Creating Space for Innovation: The Role of a “Design Zone” within a Business School

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Abstract

While there has been much attention to the design of courses and curricula on teaching the innovation process, less attention has been paid to the design of the physical space in which such teaching takes place. What is the effect of physical space on teaching and learning how to innovate? In this chapter we consider how to design a physical space most conducive to learning the innovation process. We begin with a brief review of the history of learning spaces in business education, and then we parse the innovation process into specific activities and link them to requirements for physical space. We present the design of one space, the Babson “Design Zone” that takes into account these activities as well as curricular requirements. We discuss the effects that teaching in these new spaces has not only on students but also on the role of the teacher, and we close with considerations on how design spaces may also assist the career preparation of our students.
Introduction

Space matters! The physical space in which individuals work matters for both their efficacy and efficiency, and it has long been known that smart workspace design can improve the way in which individuals communicate and coordinate their efforts (Allen, 1977). But what about the effect of physical space on students in their efforts for learning how to innovate? The physical spaces in which we teach may not always be aligned with what is required for our pedagogical approach, and our objective in this chapter is to explore the design of learning spaces in the context of teaching and learning the innovation process.

Helping students develop the skills and capacity to innovate is one of the important tasks of higher education today (Wagner, 2012). Recently, experiential approaches to learning to innovate has been the focus of course development in business, engineering, and design schools (Fixson, 2009). In such an experiential approach, learning the innovation process combines an awareness of the methods used as well as the exercise of the practices of innovating. Delivering educational offerings that cover the innovation process goes beyond designing individual courses, requiring consideration of the entire curriculum (Seidel, Marion, & Fixson, 2014) and, we will argue, the physical space in which such courses are provided.

In order to effectively develop courses and curricula, we must first understand what actually happens when individuals innovate. Parsing the innovation process into specific activities allows a recognition of how much these activities differ from each other along a number of dimensions, such as skills to be learned and emotional states required. For example, some activities demand paying attention with all of one’s senses to empathically understand motivations and behaviors of target customers; other activities require the quiet and thoughtful search for patterns in
disparate data; and still other activities require high-energy bursts of collaboration in small teams.

Helping students to learn the range of innovation activities requires an educator to pay careful attention to such things as the creation of effective interdisciplinary teams, the best way to employ problem-based learning, how to promote effective iteration by students, and the appropriate use of physical space (Fixson & Read, 2012). This last element, appropriate physical space, is the focus of this chapter. We begin with a brief review of the history of learning spaces in business education, we proceed to link innovation activities and requirements for an appropriate design and innovation space, we discuss the effects that teaching in these new spaces has on the role of the teacher, and we close with reporting on our own experiences with a newly created innovation space, the “Design Zone” at Babson College.

A history of learning spaces for business education

The design of a course or a curriculum is not only the design of lecture topics, homework assignments, and exams, but it is also the selection of the physical space in which learning takes place. Business schools often started from within existing departments or schools, such as the Wharton School’s founding in 1881 as part of the main faculty of Arts and Sciences or the Harvard Business School’s establishment out of the department of Economics, using temporary space in existing teaching halls. Stand-alone business schools also typically drew upon the conventional classroom designs of the time. The main pedagogical focus of business education was on the provision of lectures, using the traditional classroom space which was well-suited to
this approach: a professor on a high stage in good view of a room of students who themselves were not intended to interact with one another.

In contrast to the lecture format, the case study method was a novel approach to business education, involving a more discursive and participatory format. At Harvard Business School, leading up to the move to a new campus in 1925, architecture professor Charles W. Killam and architecture student Harry Korslund sketched out designs for classrooms that would support the new case method of teaching (Cruikshank, 1987). This was the first very deliberate design of a space for business education, and the history of the experience there notes that it was an iterative process to arrive at the style that has diffused so widely today. For example, the Harvard Business School Centennial history (Harvard Business School, 2014) notes that early case classrooms used small desks attached to the arm of each chair, making it difficult to spread out reading material and making it impractical to use a later ubiquitous design feature of case classrooms: name cards. In the earliest case classrooms, professors sat elevated behind a curtained barricade at the front of the classroom, prohibiting the more interactive case teaching style common today. Incremental adjustments to the case classroom design were made in the 1950s, including the development of a full-sized mock-up to be evaluated by students and faculty for sight-lines, comfort, and acoustics. The design criteria of a case study classroom is contrasted to the lecture classroom in Table 1.

-- Insert Table 1 here --

There have been different experiments in other spaces for business education as well. The use of small seminar rooms has featured in higher education in a variety of contexts, and at
Babson in the 1940s, as shown in Figure 1, small seminar rooms were outfitted to function as example boardrooms, simulating the space that graduates might find themselves in further in their careers (Murlkern, 1995). The use of seminar rooms as a complement to larger lecture and case classrooms has figured to differing degrees over the decades. For example, a broader use of seminar rooms has been part of a recent curriculum redesign at Stanford, in conjunction with constructing a new campus for their business school that more than doubled the number of such rooms. In this case, the change in physical space requirements was done in response to a shift to provide more personal interaction than had been possible with larger lecture rooms.

-- Insert Figure 1 here --

Design spaces are the most recent initiative in thinking about how physical space and pedagogical objectives are intertwined. As we outline in Table 1 a focus on a design space corresponds with a focus on appropriate areas for experiential learning, which is often team-based rather than individual, and in which the teacher needs to interact much more closely than in lecture or case based approaches. The focus of this form of learning space is on a team of students as the unit of analysis, and in many ways the development of design spaces is similar to the use of team-based laboratory work common in the sciences and engineering. Recent interesting design spaces with a campus-wide approach have been the d.school at Stanford and the iLab at Harvard. Both have been efforts at providing a large space for campus-wide programs. As we will discuss, the Babson “Design Zone” has been an effort specifically tailored to bringing a design space for teaching innovation right at the heart of a business school.
Our brief review of the history of learning spaces in business education shows how a range of spaces have been appropriate to meet the needs of a certain pedagogical dimension. This layering of new types of spaces has given both teachers and students a wider variety of physical spaces in which to interact based on the learning objectives of a given class. The learning space with which business schools are most newly experimenting is the design space, and we next turn our attention to a more detailed analysis of the range of activities that occur in an innovation project, and how each activity requires a different set of ingredients.

Teaching and learning the innovation process

Various innovation process descriptions have emerged over the years. An important strand of these descriptions originated in thoughts about design as a process that humans use to generate and test alternatives (Simon, 1996). With the emergence of computers and a new need to focus on human-computer interaction, an explicit focus on the user of the design outcome was added (Norman & Draper, 1986). Recent innovation process descriptions still contain these elements of user focus and iteration, often brought under the label of “design thinking.” For example, IDEO’s CEO Tim Brown frames the design and innovation process as three overlapping spaces of inspiration, ideation, and implementation (Brown, 2008). A leader in promoting design thinking, Stanford’s D-school labels five modes of its process as evaluate, define, ideate, prototype, and test. While these descriptions of the innovation process differ in the granularity of their process decomposition and their labeling of individual components, almost all design-focused methods include three broad sets of activities, which we term needsfinding, ideation, and prototyping (Seidel & Fixson, 2013). It is important to note that these sets of activities are not
necessarily done within a specific temporal sequence, as they can occur repeatedly throughout an innovation project.

In performing needfinding activities the project team tries to deeply understand the nature of an innovation problem, including whether a problem as initially formulated is actually the right problem to work on. Taking a human-centered perspective, the team tries to understand the motivation behind the need, learn about context in which the user is embedded, and search for insights for new and better solutions. Once the problem or innovation opportunity can be clearly articulated, a set of ideation activities is concerned with generating possible solution options. Various tools and techniques generally aim at generating a solution pool that is both large and diverse. A third set of activities, under the banner of prototyping, focuses on moving from a large number of solution options to a smaller number for consideration as the final innovation. This set of activities includes the testing, selection, combining, and re-shaping of solution ideas. While these sets of activities are presented sequentially, in practice there is considerable iteration and overlap among them.

These design-focused activities are central to the front-end of any innovation process, but there are additional elements of learning the innovation process that fall outside this realm. For example, learning specific design-for-manufacturing techniques or the steps in fabricating complex prototypes can also be important aspects in implementing an innovation that are not necessarily included in an innovation course adopting a design thinking approach.

**Matching innovation activities and physical spaces**

Although innovation work clearly requires the acquisition of design methods and techniques, innovating is not an activity that can be performed by exclusively following a pre-
defined formula. It is important to recognize that innovation inherently involves drawing from an appropriate mindset as well (Liedtka, 2014). These mindsets, in turn, are impacted by the physical environment that humans experience when engaging in design activities (Thoring, Luippold, & Mueller, 2012).

Acknowledging these strong linkages between the skills, mindsets, and physical environment to achieve high performance in innovation activities (Doorley & Witthoft, 2012), leads us to investigate in greater detail the actual spatial requirements for each of the activities sorted under the headings needsfinding, ideation, and prototyping. Below we will discuss for each innovation activity the skills to be learned, the mindset required, and how a certain form of physical space supports each activity.

*Needsfinding activities*

Needsfinding includes three major types of activities, as we outline in Table 2: User research, secondary research, and synthesis. User research consists of interviewing and observing users and other important stakeholders, as well as possibly putting oneself in the user’s experience. The appropriate mindset for this activity is empathic and curious. The tools needed by students are appropriate ‘recording’ mechanisms such as pen and paper, a voice recorder for audio, and cameras for photos and videos. As a consequence, the physical environment that often serves best for the data collection portion of user research is the user’s own environment; depending on the project this could be, for instance, his home, her work, or a public space. The design space itself does not play a large role in this activity, except for how the location of the space is proximate to the users under study, though the ability to lend audio or video recording technology to students for such ethnographic work can be helpful.
A second activity is in performing secondary research, such as collecting information about markets, industries, competitors, regulations, and intellectual property. This work requires a more analytic mindset. As a consequence the environment should provide connectivity to relevant data, and thus computer access and workspace for the team is the main support required.

The third major activity in needsfinding, synthesizing, builds on the output of first two activities. Once both primary research and secondary research have generated sufficient amount of interesting and relevant data, the next task is to mine this data for new insights. The innovation teams searches for hitherto unnoticed patterns and relationships, forming associations between otherwise disconnected data elements. This activity requires both an imaginative, creative, and contemplative mindset, as the task is to imagine unarticulated needs and to interpret ambiguities. This work often includes construction of data-visualization tools such as “ personas” (representations of a typical user) and “journey maps” (representations of a customer experience). The physical space that best supports this activity enables the innovation team to view many different pieces of heterogeneous information simultaneously. This requirement, also observed at ‘war rooms’ and ‘command centers,’ is best accommodated by providing lots of vertical work surfaces such as white boards and pin boards, allowing students to spreading out data such as quotes, diagrams, tables, figures, and photos. Ideally, the space also includes the possibility to review dynamic data such as audio and video files through advanced projection systems.
**Ideation activities**

The ideal starting point for ideation activities is a well-defined problem or opportunity statement, including important constraints. The first set of ideation activities, idea generation, is divergent in nature; it strives to generate quickly large quantities of solution options, ideally exhibiting a large diversity. To achieve this goal, the activities are themselves guided and constrained (Table 3). For example, to avoid group think and ensure diverse input, an innovation team can start by all members individually generating ideas by themselves, and then merging all ideas into an idea pool. This activity is best supported by an environment that provides stimuli for the task but otherwise avoids distraction. Tools that allow quick recording and display of individual ideas, such as paper and pencils, should be readily available. If, on the other hand, the goal is to take advantage of collective idea development where individuals build upon each other’s ideas, then a group brainstorming can be the right activity. For such team-based idea generation activity the best environments support the required attitude: imaginative, optimistic, energetic, and tolerant. The ideal space for this activity encourages an upright body posture and movement to increase energy levels, for example by using high tables and bar stools. The physical space should also provide sufficient vertical work surface for the quick display of sketches of emerging ideas for all team members to see during the activity.

--- Insert Table 3 about here ---

The second ideation activity aims at shaping ideas to improve their fit with the identified need. This involves re-shaping their degree of novelty, making them more useful through feature elimination or combination, or even merging ideas. Idea shaping requires a mix of imaginative,
optimistic, and reflective mindsets, ideally supported by large wall areas that allow relative spatial positioning of ideas to stimulate stretching, or relaxing, elements of the ideas.

Prototyping activities

Prototyping activities focus on reducing uncertainty, including tools to sift through many possible ideas and learn about which ones will work. As we illustrate in Table 4, it is helpful to split the range of prototyping activities into two groups.

In the early stages, prototyping is aimed not at validating any particular idea but instead at learning about the potential of certain concepts. The relevant skills to be learned for this activity are the ability to reduce a concept to one of its core elements, construct rough prototypes which mimic only the dimension of interest, and to put them “out there” to see how users react. Successful early prototyping is driven by curiosity and creativity paired with attentive observation and a high tolerance for unexpected outcomes—what might be termed “failures” in some people’s minds. Spaces that appropriately support this process provide access to materials and tools to quickly mock up prototypes and allow repeating this process quickly to increase the learning velocity.

--- Insert Table 4 about here ---

After the initial explorative prototyping has produced some promising concepts, later prototyping requires a rather scientific approach to problem solving and testing. Hypotheses need to be articulated, testing procedures defined, prototypes built, and experiments conducted. This form of prototyping requires more attention to detail, and a more rigorous attitude. The
physical space to support this activity needs to provide the option to layout testing plans and procedures, similar to a small project on its own. Of course, access to tools, materials, and actual workshop space remains as critical for this later form of prototyping as it was for the earlier form.

**The Babson College “Design Zone”**

At Babson College we had the opportunity to create a design space that would serve several courses in product design, innovation, and entrepreneurship. Current courses offerings span both the undergraduate and graduate student populations and include: (i) an undergraduate integrated product design course co-taught by faculty from Babson College, Olin College of Engineering and Massachusetts College of Art and Design; (ii) an undergraduate course on affordable design and entrepreneurship co-taught by faculty from Babson College and Olin College of Engineering, (iii) an undergraduate course on social entrepreneurship; (iv) a graduate product design course; and (v) a year-long graduate design and entrepreneurship action project-based course. Product design and innovation had been taught at Babson for many years, but prior efforts used a fairly generic project meeting room as the main space for such classes, consisting of a set of several conference tables and rolling desk chairs as the main space for such classes. In the spring and summer of 2014, we had the opportunity to design a classroom for teaching design and innovation from scratch, which became known as the “Design Zone” at Babson College. In advance of specifying the criteria for the novel classroom, we visited and consulted with colleagues at the Stanford d.school on their experience running and experimenting with a large campus-wide design space (c.f. Doorley & Witthoft, 2012). From this insight and with a
consideration of the innovation activities and classes we would run at Babson within the space available right at the heart of a business school, we developed a list of features we need our design space to have. There were three primary modes the design space had to support:

1. Collaborative creative mode: To support both generative and associative work by teams
2. Presentation mode: For lectures and presentations
3. Workshop mode: To enable building physical prototypes

The Babson Design Zone was to be built directly within a business school for the use of business students and with a primary focus on coursework. Beyond courses, the design zone was planned to serve as independent work space for students and as space for events on campus and to support a culture of experiential learning on campus. The location of the Design Zone was to be in the center of the graduate school and to feature a boundary defined by glass windows and glass doors, enabling others to easily see the work underway inside. Because we would have to be able to use the design space with multiple courses, two additional requirements became very important:

- Flexibility: The space needed to be flexible in that room configurations could be easily changed, both between modes within a course, and between courses.
- Storage: We needed space to store project materials when the space was used by other courses. An important criterion here was that storing and re-deploying project work should be easy and quick.
The resulting Design Zone is pictured in Figure 2, and it has many features that distinguish it from a typical meeting room for project work. The space features concrete floors to make things easier to move and to exhibit a less polished and sensitive impression than carpet. High tables and bar stools encourage an active body posture. All tables and moveable white boards are on wheels to allow quick reconfiguration of the room. Almost all walls are covered with whiteboards or pin-boards to serve as vertical work surfaces, and the room also includes two types of moveable white boards, Z-racks that can be quickly deployed, and T-walls that are sturdier. The T-walls feature hooks such that removable whiteboards can be hung on them for each class; in this way student design teams can customize their work environment, even if the space is used by others. One corner of the design room serves as material and tool storage place; student and project materials are stored in a separate hallway outside the design zone. Figure 3 shows the schematic layout of the Design Zone.

--- Insert Figure 2 here ---

--- Insert Figure 3 here ---

Experiences with the Design Zone

We have now had many experiences in making use of a design space, and we have come to reflect on the opportunities and challenges that such a space presents to instructors. There are many positive aspects to having a purpose-build design space. First, we generally find that through the use of raised work surfaces and high stools students tend to take a more active physical stance within the classroom which also translates to a higher energy dynamic within the space when compared with a traditional lecture or case study classroom. An example of students
engaged in some ideation work is given in Figure 4. Second, the space enables the instructor to walk up to close proximity to each student—there are no middle seats far from an instructor’s reach—and so a more personal connection can be made with any student, not just those sitting in the front row of a classroom. In Figure 5 we show an example of a student prototyping exercise. As instructors who like to get to know our students well, we have found this ability to hone in on each and every student to be a positive experience. Due to its flexibility, the Design Zone can also be configured in a presentation mode (Figure 6), for example for end-of-semester project presentations, or for small group design reviews (Figure 7).

-- Insert Figure 4 here --

-- Insert Figure 5 here --

-- Insert Figure 6 here --

-- Insert Figure 7 here --

There have also been some challenges in teaching in the “design zone” when compared with more traditional classroom settings. The first challenge is one of set-up and clean-up time. No matter how diligent students attempt to be, there are always myriad items to attend to in such an active room setting: Tables to be realigned, post-it notes to be stocked, whiteboards to be erased, Z-racks to be repositioned, and workshop safety waivers to be filed. We estimate that it often takes an average of 20 minutes extra per class session to either set-up before or clean-up after a session, and this is faculty time that takes away from other items. Second, while for project work a flat-floored design space is ideal, for broadcasting information the sight-lines are often a challenge and it can be hard to engage students at the back of a class during presentations, as
they need to peer over a sea of heads level to theirs. The challenge of presenting material has meant that as instructors we have had to rethink the balance of material to be presented to students in the “design zone”, at times necessitating the booking of a traditional case study classroom for long presentations.

Another important observation is the way in which the design space impacts the role of the faculty member. As the learning objectives evolve from teaching routine problem-solving to teaching skills for innovation, the pedagogical role of the teacher is simultaneously evolving. Importantly, the teacher’s role changes from one of command-and-control knowledge transfer to one of collaborative knowledge co-creation. In some sense, the teacher implicitly becomes a member of the student team. Lee (2009) refers the role of the design faculty as moving from “instructor” to “guide” to “collaborator”. In our experience, all of the design space attributes which facilitate various innovation activities undertaken by students are equally important in facilitating this new faculty role. For example, an open and flexible layout allows the teacher to freely move between teams and to quickly use moveable chairs to join a team’s table when necessary. On the other hand, faculty trained in, and used to, either lecture- or case-based teaching formats, might take some time to get used to this different teaching format. In our experience, switching between a space such as the Design Zone and more traditional classrooms, often in the same day, presents its own cognitive demands.

**Design spaces as career preparation**

We have described the importance of design spaces in the process of learning the activities underlying the innovation process, but the importance of design spaces also extends to career
preparation. Our pedagogical objective at Babson is to prepare our students as future entrepreneurial leaders who will create value, by imagining and designing new products, services, businesses and industries. We suggest that students can be trained to utilize user-oriented design thinking and design methodologies to approach business problems by expanding the definition of the “user” to include not only customers, but also retailers, suppliers, partners and other stakeholders in the value chain. Their tasks as future managers and employees will be identifying unmet needs in the marketplace and conceptualizing novel solutions to address those needs. This requires that students develop, through experiential learning, the design-oriented skills and capabilities to explore the unknown, deal with complexity, act under uncertainty, work collaboratively to co-create with stakeholders, while iteratively prototyping and experimenting with evolving ideas.

We propose that the experience acquired in a design space serves as preparation for the kinds of open-ended problems, creative activities, and collaborative workspaces which these students will encounter as they enter the workforce. Even if a student does not proceed to a position where they are doing day-to-day design work, the mere ability to know how best to use and navigate a design space is becoming ever more relevant. Increasingly, graduates of business schools may find themselves working within design spaces at innovative organizations, such as Google Ventures (Knapp, 2014). Furthermore, even more traditional corporations such as Procter & Gamble, Canadian Tire, & Home Depot are adopting the use of design spaces for innovation activities where collaborative, multidisciplinary teams can propose creative solutions to their most challenging problems. For example, Procter & Gamble initiated their Clay Street project in 2004, serving as a dedicated design space located in an offsite loft-style location. Motorola’s Razr was developed in a dedicated design space, which they refer to Motocity. Just
as students in the 1940s were prepared to work within a mock Board Room setting, today’s students can be provided an opportunity to exercise the skills and capabilities associated with design spaces that are ever more prevalent. Moreover, even if students are hired at companies which are not equipped with these spaces, as result of their exposure to the design space, students may be able to advocate for appropriate design and innovation space within their workplace, given their educational experience.

**Conclusion**

Design spaces will be increasingly part of both our pedagogical toolkit and our business landscape, and we within business schools have an opportunity to consider how best to provide the appropriate environment for our students to make use of such space. Our experience at Babson with the Design Zone has shown us how well a thoughtfully designed physical environment can mesh with our goals as innovation educators. Our specific design was tied to our own physical and curricular environment, and different schools will want to consider how best to design for their own requirements. Matching the activities expected in a design space with the physical requirements will increase the chances of creating welcoming space for innovation.
References

Figures

Figure 1: A 1949 Babson classroom used to simulate boardroom discussion

(Photo: Murlkern, 1994)
Figure 2: The Babson Design Zone
Figure 3: Schematic layout of the Design Zone

Each “pod” consists of two movable tables and six high stools.
Figure 4: Idea shaping work in the Design Zone
Figure 5: Prototyping work in the Design Zone
Figure 6: Presentations in the Design Zone
Figure 7: Small group design review in the Design Zone
# Tables

**Table 1: Overview of learning spaces for business education**

<table>
<thead>
<tr>
<th>Decade of main introduction</th>
<th>Lecture classroom</th>
<th>Case study classroom</th>
<th>Seminar room</th>
<th>Design spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880</td>
<td></td>
<td>1920</td>
<td>1940</td>
<td>2000</td>
</tr>
</tbody>
</table>

**Pedagogical focus**

- Lectures
- Case study discussion
- Small group discussion
- Experiential learning

**Space design objectives: teacher’s role**

- Visibility of professor and his or her broadcast surfaces important
- Visibility of professor and his or her broadcast surfaces important
- Facilitator of discussion important
- Interaction of professor with individuals and teams important

**Space design objectives: learner’s role**

- No interaction assumed
- Interaction among large number of individual students
- Interaction among small number of individual students
- Interaction among student teams important; Space directly supports varied experiential learning activities

**Examples**

- Wharton: Lecture theaters, 1880s
- Harvard: Allston campus move, 1925
- Babson: Campus renewal, 1950s
- Babson: Boardroom format, 1949
- Stanford: Seminar focus, 2007
- Stanford: d.school, 2004
- Harvard: iLab, 2011
- Babson: Design Zone, 2014
<table>
<thead>
<tr>
<th>Major Activities</th>
<th>Skills to be learned</th>
<th>Appropriate Mindset</th>
<th>How environment supports the activity &amp; learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>User research (primary research)</td>
<td>Interviewing, observing, and self-experiencing</td>
<td>Empathic, curious</td>
<td>Location (short distance between work space and users/stakeholders)</td>
</tr>
<tr>
<td>Secondary research</td>
<td>Searching for, analyzing, and compiling relevant information</td>
<td>Analytic</td>
<td>Connectivity (Internet connection and access to data bases); limited distractions</td>
</tr>
<tr>
<td>Synthesizing, searching for insights</td>
<td>Recognizing patterns, forming associations</td>
<td>Imaginative, creative, contemplative</td>
<td>Vertical work surfaces critical (allow viewing large amount of various data simultaneously); Capability to share dynamic materials (e.g., video)</td>
</tr>
<tr>
<td>Major Activities</td>
<td>Skills to be learned</td>
<td>Appropriate Mindset</td>
<td>How environment supports the activity &amp; learning</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Idea generation (individual)</td>
<td>Accessing own creativity</td>
<td>Imaginative, optimistic, inquisitive</td>
<td>Space that allows stimuli but avoids distractions; Tools and space to rapidly sketch out emerging ideas should be readily available</td>
</tr>
<tr>
<td>Idea generation (team-based)</td>
<td>Collaborative creative work</td>
<td>Imaginative, optimistic, energetic, and tolerant</td>
<td>Space that allows upright body posture to engage body &amp; mind for entire team (e.g. high tables/bar stools); Vertical work surfaces to display developing ideas quickly and for all team members to see</td>
</tr>
<tr>
<td>Idea shaping</td>
<td>Stretching/relaxing of elements of raw ideas to improve idea quality</td>
<td>Imaginative, optimistic, reflective</td>
<td>Vertical work surfaces that allow spatial positioning of ideas to display relative risk/potential</td>
</tr>
</tbody>
</table>

Table 3: Ideation activities and their supporting conditions
<table>
<thead>
<tr>
<th>Major Activities</th>
<th>Skills to be learned</th>
<th>Appropriate Mindset</th>
<th>How environment supports the activity &amp; learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early prototyping</td>
<td>Intuition, attention to unanticipated/interesting outcomes</td>
<td>Curious, creative, imaginative, observant, failure tolerant</td>
<td>Provides access to tools and materials to allow quick design and construction of simple prototypes; Enables fast iterations</td>
</tr>
<tr>
<td>Later prototyping</td>
<td>Hypothesis formulation; Design and execution of experiments to test hypotheses</td>
<td>Attention to detail, precision, experimental perspective</td>
<td>Provides vertical work surfaces to develop, design, and plan experiments; Provides access to tools and materials to design and construct prototypes for experiments</td>
</tr>
</tbody>
</table>