

## **Design Thinking: A Creative Approach to Problem-Solving**

### **Abstract**

Design thinking—understanding the human needs related to a problem, re-framing the problem in human-centric ways, creating many ideas in brainstorming sessions, and adopting a hands-on approach to prototyping and testing—offers a complementary approach to the rational problem-solving methods typically emphasized in business schools. Business school instructors may perceive design thinking, a relatively new and complex multi-step, iterative process, to be beyond their capabilities or time/resource constraints. This experiential exercise provides a relatively easy, low investment approach to incorporating an overview of design thinking into any course. With minimal instructor preparation, participants can have a positive experience using design thinking to solve a real problem, consuming as little as an hour of class time. This activity is suitable for undergraduate and graduate courses in any business discipline. The provided lesson plan, slides, and workbook make it easy to facilitate students' experience of the design thinking process.

Key words: Design thinking, human-centered design, human-centered problem-solving, innovation, creative mindset, creative process, creative confidence, empathy, critical thinking, problem-solving, reframing, learning by doing, active learning, process mastery

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“Four in 10 U.S. college students graduate without the complex reasoning skills to manage white collar work”

*Wall Street Journal*, January 17-18, 2015, p. A5

In today's economy, employers want people who can learn over time and solve complex problems (Belkin, 2015). Business schools have been criticized for not adequately preparing students for the complex, rapidly changing businesses environment they will face (Glen, Suciu, & Baughn, 2014). Recently, Dunne and Martin (2006), Glen et al. (2014), and others (Kurtmollaiev, Pedersen, Fjuk, & Kvale, 2018; Razzouk & Shute, 2012) have argued that design thinking offers business schools a means of addressing their perceived deficits (e.g., too lecture and case focused, inadequate opportunities to learn by doing, over reliance on rational analysis). Design thinking, which emphasizes the user need, delays search for the solution until the user need is understood, encourages learning through iterative prototyping and feedback, and embraces a bias towards action, offers a complementary approach to the rational/analytical problem-solving methods typically emphasized in business schools. Today design thinking is recognized and embraced as a successful problem-solving method, a method which melds an end-user focus with multidisciplinary collaboration and iterative experimentation to achieve desirable, user-friendly, and economically viable solutions or innovations (Brown, 2008; Dunne & Martin, 2006; Meinel & Leifer, 2012). Thus, the integration of design thinking into business school curricula, whether in a single course or across the curriculum, may help students develop the creative and critical thinking skills needed to solve complex problems (Dodd, 2014; Kurtmollaiev et al., 2018; Razzouk & Shute, 2012).

## Theoretical Foundations

The theoretical foundations of design thinking come from many disciplines—engineering, social sciences, design, and others—where people were trying to develop better or alternate ways to solve problems, particularly problems which are complex or ill-formed (Buchanan, 1992; Dam & Siang, 2018; Huppertz, 2015; Meinel & Leifer, 2012; Razzouk & Shute, 2012; vonThienen, Clancey, Corazza, & Meinel, 2018). Generally, these theorists believe that not all problems are best addressed using a rational or economic approach and that design thinking, or human-centered design, is another viable approach to addressing complex problems, particularly when there is ambiguity about the problem or solutions (Brown, 2008; Dunne & Martin, 2006; Glen et al., 2014; Horst & Melvin, 1973; Kelley & Kelley, 2013; Meinel & Leifer, 2012; Plattner, Meinel, & Leifer, 2018; Razzouk & Shute, 2012; vonThienen et al., 2018). Design thinking may be used to address a diverse range of issues from how to reduce absenteeism in a school setting to how to grow brand equity to how to achieve organizational goals (Beverland, Wilner, & Micheli, 2015; Harris & Frieler, 2017; IDEO, 2012; IDEO.org, 2015). Research suggests that the use of design thinking to solve problems may result in improvements in recognizing opportunities, taking advantage of opportunities, and effecting change and innovation (Garbuio, Dong, Lin, Tschang, & Lovallo, 2018; Kurtmollaiev et al., 2018).

In contrast to rational problem-solving, which focuses on critical thinking, design thinking emphasizes both creativity and critical thinking when solving a problem. The design thinking process uses discovery, interpretation, and ideation processes to explore or widen a problem space; then rapid prototyping, experimentation, and feedback cycles are used to refine and evolve ideas and narrow the problem space (IDEO, 2012; IDEO.org, 2015; Razzouk &

Shute, 2012; Stempfle & Badke-Schaub, 2002). Table 1 compares the design thinking and rational problem solving processes:

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### **Activity Overview**

This exercise is an introduction to the design thinking process. This hands-on activity allows participants to experience the design thinking process in its entirety in one relatively short session. Experiencing the process, as a whole, prepares participants to practice using design thinking in other contexts and to compare it with the rational approach to problem solving. Participants will: 1) work in groups, 2) select a design challenge (i.e., a problem to solve), 3) solve their design challenge using design thinking (i.e., they will discover, interpret, ideate, experiment, and evolve), and 4) discuss their learning.

Design thinking, just like rational problem-solving, can be useful in many courses and situations. This activity is appropriate for almost any adult audience in almost any context. I have successfully used this activity with undergraduate and graduate students and with peers in a professional development context. This activity has been used in organizational behavior, strategic planning, and innovation/entrepreneurship courses. I have also used it as a stand-alone workshop for graduate and undergraduate students, professionals/colleagues, and combinations of these audiences. This versatile, engaging activity may be used in any course or situation where the instructor wants to introduce participants to design thinking and expose them to a creative, exploratory approach to problem-solving.

This activity is easy to learn or adopt. It has been specifically designed to make it easy for instructors and students with little to no experience with design thinking to have a great first experience with design thinking. Many disciplines and organizations embrace and advocate design thinking and have developed their own terminology and graphics to explain the process. After experimenting with various approaches, I adopted IDEO's terminology and graphics for this activity because: 1) students found it easy to understand, 2) the graphics are clear, easy to read, and easy to reproduce, 3) they offer an educator's toolkit, and 4) the materials are shareable via a creative commons noncommercial license.

This exercise includes a detailed lesson plan (Appendix A), sample prototypes (Appendix B), slides (Supplemental Material 1), a list of prototyping supplies (Supplemental Material 2) and a student workbook (Supplemental Material 3). To assess the ease of implementation, I invited three doctoral students (of varying majors) to facilitate this activity as a workshop at a school event. Each received a copy of the lesson plan, the slides, and the workbook; we had a 20-minute conference call to discuss any questions or concerns; there were none. With minimal preparation beyond reading the lesson plan and reviewing the slides and workbook, they each facilitated a session with about 20 participants. Anonymous feedback from both the participants and the facilitators was positive, they all considered it a success.

### **Learning Objectives**

By the end of this activity participants should be able to:

- Explain the design thinking process
- Apply the design thinking process
- Assess the relative merits of a design thinking approach to problem-solving versus a rational approach

- Determine when it is appropriate to apply a design thinking approach to problem-solving

### **Instructions for Running the Activity**

**Overview.** During this activity, participants learn and practice the design thinking process under the instructor's guidance/facilitation. Working in cross-functional or affinity groups students will select or create a problem to solve, use design thinking to understand the problem (i.e., discover), search for meaning and insights (i.e., interpret), generate and refine ideas (i.e., ideate), make prototypes and get feedback (i.e., experiment), and discuss their experiences and learning. During this activity, the instructor will facilitate the exercise using the lesson plan (Appendix A) and slide deck (Supplemental Material 1) while students use the workbook (Supplemental Material 3) and the prototyping materials (see Supplemental Material 2) to learn design thinking and practice doing it.

**Logistics.** The activity can be completed in one 50-minute session, one 60-minute session, a 90-minute session, or two 50-minute sessions; a 90-minute session is ideal from a participant perspective. If implementing the exercise in two 50-minute sessions, use the 90-minute timing. The first session, will end with experimentation (students creating prototypes); the second session will pick up with the reporting and feedback phases of experimentation. In the second session, the optional Evolve discussion as outlined in Appendix A may also be added. Appendix A provides detailed instructions, including timing for each phase, and tips for successfully implementing this exercise.

**Instructions.** For many participants, this may be their first time using design thinking; they will be learning the process by doing it in an accelerated fashion (~30-40 minutes are actually spent using design thinking to solve a problem). The goal is for participants to get a feel

for the entire process. They will use the workbook as a guide while they practice design thinking—using discovery, interpretation, ideation, experimentation, and evolution to solve their selected challenge. See Table 2 for a summary of questions and activities at each step in the process; see Appendix A for more detailed instructions for moving participants through the process.

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The experience may be a bit scary to some participants and exciting to others. The workbook helps participants focus and breaks the learning down into discrete, manageable steps, so they can focus on learning and practicing a new process—design thinking. The instructor’s facilitation and encouragement provides participants with the support needed to sustain an engaging and effective learning environment.

There are several additional activities that I have used to assess the impact of or reinforce this learning activity: recap/reflection at the beginning of the next class, requesting feedback on the activity (Supplemental Material 4), pre-post assessment of content knowledge (Supplemental Material 5), and application/analysis assignments. See Appendix A for more information about these activities and design thinking grading rubrics. See Appendix C for an example of how participants might solve a business problem using design thinking.

### **Instructions for Debriefing**

The debrief starts after teams complete the design thinking process and present their prototypes. To start the debrief, congratulate participants on having creatively solved a problem

using design thinking. Typically, participants are feeling energized and excited at this point and are eager to talk about their experience. Ask:

- In your own words, based on your own experience, how does design thinking differ from rational problem-solving? How is it the same?
- Can you imagine situations where you might use this approach in the future? In what types of situations or conditions would you use it?
- Lessons learned from this experience?

Generally, participants, play back the process (i.e., they describe it), express willingness to use the approach in the future, and have ideas about where and when to use it (most conclude it might work in almost any complex situation where there are many paths to success or many possible solutions).

## **Conclusions**

This experiential learning activity offers a relatively easy way to introduce the design thinking process to learners. Participants learn by doing in an accelerated manner which builds their creative problem solving competencies while developing their creative thinking and critical thinking skills. This activity can be integrated into any course to aid in the development of creativity, critical thinking, and complex problem solving skills; the skills so in demand in today's world.



## Appendix A: Lesson Plan

### Design Thinking: A Creative Approach to Problem-Solving

#### List of Supplemental Materials

- Slides: Supplemental Material 1
- List of Prototyping Supplies: Supplemental Material 2
- Workbook: Supplemental Material 3
- Feedback Form: Supplemental Material 4
- Content Mastery Mini-Assessment (Pre and Post): Supplemental Material 5
- Optional: Framestorm Pinkcast 2.5 video: <https://www.danpink.com/pinkcast/pinkcast-2-5-why-you-should-frame-storm-before-you-brainstorm/>

#### Before the Activity:

- Review learning objectives and lesson plan (Appendix A)
- Review slides: Supplemental Material 1
- Review list of prototyping supplies and assemble supplies: Supplemental Material 2
- Review workbook: Supplemental Material 3
- Make copies of workbooks
  - For environmental reasons, you may resist printing the workbook for participants or be tempted to only produce one workbook per group. I have done this and I encourage you not to repeat my mistake. Student engagement is higher and more widespread when each student has access to the tools and references needed to succeed.
- Review Table A1 which outlines the timing for each part of the activity, depending on the duration of the class session.

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- Develop plan for breaking participants into groups
  - Have a maximum of four people per team, ideally three; this fosters high engagement (i.e., minimizes talk wait time, allows more air time per person).
  - If you have established or ongoing teams, use them. If ongoing teams are large, 5-6 people, break each team into two groups temporarily for this exercise.
  - If you do not have established teams and you have only 50 minutes, use convenience groupings of 3 people (i.e., 3 people sitting next to each other who can easily huddle to become an ad hoc team).
  - If you do not have established teams and you have 90 minutes or more, you may create cross-functional teams by having participants form a line, organizing themselves by major, and then counting off (e.g., if you have 30 people organized by major they can count off by ten to form ten groups of three).
  - Teams may also be organized by shared interest in a challenge. Either participants or the instructor may identify challenges and then participants may organize themselves around a problem in which they have an interest (i.e., affinity groups).
    - If you take this approach, the key is to keep it moving; this should not take a long time.
    - Get ideas on the board quickly and have participants declare quickly.
    - If a lot of participants express interest in a challenge, multiple teams may tackle the same problem (to keep the team size small).

- Assemble prototyping supplies and sample prototypes
- Check out the room and A/V equipment
- Review and decide upon any assessments and/or follow up assignments you may want to implement (see Related Assessments, Assignments, and Grading Rubrics near the end of this Appendix)
- Nice to have on hand
  - Timer
  - Bell

### **Immediately Before Activity**

- Display/distribute prototyping materials on a table near the front or back of the room in a location where everyone can access it, ideally from all sides
- Set up A/V and display opening slide
- Place one workbook at each seat

### **During the Activity**

- ***Introduce the activity***
  - Start by asking for a show of hands for: Who has heard of design thinking? Who has used design thinking to solve a problem?
  - Typically, five to ten people (out of 20-30) will raise their hands indicating awareness of the concept; typically, only one or two say they have used design thinking.
  - Then move right into the activity.
- ***Establish importance and relevance of design thinking***
  - Ask for volunteers to read to the class the quotes you have selected to capture participant interest (e.g., first quote, slide 2; second quote, slide 3). The quotes may be tailored to

your participants and your learning objectives; the quotes are to help students see the personal importance and relevance of design thinking (Nilson, 2010).

- Then advance to slide 4, explain that design thinking is a way of thinking, an approach to problem solving, an approach to innovation or design. The key point of difference is that it takes into consideration human factors, not just rational factors like feasibility and viability.
- Tips: This section should move quickly not be an extended discussion, otherwise you will run out of time for the learning activity.
- ***Introduce the design thinking process***
  - Ask participants to volunteer to read the steps in the design thinking process (slide 5 in the slide deck), ask them to describe each step in their own words.
    - In my experience, students can explain the steps in their own words even though they are seeing the process for the first time. The use of peer to peer instruction like this versus me explaining the steps encourages engagement and a deeper level of learning (Nilson, 2010).
  - Tips: Let participants know that this will be a very fast paced session, very hands on—they will practice using the entire design thinking process and you will be pushing them to try this new approach quickly.
- ***Form teams***
  - Implement whichever team formation approach you selected during your pre-activity planning.
- ***Explain the purpose of the workbook and refocus on the activity***

- Ask participants to locate their workbook. Explain that they will be using the workbook as a guide during the activity. They can take notes in it and use it as a reference. Note that the design thinking process is outlined on page one of their workbook just as it is on slide 5 (which should still be on the screen). Teams will work through the design thinking process concurrently with you calling time for each step and briefly introducing the next step.
  - The entire class will be going through the workbook together.
  - You will briefly explain each step.
  - You will call time after each step.
  - Each team will work together—do each step on a challenge of their own choosing.
- ***Select a challenge***
  - Optional: Before they start selecting or creating a challenge, show video about framestorming here: <https://www.danpink.com/pinkcast/pinkcast-2-5-why-you-should-frame-storm-before-you-brainstorm/>
  - Ask teams to select or create a challenge; they can pick from one of the samples on page 1 of their workbooks, other samples you provide, or create their own—give them 3-5 minutes to complete this activity. Use the bell to call time.
    - Challenges may be tailored to the course or context.
    - For example, in a human resource management or organizational behavior course, a challenge might be: How can Amazon reduce absenteeism in its warehouse operations? In an operations management course, a challenge might be: How can Facebook improve productivity across its workforce?

- Selecting a challenge should not be an agonizing decision. Remind them this is a practice run—an overview of the process; they will be learning a new approach to problem-solving by doing it (they will not be stuck with this challenge forever).
- Tips: Regardless of the course, I let students pick a challenge they care about, rather than require they pick a challenge related to the course. This level of autonomy/choice increases engagement and can help improve mastery, which may increase their ability to apply design thinking in other contexts later.
- ***Discover, Part A***
  - Ask participants to turn to page 2 in their workbook, explain:
    - They are starting the discovery process (relate to slide 5).
    - They will have 5 minutes to brainstorm/capture what they know about their challenge and what they want to know about it.
    - Use bell to call time.
  - Tips: Encourage participants to generate/list as many items as possible for both lists (“know”/“need to know”). Encourage them to minimize debate/evaluation of the items. If they are debating an item, they do not know it—it should go on the “need to know” list. Walk around and observe teams and how they are developing their lists, if you notice participants are debating items versus listing items, remind them they are in the discovery process.
- ***Discover, Part B***
  - Ask participants to turn to page 3 in their workbooks, acknowledge that you are pushing them. Explain:
    - You have confidence in their ability to do this.

- They are still in the discovery phase (refer to slide 5).
- They will have 5 minutes to try to find the information they “need to know.”
- Encourage them to use their phones and computers to call friends/experts to conduct research; everyone should be actively working on discovering information.
- Use bell to call time.
- Tips: Students often think this task is fun. It is not every day that an instructor says. “Pull out your laptops, tablets, and smartphones. Make some phone calls. Do some research.” Encourage every member of each team to actively search for needed information. As you walk around, if you notice someone not participating, encourage them with a quiet word.
- ***Interpretation, Part A***
  - Ask participants to turn to page 4 in their workbooks, explain that they are now moving into the interpretation phase (refer to slide 5). They will have 5 minutes to search for meaning and insights in the data they have collected (i.e., make sense of the data they have assembled).
  - Ask for a volunteer to explain in their own words what a pattern is.
  - Ask for another volunteer to explain in their own words what an anomaly is.
  - Ask one volunteer to explain why it might be important to look for stories, patterns, and anomalies.
  - Remind them that you know you are pushing them.
  - Encourage them to search for stories, patterns, and anomalies which may help them understand their challenge or gain insight into their challenge.
  - Use bell to call time.

- Tips: Circulate among the teams as they work. Answer any questions they might have.  
Ask them if they have a deeper understanding of their challenge now? Of their user(s)/stakeholder(s)?

- ***Interpret, Part B***

- Ask participants to turn to page 5 in their workbooks, explain that you are asking them to dig deeper, to search for insights (refer to slide 5 to place them in the process). Their assignment is to list all users and needs they have identified and to develop at least one insight and hypothesis or point of view (POV) for each user.
- Advance to slide 6 and review the framework: user+need+insight=hypothesis or point of view.
  - This is typically the most challenging step of the process for participants, so spend a few minutes explaining it and reviewing examples (see next steps).
- Move to slides 7 and 8. Review examples provided or your own examples. This should be a brief discussion, not prolonged.
  - For example: the manager of the Amazon fulfillment warehouse in Baltimore (user) needs her operation to be more efficient (need), because her bonuses and performance reviews are based on efficiency targets, but the workers in the warehouse who significantly influence operating efficiency don't have bonus plans or performance reviews (insight), so what if we could create performance incentives for workers in the warehouse (hypothesis or point of view).
  - For example: a 9th grade girl in Baltimore, who is new to her school (user), needs to eat healthy and to be socially accepted (needs), but it is more important for her



to feel socially accepted than eat healthy (insight), so what if we could make eating healthy socially acceptable or cool (hypothesis or point of view).

- Optional: Ask for a volunteer to share an example.
- Participants have 5 minutes to create examples.
- Use bell to call time.
- Tips: Encourage participants to use the format template (user+need+insight=hypothesis or point of view). Encourage them to be as specific as possible when identifying users and needs (e.g., instead of their user being anyone experiencing poverty, focus on people living in poverty in their town or instead of their user being all students, focus on students in their school).
- ***Ideate, Part A***
  - Ask participants to turn to page 6 in their workbooks, explain that they are now moving into the ideation phase (refer to slide 5), for this activity they will be working individually; they will be brainstorming by themselves. They will have 2 minutes to generate as many radical ways to meet a user's need as possible taking into consideration their insights and hypotheses (from the previous task). Remind people to work quietly by themselves. Use bell to call time.
  - Tips: Circulate among teams and encourage any individual who seems stuck. Occasionally, an individual will say, "I'm not good at brainstorming;" you may respond: "yet, with practice you can get better."
- ***Ideate, Part B***
  - Explain participants are still in the ideation phase (refer to slide 5) and will have 3 minutes to share their ideas with their teammates. They are sharing—not judging, not

defending, not explaining. To share, ask each team member to hold up their worksheet in front of themselves, like a poster, and let their teammates read their ideas; demonstrate this or model it with a team. Once they have read each other's ideas, they may ask clarifying questions and offer suggestions. Use bell to call time.

- Tips: If you notice participants trying to sell or defend their ideas, ask the group/class to explain why we don't want to focus on selling or defending (for example, appropriate responses might be: trying to minimize defensiveness, trying not to “fall in love with our own ideas” while ideating and before user feedback, trying to create ideas now—not judging ideas, trying to be open/empathetic, trying to remember that the user's feedback is the important feedback).

- ***Experiment – Prototype***

- Ask participants to turn to page 7, explain that now they are moving into the experimentation phase (refer to slide 5) and will have 5 minutes to create a prototype for one of their ideas/solutions to address their user(s) need(s).
  - Show them the prototyping materials.
  - Explain that both tangible and intangible ideas can be prototyped.
  - Prototyping may include creation of storyboards, role playing, process/flow maps, sketches/diagrams, and paper models of user interfaces (e.g., for apps, web pages, service experiences, operating processes, etc.).
  - Show them the sample prototypes (see samples in Appendix B).
  - Invite participants to come get their materials and make their prototypes.
  - Use bell to call time.

- Tips: Participants are usually very engaged in this task. Remind them to stay on task, as time is limited. If they ask for extra time and you can accommodate it, do so (e.g., allow 5 more minutes).
- ***Evolve – Experiment***
  - Explain that teams will now be iterating between the experimenting and the evolving phases (refer to slide 5) and will have one minute to present their idea and others will have one minute to ask questions and give feedback.
    - If you have a small enough group and a long time, all teams may present.
    - If you have a very large group and little time, two-three teams report.
    - When teams present, they must follow the format: user+need+insight=hypothesis or point of view=>solution idea (no background explanations, no justifications, no selling).
    - When teams receive feedback, they just listen and take notes, no response is necessary; they should listen for understanding and then take the feedback under advisement.
    - If you have time, teams may discuss how they will evolve their problem-solving. Will they refine, revise, pivot? How will they iterate?
  - Tips: Write the format on the board (user+need+insight=hypothesis or point of view=>solution idea), and for the first one or two presentations point to each item in the format to remind presenters to stay on track. Usually participants get the idea very quickly and follow the format. If a team starts with an elaborate explanation or otherwise gets off track, you can merely point to the format and/or ask who is your user while pointing to the format.

- ***Debrief***

- Move to Slide 9. Congratulate participants, on completing a problem-solving task using design thinking. Review how rational problem-solving and design thinking differ.  
Advance to slide 10, ask participants to compare and contrast rational problem-solving with design thinking (human centered problem-solving). Ask participants:
  - What are your reactions and reflections on this experience?
  - Where/when could you use design thinking in this course?
  - In your own words, based on your own experience, how does design thinking differ from rational problem-solving? How is it the same?
  - Can you imagine situations where you might use this approach in the future? In what types of situations or conditions would you use it? ...in life? ...at work?  
Where might it not be appropriate?
  - Lessons learned from this experience?
- Tips: Let participants do most of the talking. At this point they are usually excited and engaged. Through your facilitation skills keep the focus on what participants have learned and how they can use this learning in the future or in the course.

- ***Wrap Up***

- Move to slide 11.
  - Thank participants for their engagement.
  - Ask them to complete the feedback form, if you are using it (see Supplemental Material 4).
    - Collect feedback forms once completed

- Describe any follow up assignment (see Related Assessments, Assignments, and Grading Rubrics).
- Answer any questions.
- Ask participants to return any unused prototyping materials and to help clean up any trash.
- Tips: If a team created a good sample prototype, ask them if you can use it in future sessions as a sample. Retain the prototype or take a picture of it.

### **After the Activity**

- Clean up any trash/waste
- Implement any assessments or follow-up assignments

### **Ways to Customize or Modify This Exercise**

- You may modify the slides to fit your audience:
  - Consider changing quotes to be more relevant to your audience...the quotes are intended to establish the importance and relevance of the topic for your audience.
  - Consider changing Interpreting samples (slides 7 & 8) to better fit your course.
  - Consider creating additional challenge samples, which might better fit your audience and/or course.

### **Related Assessments, Assignments, and Grading Rubrics**

- Recap/reflection at beginning of next class – When using this in a course, start the first session after this activity by asking students to recap (i.e., explain in their own words, verbally or in writing) what they did during the activity and what they learned from this activity.

- Request feedback on activity – Use a classroom assessment technique, a request for feedback on the activity (see Supplemental Material 4). If using this approach, consistent with best practices, it is important to summarize the feedback and share it with the class (Angelo & Cross, 1993). Plans to respond to the feedback should also be discussed.
- Pre-post assessment of content knowledge – Use a classroom assessment technique to assess prior knowledge (e.g., pre-test) and learning associated with this activity (e.g., post-test). See Supplemental Material 5.
- Application/analysis assignments – There are two types of assignments that I often use to assess and reinforce learning associated with this activity: 1) a compare and contrast assignment, and/or 2) an application assignment.
  - Compare and Contrast Assignment: Ask students to compare two concepts or models.
    - For example, if teaching a strategy course, ask students to explain the similarities and the differences between the strategic planning process and the design thinking process.
    - In an entrepreneurship class, ask students to assess the relative merits of the lean launch process versus the design thinking process.
  - Application Assignment: Ask students to use design thinking to solve a problem.
    - For example, in a strategy course ask students to use design thinking to analyze a firm's business situation described in a case and develop recommendations for the firm. See Appendix C for an illustration of this.
    - In an entrepreneurship course, ask students to design and conduct an experiment that will help them better understand the needs and wants associated with an opportunity or space that they are interested in pursuing.

- Grading Rubrics – See Shively, Stith, and Rubenstein’s (2018) discussion about assessing design thinking and a sample rubric for assessing creative and critical thinking (see page 157).

**Table A1: Sequence of Activities**

<b>Sequence of Activities</b>	<b>90 Minutes</b>	<b>50 Minutes</b>	<b>60 Minutes</b>
1. Introduction/definition	5	3	5
2. Form teams	5	2	5
3. Identify challenge	10	3-5	5
4. Solve the challenge using design thinking	10	10	10
a. Discover	10	10	10
b. Interpret	5	5	5
c. Ideate	5-10	5	5
d. Experiment	5	0	3
e. Evolve			
6. Discuss process/outcomes	10	3	5
7. Critique problem-solving approaches	15	3-5	5
8. Wrap-up	5	2	2
Total time	85-90	46-50	60



## Appendix B: Sample Prototypes



**Sample One.** Students at a university need a faster, easier to navigate, more user-friendly way to interact with the administration regarding admission applications, paying bills, getting financial aid, exchanging documents, and making appointments. They feel like the current system is outdated, antiquated, and disrespectful of their time and their needs. What if we created a one-stop, individual portal with a dashboard where students could monitor the status of their requests and interact with administrators electronically. See prototype of screen for portal, which could be web and app based.



**Sample Two.** Older people at risk of falling, want to be independent and safe, what if we created a stylish watch band medical device which detects falls and notifies loved ones and emergency assistance while communicating/monitoring vital signs. See prototype of device.

**Sample 3.** Minority youth in Baltimore need tutoring and support to ensure their success in school. They lack resources and access to caring, expert tutors. What if we created a volunteer corps of tutors that could be matched with students in need. Tutors would work with students

over the internet and report to parents and/or teachers periodically. Participants acted out the process using frames to simulate video screens on a computer.



**Sample 4.** Students in Baltimore need access to high quality education. Current schools are underperforming. What if we passed legislation that increased funding for education in Baltimore and gave parents, teachers, and students equal voice in deciding how the money would be spent. See prototype which symbolizes process, stakeholders, and messaging needed to achieve process.

## **Appendix C: Solving Business Problems Using Design Thinking**

This example illustrates how students might use the design thinking process to solve a business problem. In this example, I provided the challenge; all teams worked on the same challenge. Students in a strategic planning course were given an article from the *Wall Street Journal*: “Snapchat Cracks Open Its ‘Walled Garden’” and asked to analyze the situation and come up with a recommendation using the design thinking process as outlined in the workbook.

### **Discover – Understand the problem**

Students read the article and record what they know about the situation (e.g., Snapchat is now allowing verified users to share content outside of the app, this is different from the original user experience, where content could only be shared one-on-one or in closed social circles on the platform and content was ephemeral); they would also generate a list of things they want to know (e.g., How do users feel about this change? How will this change who uses Snapchat?) and note how they might find/secure that information. Then students use their phones and laptops to search for information. They might call a friend who is a heavy Snapchat user and ask her what she thinks; they might reach out to a Snapchat user community and ask users what they think. They collect as much data as they can, given the time limits of the exercise.

### **Interpret – Search for meaning and insight**

Students analyze the data they collected, looking for stories, patterns, and anomalies or outliers. They might realize that heavy Snapchat users are perplexed and offended by this change. Users think this makes Snapchat just like any other social media outlet where you can post a video—like Facebook, Twitter, and YouTube. Students realize, based on the facts in the article, the change was only being made to drive daily user growth (which is down to 3% versus

17% in the last quarter) and this change is alienating users, so their insight is to look for other ways, more compatible with the brand experience, to drive user growth.

### **Ideate – Generate ideas**

Each member of the team takes a few minutes to individually brainstorm as many ideas as they can about how to drive user growth. Then they share their ideas with each other. They realize they have generated new marketing, product, customer service, and customer experience ideas (e.g., create online ads which are mini tutorials to introduce prospects to Snapchat, create a viral, virtual tag game using Snapchat where users are rewarded for bringing a new friend into the game, etc.).

### **Experiment – Test assumptions**

The team mocks up a screen shot of the new video post feature being rolled out and the proposed virtual tag game and then asks people in the class which they would rather use (a very simplified version of A/B testing). About two-thirds of the class prefer the virtual tag game.

### **Evolve – Consider where to go next**

The team recommends that Snapchat slow or stop implementation of their new strategy and invest three months in rapid prototype development and testing of alternate approaches to growing daily users. They recommend the virtual tag game and the other ideas they generated be refined and more formally tested with users and prospective users.

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**Table 1: Comparison of Problem-Solving Approaches**

<b>Design Thinking Problem-Solving</b>	<b>Rational Problem-Solving</b>
<p><i>Discover – Understand the challenge/problem</i></p> <p>Focus on what is known <u>and</u> what is unknown and how we can learn what we don't know</p> <p>Collect data, observe users, conduct research focusing on empathy with the user</p>	<p><i>Define problem</i></p> <p>Focus on the key issue(s) in the situation as understood</p>
<p><i>Interpret – Search for meaning and insight</i></p> <p>Look for stories, patterns, and outliers in the collected data; analyze data, interpret, seek insights</p>	<p><i>Identify decision criteria</i></p> <p>Define which criteria will be used to make the decision</p>
<p><i>Ideate – Generate ideas</i></p> <p>Brainstorm or use other creativity and ideation techniques to generate lots of ideas or possible solutions</p>	<p><i>Allocate weights to criteria</i></p> <p>Determine how important each decision criterion is; assign a weight to each criterion</p>
<p><i>Experiment – Test assumptions</i></p> <p>Rapidly generate prototypes, get feedback, develop hypotheses and conduct experiments</p>	<p><i>Develop alternatives</i></p> <p>Generate solution alternatives, often a rational set of options (e.g., go-no go; do nothing, pursue option 1, pursue option 2, pursue both options; etc.)</p>
<p><i>Evolve – Consider what to do next</i></p> <p>Respond to feedback, iterate, pivot</p>	<p><i>Evaluate alternatives</i></p>



Design Thinking Problem-Solving	Rational Problem-Solving
	Rate each solution using the decision criteria.  Then use the weights and ratings to determine the score or desirability of each alternative
	<i>Select best alternative</i>  The alternative with the highest score is the “right/best” answer

**Table 2: Summary of Questions and Activities for Each Step of the Design Thinking****Process**

<b>Design Thinking Process</b>	<b>Questions and Activities</b>
<i>Discover – Understand the challenge/problem</i>	What do we know? What do we need to know? How will we learn what we need to know? Under the instructor's direction, using the workbook, participants will talk, collect data, observe, and do research.
<i>Interpret – Search for meaning and insights</i>	What does the data mean? What does the data mean to end users and stakeholders? What are our insights?  Once participants have collected data they will look for stories, patterns, and anomalies in the data collected. They will seek insights and develop hypotheses.
<i>Ideate – Generate ideas</i>	How might we...?  Participants will individually brainstorm ideas then share their ideas with team members.
<i>Experiment – Test assumptions</i>	Will this work? Are our assumptions valid?  Participants will make prototypes, present their prototypes to users, and get feedback.
<i>Evolve – Consider where to go next</i>	What are our next steps? Should we pivot?  How will we iterate?

Design Thinking Process	Questions and Activities
	Time permitting, participants will decide whether and/or how to revise or refine their ideas.