values, and responding to feedback from users or communities. Research on design cognition suggests that such learning is

iterative and non-linear, with experts and novices differing not only in outcomes, but in how they approach and revise problems over time [7]. From an assessment perspective, this raises difficult questions about what counts as progress and how growth should be documented. A technically refined solution may reflect limited learning if it emerges without engagement with context, while a less polished artifact may represent substantial learning if it results from thoughtful iteration and stakeholder consideration. Reflective practice has been widely cited as a key mechanism for making this learning visible [9]. Reflection allows students to articulate reasoning, acknowledge uncertainty, and connect experience to future action. However, reflection is not inherently meaningful. Its value depends on how it is framed, supported, and interpreted. Faculty often report uncertainty about how much structure to provide and how to distinguish substantive reflection from superficial commentary [4]. These challenges reinforce the need for assessment approaches that help faculty reason collectively about evidence, moving beyond relying on isolated judgment or static instruments.

Faculty Assessment Literacy and Program Improvement

Assessment literacy refers to faculty capacity to design assessments, interpret evidence, and use results to support learning and improvement. While engineering faculty are typically well prepared in their technical fields, many have limited formal training in educational assessment [5]. As a result, assessment practices are frequently shaped by local norms, inherited materials, or accreditation requirements rather than by shared understanding of learning goals. These dynamics are particularly visible during accreditation cycles. Faculty are asked to demonstrate alignment among outcomes, instruction, and evidence, often across multiple courses and years. While these processes are intended to support continuous improvement, they are often experienced as burdensome and disconnected from teaching practice [6]. Assessment work can become transactional, focused on producing documentation rather than on understanding student learning. Prior work suggests that collaborative, context-specific approaches are more effective than generic training for building faculty assessment capacity, as faculty benefit from opportunities to examine concrete examples, compare interpretations, and negotiate shared meaning around evidence. However, few tools are designed specifically to support these conversations in project-based and design-focused settings.

Playful and Gamified Approaches to Faculty Learning

Play and gamification have been explored as ways to support engagement, creativity, and collaboration in educational settings. In faculty development contexts, games and simulations have been used to support learning about pedagogy, teamwork, and decision-making by creating low-risk environments for experimentation. Play introduces several affordances that are particularly relevant to assessment work. It lowers the stakes of participation, making it easier to surface uncertainty or disagreement. It encourages exploration rather than optimization, allowing participants to consider multiple possibilities without immediate pressure to decide. It also externalizes thinking through shared artifacts and prompts, which can anchor discussion and support collective sensemaking. At the same time, assessment is often framed as serious, technical work, governed by rules and standards. This framing can inhibit creativity and open dialogue, particularly when faculty feel constrained by accountability pressures or time limitations. This framing can inhibit creativity and collaboration, especially when faculty feel constrained by time or accountability pressures. Treating assessment as a design space that can

be explored through play offers a different entry point, one that aligns with how engineers are accustomed to working through complex problems [8, 10]. The Lifelong Learning Challenge Game builds on this literature by combining insights from PBL assessment, human-centered engineering, faculty assessment literacy, and playful learning. It provides a design-oriented activity that supports exploration, conversation, and shared judgment around assessment choices, grounded in faculty members' own teaching contexts.

Design of the Lifelong Learning Challenge Game

The Lifelong Learning Challenge Game was designed around a simple premise: if assessment in project-based and human-centered engineering courses is itself a design problem, then faculty should be given tools that allow them to design assessments together. The game begins with situations faculty recognize immediately from their teaching practice: messy projects, evolving constraints, and students learning unevenly over time. The goal was not to produce a single correct one, but to create a structured space for exploration, conversation, and shared sensemaking around assessment choices.

Design Goals and Constraints

Several design goals guided development of the game. It needed to be usable within realistic faculty time constraints. Participants should be able to understand the mechanics quickly, engage meaningfully within an hour, and leave with ideas that felt applicable to their own courses. The game needed to be generative rather than prescriptive. Instead of converging on a single best practice, the activity was intended to surface multiple possibilities and make trade-offs visible. The game needed to support shared language around outcomes and evidence, particularly for learning goals that are difficult to observe directly, such as adaptability and lifelong learning [3]. The design also had to accommodate variation across disciplines, course levels, and faculty experience. Participants bring different assumptions about assessment, different constraints on implementation, and different relationships to accreditation processes. Accordingly, the game was designed to be modular and adaptable, allowing facilitators to tailor contexts, outcomes, or prompts to local needs while preserving the core structure. This balance between structure and flexibility was necessary for use across both faculty development and program-level settings.

Card Types and Structure

The game consists of three primary card decks, each representing a distinct dimension of assessment alignment: engineering contexts, learning outcomes, and assessment strategies. Assessment ideas emerge through the combination of these elements, with no single deck driving the outcome on its own. Engineering context cards (Figure 1) describe common project scenarios in design and project-based courses. Examples include community-based redesign projects, sustainability challenges with external stakeholders, global collaboration projects, resource-limited builds, and industry-sponsored capstones. These cards anchor gameplay in recognizable situations and help faculty move beyond abstract discussion to concrete cases [2].

An electronic copy of the *Lifelong Learning Challenge Game* is available online at: <https://brockcraft.github.io/lc-game/> [11].

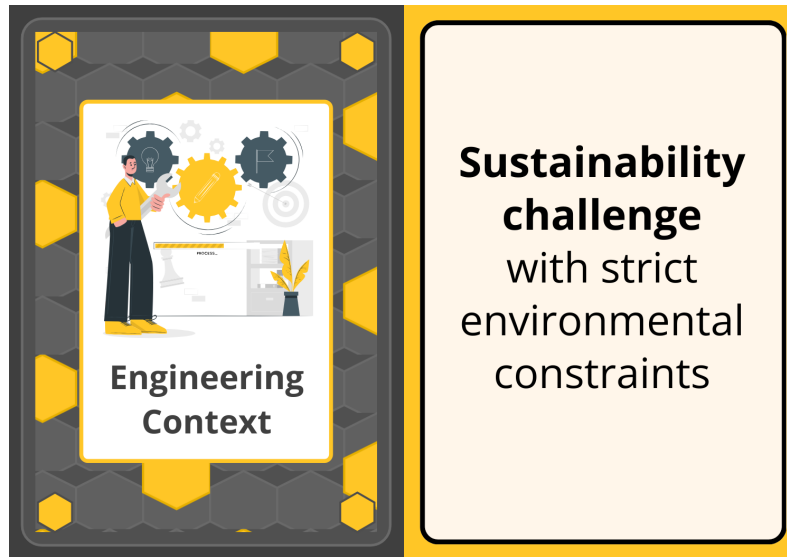


Figure 1. An example of an Engineering Context card

Learning outcome cards (Figure 2) focus on outcomes that are widely valued but often under-assessed in engineering programs. Many emphasize lifelong learning behaviors, such as identifying knowledge gaps, seeking feedback, adapting to new tools, or reflecting on learning strategies. Others address collaboration, ethical awareness, or systems thinking. The language on these cards is intentionally action-oriented, making it easier for faculty to imagine what the outcome might look like in student work.

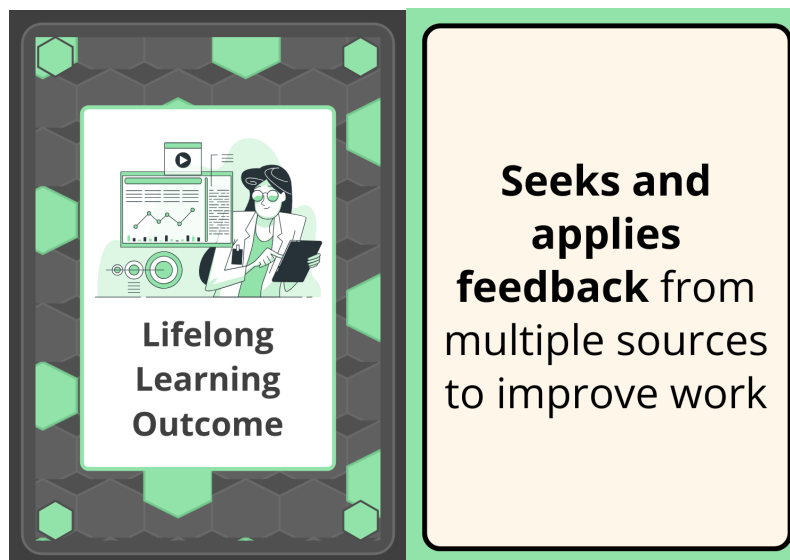


Figure 2. An example of a Lifelong Learning Outcome card

Assessment Strategy cards (Figure 3) represent a range of possible evidence sources. These include structured reflection prompts, learning journals, peer evaluations, process videos, milestone reviews, portfolios, and documentation of iteration decisions. The deck intentionally mixes familiar strategies with less commonly used ones to prompt comparison and discussion.

No strategy is presented as universally appropriate, reinforcing the idea that alignment depends on context.



Figure 3. An example of an Assessment Strategy card

In addition to the core decks, the game includes Challenge cards that shape how participants engage with each combination. Prompts such as “Come up with the worst idea” or “Design something you could try next week” are intentionally playful. They disrupt habitual thinking, lower the stakes of participation, and invite creativity without immediate pressure to implement or evaluate ideas.

Gameplay Mechanics

Gameplay is deliberately simple. In a typical round, participants draw one card from each of the three main decks to create a context–outcome–assessment combination. They then respond to a prompt by proposing an assessment approach that connects the three elements. Gameplay is collaborative rather than competitive and functions primarily as a design conversation. The game does not ask participants to fully specify rubrics or grading schemes. Instead, attention is focused on alignment questions. Does this assessment make sense for this context? What kind of learning would it surface? What would be difficult to implement or interpret? These questions often lead to rich discussion, especially when participants bring different disciplinary perspectives or teaching experiences to the table [8]. Facilitation plays a critical role. Rather than evaluating ideas as good or bad, facilitators encourage participants to articulate assumptions, note constraints, and build on one another’s suggestions. Humor and exaggeration, especially in response to “worst idea” prompts, help reduce defensiveness and invite risk-taking.

Connection to Program-Level Assessment

Although the game is playful, it was intentionally designed to connect to formal program assessment work. Each card combination can be mapped to specific student outcomes and evidence types, making it possible to translate gameplay insights into documentation for continuous improvement. In practice, faculty often move fluidly between creative exploration

during gameplay and more structured mapping afterward. By externalizing assessment ideas onto cards and shared artifacts, the game creates a bridge between informal conversation and formal assessment planning. This dual function proved critical for adoption within an accreditation review cycle, where faculty needed tools that were engaging but also credible and defensible [6].

Implementation Contexts

The Lifelong Learning Challenge Game was implemented in two primary contexts: a faculty development workshop and a series of program-level assessment meetings conducted during an accreditation review cycle. While the core game mechanics remained consistent, each context shaped how the activity was framed, facilitated, and documented, as well as how faculty interpreted its relevance and legitimacy. Examining both settings helps clarify how playful assessment tools can function at different scales within engineering programs and under differing institutional constraints.

Faculty Development Workshop Context

The first implementation took place in a faculty development workshop focused on assessment in project-based and design-oriented courses (Figure 4). Participants included faculty from multiple engineering disciplines, as well as colleagues with experience in design, innovation, and human-centered approaches. Teaching experience ranged from early-career instructors to senior faculty who had participated in multiple accreditation cycles. This diversity of experience was intentional and shaped the nature of gameplay and discussion. The workshops were 60 minutes long and structured around small-group gameplay. After a brief introduction, participants were grouped into tables of four to six and given a complete set of cards. Facilitation emphasized that the goal was exploration rather than consensus. Faculty were encouraged to move quickly, sketch ideas loosely, and talk through their thinking rather than polish solutions. This framing was designed to lower the stakes of participation and signal that provisional or incomplete ideas were both acceptable and useful. Gameplay was interspersed with short reflection moments. After each round, groups shared one assessment idea that challenged their assumptions or raised practical concerns. Prompts such as “What would be hardest to implement” or “What evidence would students resist most” helped shift discussion from ideation toward feasibility and interpretation. These moments often surfaced shared constraints related to time, grading load, and student engagement, creating opportunities for peer-to-peer problem solving [5]. Participants frequently commented that the game felt different from typical assessment workshops. Instead of working individually through alignment templates, they were invited into a collaborative design space grounded in familiar teaching contexts. Faculty noted that the playful format made it easier to admit uncertainty and ask questions about assessment practices they had previously taken for granted, particularly in mixed-experience groups where conventional hierarchies were temporarily softened.

Program-Level Assessment and Accreditation Context

The second implementation occurred within a human-centered engineering department during preparation for an accreditation review. In this context, the game was embedded within a series of faculty meetings focused on student outcomes, evidence, and continuous improvement. Rather than functioning as a standalone activity, gameplay was integrated into ongoing assessment work

and explicitly connected to program documentation needs. Here, the game served as a bridge between individual courses and program-level goals. Faculty brought examples from their own project-based courses and used the cards to explore how existing assignments might support targeted outcomes. This process often revealed that some outcomes were well supported by existing practices, while others relied on indirect or weak evidence [6]. These realizations emerged through collective discussion rather than through top-down review of assessment matrices. Documentation played a larger role in this setting. After gameplay, groups recorded key insights on shared worksheets, noting potential evidence sources, implementation challenges, and connections to specific courses. These artifacts were later used to inform outcome maps and assessment plans. In this way, the game supported both creative exploration and the production of materials required for formal review. Faculty reported that using the game during the accreditation cycle helped reframe assessment conversations. Rather than starting with outcome statements and working backward, gameplay encouraged faculty to begin with what students do in their courses. This shift helped reposition assessment as an extension of teaching practice rather than as an external or compliance-driven requirement.

Comparison Across Contexts

Across both contexts, several patterns were consistent. The game supported shared language and collaboration among faculty who often design and assess courses in relative isolation. The physical cards acted as boundary objects, allowing participants to anchor discussion even when they brought different disciplinary perspectives or levels of assessment experience [8]. At the same time, the two contexts highlighted different strengths of the tool. In workshops, the game functioned primarily as a catalyst for conversation and idea generation. In program-level settings, it became a sensemaking tool that supported alignment and decision-making. In both cases, the balance between play and purpose proved critical. When the game was framed as exploratory but clearly connected to real instructional and programmatic decisions, faculty engaged deeply without perceiving the activity as trivial or burdensome.

Data Sources and Methods

This study adopts an exploratory qualitative approach to examine how the Lifelong Learning Challenge Game functions as a tool for faculty assessment design and sensemaking. The intent was not to evaluate the effectiveness of the game or to test predefined hypotheses, but to understand how faculty engaged with the activity, what kinds of assessment ideas it generated, and how it shaped conversations about evidence in project-based and human-centered engineering contexts. The work is best characterized as a qualitative case study situated within ongoing faculty development and program improvement efforts, consistent with design-based and practice-oriented research traditions [5].

Study Context and Participants

Data were collected across multiple implementations of the game, including faculty development workshops and department-level assessment meetings. Participants were engineering faculty involved in teaching project-based or design-oriented courses, with varying levels of experience related to assessment and accreditation. Some participants were deeply familiar with human-centered engineering approaches, while others encountered this framing primarily through shared

program outcomes. Participation in the game activities occurred within existing professional responsibilities such as teaching workshops or departmental meetings. The study focused on collective activity and shared sensemaking rather than on evaluating individual faculty beliefs, performance, or learning outcomes. No demographic data were collected beyond participants' roles as instructors in project-based courses. The unit of analysis was faculty interaction with the game and with one another around assessment design.

Data Sources

Multiple qualitative data sources were used to capture how faculty engaged with the game and how assessment ideas developed through play. These sources included:

- Observational field notes taken during gameplay and facilitated discussions, with attention to interaction patterns, points of uncertainty, and moments of convergence or disagreement.
- Artifacts generated during gameplay, including completed card combinations, written notes, worksheets, and photographs of table layouts. These artifacts provided tangible records of assessment ideas and alignment decisions.
- Post-activity reflections and informal feedback collected through short written prompts and facilitated group discussion at the conclusion of workshops and meetings. These reflections captured faculty perceptions of usefulness, relevance, and transferability to their own courses.

No student work, student data, or evaluative measures of faculty learning were collected as part of this study. The focus remained on faculty activity related to assessment design and interpretation of evidence as it unfolded during gameplay.

Analytic Approach

Data analysis followed an iterative, thematic approach. Field notes and artifacts were reviewed to identify recurring patterns in how faculty talked about assessment, the types of assessment strategies proposed, and the challenges or tensions that surfaced during gameplay [3]. Initial codes were developed inductively and focused on themes such as alignment, feasibility, process versus product, and perceptions of assessment burden. These codes were refined through multiple passes across the data, with attention to similarities and differences between workshop and program-level contexts. Analytic attention was given to moments where faculty explicitly revised, questioned, or reconsidered existing assessment practices, as these moments often signaled shifts in assessment literacy or perspective [9]. Rather than seeking saturation in a strict qualitative sense, the analysis aimed to surface illustrative examples that shed light on how the game supported or constrained assessment thinking. Observations and artifacts were used to ground interpretations in documented faculty activity rather than retrospective accounts alone.

Researcher Positionality

The authors were involved in the design and facilitation of the Lifelong Learning Challenge Game, positioning this work within a design-based research and reflective practitioner tradition [8]. This dual role provided deep access to context and faculty sensemaking, while also requiring reflexivity in analysis. Throughout the study, facilitation choices, participant feedback, and the

structure of the activity itself were treated as analytic resources, and attention was given to how the structure and framing of the game shaped interaction.

Findings

Analysis of observations, gameplay artifacts, and faculty reflections revealed consistent patterns in how the Lifelong Learning Challenge Game supported assessment design and faculty sensemaking. The game functioned as a catalyst for structured conversation instead of producing standardized assessment solutions. It helped faculty articulate values, surface assumptions, and negotiate practical constraints associated with assessing learning in project-based and human-centered engineering courses. The findings below describe recurring patterns observed across implementations, organized around three themes: the nature of assessment ideas generated, shifts in faculty collaboration and discourse, and the ways gameplay surfaced gaps in existing assessment practices.

Assessment Ideas Centered on Learning Processes

Across implementations, faculty consistently proposed assessment ideas that emphasized learning processes as primary sources of evidence. When asked to align outcomes such as adaptability or lifelong learning with specific project contexts, participants gravitated toward evidence that captured decision-making, iteration, and reflection. Common examples included short process videos documenting design pivots, annotated project plans showing how teams responded to new constraints, and structured reflection prompts tied to moments of uncertainty. Many of these ideas were familiar in form but newly valued in function. Faculty noted that they had previously used reflections or journals as peripheral activities rather than as central sources of evidence. Gameplay helped reposition these practices as legitimate assessment tools by making their alignment with specific contexts and outcomes explicit [9]. At the same time, gameplay prompted discussion of trade-offs. Faculty frequently raised concerns about grading load, consistency across teams, and student buy-in. Rather than halting ideation, these concerns became productive constraints, leading participants to converge on smaller, more targeted assessment moments embedded within projects rather than large, end-of-term assignments that were difficult to interpret meaningfully [3].

Gameplay Supported Shared Language and Collaboration

A pattern involved changes in how faculty talked with one another about assessment. The physical cards acted as shared reference points, allowing participants from different disciplines or course contexts to anchor discussion around common artifacts. This externalization of ideas supported clearer articulation of assumptions and facilitated comparison across perspectives, particularly for outcomes such as adaptability or collaboration [8]. Discussions frequently revealed that faculty used similar language to describe outcomes but held different underlying assumptions about what those outcomes looked like in practice. For example, adaptability was variously described as technical flexibility, responsiveness to feedback, or willingness to revise problem framing. By situating these discussions within specific project contexts, faculty were able to clarify and, in some cases, reconcile these interpretations. Participants also shared that the playful framing reduced pressure to appear confident or authoritative. The game created permission to ask basic questions and acknowledge uncertainty, an effect that was especially

noticeable in mixed-experience groups where early-career and senior faculty engaged as peers rather than as experts and novices.

Surfacing Gaps and Blind Spots in Assessment Practices

Gameplay consistently surfaced gaps in existing assessment plans, particularly for outcomes that cut across courses or unfold over time. In several cases, faculty realized that while their projects strongly supported certain learning goals, they lacked intentional mechanisms for capturing evidence of that learning. One illustrative example involved a long-running sustainability design challenge. Faculty initially assumed the project supported lifelong learning because students regularly encountered unfamiliar technologies and external stakeholders. During gameplay, however, participants struggled to identify specific assessment strategies that would make this learning visible. This difficulty prompted collective recognition that learning was occurring but was not being documented in ways that could support program-level claims [6]. In response, the group developed a structured reflection log tied to existing project milestones. Rather than adding a new assignment, they modified an existing deliverable to include prompts about learning strategies, information sources, and decision-making. This modification was later adopted across multiple project courses, illustrating how gameplay insights translated into concrete changes in assessment practice.

Faculty Perceptions of Play and Seriousness

An important finding concerned how faculty reconciled the playful nature of the game with the seriousness of assessment work. Initial skepticism was common, particularly in program-level settings associated with accreditation. However, once gameplay began, participants largely treated the activity as legitimate and productive. Faculty noted that the game enabled deeper engagement with assessment than traditional meetings or documentation exercises. Rather than trivializing assessment, the playful structure created space for focused discussion by reducing defensiveness and encouraging experimentation. Faculty frequently described the activity as “serious work done differently,” a characterization that aligns with prior research suggesting that play can support sensemaking and creativity in professional learning contexts [10].

Discussion

The findings suggest that the Lifelong Learning Challenge Game functions less as a discrete assessment tool and more as a design-oriented catalyst for reframing how faculty approach assessment in project-based and human-centered engineering courses. The game supports a shared design process in which faculty explore evidence, negotiate meaning, and make trade-offs visible. This section interprets the findings by focusing on what the game enables faculty to do differently, particularly with respect to assessment-as-design, the role of play in serious faculty work, and implications for faculty development and program-level improvement.

Assessment as a Design Activity

Across implementations, gameplay shifted how faculty talked about assessment. Participants moved away from language focused on grading mechanics or coverage and toward questions about evidence, learning processes, and alignment with intent. This shift mirrors how engineers typically approach design problems, by working within constraints, considering multiple

possibilities, and iterating toward workable solutions rather than optimizing a single metric [8]. Treating assessment as a design activity also legitimized provisional thinking. Faculty felt comfortable proposing incomplete ideas and refining them through conversation. In contrast to traditional assessment planning contexts, where expectations of precision can discourage experimentation, the game framed partial ideas as productive starting points. This framing is particularly important for outcomes such as lifelong learning or adaptability, which resist precise specification. Faculty explored multiple ways these outcomes might appear in student work across contexts, developing a more nuanced understanding of credible evidence [3].

Play and Serious Work in Faculty Assessment

Another implication concerns the productive role of play in faculty assessment work. Assessment is often treated as a high-stakes, technical activity governed by rules and external accountability. While rigor is necessary, this framing can inhibit open dialogue and risk-taking, especially when faculty feel constrained by time or institutional pressure. The findings challenge the assumption that play undermines seriousness. Faculty engaged deeply with assessment questions during gameplay, often more so than in traditional meetings. The playful elements lowered the stakes of participation, making it easier to surface uncertainty, disagreement, and tacit assumptions. Rather than trivializing assessment, play created conditions for more thoughtful engagement [10]. Importantly, the game worked best when play was clearly connected to real instructional and programmatic decisions. When faculty understood how gameplay insights could inform course design or accreditation documentation, they treated the activity as both legitimate and worthwhile. This balance between play and purpose emerged as a critical condition for success.

Implications for Faculty Development

The results point to several implications for faculty development around assessment. First, faculty benefit from tools that anchor discussion in concrete teaching contexts rather than abstract frameworks. Context cards drawn from familiar project scenarios helped faculty connect assessment ideas directly to their own courses. This grounding in practice reduced abstraction and supported transfer to teaching decisions. Collaborative design activities appear to support assessment literacy more effectively than individual training or documentation exercises. The game enabled peer learning by making differences in interpretation visible and discussable. This shared sensemaking is critical for coherent program-level assessment but is often difficult to achieve through templates alone [5]. The findings also suggest that meaningful faculty development does not require extensive time or infrastructure. Short, well-facilitated activities that respect faculty expertise and invite creativity can produce insights that carry forward into course and program design.

Implications for Program-Level Assessment

At the program level, the game helped shift assessment conversations from questions of compliance to questions of learning. By starting with what students do in project-based courses, faculty were better able to identify authentic evidence already embedded in the curriculum, as well as gaps that warranted attention. This shift supported more grounded and defensible program-level claims. The game also supported alignment across courses without forcing

uniformity. Faculty recognized that different project contexts call for different assessment strategies, even when targeting the same outcome. This flexibility is particularly important in design-centric programs, where variation across courses reflects pedagogical intent rather than inconsistency [7]. Taken together, these findings suggest that playful, human-centered tools can complement formal assessment structures by supporting the sensemaking and collaboration that underlie effective continuous improvement. Rather than replacing existing frameworks or requirements, such tools can help faculty engage more thoughtfully with the assessment work they are already expected to do.

Limitations and Future Work

As an exploratory study grounded in authentic faculty practice, this work has several limitations that shape how the findings should be interpreted. These limitations are not weaknesses to be resolved retroactively, but boundaries that clarify the scope of the contribution and point toward future inquiry. The study draws on a limited number of implementations within a small set of institutional and disciplinary contexts. Participants were faculty already engaged in project-based or design-oriented teaching, and many were involved in ongoing assessment or accreditation work. As a result, participants may have been more receptive to reflective assessment conversations than faculty working in more traditionally structured or lecture courses. Implementations in different institutional settings or disciplinary cultures may surface different patterns of use and engagement. The data consist primarily of qualitative observations, artifacts, and faculty reflections. While these sources provide insight into sensemaking, collaboration, and assessment reasoning, they do not directly measure long-term changes in assessment practice or downstream effects on student learning. In several cases, faculty articulated intentions to revise assessments, but the extent to which these changes were sustained over time remains uncertain. Longitudinal studies would be needed to examine how gameplay influences assessment practices beyond the immediate implementation and whether observed shifts persist across semesters or accreditation cycles [3].

The authors' dual roles as designers and facilitators introduce potential bias. This work is situated within a design-based research and reflective practitioner tradition, where iterative development and close involvement with participants are central [8]. While this positioning enabled deep access to faculty sensemaking and contextual nuance, facilitation choices inevitably shaped gameplay and discussion. Future studies could examine how the game functions when facilitated by others or implemented without direct involvement from the designers. Several directions for future work emerge. One priority is to study how assessment ideas generated through gameplay translate into sustained changes in course design and program-level assessment. Tracking revisions to assignments, evidence sources, and outcome maps over multiple cycles would provide stronger insight into impact. Another direction involves adapting the game to support additional outcomes beyond lifelong learning. Early implementations suggest strong potential for exploring teamwork, ethical reasoning, communication, and systems thinking. Developing targeted card decks for specific program priorities could increase relevance while preserving the game's core structure. There is also opportunity to explore alternative formats. While the physical card-based version supports rich, in-person interaction, hybrid or digital versions could extend the game's reach to remote faculty development or cross-institutional collaboration. Such adaptations would need to preserve the informal, conversational qualities that appear central to the game's effectiveness. Future work could examine how similar

game-based approaches might support student reflection or co-design of assessment criteria. Extending the game's human-centered ethos to include students may offer new ways to align assessment with learning in project-based environments.

Conclusion

Project-based and human-centered engineering courses ask students to engage in learning that is complex, situated, and iterative. These experiences are widely valued, yet they place sustained pressure on assessment practices that were not designed to capture learning as it unfolds over time. Faculty are often caught between what they believe matters for student learning and what they feel able to assess in credible, feasible ways. This tension is especially visible for outcomes such as reflection, adaptability, and lifelong learning, where evidence is distributed across time and context rather than concentrated in final products. This paper has presented the Lifelong Learning Challenge Game as one response to that tension. The game creates a structured, playful space in which faculty can design assessments together. By combining project contexts, learning outcomes, and assessment strategies, the game helps make assessment alignment tangible and discussable, supporting comparison, negotiation, and shared judgment around evidence in design-oriented settings.

Across faculty development workshops and program-level assessment meetings, the game consistently shifted assessment conversations away from compliance and toward learning. Faculty generated assessment ideas that emphasized process, reflection, and adaptation, particularly for outcomes that are often difficult to assess. The playful structure lowered barriers to participation, invited honest discussion of constraints, and supported collaboration among faculty who might otherwise approach assessment work in isolation. Importantly, the game did not replace existing assessment structures or accreditation requirements. Instead, it complemented them by supporting the human work that underlies effective assessment, shared language, professional judgment, and sensemaking. When assessment was treated as a design activity rather than a documentation exercise, faculty were better able to connect outcomes to what students do in their courses and to identify where evidence was strong, weak, or missing.

The broader contribution of this work lies in demonstrating how playful, human-centered tools can support serious assessment work in engineering education. As programs continue to expand project-based and human-centered approaches, assessment practices must evolve accordingly. The Lifelong Learning Challenge Game offers a design-oriented, adaptable approach that invites faculty to engage assessment as a collaborative, creative, and reflective practice grounded in everyday teaching contexts, as a collaborative, creative, and reflective practice grounded in everyday teaching contexts.

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