Team Igniter: an adaptive toolkit to guide and leverage collaboration in teams seeking to problem-solve and innovate

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TEAM IGNITER

An adaptive toolkit to guide and leverage collaboration in teams seeking to problem-solve and innovate

By Vinicius de Andrade Romualdo

A Thesis submitted in partial fulfillment of the requirements for the degree of Master of Fine Arts in Visual Communication Design

School of Design
College of Imaging Arts & Sciences

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Team Igniter: an adaptive toolkit to guide and leverage collaboration in teams seeking to problem-solve and innovate

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Abstract

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Summary

Even though interdisciplinarity has consistently been debated and supported during faculty meetings at RIT, still, academic programs confine themselves into silos, hampering student integration. The struggle to effectively collaborate becomes evident in the existent on campus initiatives that challenge students from different disciplines to work together. The consequence is the under-utilization of the students’ potential which leads to mediocre outcomes.

This thesis investigated main collaboration problems typical of groups seeking to problem-solve such as groupthink, production blocking, social loafing and social anxiety. These issues were studied in the academic context through a user-centered methodology that involved observations and interviews with college students. The proposed solution integrated user experience (UX) methods with social psychology’s research findings and game design dynamics into a toolkit constituted of both digital and tangible components that complemented each other to offer an interactive and immersive experience. The purpose of the toolkit was to provide a fluid framework to guide teams seeking innovation to leverage student collaborations and thus promote a genuinely academic synergy that is likely to lead to more innovative ideas and solutions.

Keywords

Collaboration, interdisciplinarity, design thinking, creative ideation, game design, user experience, group dynamics, groupthink, social psychology, brainstorming, social loafing, social anxiety, production blocking.
Introduction

The design field, as much as many other fields in academia, needs a reform in their present curriculum that stimulates interdisciplinary interactions and better prepares future professionals to collaborate with those from other disciplines. This thesis seeks to serve as a stepping stone to that reform by guiding college students on how to collaborate more effectively and generate innovative solutions that go beyond the ordinary.

The design thinking methodology has become increasingly popular across other disciplines and has contributed significantly to a more aligned collaboration flow between designers and other professionals. IDEO, an innovation design firm founded in California, should be credited for that popularization. At RIT, many programs outside the School of Design have incorporated design thinking into their curriculum which serves as stimuli for student participation in multidisciplinary initiatives.

Gamification, a term originated from game design, also takes a significant role in this thesis. It bridges some key factors from psychology, such as social behavior and intrinsic and extrinsic motivations, which are essential to promote effective user engagement and thus enhance the experience. Since this thesis aims to develop positive behavioral changes in students when collaborating in groups, it was indispensable to study, observe and hear their frustrations and delight so as to align the outcome of this project to their needs.
Situation Analysis

Design is, by nature, an interdisciplinary field that is composed of several specializations (i.e. graphic, interaction, industrial, visual, motion graphics, game, and many others) which overlap not only amongst themselves but also with external fields in science and the humanities. This overlapping requires a minimum understanding of multiple adjacent areas of knowledge to enhance the quality and effectiveness of interactions among professionals from varied disciplines. In the past few decades, collaboration has become more and more a constant in interdisciplinary groups due to the ever increasing complexity of problems. Thus, it is paramount for professional designers to be able to effectively work collaboratively. Universities have a vital role in forming professionals that not only thrive in their specializations but also transcend solo accomplishments to achieve greater goals originated from the synergy that teamwork brings.

RIT offers its students some opportunities to pursue interdisciplinary experiences during their academic journey. A lot of them have roots in entrepreneurship programs, like IdeaLab, for example, where students are challenged to solve, in a weekend, real problems brought by the community. It is held twice a year in the Simone Center building and has great appeal to designers, engineers and business students. *Eureka! is another interdisciplinary initiative for students and faculty within the School of Design at RIT to collaborate and creatively solve social problems that are real, using the city of Rochester as their living classroom.*
Problem Statement

Groupthink is a major problem commonly evidenced in teamwork. The term originated from social psychology research by Irving Janis (1972). He noticed that the rush to reach a common denominator that will minimize group conflicts, avoiding critical evaluation and external influences, often leads to irrational and poor decision-making outcomes. Groupthink is often associated with the traditional brainstorming method as a negative outcome that its “abstain from criticism” rule provokes. According to Janis:

A group is especially vulnerable to groupthink when its members are similar in background, when the group is insulated from outside opinions, and when there are no clear rules for decision making.

RIT has many interdisciplinary initiatives that encourage and exercise group collaboration between students. A closer look at these interactions reveals struggles in team management and guidance, especially when the personalities of the individuals involved are not taken into consideration. This often times results in groupthink, which leads to poor participation of the members involved and thus mediocre outcomes.

This thesis project proposes a solution that will address the following identified challenges, from a top to bottom perspective:

In what ways might this thesis:

• promote academic synergy?
• help RIT academia produce more meaningful and innovative projects?
• make students seeking innovation collaborate more efficiently?
Target Audience

This thesis project aims at higher education students as the primary users, irrespective of their majors or which school year they are in. However, for the purposes of applying a user-centered methodology, it made sense to use RIT’s academic population as a representative sample of the conceptual target audience. In this context, the most representative age-range on campus varies from 17 to 30 years old.

The value that this project seeks to bring to students is to provide them with a problem-solving framework that will leverage their collaboration when working in groups.

Although the framework that is proposed in this thesis focuses on teams that have innovation as a goal, some of its methods could still apply to other kinds of groups that seek guidance on how to collaborate more efficiently and weed out groupthink from their teamwork.

Professors are also a crucial and complementary part of the target audience since they are often involved with or responsible for proposing group projects and interdisciplinary initiatives. However, their motivations and uses for the outcomes proposed in this thesis are different from what is intended for the students. Still, the professors’ insights were taken in consideration during the entire design process, and many of the features developed in the application were designed having them in mind.
Research

The research focus of this thesis aimed to provide a solid understanding of several topics to coherently support the design decisions. The investigated topics covered a broad range of disciplines that transcended the design field itself. Social psychology, interdisciplinarity, usability and creative thinking were explored as well as user experience design, design thinking, and game design.

Groups of students that are trying to solve a problem creatively tend to have one approach in common when ideating for solutions: brainstorming. Therefore, this thesis research started from a deep investigation of this method – and some of its variations – in an attempt to build on the scientific knowledge that has been produced mostly in the social psychology field.

The process of analyzing all the research about brainstorming involved laying sticky notes on the wall (as can be seen in Figure 1 on the following page). This helped synthesize and have a holistic visualization of the most significant findings that were categorized into problems, recommendations, and relevant concepts.
Figure 1. Brainstorming research compilation of key findings.
The Brainstorming Fallacy

Much research has been done questioning the actual effectiveness and efficiency of brainstorming in groups. Despite all the evidence showing lower quality and performance of brainstorming groups when compared to individuals brainstorming alone, this traditional technique — proposed by Alex Osborn as an ideation tool for his advertising company in the late 50’s — is still highly used today and advocated around the world (Furnham 2000).

Several factors could possibly account for the production loss in groups of people brainstorming together. They are usually classified into procedural constraints – which include production blocking, evaluation apprehension and social loafing – or social factors such as performance comparison between members of the group.

Social loafing, also known as “free riding,” refers to the tendency of a few individuals in a group to make less effort when they know others will do it. Diehl and Stroebe (1987) associate this effect to the fact that individual contributions of members get lost in authorship as the group size increases (lower identifiability). They also argue that it decreases the perceived effectiveness of individual contributions.

Evaluation apprehension relates not only to social anxiety effects of speaking in public but also takes in account the fear of being judged and criticized, whether as being the team member that is useless or the one that is too bossy.

Production blocking consists in the limitation that speaking and listening implies in an oral brainstorming, which may cause members to forget about their ideas since only one person can speak at a time. Evidence in the experiments done by scholars (Diehl and Stroebe 1987) suggest that this is the most significant procedural constraint for productivity loss in group brainstorming.

Social comparison-matching is a phenomenon that was further explored by Paulus and Camacho (1995) in brainstorming groups that revealed a tendency of low-anxious members in a group to lower their performance to match high-anxious members. According to the researchers, this downward-matching could be explained by either a lack of pressure to perform well or by an attempt to reduce group awkwardness.
A Better Brainstorming

All this empirical research not only validated and tried to explain some of the causes of the problems in group collaboration but it also provided some useful recommendations that were applied in the final application designed for this thesis.

One of the most successful methods that has been proved to increase the performance of group ideation effectively is brainwriting, a variation of brainstorming that involves the writing of ideas in a round robin fashion with no spoken word and passing each other’s ideas around so that everyone is exposed and influenced by each others’ ideas. Paul B. Paulus and Huei-Chuan Yang (2000) further investigated the topic in their experiments using this method and gathered evidence suggesting that:

Writing ideas instead of speaking them in groups eliminates the problem of production blocking since individuals do not have to wait their turn to generate ideas. It may also reduce evaluation apprehension since the written format eliminates the need for public speaking and is typically more anonymous than oral brainstorming.

Another interesting finding that can be easily applicable is the use of unique instruments during the idea generation to help increase identifiability about the authors of ideas when they are not discussed orally. These tools could be different color pens or papers, for example.
Survey of Literature

Creative Thinking

A Whack on the Side of the Head
This classic book on creative thinking provides several interesting ideation methods to be explored in order to dismantle the “mental locks” – Oech’s metaphor for the negative attitudes that undermine our native ability to be creative. He deconstructs each of the ten “mental locks” explaining the harm they cause and providing exercises on how to overcome those limitations.

Imagine, How Creativity Works
This book reinforces the thought that creativity is inherent to humankind and deconstructs its preconception of being a quality of a few gifted people and reserved for particular disciplines and professions. He exposes and discusses several real cases of creative thinking in solo and teamwork situations, suggesting how their thought process could be replicated in other contexts.

Thinkertoys, a handbook of creative-thinking techniques
More than just a textbook, Thinkertoys is a toolkit of several ideation methods that are divided into two categories: 1) linear, which deals with the more analytical left side of the brain and 2) intuitive, which exercises the imaginative right side.

The Creativity Challenge
This book aims to challenge default ways of thinking by providing several unusual exercises that seek to leverage creativity. It challenges the user to pick one exercise at random every day and be determined to execute it.

Design Thinking

Bootcamp Bootleg
Provided for free by Stanford’s d.school, this PDF serves as an introductory guide to design thinking with a selection of their most used methods which are described individually with application examples.

Design Kit
This website made available by IDEO, provides a design thinking toolkit with several fully described and exemplified methods and exercises with case applications and videos.
Universal Principles of Design
This book offers a selection of 100 fundamental design methods from varied design disciplines. Its goal is to serve as a quick reference guide that provides useful techniques and strategies with its descriptions, guidelines, and examples of application.

Game Design

Gamify: How Gamification Motivates People to Do Extraordinary Things
This book provides insightful thoughts on gamification and how it can be applied to align the interests of both customers and businesses so as to achieve their goals through engagement and motivation. The author also goes through mini-cases that offer more practical and tangible analysis on the different outcomes of gamification when applied in different contexts.

The Art of Game Design: A Book of Lenses
This book makes a case for good game design based on the premise that it is universal, regardless of platform or medium. It also instigates designers to look at their games through multiple perspectives — introduced as lenses — which cross over a diversity of disciplines that must be taken into consideration.

The Gameful World: Approaches, Issues, Applications
This book provides over 50 perspectives from industry and academic experts on gamification and how it affects our society in multiple and unique levels, from privacy to ethics.

Interdisciplinarity

A taxonomy of interdisciplinarity
This excerpt from The Oxford Handbook of Interdisciplinarity provides an overview of the evolution of the taxonomy of interdisciplinarity, collecting thoughts from leading researchers of the term from around the world and offering a broad and up-to-date perspective on the concept.

Creating Interdisciplinary Campus Cultures: A Model for Strength and Sustainability
In this book, Professor Klein discusses some strategies that can be applied by faculty and administrators to enable interdisciplinary work on academic environments in a sustainable and efficient manner.
Elastic minds? Is the interdisciplinary/multidisciplinary curriculum equipping our students for the future: A case study

This case study analyzes the tendency of design programs, particularly at the postgraduate level, to form smaller studio-based courses across a variety of disciplines, in an attempt to prepare students for the interdisciplinary world they will face outside academia.

How to be a multidisciplinary designer

This online article posted at Digital Arts, discusses the importance of having a multidisciplinary skill set in order to thrive in the rapidly changing industry designers are immersed in. By interviewing designers from several agencies in the UK, Wyatt also makes a case for why collaboration is paramount nowadays based on their experience sharing.

Social Psychology

Effect of perceived expertness upon creativity of members of brainstorming groups

This article examined the influence of expert presence in brainstorming groups. It concluded that not only groups with declared experts produced fewer ideas, those ideas were also less practical and original in their evaluation. The researchers argued that the perceived expertness inhibited the group participation thus hindering their performance.

Groupthink: psychological studies of policy decisions and fiascoes

In this book, Janis introduces the concept of groupthink by analyzing several cases of US failures on political decisions that could have been avoided had the people involved been aware of their cognitive biases that can be triggered by teamwork.

Groupthink - The brainstorming myth

Jonah Lehrer makes several cases for why brainstorming, in the way it was proposed by Alex Osborn back in 1948, is not effective, based on various discoveries by researchers that show evidence of low performance of groups which used brainstorming compared to the ones without. The reason seems to be in the criticism inhibition rule of brainstorming, which although avoids conflicts, ends up impairing debates that could lead to novel ideas.

Idea Generation in Groups: A Basis for Creativity in Organizations

This article discusses the benefits of group ideation and reports the results of experiments done to optimize the brainstorming process by reducing social loafing and eliminating production blocking. This was achieved through a written, turn-based technique – brainwriting – that showed considerable production gains compared to regular oral brainstorming.
Intrinsic and Extrinsic Motivations Classic Definitions and New Directions
This journal article reviews the definition of intrinsic and extrinsic motivations comparing the classical perspective to contemporary research.

Persistence in Brainstorming: Exploring Stop Rules in Same-Sex Groups
The experiment described in this article tested with same gender groups two different stop rules for brainstorming methods: stop when the participants ran out of ideas (expectancy rule) and stop when the participants were satisfied (satisfaction rule). The findings revealed that men tend to be more persistent when the first rule is applied while women are more persistent with the latter.

Productivity Loss In Brainstorming Groups: Toward the Solution of a Riddle
The experiments described and analyzed in this article investigated all three possible reasons for productivity loss observed at conventional brainstorming of interactive groups: free riding, evaluation apprehension, and production blocking. Their findings suggest that the latter is the most significant factor of the three.

Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being
This article discusses the influence of factors such as the Self-Determination Theory on intrinsic motivation and pro-activeness of individuals. Its findings propose three basic psychological needs that enhance intrinsic motivation: competence, autonomy, and relatedness.

Social Influence Processes in Group Brainstorming
This article examined other influences in group brainstorming performances besides just procedural constraints (such as production blocking). The researchers conducted a series of studies which concluded that social factors, such as the exposure to performance standards, would also play a significant role influencing brainstorming processes. Finally, they proposed an explanation for productivity loss in group brainstorming due to a social matching factor in which low-anxious participants would decrease their performance to match the performance of the high-anxious participants.
The Brainstorming Myth
In this article, the author compiles many findings of past research about the proven inefficiency observed in brainstorming groups when compared to individual brainstorming. Finally, he attempts to provide a guideline for managers to improve their brainstorming methods in their business.

The Role of Social Anxiousness in Group Brainstorming
Paulus and Camacho examined the influence of evaluation apprehension in brainstorming groups by doing two different experiments. In the first test, they were able to validate their hypothesis that groups containing all low-anxious would outperform the high-anxious group. In the second experiment, where mixed groups of 2 low-anxious and two high-anxious members were brainstorming together, they observed a downward matching tendency which showed that low-anxious members would lower their performance to match the high-anxious ones in a probable attempt to make the discomfort of the latter less awkward.

The “Rules” of Brainstorming: An Impediment to Creativity?
In this paper, Feinberg and Nemeth shed light on the negative influences of the basic rules of brainstorming. The researchers argue that the no-criticizing rule may actually inhibit creativity and thus generate less ideas because it imposes a limited mental framework that hampers divergent thinking. They also concluded that choosing the proper wording – “suggestions” instead of “rules” – may have a positive influence on the performance of brainstorming groups.

The Effects of Facilitation, Recording, and Pauses on Group Brainstorming
This study examined the production blocking issue evidenced in brainstorming groups through a perspective of adding a facilitator. The results showed that groups brainstorming with facilitation not only outperformed groups without facilitation but also nearly equated the performance of individuals brainstorming alone. The other parameters observed by the researchers – using a flip board to record their process and proposing periodic pauses throughout the brainstorming – had no significant effect.

Why Group Brainstorming Is a Waste of Time
This online article, posted on the Harvard Business Review website, criticizes the brainstorming method, considering it a mere placebo. It summarizes key points that explain the reasons for its failure, based on research publications by psychologists. Finally, the author discusses why its practice is still so widely adopted.
Usability

**Don't Make Me Think**
Considered one of the most essential books in usability, this book discusses good practices and uses common sense to evaluate existing websites and applications. Although most of the examples it provides are web related, its application can be further extended to any kind of interface — digital or physical — being designed.

**Handbook of Usability Testing**
This book provides more in-depth instructions on planning, designing and executing a usability test. It also recognizes the limiting factors of different tests methods and provides the do’s and don’ts that a moderator should follow to maintain an unbiased test.

**Rocket Surgery Made Easy**
On this book, Steve Krug expands on the process of designing and executing a usability test, providing a step-by-step guide that can apply to any product in order to improve it.

UX Design

**Designing for Interaction**
This book highlights the important role of interaction design in making products that go beyond the dichotomy of form and function. Usability, usefulness and desirability must be taken into consideration as well. It also discusses case studies from the industry providing successful methods that can be incorporated into the design process.

**Designing for Behavior Change**
This book exposes the benefits that findings from behavioral psychology and economics can bring to the UX design field, especially when the goal is to promote positive change in the audience’s behavior. The author also presents three strategies to lead to those changes and analyzes products with similar approaches that are out in the market.

**Lean UX: Applying Lean Principles to Improve User Experience**
This book integrates user experience design with agile and lean software development methodologies. The author introduces a 5-step process that goes through solving the problem collaboratively, sketching the ideas out, prototyping, pairing designers and developers to work together and finally creating a style guide that facilitates next iterations.
**The Elements of User Experience**

One of the essential references for interaction design, this book breaks down the complexity of user experience into segments that can be easily assimilated and followed. It focuses on presenting ideas that define UX and leverages critical thought rather than providing a one-size-fits-all technique.
## Competitive Analysis

In order to innovate and differentiate from what is already out there, the competitors had to be identified and studied. This also provided a benchmarking opportunity to enhance the entire experience by considering features and dynamics from different contexts and redefining it for the purpose of this project. These are the competitors and similar apps that were analyzed:

<table>
<thead>
<tr>
<th>Competitor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Creative Whack Pack</strong></td>
<td>Created by Roger von Oech, the <em>Creative Whack Pack</em> is a deck of 64 cards that provides creative thinking ideas to challenge the mental locks that keep people from innovating.</td>
</tr>
<tr>
<td><strong>Designercise</strong></td>
<td><em>Designercise</em> is a physical ideation toolkit for professionals that combine design thinking with cognitive sciences to create dynamic group games that boost creative thinking. The deluxe kit, which costs $180 and is yet to be released in December 2015, is composed of 11 decks of cards, two roulette spinning wheels, and one wooden spinner.</td>
</tr>
<tr>
<td><strong>Rory's Story Cubes</strong></td>
<td>It is a storytelling technique that uses unique sets of cubes which contain different icons on each side from a particular theme. The game is played by rolling out a set of 9 cubes with mixed themes and coming up with stories based on the results.</td>
</tr>
<tr>
<td><strong>The Brainstormer</strong></td>
<td><em>The Brainstormer</em> is an app, available only for Apple devices, that randomizes brainstorming in three levels: plot, subject and setting/style that are aligned and picked through three concentric roulette. It aims to break creative blocks and serves as stimuli for writers, painters, designers and any creative mind.</td>
</tr>
<tr>
<td><strong>The Extraordinaires</strong></td>
<td><em>The Extraordinaires</em> is a Design Thinking game that exercises observation, user empathy, sketching and presentation. The set comes with three different decks of cards (the personas, the objects to design and the Think Cards) in a plastic housing that stores the cards, pen, and paper while serving as a workstation for sketching. It also acts as a support stand for the user’s card. The cards can be drawn by just sliding them from the back of the housing.</td>
</tr>
</tbody>
</table>
Process

Methodology

The methodology that was used in this thesis combined a Lean UX approach with user-centered methods originated from design thinking. Therefore, less emphasis was given on documentation-like deliverables in order to focus on rapid prototypes that allowed the concept to be tested sooner rather than later and reiterated based on user feedback.

Value Discovery

The validation of the problem started with an in situ observation at the IdeaLab event held in the Simone Center at RIT, during an intensive weekend of interdisciplinary group collaborations. The points being observed within the interaction between team members were:

- Leadership roles
- Frictions and pain points
- Excitement and delighting points

After the observations and at the end of the students collaborative sessions, quick interviews were done with ten participants to better understand their struggles during teamwork. (See Appendix B for questions)

The validation of the identified problems through observation and interviews with students working collaboratively just scratched the surface of a much deeper issue that has been investigated for decades by social psychologists. Nevertheless, this was an indispensable part of a user-centered process which evidenced that problems in group collaboration are still real and current.
Design Ideation

This present thesis can be synthesized by the diagram below (Figure 2). The main goal is to integrate UX methods with social psychology’s research findings and game design dynamics into an interactive teamwork experience that provides an engaging framework to guide teams seeking to innovate.

The linear fluxogram shown on the following page (Figure 3) depicts the optimized framework for group collaboration that was designed based on a combination of personal experience, observations made during the Value Discovery session and most importantly on the literature reviewed for this thesis (IDEO’s Design Kit, Lehrer, Michalko and von Oech). For visualization purposes, the diagram was divided into three parts, but they are all part of a single linear flow.

It is important to highlight that even though the framework has a linear structure, the collaborative process that will result from the game experience will be flexible and dynamic. The goal of the final application is by no means to provide a "one size fits all" solution to every collaborative project. Instead, the embedded game experience is intended to allow unique collaborative experiences in every iteration by offering a randomized variety set of combined methods from design thinking and creative thinking.
Optimum Collaborative Process Framework

The "optimum framework" provided the backbone for designing the experience. Each colored heading on the diagram represents a phase in the collaboration methodology with its own unique set of methods and instructions (provided by the app) some of which requires the use of the complementary tangible components of the toolkit in varied ways.

Figure 3. Optimum Collaborative Process Framework.
The Four Collaboration Phases

The scope of this thesis project embraced only the initial four phases of the optimum collaboration process (shown previously in Figure 3): the Icebreaker, the Detective (initially named Explorer), the Artist and the Judge. In other words, the toolkit was designed to help guide groups that are meeting for the first time and want to generate innovative ideas to solve a certain challenge. Once those ideas are generated, the toolkit default process methodology will go as far as assisting them in judging those ideas, but everything after that will be the responsibility of the group to define how to go about executing those ideas (The Warrior phase).

The Icebreaker Phase

The Icebreaker phase was designed to help reduce the level of social anxiety between members of the team, regardless if they know each other or not, in an attempt to make them feel more comfortable and thus perform more efficiently together. In order to achieve this, two methods were created: Leave Your Shoes by the Door and Say My Name.

Leave Your Shoes by the Door

In the Leave Your Shoes by the Door method, team members are instructed to first pick their own unique pen color and to always use that same chosen color. This was determined to raise identifiability of written notes. Then, in the next step, members are asked to individually write down on a piece of paper their age, origin, current title/expertise and education/professional background. Finally, the last step of this method is to crumple the paper they just filled into a ball and throw it aside. They are then instructed not to talk about what has been written down.

This method was proposed to address an issue related to perceived expertness in group collaboration. Research has shown that the presence of declared experts in a group inhibit the expression of the fewer expert members thus causing them to participate less and have a lower productivity (Collaros and Lynn 1969). Besides it make the overall experience less pleasant for the other members involved.

Say My Name

During the Say My Name method, team members are instructed to take turns to state their first name only and then share fun facts about themselves such as hobbies, favorite color, “if they had a superpower...” and “if they were an animal...” The purpose of this method is to lower their evaluation apprehension by revealing a personal interest that might be common to others, thus generating sympathy.
The Detective Phase

The Detective phase encompasses all the methods that are related to identifying a problem, dissecting and understanding it in order to lay the ground for a productive discussion that leads to creative problem-solving. Most methods selected for this stage were adapted from Michael Michalko, one of the most respected specialists in creativity who has researched and gathered several creative-thinking techniques.

Creativity experts like Arthur B. VanGundy (1987) and Michalko (2006) have stressed that the way a problem or challenge is phrased is determinant to influence the approach taken by the problem-solvers. In their books, they both suggest the use of an invitational stem, or in other words, a model for framing a problem that starts with “in what ways might...” (IWWM). According to VanGundy:

\[
\text{Beginning a statement with this phrase allows for and encourages a divergent response. In contrast, beginning a statement with the word "how," for example, is more likely to direct you to one possible response. Thus, the invitational stem, IWWM?, helps avoid premature problem closure.}
\]

Once the problem is defined, the team immerses in Design Thinking in order to understand and empathize with their user. In this stage, the group members are guided to use the cards that provide Design Thinking methods on their own that were extracted from Bootcamp Bootleg which is made available by the Institute of Design at Stanford.

The Artist Phase

During the Artist phase, the team will focus on generating ideas about their challenge. Most methods chosen for this stage were adapted from the original brainstorming proposed by Alex Osborn (1957) and used the variations proposed by different researchers in the Social Psychology field (Diehl and Stroebe 1987; Paulus and Yang, 2000; Paulus and Dzindolet 1993). It is also during this phase that the Creative Thinking deck of cards will be used as means to provide stimuli to the group thinking.

First, Team Igniter will guide the team through three different methods for generating ideas in the specified order: brainwriting, individual brainstorming, and interactive brainstorming. The reason for this chosen order was to minimize social factors such as evaluation apprehension that might lower the group performance in the initial stage of idea generation.
In brainwriting, the ideas are generated silently and individually however it requires that everyone in the team rotate their notes to get stimulated by the ideas that the others are writing. It also induces some pressure and sense of competition that avoid free riding from team members and motivate everyone to participate.

During individual brainstorming, each team member will work on their own generating as many ideas as they can in the given time. After the time is over, all the sheets with ideas generated will be exchanged, so everyone get further stimulation from what is being generated.

By the time the team reaches the interactive brainstorming method, also known as the traditional oral brainstorming, they will have produced a considerable amount of ideas in the previous two methods which will help get a conversation started. This order is also key to promoting a more productive discussion because the team will already have a pool of ideas completely free of any judgment or criticism, that otherwise would be likely to have been filtered if the team had started with the interactive brainstorming in the first place.

After the first round of the brainstorming methods trilogy, Team Igniter app will suggest the team to take a break to allow their ideas and thoughts to incubate and new associations to be made. Roger von Oech, an internationally renowned expert in creativity and innovation, argues for this method saying that that when someone returns to an idea or problem after incubating, they will approach it with somewhat different assumptions.

After returning from the timed break, the team will go through a second round of the a very similar brainstorming trilogy of methods. The difference is that this time, they will generate ideas under creative constraints that should stimulate their thought process. Those constraints are determined by the cards they randomly pick from the Creative Thinking deck.
The Judge Phase

The last of the phases in the default process methodology proposed by Team Igniter app, the Judge phase contains the methods that will be used to evaluate all the ideas generated and help the team select the few that should be carried in the execution phase.

One of the proposed methods is the **PMI technique**, created by Edward de Bono (2002). In this evaluation method, the team members take turns to list positive aspect of the idea being evaluated until depleted. Similarly to the previous step, they take turns to list all the negative aspects of the idea instead. Until finally they list the idea’s interesting aspects (neither positive or negative). Based on these three parameters, they can compare how each idea perform and select the few that have greater potential to be executed.

Another ground rule that was useful as a pre-method in the Judge phase is to determine that all team members must raise a positive aspect about an idea before introducing a concern, question or problem with it (Ricchiuto 1996). This approach neutralizes a natural negative bias related to evaluation apprehension, enabling the team to generate more ideas. (von Oech 1998).
The Complete Toolkit

The outcome of this thesis combined both digital and physical components that were integrated into a single cohesive toolkit, named Team Igniter. The core kit consists of the main iPad app, four decks of cards and four board templates, all packed in a plastic housing.

The iPad app is the core facilitator tool which provides instructions on how to collaborate and use the cards according to the phase the team is. It also enables several useful features that were designed to enhance the experience:

- **calculate** customized duration of levels based on player’s input of availability
- **timing** capabilities which would allow players to keep track of their turns
- **progress saving** in case they have to stop in the middle of the collaboration
- **flow and continue later on**
- **quick search** on the methods for future reference
- **bookmarking** of favorite methods found on the tangible cards.
- **customization** of methods, cards and process methodologies

Physical deliverables – materialized in this thesis as four unique and customizable decks of cards – were designed to complement the Team Igniter’s digital application. The random factor that the cards add to the gameplay helps raise expectancy in the users, thus making the experience more exciting. They also contribute to keeping the team engaged as the decks are often instructed to be shuffled, picked and combined across different methods, which improves the collaboration dynamics. Finally, the cards bring a sense of touch that is inherent of tangible things leading players to put their smartphones down and to get immersed in the gameplay.
The Four Decks

Questions, Senses, Design Thinking and Creative Sparks are the names of the four decks designed to enhance the toolkit. Each one of them is intended to be used by the team at a particular stage in the collaboration process. The methods within Team Igniter app provide instruction to the users about when and how to use the decks. Some methods can even request the combined use of two or more decks at once.

The Questions deck is the first to be employed in the default's process methodology proposed by the app. Its purpose is to help the team polish and clarify their problem statement by asking multiple questions that focus on one of the six elemental question starters (why, what, where, when, who and how) at a time. The description used in the Question cards references Michael Michalko’s Thinkertoys and helps the team members understand what aspect of the problem is being uncovered by asking each kind of question.

The Senses deck consists of five cards (touch, sight, hearing, taste, and smell) designed to be used in combination with the Question deck. The concept behind it is to generate guided questions that bring a spotlight to user senses which could reveal interesting aspects of the problem that are often neglected. This method named combinatorial question equation was proposed by Tanner Christensen and helps, according to him, stimulate curiosity and gather insights from surrounding elements.

The Design Thinking deck makes a collection of fundamental user-centered methods that should help the team gain empathy and a more meaningful understanding of whom the target of the problem is. In total, 12 methods were picked and synthesized from the d.school’s Bootcamp Bootleg which is made available for reuse in their website.

The Creative Sparks deck consists of a collection of 15 ideation-boosting methods from creative thinking experts such as Roger von Oech and Jack Ricchiuto. The purpose of this deck is to stimulate the team’s thinking during the Artist phase when ideas for solutions are being prospected. It also proposes some constraints to their ideation in order to lead to more innovative and off-beat solutions.

Card Formats

The format of the cards was one of the first design issues to be solved. The form factor was intentionally favored over function to break the paradigm of conventional playing cards – often shaped in a rectangular format for better handling and content display. The benefits for this tradeoff was to convey the idea of creativity better as well as provoke curiosity in the players. Also, it helps the users to associate instantly to which deck a card belongs to by just glancing at its format.
Each one of the four decks was designed to have its own polygonal format (Figure 5): the hexagon (Questions Deck), the pentagon (Senses Deck), the square (Design Thinking) and the triangle (Creative Sparks).

There is also a more philosophical rationale behind the variation of the card formats. They can be perceived as a metaphorical representation of the problem-solving process flow proposed in this thesis. First, in the Detective phase when the team is investigating the problem and trying to define it, there are many faces to be considered. Therefore, the cards used in this phase are the most complex in terms of sides (hexagon and pentagon). As the team progresses throughout the process they refine their problem by gaining insights from user empathy, thus using a simpler deck (square). Finally, when they reach the Artist phase, the problem should have been broken down to its essence to generate creative solutions effectively. At this stage, the deck used is represented by the simplest form of a polygon, the triangle.
### Cards Specifications

Although the cards in the prototype were printed in a thick stock paper (100 lb matte), its ideal specification should have a plastic-like texture that would allow an easy handling and shuffling of the cards. Therefore, a Con-Tac brand vinyl should be applied in the cards after being printed, which would also provide a better protection thus increasing their duration.

### Template Boards

Four unique template boards were also designed to place each deck of cards during gameplay. For the purposes of prototyping used in the presentation and testing, the boards were printed in a heavyweight 100g matte paper (as demonstrated in Figure 4). In a real production scenario, the material specifications would be similar to other board games such as Monopoly, which uses layers of cardboard that are reinforced in the folding lines and laminated with plastic to allow multiple folding and prevent from breaking during use.

### Packaging

The package was designed to store, protect and keep all the physical components together, in a reasonably portable and small box. Since all the formats of the cards were designed to fit within a common circumference, it made sense to use a cylinder as the package format. The box consists of two pieces, a base and a cap, that were 3D modeled (Figure 6) in Autodesk Fusion and printed at the Industrial Design graduate lab at RIT. The lock system designed to hold the cap to the bottom of the package was inspired from bulk CD packaging. Team Igniter’s logo is also engraved in the cap to reinforce the brand.

![Figure 6. Render image of the 3D modelled packaging designed to store the toolkit.](image-url)
The Need for a Mobile Version

In Team Igniter’s context of use, only one iPad is necessary to guide the entire team through their collaboration process. However, there are sections in the app that are more suited to be experienced individually, such as My Innovation Library where the user would most likely need to take his or her time to manage their personal library of innovative methods, cards, and methodologies.

This dichotomy of experiences raised an issue in terms of practicality, since a significant amount of students, as observed in the surveys done with the users, don’t own an iPad and thus would not be able to directly benefit from one of the most crucial features of the app: to be able to build their own collection of methods. Another anticipated issue in case the users didn’t own an iPad is that their access would be limited. Therefore, it would not make sense for every team member to create an account that could only be accessed from a borrowed device.

Team Igniter Lite was the solution found to expand the reach and motivate users to create and keep their individual accounts active. It is the mobile version of the application designed to bring portability and easy access to the individual experience of Team Igniter’s Innovation Library. In this simpler version, the users are not able to use the team coaching features. Instead, it focuses on enabling them to access, edit and manage their own collection of methods, cards, and connections. Although it was initially proposed that this mobile version would be designed for Android devices, a change of platform to the most recent version of iPhone (6) made more sense in order to maintain a consistency of design patterns developed for the iPad app.
Empathy Map

This method was applied to synthesize the initial observations made of the primary target audience – the students – working collaboratively during the IdeaLab event at RIT. It helped uncover insights and clarify the user needs based on their behavior and actual quotes.

### Needs:
- Get teamplay started
- Break the ice
- Manage time on tasks
- Focus team’s attention
- Give everyone a voice/turn
- Generate lots of ideas
- Keep everyone engaged
- Block negative criticism
- Be efficient

### Insights:
A lot of time is wasted on the actual process of deciding what to do.

Perceived expertise or low self-esteem might inhibit participation of some team members.

Although students like getting different perspectives from other majors, they tend to avoid discussions/friction just to speed up decisions.

Larger groups (6+) and pairs tend to lose focus more frequently.

### Say
- “I really enjoy getting perspective from different majors”
- “What do you guys think?”
- “This won’t work because...”
- “How are we going to do this?”
- “What do you think we should do?”

### Think
- “I don’t want to do this all by myself”
- “Some people are so opinionated about the correct way of doing things”
- “Coming up with a group consensus is so hard”
- “What a stupid idea...”
- “Why isn’t he/she helping?”
- “Get off your phone, would you?”
- “Agree to disagree...”

### Do
- Get to know everyone’s background at first in order to divide tasks
- Split up the team into smaller groups
- Have parallel off-topic conversations
- Work individually in their own laptops while others discuss different issues

### Feel
- Over confident about personal idea
- Hesitant about speaking up and sharing ideas because not everyone in the team is familiar
- Uncertain about own capabilities to help the group with something
- Admired about the efficiency and capability of other team members
- Worned out about group interaction
- Tired of people talking in loops
User Personas

Stan Griffin, the Idealistic
Associate Professor at RIT

“Students must learn how to effectively cooperate with each other in order to achieve innovative outcomes that can actually make a difference in this world.”

Demographics
61 years old
Married
Father of two children
Ph.D. in Electrical Engineering

Professional
Stan lectures an interdisciplinarity class that introduces Design Thinking to engineers in an attempt to broaden their perspectives and open their eyes to the importance of listening to what the users have to say. Often times, he assigns his students to get involved in multidisciplinary academics events where he also helps by coaching teams.

Goals & Tasks related to the app
He regularly reads about dynamics and methodologies to facilitate group interactions. Stan wishes there was a way he could summarize and keep track of them in one easily accessible place. He would like to be able to test different methods with his students doing the same project to compare the outcomes.

Environment
He spends most of his week time at RIT, whether teaching classes, meeting with other faculty or in his office assisting students. He likes to reserve a couple of hours in the morning for his daily readings on his iPad about news and tech updates.

Personality
Slightly introverted, passionate about problem-solving

Interests
Fishing, reading, drinking coffee.
Sarah Bryant, the Enthusiastic
Senior Industrial Design student

"Although group projects can be a bit awkward in the beginning, I feel like the constant feedback exchange from different opinions results in much better solutions for the project."

Demographics

21 years old
Single
Oldest sibling
Undergraduate student at RIT

Professional

Sarah works part-time as an assistant for the Industrial Design 3D printing lab where she helps her colleagues. Although she is about to graduate this year, she still manages to be in the Singing Club and the AlphaPi fraternity. She enjoys getting involved with all sorts of campus activities, especially the ones that she feels like she can contribute with her design skills, like IdeaLab or Eureka.

Goals & Tasks related to the app

During group projects, Sarah often gets annoyed by being the only one who talks and takes the initiative to get things done. She wishes there was a way to keep everyone involved and at the same page without having to boss them around and tell everyone what to do.

Environment

Sarah spends her day having classes at RIT and mostly in the Industrial Design lab where she can have access to all the tools and materials she needs to work on all her projects.

Personality

Extroverted, optimistic and creative

Interests

Dancing, cats, ice skating, socializing with friends
Kevin Bailey, the Systematic
Junior Mechanical Engineering student

"Sometimes it gets boring to do just the required coursework on my own. I want to try hands-on practical problems with a real team."

Demographics
20 years old
Single
Only child
Undergraduate student at RIT

Professional
Kevin is an above average undergraduate student that is worn out of his program’s regular coursework. He would like to apply his engineering education to practical solutions that can improve society.

Goals & Tasks related to the app
He has heard about his university’s startup incubator competition and thought about gathering a team to sign up with a project. He posted flyers around campus about his idea however he is a bit skeptical and afraid about how to collaborate with some random people he has never met.

Environment
Kevin lives on campus, and as soon as he is finished with classes, he usually goes straight back to home to play video games and relax for the rest of the day. When midterms approach, he changes his behaviors to studying all night long in order to catch up with his classes.

Personality
Slightly introverted, analytical and curious

Interests
Netflix, games, gym, drinking with friends
User Scenarios

Scenario 1

**Context**
Professor Stan assigned an interdisciplinary exercise as the final project for his Design Thinking class. In order to give a richer experience for all involved, he proposed his engineering students to team up with students from another class in the School of Design and work together to solve a common challenge. He suggested to all teams to use Team Igniter, a toolkit he had learned about through RIT’s newsletter but left it up to the teams to decide.

**Usage**
Before the beginning of the project, Stan created an account in the app to visualize the methods and processes that the app proposed by accessing his innovation library. Then he customized his own process with a set of methods that he thought would be best for the time frame his students had. Finally, he shared his custom process to the teams that opted to use Team Igniter.

**Outcomes**
By the end of the project, Stan got a positive response from the teams that used Team Igniter. They reported having less struggle deciding what to do and mentioned that the guidance provided by the app methods kept them focused. Stan also noted a considerable difference in the innovative aspect of the solutions provided by the groups that used the app, which showed a better understanding of the problem and generated more unusual ideas with great potential.
**Scenario 2**

**Context**
After Kevin had posted flyers around campus recruiting students to participate in the startup he wanted to make for the business competition of his university, he got three potentially interested students: a designer, an MBA student, and another engineer. He asked for advice from his professor on how to go about leading the meeting they scheduled, and he was suggested to try Team Igniter.

**Usage**
He created an account and set up a new project before meeting with the other team members. Once they arrived, he started the Icebreaker phase and let the app guide his lead and time their group dynamics. Then they went through the Detective phase and defined the problem they would like to solve. At the end of every key method, Kevin’s team took snapshots of the progress they made and decided to stop before getting into the research. The other phases of the project were left to be resumed on the next meeting.

**Outcomes**
Kevin was very satisfied with how smooth and fluid the meeting went. Team Igniter not only helped to get the project started but also kept everyone engaged and on the same page. The timer during each method kept the team on track and helped them be efficient. At the end, he also added the other members contact information who also got their invitation to join and download Team Igniter.
**Style Guide**

The iOS Human Interface Guidelines made available by Apple on their developer’s website was the starting point for designing the actual layout of Team Igniter application. It provided the necessary references regarding proper design patterns when designing for iPad and iPhone – such as proper resolution, display size, standard icons and typographic recommendations.

**Visual Identity**

The visual identity designed for Team Igniter appropriated of three key concepts to define its brand: simplicity, precision, and reliance. In order to convey these concepts, the visual style combined a minimalist aesthetic with the use of vector graphics that were created based on the relationships between geometric forms and subtle lines. Three inspirational mood boards were also created from a collection of images that reflected the style that represented the intended concepts.

**Logo**

The concept of the final logo (Figure 7) reaffirms the identity guidelines by combining the four geometric forms – triangle, square, pentagon and hexagon – used as the card formats. The logotype was designed with Ohmega Sans Regular, a sans-serif display typeface created by HRMN, LLC and licensed as free for personal use. In the case of future implementation and release of this thesis product out in the market, the author will be contacted to obtain an agreement about commercial use.

![Figure 7. Team Igniter logo versions. (A) Color version, (B) outline color version and (C) outline on grayscale.](image)
Colors

Team Igniter’s visual identity was designed with a monochromatic palette that used a pure cyan combined with subtle shades of gray (Figure 8). The reasoning behind this sober and cold color palette matches the attempt to make an application that looks professional and serious while still conveying the idea of technology and innovation.

![Color palette sampler with codes.](image)

Typography

In terms of typography, Team Igniter opted for Roboto, a geometric sans-serif typeface designed by Christian Robertson and made available by Google for free for both download and use. Its extensive family ranges from thin to ultra-bold weights and also provides a condensed set, making Roboto a very versatile and legible choice (see Figure 9).

**Roboto Regular**

abcdefgijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

1234567890.:,;"'(!?)+-*/=

**Roboto Condensed**

abcdefgijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

1234567890.:,;"'(!?)+-*/=

The type sizes applied in the digital applications varied from 12pt for smaller text such as tooltips or subcategories, 17pt for general body text and 20pt for headings.

![Samples of typefaces used in the app, Roboto Regular and Roboto Condensed.](image)
The icons that compose the application’s UI (Figure 10) were designed based on the combination of simple solid geometric forms. The UI elements also followed Apple’s recommended minimum dimension of 44px to improve tapping precision.

Various illustrations (see Figures 11 and 12 on the following page) were created following a more abstract style that sought to convey the essence of the message according to the section or context they were inserted in.
Figure 11.
Abstract illustrations used in the intro screens.

Figure 12.
Abstract illustrations that are used to represent the four phases of the collaboration process.
(a): The Icebreaker,
(b): The Detective,
(c): The Artist and
(d): The Judge.
The grids created for both iPad, and iPhone apps followed the recommendations established by Apple when defining the minimum margins (as seen in Figures 13 and 14). The layout compositions of the iPad app screens were designed to accommodate a retina display resolution of 2048 X 1536 pixels with the guidance of the rule of thirds and diagonal lines.

Figure 13. iPad grid. The red bars represent the iPad’s minimum “safety” margins, while the yellow is reserved for toolbar and navigation. The surrounding blue frame sets the inner padding which was set to balance the white space in the layouts.

Figure 14. iPhone grid. The red bars represent the iPhone’s minimum “safety” margins, while the purple indicates the navigation bar and the yellow, the toolbar. The blue highlights sets the inner padding which was set to balance the white space in the layouts.
Layout style

In order to convey elegance, an overall darker tone was set for the background and combined with subtle variations on shades of gray that helped create a sense of depth and focus. Cyan highlights were used uniformly across screens as a visual signifier to either indicate an active element that affords an interaction (Figure 15) – such as a button or link – or to stress an important information that the app is drawing the user’s attention to (Figure 16). Basic geometric shapes and guidelines were used as the foundation for every visual element designed in the layout.
**Paper Wireframes – iPad App**

The first round of wireframing was hand sketched with a fine point sharpie on index cards to facilitate and stimulate quick feedback in a timely manner.

Figure 17. Sketch wireframes for iPad app.
Figure 18. Sketch wireframes for iPad app.
Figure 19. Sketch wireframes for iPad app.
Digital Wireframes – iPad App

From the roughly sketched paper wireframes, the layout of the app started to gain shape during the process of translation to the digital mean.

Figure 20. Digital Wireframes for iPad app.
Figure 21. Digital Wireframes for Ipad app.
Figure 22. Digital Wireframes for Ipad app.
Paper Wireframes – iPhone app

In order to build a cohesive and consistent system, the design of Team Igniter's iPhone app followed most patterns and visual style previously established in its parent iPad version. Therefore, the process of creation of the Lite version was streamlined and done directly from the paper wireframes (shown in figure 23) to the finalized layout screens.

Figure 23. Sketch wireframes of the iPhone app.
Final Application

App Design and Prototype Implementation

The process of implementation of this thesis took advantage of the Adobe Creative Cloud software (specifically Illustrator, Photoshop, and InDesign) to execute both digital and print components.

The high-fidelity prototype was achieved through an online rapid prototype tool, InVision, which uses the designed layouts saved as static images to simulate the interactions and transitions of a working prototype. However, there is no back-end built into it, which means the prototype is not able to save or store data from the user experience.
App User Experience and Interface Design

In general, Team Igniter app is organized into four main sections that are accessible from the home screen. They are: My Connections, Start a New Project, Resume Project and My Innovation Library. This organizational structure was achieved based on content similarity and relevance of features. The function mapping (shown in Figure 24) was the starting point that helped determine the overall basic actions which the user would be able to execute using the app.

![Function Mapping]

The iPad app was also designed to be used specifically in the landscape orientation to make the most use of the screen real estate without requiring to have the users scroll like in a web page.
Intro screens

When first opening Team Igniter, the user is led through a 4-screen overview of the purpose and functionalities of the app. The last one in those series introduces the two action buttons: “sign up” or “existing account” (Figure 25).

The requirement of an account creation to use Team Igniter was determined based on the need to provide an accessible and secure way of storing methods, process and cards that the users could save, edit or create throughout their experience. This way, the personal library built by the user throughout their use experience would be safe in their account in case their device was lost or damaged. The account also allows the user to access Team Igniter seamlessly through its Lite version designed for mobile phones in order to have quick references of their favorite methods and cards.
User Dashboard

The user dashboard (Figure 26) containing account information and settings was solved as an overlay that can only be accessed through the home screen since its content doesn’t represent a need for constant and recurring use.

![User Dashboard](image)

Figure 26. User dashboard.

Start a New Project

The setup required when starting a new project in Team Igniter was divided into two steps so as to streamline the process for the user. This strategy, also known as progressive disclosure, manages information complexity by reducing the cognitive load on the user (Lidwell, Holden & Butler, 2003, 154).

In the first screen (see Figure 27 on the next page), the user can name the project, chose the process methodology which will guide the team’s collaboration and set parameters related to the team’s schedule (number of sessions and time available).
On the following screen (Figure 28), the user is prompted to input data that is specific to the team members: the number of participants and their details (gender, name and email). Based on research evidence (Bray, Kerr, and Atkin, 1978) that shows that the number of ideas decrease as group sizes increases, the game will be designed to accommodate up to a maximum of six players at a time and suggest a minimum of three.

Figure 28. Project Setup screen, step 2. The keyboard slides up upon tapping on a textbox. Also, the app provides a recommendation about the number of members in a team.
Project Timeline

Once the team has set up a new project they are directed to their project timeline (Figure 29) where they can get a broader, holistic view of the entire collaboration process and all its four phases they are about to experience (Icebreaker, Detective, Artist and Judge).

When they first start a new project, all methods will be unavailable for quick, direct access. However, as the team completes a method, its respective quick access will be unlocked in the Project Timeline screen (Figure 30). This screen also provides information about group members, progress and allow the snapshots that were taken to be accessed.
Methods Screens

The extensive content required to describe certain methods was one of the first design challenges to be solved. How could methods be displayed within the limitations of an iPad screen in a way that it was still legible but without presenting an overload of information to the users?

The solution – which was crucial to shaping the coaching experience provided by the app – was to break the content within one method into steps, and have the user progressively reveal the content by tapping on the check marks (as shown in Figure 31). This technique, known as chunking, “is especially useful when people are required to recall and retain information, or when information is used for problem solving.” (Lidwell, Holden & Butler, 2003, 30).

Figure 31. Brainwriting method screen. The user is lead to tap on the highlighted diamonds in order to reveal the next steps.
My Innovation Library

My Innovation Library is the place where all the application dynamics are stored and can be managed. In there, the user is able to find content that is relevant to three fundamental components in the application: methods, cards and process methodologies.

Methods, key methods and pre-methods

Methods refers to the instructions that are given by the app as a guidance to the group collaboration. Although the app initially provides a total of 24 methods from default, they can still be modified, bookmarked, deleted and created by the user. In fact, the library was designed to grow and improve as users experience new methods and add them to their repertoire. Methods vary in type as indicated in the top left part (Figure 32). They can be classified as Methods, key methods or pre-methods.

Methods and key methods are very similar in nature, as they both consist in a set of up to five steps that should be concluded within a determined time limit. The difference is that, upon the completion of a key method, the users will be automatically instructed to take a snapshot of their work to save their progress (see Figure 33 in the next page).
This strongly recommended follow up function was imposed to stimulate a positive habit of organizing and clarifying the key outcomes from the group collaboration for future references or multiple session projects. Lastly, pre-methods refers to non-timed instructions that precedes the setup of another method which requires a certain preparation, such as the shuffle and distribution of deck of cards for example (as shown in Figure 34).

Figure 34. An example of a pre-method.
The cards that are displayed in *My Innovation Library* are the same, in terms of content, that comes with the physical toolkit. They were replicated in the digital application in order to offer a backup to the printed cards in case they get lost or damaged. Therefore, if the users need a reprint, they have the alternative to send the card directly to their email for print. Besides, the application allows the user to customize and create new cards, similarly to the flexibility they have with the methods.

**Process Editor**

One of the key functionalities of *My Innovation Library* is the *Process Editor* which occupies the first third portion of the screen (as shown in Figure 35).

The *Process Editor* allows the user to edit an existing *process methodology* or create his or her own while browsing the methods in the library. A *process methodology* refers to the set of *methods* and dynamics that will be used to guide the team’s project. Therefore, the *Process Editor* was a feature designed for more advanced users that either have experienced Team Igniter’s proposed default methodology or users that already have a personal experience with various methods like a professor would likely to have.

Even though there are two distinct contextual menus displayed in the bottom part of *My Innovation Library* section (Figure 35a and 35b) their individual areas of influence are supported by the gestalt principle of proximity. In other words, the placement of the action buttons suggests which area of the screen they will take action upon based on their proximity.
Therefore, the user is most likely to map the action of tapping on the next arrow on the screen (indicated by Figure 35) to updating the content of that specific area enclosed visually.

Given the complexity in terms of information introduced by Team Igniter – especially in the My Innovation Library section where content density is as its highest – it was necessary to provide help assistance throughout the application. To address this issue, the solution found was to use transparent overlays with callouts explaining key points in the screen. Those overlays are triggered by the user when tapping on the help icon (as shown in Figure 36). This process of organizing information named three-dimensional layering helps reinforce relationships in the content presented. (Lidwell, Holden & Butler, 2003, 122).

Figure 36. Help overlay displayed in My Innovation Library screen.
My Connections

My Connections contains all the team members that have collaborated with the user and also the ones actively added by the user, storing information on their names, pictures and email (Figure 37). When a new project is created, the team members inserted during the setup will automatically be added to their respective accounts. The users who don’t have a registered account yet will receive an email inviting them to download Team Igniter for free and providing links to both versions (iPad and Lite).

The users may also add a connection on their own, update and delete the information about any connection. In order to provide a streamlined alternative for finding a connection, a search function is also available and especially useful when the number of connections substantially increase.

All images used in the prototype have the permission for use from their respective owners who were contacted by email and electronically consented (see Appendix D).
Resume Project

In the Resume Project screen, the users are able to see all projects they have created in Team Igniter, with overall information on date created, progress, number of members and number of snapshots taken (Figure 38). From this screen the user is also able to delete an existing project and access the settings of a specific project.

![Resume Project](image)

Figure 38.
Resume Project screen.
Team Igniter Lite

Team Igniter Lite carried over the same visual identity established in the core iPad app in order to keep consistency (see Figures 39a and 39b). Although it can be considered as an “add-on” application, its use would be strongly recommended because it stimulates the use of the individual aspect of the app that is key to promoting the desired exchange of knowledge between students and professors.

In terms of information architecture and usage flow, this lite version followed its parent iPad app so that the user would not have to learn a new experience flow and would still be familiar with the content hierarchy.

Some changes in terms of content had to be made in the initial intro screens in order to adapt to the new screen real estate limitations and to properly describe the Lite version.
Figure 40. (a, b): Intro screens, (c) Home screen and (d) Profile dashboard.

Practical and accessible
Carry your methods and cards in your pocket and quickly access them whenever you need.

Keep in touch
Always have your connections’ contact details with you!

Welcome, Keli!

ACCOUNT
NAME: Keli DiRisio
GENDER: Female
TELEPHONE: 585-309-1234
EMAIL: kxd1234@rit.edu
PASSWORD: ********

SETTINGS
Notifications: ON
Time beep: ON

LOG OUT
In the mobile version, one of the most significant changes was the layout adaptation to a more vertical navigation with scrolling (as shown in figure 41), instead of the horizontal pagination used in the iPad app. This pattern of navigation was observed to be more recurring on smaller devices, thus providing a more intuitive experience that match the users expectations when using their iPhones.

![Figure 41. My Connections Screen showing a contextual change in the navigation bar when a connection is selected.](image)

The bar at the top, referred to as navigation bar, provides contextual information to where in the app the users is as well as allows him or her to navigate back to previous screens. When an item is selected, a feedback is provided by filling the diamond color (as indicated in Figure 42). This also causes a contextual change of the navigation bar, giving the user some options of actions related to that selected item, such as unselecting, editing, deleting or sharing.

The bottom part of the screen was used to accommodate the section tabs of My Innovation Library (Figure 42 in the next page). This type of navigation is externally consistent with many other consolidated apps, such as Instagram for example.
Figure 42. (a, b): My Innovation Library, (c) visualizing a method screen and (d) editing a method.
Another well known convention in iOS applications is the use of the swipe gesture to exclude an item from a list. This was implemented in the mobile version to give more expected alternatives of executing the same action, in this case deleting (as highlighted in Figure 43).

![Figure 43. Demonstration of the “swipe to delete” gesture in My Innovation Library.](image-url)
Figure 44. (a, b): Cards tab of My Innovation Library, (b) visualizing a specific card and (c) editing that card.
Figure 45. (a, b) the screens used to create cards and methods and (c, d) the search function has a dedicated tab of its own allowing an integrated search in both Methods and Cards tab.
Evaluations

Team Igniter was evaluated through two separate testing methods in order to gather user data on distinct aspects of the toolkit: the effectiveness and efficiency of the dynamics proposed by the app as well as the usability of the user interface itself. Those evaluation plans also aimed to test the two different experiences that the app offers: in group and individually.

The decision of having two test plans with a shorter number of participants instead of having a single test with several subjects is also supported by research evidence which indicates that 5 users suffice to uncover 85% of all the usability problems of an application being evaluated (Nielsen 2000).

As part of the post-questionnaire phase in both tests, participants were asked to fill a System Usability Scale (SUS). John Brooke proposed this reliable scale in 1986 as a simpler and standardized method to measure usability of services and products. The method uses 10 questions in a Likert scale which participants have 5 options to choose from (varying between 1 being strongly disagree and 5 being strongly agree).

The following research questions were initially determined in order to help define the tasks and questions to be asked to the participants:
• How intuitive are the interactions proposed by the app?
• How pleasant is the group experience when collaborating using the app?
• How effective and efficient is the app in helping the user generate more and better ideas?
• What’s the value perceived in the app by the user?
• What questions do you users have when going through the experience?
• What do users think of the visual aesthetic designed for the app?
• What do users think about the tangible component (cards)?
Group Test Plan

Objectives
The purpose of this first test was to measure the effectiveness and efficiency of the app’s proposed ideation methods in the Artist Phase. Its primary goal is to evaluate the Team Igniter’s facilitation experience in its designed context of use by a group of students.

Participants
Since this test involved a comparison between groups, only a snippet of the target audience’s population was considered for this study in order to have homogeneous teams of participants with similar motivations and backgrounds. The participant’s profile recruited were undergraduate design students who had recently (in the past 3 months) been involved in a group project. Since design students are constantly doing group projects that include ideation and seek innovation, they would optimally benefit from the proposed experience. The groups also mixed males and females participants to avoid single-gender biases.

Compensation
Although the participation in this usability study was voluntary with no promised compensations, a $5 Java’s gift card was given to each participant upon arrival to the test session in order to reward them for their time and also provide them with an extrinsic motivation to boost their engagement.

Recruitment Procedure
Participants were recruited with the help of Professor Lorrie Frear, who contacted potentially interested students in her class. Further contact was made by email, and the potential participants were asked to fill out an online screener questionnaire that helped select a total of 6 participants, being three female and three male.

Methodology
This evaluation focused on comparing two different groups of participants that were collaborating towards generating ideas to solve the same proposed problem. In order to make that comparison, one of the groups (Group 1) used Team Igniter app as a coach to assist in their ideation challenge, while the other group (Group 2) served as a control group by having no induced stimulation to their ideation process. In order to mitigate a possible learning curve intrinsic to a first-time use of the app, Group 1 went through the Application Exploration phase before the Ideation Task. This way they would be at least familiarized with the aesthetics and some design patterns of the application before actually using it to perform a task.

Participants in both groups were asked to write down all ideas generated and observed during the entire process. Both groups were not informed of the study’s intent to evaluate and compare their ideation statistics to avoid competition biases that could have influenced their behavior and performance for better or worse.
Session Outlines

Each full session had a duration of approximately one hour.

- Introduction: 5 minutes
- Pre-task Conversation: 5 minutes
- Ideation Task (I or II): 25 minutes
- Application Exploration: 15 minutes
- Post-Questionnaire: 5 minutes
- Debrief: 5 minutes

Upon all participants’ arrival, the initial 5 minutes of the session was dedicated to introducing the researcher and providing a brief explanation about this present thesis study. The formalities – such as the consent form – required for the test were also presented during this stage. The participants were then informed about the outline of the section to mitigate any time concerns they might have.

The pre-task conversation served as an icebreaker but also to stimulate participants to a mindset of group collaboration that would be asked of them in the following stages. The next stage purposely varied across the two different test sections. The first section went through the 15 minutes of Application Exploration first before doing the Ideation Task, which took 25 minutes, while the second group did the inverse order. Finally, both groups were asked to fill an SUS form and answer some questions during the Post Questionnaire stage. In the Debrief, participants had their questions answered and were provided some more in-depth details about this thesis research.

Introduction

- Introduce researcher and participants
- Review and sign consent form
- Discuss purpose and goals of study
- Outline the testing session stages
- Acknowledge prototype limitations
- Exemplify think aloud technique

Pre-task Conversation

Prior to proposing the task, students were asked about their familiarity with interdisciplinary initiatives around RIT (with Eureka!, IdeaLab and Tiger Tank as given examples). All these initiatives were then briefly explained and contextualized to make a real-world scenario for the upcoming task that participants could better relate to.

- Ask general questions about their recent group experiences
- Ask participants about the challenges, benefits, and downsides of teamwork
Ideation Task (I or II) Participants in Section 1 were given a task to be completed with the guidance of the Team Igniter app combined with the deck of creative thinking cards. Participants in Section 2 – the control group – were given the same task but with no bias to their methodology, in other words, they didn't have any assistance from the Team Igniter app nor the cards.

Application Exploration
- Let users explore the app on their own for 5 minutes
- Ask and answer questions as users interact with the app

Post Questionnaire
- System Usability Scale (SUS)
- Cards (format, size, purpose, template)
- App Experience (ideating in group)
- App visual aesthetic (logo, identity)

Debrief
- Answer any questions participants had
- Clarify any problems that the participants had with the interface

Task Description Both groups were asked to generate ideas about “How to get students interested in participating in collaborative opportunities across RIT”. This task was intentionally chosen so that it could relate to the participants academic experiences while promoting a constructive debate around the theme addressed by this thesis. The time limit given to both groups to execute the task was the same – 25 minutes. In order to enhance the participant’s commitment and motivation in executing the task, they were all informed that Professor Lorrie was interested in the ideas they would come up with and would have access to them after the study.

Group 1 participants started from the title screen of the Artist Phase. They were instructed to use Team Igniter app and follow its guidance to work on the proposed task. Group 2 participants were instructed to perform the proposed task until they felt like they were completely satisfied with the ideas generated or time was up. They were asked to ideate solutions as they would normally do for a group project.

Test Environment and Equipment The evaluations took place in the Wallace Library in room 4688 which was reserved online in advance through the library website. It is a private room located on the 4th floor of the library and equipped with a whiteboard on the wall and a large table with 4 chairs. One iPad was provided to the group of participants to use and be able to test the Team Igniter application.

The deck of creative thinking cards – necessary for the dynamic proposed on the task – and its template board were also printed in its proper scale and format. A MacBook was used to record and capture the screen being used through Lookback, a free software for gathering user feedback on several types of devices.
Roles

The observer and moderator roles were all performed by the present author of this thesis. Since the timer in the prototype is static, it was the responsibility of the moderator to externally keep track of the time and inform the participants. In order to mitigate potential attention loss of data from the participants, an external camera was set up to capture the participants’ body reactions and audio that were later analyzed. The iPad with the use of Lookback software also captured the screen, the frontal camera and the sound around it.

Data Collected + Evaluation Measures

The data collected for comparison focused on two objective measures (the total number of ideas written down and the total number of unique ideas generated) and two subjective parameters (perceived creativity of ideas and the practicality of ideas).

Results

Participants in the first group, which used Team Igniter app as their coach to solve the proposed problem, were able to generate 44 ideas in total, nearly three times as much as the control group which generated a total of 15 ideas. Once those ideas were analyzed and filtered to disregard the duplicates, their performance contrast became even more evident: group 1 came up with 20 clusters of unique ideas whereas the control group was able to generate only four unique ideas.

After the conclusion of the study, all ideas generated were printed on individual strips of paper and then organized on an evaluation board that was divided into four quadrants by two axes containing each an opposite qualification on its extremities (see figure 46 on the next page). For instance, the horizontal axis referred to the practicality of the ideas, that could vary from unrealistic to applicable/practical. The vertical axis measured the creativity of the ideas and could be classified from common/expected to whacky/unusual. Professor Lorrie Frear helped on the judging of the ideas in order to reduce the evaluation bias by having an external judge.

The evaluation board (Figure 46) shows that 9 out of the 10 ideas classified as whacky/unusual were made by the group that used Team Igniter. Another interesting observation is that vast majority of the ideas (14 out of 15) generated by the group that brainstormed ideas on their own were classified in the quadrant that contained common/expected ideas that were applicable/practical. Although this experiment doesn’t have a real scientific value due to its small sample, still the results provide a positive indication that the app can be useful in helping groups generate more and better ideas.
Figure 46. Idea evaluation board.
Individual Test Plan

Objectives
This second test plan aimed to evaluate the app’s usability. The proposed specific goals were to:
- Collect data on app functionalities, user understanding, and satisfaction
- Validate the first-use intuitiveness of the application
- Gather user insights for future iterations of the designed prototype

Participants
The participant profile sought in this study was less restrictive since the goal now was to test the app’s ease of use. Therefore, any RIT student regardless of education level would be a good fit. However, a preference for a diversity of backgrounds was sought in order to collect different perspectives that could lead to unusual insights. Also, a diversity of gender was preferred, having an evenly split ratio of male and female participants.

Compensation
The participation in this evaluation was entirely voluntary, and no compensation was provided to the participants.

Recruitment Procedure
No formal recruitment procedure was made for this test round. Instead, a guerrilla tactic was used to recruit. In other words, participants were approached on-the-go and invited to volunteer based on their availability at the time.

Methodology
The focus of this evaluation was to have the users individually explore most of the key functionalities in Team Igniter app. Therefore, this was a task-based evaluation in which participants had to complete six pre-determined tasks that could be achieved through the prototype.

Session Outlines
Each session had a duration of approximately thirty-five minutes.
- Introduction: 2 minutes
- Background Questionnaire: 2 minutes
- Acknowledgments: 1 minute
- Pre-task exploration: 5 minutes
- Tasks: 15 minutes
- Post-Questionnaire: 5 minutes
- Debrief: 5 minutes

Introduction
First, participants were thanked for their time and then informed about the estimated duration of the entire session. At the end of this phase, they were asked to sign a consent form (see Appendix E) which granted permission to record the evaluation session and use it for the research purposes of this thesis.
A quick background questionnaire was orally asked to get some demographics information about the participants and correlate their performance with other variables such as iPad expertise, country of origin, the area of study, etc.

Before starting the evaluation, participants were informed about the limitations within the prototype and most importantly that they were not the subjects of evaluation.

In this phase, the participant was prompted to explore the initial five screens of the app and verbalize his or her first impressions based on that little information. The goal with this was to see if the users were able to understand what the app was about by reading through the intro screens and also to check their assumptions in regards to the sections' labels.

Participants were given a total of six different tasks (see Appendix G) that were presented through scenarios which induced an exploration of all sections and the most important functionalities within the app.

After the completion of the tasks, participants were asked to fill an SUS form and an open-ended questionnaire about what their experience using the Team Igniter’s app.

Last, during the debrief participants, were provided with answers to their questions and problems that they had with the interface.

The evaluations took place in VCD graduate lab (room 1305) located in James E. Booth Building. The required equipment was a Macbook computer to record the session using Lookback, table and two chairs, one for the participant and the other for the moderator. One iPad was also provided to the participants to use and be able to test the Team Igniter application.

The task completion was measured as an objective data and classified as either successfully completed or not completed, being an indicator that the users understand the navigation or not. However, the most valuable data consisted of the notes taken during or after the test (transcribed after testing from the recording analysis). This subjective data provided invaluable insights that revealed user’s pain points and delights from the experience.
Results

Overall, the outcomes of the individual testing were considerably positive. All participants were able to conclude all six tasks successfully which could be translated in their understanding of the navigation. The three most recurrent words that the users wrote down in the post-questionnaire to describe the application was clean, easy-to-learn and helpful for group dynamics. When asked about three things they liked best about Team Igniter, 5 out of the 6 participants pointed out the visual style and the methods to guide group collaboration as their favorite. The ability to customize their own process was also praised.

The average of the SUS scores recorded by all six participants was 77.5 which, despite being a score out of 100, it doesn’t represent an actual percentage. According to a statistical UX analyst’s graph (Sauro 2011) which translates that score into a percentile rank, this data suggests that, in terms of usability, the participants rated Team Igniter’s user interface as a “B+.” An excellent score but that also indicates there are still some issues to be solved.

Most feedback issues were related to mitigating the learning curve of the interface, especially in My Innovation Library, which is the most complex and visually dense screen of the app. Although the app already provides a help assistance, it was observed that only half of the participants noticed and actually used it. One user even raised the problem that the help button blends in with the other graphic elements around it, making it hard to notice. It was also noted that the users who used the help conclude the tasks more quickly and with fewer issues. Therefore, it seems that the designed help is useful, but it is likely to go unnoticed by the user.
One possible solution could be to present it as a first-time walkthrough screen (see Figure 47 on the previous page) that the users can dismiss by tapping in a "don't show this again."

A minor problem related to the labeling of sections caused a slight confusion in international participants, especially "Resume Project" and the "Decks" tab, however, they were still able to understand it later on with use. To address this problem and speak the users language, they were reworded to "My Projects" and "Cards" instead (as shown in Figure 48a and 48b respectively).

Figure 48. Updated screens after user feedback. (a): Home screen, (b): My Innovation Library screen
Imagine RIT Exhibition

*Imagine RIT*, a creativity and innovation festival that took place at RIT on May 7th was a great opportunity to expose this thesis project. Although the event attracts thousands of visitors, its context does not favor usability testing since the majority of people attending are often in a hurry to see all the exhibitions around campus. Still, it offered a valuable opportunity to disclose and validate the concept and also get feedback on the visual design.

A tabloid format poster was created to summarize the concept behind Team Igniter and attract visitors from a distance. The poster hung next to where the project was exposed. Three MacBook computers from the VCD lab 1305 were used to display both the iPad and iPhone apps. All four decks were also distributed on the table over their respective boards, along with the 3D printed packaging and the quickstart guide.

The plan consisted of setting up an iPad to showcase the high-fidelity prototype and let visitors do free exploration on their own. After they had explored the app, further explanation on the concept was provided. Lastly the visitors were be prompted to fill out a 5-minute printed survey that was on the table.

Overall the survey results showed a very positive reaction in all measured parameters (see Appendix J for all responses). Most visitors (80%) were extremely satisfied with both the ease of use of the app and the usefulness of the toolkit concept. The other 20% still rated these two parameters as “very satisfying”. In terms of visuals, 11 out of 15 thought the app was “extremely appealing” while 4 marked it as “very appealing.”
Conclusion

This thesis investigated the most recurring problems faced in group collaboration of teams of students seeking to problem-solve creatively. Design, as a fundamentally interdisciplinary field rooted in communication, should take the lead in providing better means to integrate people and enhance their collaboration towards innovation.

The proposed solution integrated UX design which helped craft an experience that is meaningful to the user, Social Psychology which provided an empirical research foundation with applicable methods to improve team collaboration and Game Design elements to make the experience more engaging and dynamic. The final outcome took form as a toolkit named Team Igniter, which consisted in an iPad app as the main component complemented by four decks of printed cards and an optional add-on Lite iPhone version of the main app for portability.

The evaluations done with the actual users indicated that the proposed solution successfully achieved the goals to leverage group collaboration of students. Not only a considerable higher amount of ideas (44) were generated by the group that used Team Igniter app as their facilitator in comparison to a control group (15). Also, the ideas were more unusual and practical as well. It is important to acknowledge that, despite validating the effectiveness of the concept, these evaluation studies had an essentially qualitative and exploratory bias. Therefore, further studies with a much larger user population need to be made in the future to provide enough quantitative data that would offer scientific relevance.

It was never the pretension of Team Igniter to be a single best formula or recipe to creativity or to group collaboration that is guaranteed to work for everyone, every time. It is intended to serve as a backbone to facilitate and quick start those team interactions. The key point is to provide an adaptive application that evolves and gets incremented by their users based on their individuality and own experiences.
Final Considerations

Team Igniter was designed for educational purposes with no commercial intent to it. From the start, the toolkit was designed to be an adaptive and an ever-evolving library of knowledge meant to be shared.

The concept of having an adaptive toolkit that could leverage team collaboration at universities is what drove the pursuit of this topic. A simple change of behavior in the way students collaborate at universities could have a significant impact on the society. After all, besides shaping the professionals of the future, the academia is still determinant in driving breakthroughs around the world. Thus, the better students are prepared to collaborate with their peers across disciplines, more and more will they reach innovation and make a change for a better world.
# Appendices

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Appendix A - Original Thesis Proposal

Rochester Institute of Technology
College of Imaging Arts & Sciences | School of Design
MFA Visual Communication Design

THESIS PROPOSAL

*Synergy by design*
Integrating creative ideation + design thinking
to improve collaborative group dynamics

Vinicius de Andrade Romualdo

*December 15, 2015*
Synergy by design: integrating creative ideation + design thinking to improve collaborative group dynamics

Vinicius de Andrade Romualdo

December 15, 2015

Approval

Title
Synergy by design: integrating creative ideation + design thinking to improve collaborative group dynamics

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Abstract

Synergy by design: integrating creative ideation + design thinking to improve collaborative group dynamics
Vinicius de Andrade Romualdo

Summary
Even though interdisciplinarity has been constantly debated and supported during faculty meetings at RIT, still, academic programs confine themselves into silos, hampering student integration. The struggle to effectively collaborate becomes evident in the existent on campus initiatives that challenge students from different disciplines to work together. The consequence is the under-utilization of the students’ potential which leads to mediocre outcomes.

This thesis project aims to integrate user experience (UX) methods with social psychology’s research findings and game design dynamics into an interactive experience constituted of both digital and tangible components. The goal of this experience is to provide a fluid framework to guide teams seeking innovation in order to leverage student collaborations and thus promote a truly academic synergy that leads to better results.

Keywords
Interdisciplinarity, design thinking, creative ideation, game design, user experience, group dynamics, groupthink, social psychology
Situation analysis

Design is, by nature, an interdisciplinary field that is composed of several specializations (i.e. graphic, interaction, industrial, visual, mograph, game and many others) which overlap not only amongst themselves but also with external fields in science and the humanities. This overlapping requires a minimum understanding about multiple adjacent fields of knowledge in order to enhance the quality and effectiveness of interactions among professionals from varied disciplines. In the past few decades, collaboration has become more and more a constant in interdisciplinary groups due to the ever increasing complexity of problems, thus it is paramount for professional designers to be able to effectively work collaboratively. The university has a key role in forming professionals that not only thrive in their own specializations but also transcend solo accomplishments in order to achieve greater goals originated from the synergy that teamwork brings.

RIT offers its students some opportunities to pursue interdisciplinary experiences during their academic journey. A lot of them have roots in entrepreneurship programs, like IdeaLab, for example, where students are challenged to solve, in a weekend, real problems brought by the community. It is held twice a year in the Simone Center building, and has great appeal to designers, engineers and business students. Eureka is another interdisciplinary initiative for students and faculty from the five different School of Design disciplines at RIT to collaborate and creatively solve problems, using Rochester as their living classroom.
Problem Statement

Groupthink is a major problem commonly evidenced in teamwork. The term originated from social psychology research by Irving Janis (1972). He noticed that the rush to reach a common denominator that will minimize group conflicts, avoiding critical evaluation and external influences, often leads to irrational and poor decision-making outcomes. Groupthink is often associated with the traditional brainstorming method as a negative outcome that its “abstain from criticism” rule provokes. According to Janis:

A group is especially vulnerable to groupthink when its members are similar in background, when the group is insulated from outside opinions, and when there are no clear rules for decision making.

RIT has many interdisciplinary initiatives that encourage and exercise group collaboration between students. A closer look at these interactions reveals struggles in team management and guidance, especially when the personalities of the individuals involved are not taken into consideration. This often times results in groupthink, which leads to poor participation of the members involved and thus mediocre outcomes.

Lastly, this thesis project seeks to propose a solution that will address the following identified challenges, from a top to bottom perspective:

In what ways might this project:
• promote academic synergy?
• help RIT academia produce more meaningful and innovative projects?
• make students collaborate more efficiently?
Design Inquiry

The design field, as much as many other fields in academia, needs a reform in their present curriculum that stimulates interdisciplinary interactions and better prepares future professionals to collaborate with those from other disciplines. This project seeks to serve as a stepping stone to that reform by providing guidance to college students on how to collaborate more effectively and generate innovative solutions that go beyond the ordinary.

The design thinking methodology has become increasingly popular across other disciplines and has contributed significantly to a more aligned collaboration flow between designers and other professionals. IDEO, an innovation design firm founded in California, should be credited for that popularization. At RIT, many programs outside the School of Design have incorporated design thinking into their curriculum which serves as a stimuli for student participation in multidisciplinary initiatives.

Gamification, a term originated from game design, also takes an important role in this project. It bridges some key factors from psychology, such as social behavior and intrinsic and extrinsic motivations, which are essential to promote effective user engagement and thus enhance the experience. Since this thesis aims to promote positive behavioral changes in students when collaborating in groups, it becomes indispensable to study, observe and hear their frustrations and delight so as to align the outcome of this project to their needs.
Survey of Literature

The research focus of this project aimed to provide a solid understanding of several topics that coherently support the design decisions. Some topics included, but were not limited to: interdisciplinarity, user experience design, creative ideation methods, design thinking, social psychology, game design and usability.

Imagine, How Creativity Works

This book reinforces the thought that creativity is inherent to humankind and deconstructs its preconception of being a quality of a few gifted people and reserved for certain disciplines and professions. He exposes and discusses several real cases of creative thinking in solo and teamwork situations, suggesting how their thought process could be replicated in other contexts.

A Whack on the Side of the Head

This classic book on creative thinking provides several interesting ideation methods to be explored in order to dismantle the “mental locks” – Oech’s metaphor for the negative attitudes that undermine our native ability to be creative. He deconstructs each of the ten “mental locks” explaining the harm they cause and providing exercises on how to overcome those limitations.

Thinkertoys, a handbook of creative-thinking techniques

More than just a textbook, Thinkertoys is a toolkit of several ideation methods that are divided into two categories: 1) linear, which deals with the more analytical left side of the brain and 2) intuitive, which exercises the imaginative right side.

The Creativity Challenge

This book aims to challenge default ways of thinking by providing several unusual exercises that seek to leverage creativity. It challenges the user to pick one exercise at random everyday and be determined to execute it.
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| Online Article | Jonah Lehrer makes several cases for why brainstorming, in the way it was proposed by Alex Osborn back in 1948, is not effective, based on various discoveries by researchers that show evidence of low performance of groups which used brainstorming compared to the ones without. The reason seems to be in the criticism inhibition rule of brainstorming, which although avoids conflicts, ends up imparring debates that could lead to novel ideas.

Jonah Lehrer<br>www.newyorker.com/magazine/2012/01/30/groupthink

**Why Group Brainstorming Is a Waste of Time**
This online article, posted at the Harvard Business Review website, criticizes the brainstorming method, considering it a mere placebo. It summarizes key points that explains the reasons for its failure, based on research publications by psychologists. Finally, the author discusses why its practice is still so widely adopted.

Tomas Chamorro-Premuzic<br>www.hbr.org/2015/03/why-group-brainstorming-is-a-waste-of-time

**How to be a multidisciplinary designer**
This online article posted at Digital Arts, discusses the importance of having a multidisciplinary skill set in order to thrive in the rapidly changing industry designers are immersed in. By interviewing designers from several agencies in the UK, Wyatt also makes a case for why collaboration is paramount nowadays based on their experience sharing.

Paul Wyatt<br>www.digitalartsonline.co.uk/features/creative-business/how-be-multidisciplinary-designer/

**Design Thinking**
This website made available by IDEO, provides a design thinking toolkit with several fully described and exemplified methods and exercises with case applications and videos.

Website<br>IDEO<br>www.designkit.org

**Bootcamp bootleg**
Provided for free by Stanford’s d.school, this PDF serves as an introductory guide to design thinking with a selection of their most used methods which are described individually with application examples.

Stanford d.school<br>www.dschool.stanford.edu/use-our-methods/the-bootcamp-bootleg/

**Game Design**
This book provides insightful thoughts on gamification and how it can be applied to align the interests of both customers and businesses so as to achieve their goals through engagement and motivation. The author also goes through mini-cases that offer more practical and tangible analysis on the different outcomes of gamification when applied in different contexts.

Book<br>Brian Burke<br>2014

**Gamify: How Gamification Motivates People to Do Extraordinary Things**
This book provides over 50 perspectives from industry and academic experts on gamification and how it affects our society in multiple and unique levels, from privacy to ethics.

Book<br>Steffen P. Walz and Sebastian Deterding<br>2015

**The Gameful World: Approaches, Issues, Applications**
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<td>This book makes a case for good game design based on the premise that it is universal, regardless of platform or medium. It also instigates designers to look at their games through multiple perspectives — introduced as lenses — which cross over a diversity of disciplines that must be taken in consideration.</td>
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<td>Julie Thompson Klein</td>
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<tbody>
<tr>
<td>The Oxford Handbook of Interdisciplinarity</td>
<td>This excerpt from The Oxford Handbook of Interdisciplinarity, provides an overview about the evolution of the taxonomy of interdisciplinarity, collecting thoughts from leading researchers of the term from around the world and offering a broad and up-to-date perspective about the concept.</td>
</tr>
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<table>
<thead>
<tr>
<th>Journal Article</th>
<th>Elastic minds? Is the interdisciplinary/multidisciplinary curriculum equipping our students for the future: A case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art, Design &amp; Communication in Higher Education</td>
<td>This case study analyzes the tendency of design programs, especially at postgraduate level, to form smaller studio-based courses across a variety of disciplines, in an attempt to prepare students for the interdisciplinary world they will face outside academia.</td>
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<table>
<thead>
<tr>
<th>Journal Article</th>
<th>Groupthink: psychological studies of policy decisions and fiascoes</th>
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<tbody>
<tr>
<td>American Psychologist</td>
<td>In this book, Janis introduces the concept of groupthink by analyzing several cases of US failures on political decisions that could have been avoided had the people involved been aware of their cognitive biases that can be triggered by teamwork.</td>
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<thead>
<tr>
<th>Journal Article</th>
<th>Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being</th>
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</thead>
<tbody>
<tr>
<td>American Psychologist</td>
<td>This article discusses the influence of factors such as the Self-Determination Theory on intrinsic motivation and pro-activeness of individuals. Its findings proposes three basic psychological needs that enhances intrinsic motivation: competence, autonomy and relatedness.</td>
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<tr>
<th>Journal Article</th>
<th>Intrinsic and Extrinsic Motivations Classic Definitions and New Directions</th>
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<tr>
<td>Contemporary Educational Psychology</td>
<td>This journal article reviews the definition of intrinsic and extrinsic motivations comparing the classical perspective to contemporary research.</td>
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<tr>
<td>Synergy by design</td>
<td>Vinicius de Andrade Romualdo</td>
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<tr>
<td>-----------------------------------------</td>
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<tr>
<td><strong>Usability</strong></td>
<td></td>
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<tr>
<td>Book</td>
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<tr>
<td><em>Don’t Make Me Think</em></td>
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<tr>
<td>Considered one of the most essential books in usability, this book discusses good practices and uses common sense to evaluate existing websites and applications. Although most of the examples it provides are web related, its application can be further extended to any kind of interface — digital or physical — being designed.</td>
<td></td>
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<tr>
<td>Steve Krug</td>
<td>2014</td>
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<tr>
<td><strong>Rocket Surgery Made Easy</strong></td>
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<tr>
<td>On this book, Steve Krug expands on the process of designing and executing an usability test, providing a step-by-step guide that can be applicable to any product in order to improve it.</td>
<td></td>
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<tr>
<td>Steve Krug</td>
<td>2009</td>
</tr>
<tr>
<td><strong>Handbook of Usability Testing</strong></td>
<td></td>
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<tr>
<td>This book provides more in-depth instructions on planning, designing and executing a usability test. It also recognizes the limiting factors of different tests methods and provides the do's and don'ts that a moderator should follow in order to maintain an unbiased test.</td>
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<tr>
<td>Jeffrey Rubin and Dana Chisnell</td>
<td>2008</td>
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<tr>
<td><strong>UX Design</strong></td>
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<td>Book</td>
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<tr>
<td><em>Lean UX: Applying Lean Principles to Improve User Experience</em></td>
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<tr>
<td>This book integrates user experience design with agile and lean software development methodologies. The author introduces a 5-step process that goes through solving the problem collaboratively, sketching the ideas out, prototyping, pairing designers and developers to work together and finally creating a style guide that facilitates next iterations.</td>
<td></td>
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<tr>
<td>Jeff Gothelf</td>
<td>2013</td>
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<tr>
<td><strong>Designing for Interaction</strong></td>
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<tr>
<td>This book highlights the important role of interaction design in making products that go beyond the dicotomy of form and function. Usability, usefulness and desirability must be taken in consideration as well. It also discusses case studies from the industry providing sucessful methods that can be incorporated to the design process.</td>
<td></td>
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<tr>
<td>Dan Safferv</td>
<td>2009</td>
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<tr>
<td><strong>Designing for Behavior Change</strong></td>
<td></td>
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<tr>
<td>This book exposes the benefits that findings from behavioral psychology and economics can bring to the UX design field, especially when the goal is to promote a positive change on the audience’s behavior. The author also presents three strategies to lead to those changes and analyzes products with similar approaches that are out in the market.</td>
<td></td>
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<tr>
<td>Stephen Wendel</td>
<td>2013</td>
</tr>
<tr>
<td><strong>The Elements of User Experience</strong></td>
<td></td>
</tr>
<tr>
<td>One of the most essential references for interaction design, this book breaks down the complexity of user experience into segments that can be easily assimilated and followed. It focuses on presenting ideas that define UX and leverages critical thought rather than providing a one-size-fits-all technique.</td>
<td></td>
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<tr>
<td>Jesse James Garret</td>
<td>2011</td>
</tr>
</tbody>
</table>
Competitive Analysis

In order to innovate and differentiate from what is already out there, the competitors must be identified and studied. This also provides a benchmarking opportunity to enhance the entire experience by considering features and dynamics from different contexts and redefining it for the purpose of this project. These are the competitors and similar apps being analyzed:

**Creative Whack Pack**
Created by Roger von Oech, the *Creative Whack Pack* is a deck of 64 cards that provides creative thinking ideas to challenge the mental locks that keep people from innovating.

**Designercise**
*Designercise* is a physical ideation toolkit for professionals that combine design thinking with cognitive sciences in order to create dynamic group games that boost creative thinking. The deluxe kit, which costs $180 and is yet to be released on December 2015, is composed of 11 decks of cards, 2 roulette spinning wheels and 1 wooden spinner.

**Rory’s Story Cubes**
It is a storytelling technique that uses unique sets of cubes which contain different icons on each side from a particular theme. The game is played by rolling out a set of 9 cubes with mixed themes and coming up with stories based on the results.

**The Brainstormer**
An app, available only for Apple devices, that randomizes brainstorming in three levels: plot, subject and setting/style that are aligned and picked through three concentric roulettes. It aims to break creative blocks and serves as a stimuli for writers, painters, designers and any creative mind.
Methodology

The methodology that will be applied in this project will combine a Lean UX approach with user-centered methods originated from design thinking. Therefore, less emphasis will be given on documentation-like deliverables in order to focus on rapid prototypes that will allow the concept to be tested sooner rather than later and reiterated based on user feedback.

Value Discovery

The validation of the problem started with an in situ observation at the IdeaLab event held in the Simone Center at RIT, during an intensive weekend of interdisciplinary group collaborations. The points being observed within the interaction between team members were:

- Leadership roles
- Frictions and pain points
- Excitement and delightment points

After the observations and at the end of the students collaborative sessions, quick interviews were made with ten participants in order to better understand their struggles during teamwork. (See Appendix 1 for questions)

Card Sorting

The next step in the plan is to apply a Card Sorting exercise to a focus group of students in order to generate ideas of gameplay that are relevant to their goals and needs. This group will be formed of six RIT students from varied programs, gender, age and levels.
Target Audience

This thesis project will be centered on RIT students as the primary users, irrespective of their level of education or majors. The most representative age-range on campus varies from 17 to 30 years old.

The value that this project will bring to students resides in the fact that it will provide them with a problem-solving framework that will leverage their collaboration when working in groups.

Although the framework that is being proposed in this thesis will be designed for groups that have innovation as a goal it still can be applicable to other kinds of groups that seek guidance on how to collaborate more efficiently and weed out groupthink from their teamwork.
Design Ideation

This present thesis can be synthesized by the diagram bellow. Its main goal is to integrate UX methods with social psychology’s research findings and game design dynamics into an interactive teamwork experience that provides an engaging framework to guide teams seeking to innovate.

The diagram shown on the following page depicts the optimized linear framework for group collaboration that was designed based on a combination of personal experience, observations made during the Value Discovery session and most importantly on the literature reviewed for this thesis (IDEO’s Design Kit, Lehrer, Michalko and von Oech). For visualization purposes, the diagram was divided into three parts, but they are all part of a single linear flow.

It is important to highlight that even though the framework has a linear structure, the collaborative process that will result from the game experience will be flexible and dynamic. The goal of this project is by no means to provide a “one size fits all” solution to every collaborative project. Instead, the embedded game experience is intended to allow unique collaborative experiences in every iteration by offering a randomized variety set of combined methods from design thinking and creative thinking.
Synergy by design

Optimum Collaborative Process Framework

**IMAGINATIVE PHASE** (Divergent Thinking)
- Ice breaker
- Discard introductions
- Name
- Origin
- Ask questions about personality
- Tell about personal interests
- Research potential topics
- Random generation
- Define problem statement
- Zoom-out (broader perspective) by asking "why"
- Zoom-in (detailed perspective) by asking "why, what, where, when, how"

**INCUBATION PHASE**
- Deep research
- Understand user needs
- Personas
- Empathy Maps
- Scenarios
- Observations
- Interview
- Understand client requirements
- Analyze competition
- Compare to old versions
- Rewrite if necessary
- Quantitative
- Brainstorming (W’s questions x 5 senses)
- Oracle of randomness

**PRACTICAL PHASE** (Convergent Thinking)
- **The artist**
  - Quantitative
  - Brainstorming (W’s questions x 5 senses)
  - Oracle of randomness
  - Do something else unrelated to the problem
  - Relax

- **The judge**
  - Quantitative
  - Ask "what if"
  - Oracle of randomness
  - "Creative no"

- **The warrior**
  - Qualitative
  - Criticize
  - Share background experience
  - Skills contribution
  - Divide tasks

- **The bard**
  - Individually or subteams
  - Checklist

**PRACTICAL PHASE** (Convergent Thinking)
- Get it done!
- Show & tell progress check
- Make revisions
- Implement
- Presentation
- Disclosure
- Show RIT opportunities
- Push it forward

- Individually or subteams
- Iterates
- Next steps
- Individually or subteams
- Iterates

Vinicius de Andrade Romualdo
**Game Mechanics**

The “optimum framework” shown in the previous page will provide the backbone for the game mechanics. Every white rectangle on the diagram represents a level of the gameplay with its own unique set of rules and instructions (provided by the app) that will require the use of the complementary tangible components of the game (see Project Deliverables) in varied ways.

For example, during the “Icebreaker” level, the users will be instructed to not talk about their own academic expertises or titles but instead focus on personality traits and interests. Then they will be prompted to interact with a tangible object that randomizes the experience (i.e. it could be to draw a random card from a certain deck included in the game or roll a dice with messages on its faces).

Based on research evidence (Bray, Kerr, and Atkin, 1978) that shows that the number of ideas decrease as group sizes increases, the game will be designed to accommodate up to a maximum of six players at a time.

The digital “coach” app will provide instructions on how to play the game and use the tangible kits according to the level the players are on. It also enables several features that considerably enhances the gameplay:

- **calculate** customized duration of levels based on player’s input of availability
- **timing** capabilities which would allow players to keep track of their turns
- **progress saving** in case they have to stop in the middle of the collaboration
- **flow and continue later on**
- **quick search** on the methods for future reference
- **bookmarking** of favorite methods found on the tangible cards.

Physical deliverables will play a key complementary part in the game by adding randomization to the gameplay of the levels, raising expectancy. It also brings a sense of touch that is inherent of tangible things leading players to put their smartphones down and to get immersed in the gameplay.
Project Deliverables

The final outcome of this project will be a combination of both digital and physical components. This decision is justified by the variety of distractions that a smartphone can bring to the users as they play the game. Thus the necessity to intentionally force the players to step out of their phones for a while. Setting the focus on the collaboration process itself makes the experience more immersive and effective.

**Digital deliverables**

- High-fidelity app prototype that allows user interaction and testing
- 2nd iteration of high-fidelity app prototype after user feedback
- UX Design Document (in PDF):
  - Competitive Analysis
  - 2 User Personas
  - 2 Empathy Maps
  - 2 User Scenarios
  - Process/Information Flowcharts
  - Sketches
  - Wireframes with Annotations
  - Style Guides and Tiles
    - Visual identity
    - Logo
    - Moodboards
    - Typography
    - App grid
  - Final UI Design
  - Usability Protocol & Reports with photo records

**Specifications**

The application will be designed for both Android phones and iPad.

**Physical deliverables**

- 1 deck of at least 10 cards with Creative Thinking methods
- 1 deck of at least 10 cards with Design Thinking methods
- 1 deck of 5 cards about senses
- 1 deck of 6 cards about emotions
- 1 deck of question starters (why, what, who, where, when, what if, how)
Implementation Strategies

The process of implementation of this thesis will take advantage of the Adobe Creative Cloud software (especially Illustrator, Photoshop and InDesign) to execute both digital and print components.

The paper prototyping will be hand sketched with pencil onto index cards to facilitate and stimulate quick user feedback in a timely manner.

The high-fidelity prototype will be achieved through an online rapid prototype tool, InVision, which uses the designed layouts saved as static images to simulate the interactions and transitions of a working prototype. However, there is no back end built into it, which means the prototype will not be able to save or store data from the user experience.
Evaluation plan

The evaluation plan will consist of two rounds of prototype testing focused on usability. The first round will be done with the paper prototype in order to validate the game mechanics and collect suggestions to improve the group dynamic experience.

The second round will test the high fidelity prototype. Both rounds will be qualitative with a predetermined target number of participants of up to 12 students from diverse backgrounds which will be split in 2 groups as the maximum number of players for the game is set to 6. The location for testing shall be in VCD’s rooms 1305 or 1611, based on availability.

Imagine RIT, a creativity and innovation festival that takes place at RIT on May 2nd will also serve as a great testing site for the app. Although the event attracts thousands of visitors, their profile type would not favor usability testing since people would most likely be in a hurry to see all the exhibitions around campus. Still, it offers an opportunity to disclose and validate the concept, and also get feedback on visual design. The plan consists of setting up ipads with the running high fidelity prototype to let visitors do free exploration on their own. After they explored the app, a quick explanation on the concept would be given and lastly they would be prompted to fill out a 5-minute digital survey through Google Forms.
Synergy by design

Timeline

The scheme below portrays how the design methodology would ideally be executed throughout each semester. The colored marks represent major deadlines to be followed and the black bars indicate the milestones to be accomplished.
Dissemination

The dissemination plan transcends the thesis timeline since it starts once everything is finished and tested. The plan to promote the final outcome will start at RIT by presenting it to interdisciplinary initiatives that could potentially make use of this collaboration toolkit, such as Eureka, IdeaLab and Studio 930. The next step will include submission to the following design competitions around the world:

- Adobe Design Achievement Awards
- Core 77 Design Awards
- RedDot Design Awards
- HOW Interactive Design Awards
- iF Design Award
Appendix B – IdeaLab Interview Script

1. Demographics: name, major, age, country.

2. Is this your first time participating in the IdeaLab? (How many times, before?)

3. What motivated you to participate?

4. What did you think of it? Did it meet your expectations?

5. Please list the top three (3) key takeaways you learned here today.

6. When you first met your team members, did you already know what everyone’s major was about? Please list all the majors within your team and describe your current understanding about what their major is/does.

7. What do you think were the biggest struggles in your team work?

8. What do you think helped your team work well/better?

9. Have you ever done class work/projects with students outside your major?

10. If yes, what was it?

11. Why did you decide to work with students from other disciplines?

12. How did you find your team members?

13. If no, why not?

14. Have you ever taken classes outside your school/major? Why did you take them?
## Appendix C – IdeaLab Responses

### Name (10 responses)

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<thead>
<tr>
<th>Name</th>
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<tr>
<td>Nino</td>
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<tr>
<td>Solomna</td>
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<tr>
<td>Maneille</td>
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<td>Kayla</td>
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<td>Elizabeth</td>
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<td>Ivan</td>
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<td>Shash</td>
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<td>Matt</td>
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### Major (10 responses)

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<td>IE, undergrad</td>
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<td>EE, undergrad</td>
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<tr>
<td>EE, undergrad</td>
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<tr>
<td>Mechanical Engineering, undergrad</td>
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<td>EE, undergrad</td>
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<tr>
<td>Electrical Engineering Tech, undergrad</td>
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<tr>
<td>New Media Marketing, undergrad</td>
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<tr>
<td>electrical engineer, undergrad</td>
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<tr>
<td>Electrical Eng. grad</td>
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<td>EE, grad</td>
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### Gender (10 responses)

- Male: 70%
- Female: 30%

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### Country (10 responses)

- United States
- United States
- United States
- United States
- United States
- United States
- Ukraine
- Brazil
- Urugu
- Venezuela

### Part 2

#### Is this your first time participating in the IdeaLab? (10 responses)

- Yes: 30%
- No: 70%

#### What motivated you to participate? (10 responses)

- New and exciting idea
- Thought it would be an exciting journey
- Continuity of learned concepts
- Desire to test marketed ideas
- Knowledge of the event
- Excited to do something new
- Learning new skills
- To help others
- To be exposed to different people
- I was interested in Something Else

#### What did you think of it? (10 responses)

- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%
- Great: 100%

#### Please list the top three (3) key takeaways you learned here today. (10 responses)

1. New and exciting idea
2. Continue with the learning process
3. Experience with new concepts
When you first met your team members, did you already know what everyone’s major was about? (18 responses)

- Yes: 77%
- No: 23%

Please list all the majors within your team and describe your current understanding about what their major is/does. (18 responses)

- Mechanical engineering: students study the behavior of mechanical systems and how to design systems to be efficient, safe, and effective. They learn about materials, structures, and how forces act on objects. This major is relevant to engineering fields such as aerospace, automotive, and manufacturing.

- Industrial design: students learn about the processes and techniques used in the design of products and systems. They study human factors, aesthetics, and market analysis to create designs that meet the needs of users.

- Architecture: students focus on the design and construction of buildings and other structures. They learn about structural design, materials, and environmental considerations to create sustainable and safe spaces.

- Applied mathematics: students study mathematical concepts and techniques to solve real-world problems. They apply these skills to fields such as finance, engineering, and data science.

- Computer science: students learn about the design and implementation of algorithms, data structures, and software systems. They study programming languages and techniques to create efficient and effective software solutions.

- Industrial designer: someone who comes up with a new project, how it all works together, usability, everything that makes a product or more renewable.

- Ask about what their strangest skills are coordinating and split the work based on the balance of what people can balance.

- Engineering feasibility, making it work, but that’s overemphasizing what they do.

What do you think were the biggest struggles in your team work? (18 responses)

- Getting started, figuring out how to break out as a group.
- Meeting of classes, making sure everyone is on the same page.
- Time constraints, making sure everyone is on the same page.
- Having different roles and responsibilities.
- Time management, ensuring everyone is on the same page.
- Listening to one idea, one person, and getting everyone on the same page.
- Time constraints, making sure everyone is on the same page.
- Time management, ensuring everyone is on the same page.
- Time constraints, making sure everyone is on the same page.

What do you think helped your team work well/better? (18 responses)

- Getting everyone on the same page at first in order to divide tasks.
- Willingness to share ideas.
- Willingness to change paradigms.
- Different points of view.
- Getting everyone on the same page at first in order to divide tasks.
- Listening to one idea, one person, and getting everyone on the same page.
- Time management, ensuring everyone is on the same page.
- Teamwork, everyone was willing to work.
- Time constraints, making sure everyone is on the same page.
- Listening to one idea, one person, and getting everyone on the same page.

In case YES, what was it? Why did you decide to work with students from other disciplines? How did you find them? (3 responses)

- English class last year, work with different students.
- Project class, work with different students.

In case NO, why not? (1 response)

- Will probably do it with thesis.

Have you ever taken classes outside your school/major? (10 responses)

- Yes: 50%
- No: 50%

In case YES, why did you take it? How was your experience? Would you do it again? (1 response)

- Criminal justice, very long lecture, different setting, a lot of different majors in there.

In case NO, why not? Are you interested taking others in the future? (1 response)

- Graphic design only.
Appendix D — Photo Use Permission Emails

Photo use permission

--

--

1. Vinicius de Andrade Romualdo

3. Jordan Roelof (Team Igniter)

5. Lara Celdon (Team Igniter)

7. Leticia Fossa

9. Shikapriya Santhan

11. Jam Piscillo

13. gokelaniroko@hotmail.com

15. Hili RJ (BIT Student)

17. Neil Dilissa (BIT Student)

19. MAOB ZAIZIE (BIT Student)

21. Liying Wang

23. Yunyi Gu

25. Arvind Rajappa

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*Note: The emails are shown in reverse chronological order.*
Appendix E – Consent Form

Consent & Recording Release Form

I agree to participate in the study conducted and recorded by Vinicius de Andrade Romualdo for his thesis project.

I understand and consent to the use and release of the recording by Vinicius de Andrade Romualdo. I understand that the information and recording is for research purposes only and that my name and image will not be used for any other purpose. I voluntary cease to claim any rights to the recording and understand the recording may be copied and used by the author without further permission.

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

Please sign below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

Date:_________

Please print your name: ____________________________________________________

Please sign your name: ____________________________________________________

Thank you!
I appreciate your participation.
Appendix F – Group Test Protocol

Pre-study Questions
1. Can you briefly describe your most recent group project experience?
2. How would you rate that recent experience? (A to F)
3. What were the biggest challenges in your team work?
4. What were the positive aspects about working in groups?
5. What were the negative aspects about working in groups?

Post Interview Questions
1. What are your overall impressions of the app?
2. Name three words or characteristics that describe this app.
3. What are the three things you like best about Team Igniter?
4. What are the three things you like least about Team Igniter?
5. If you could make one significant change to this app, what change would you make?
6. Would you recommend Team Igniter to a colleague or friend?
7. Do you have any other questions or comments about the app or your experiences with it?
Appendix G – Individual Plan Protocol

Introduction

Thank you so much for volunteering to participate in this usability evaluation for my thesis. It should take around 30 minutes. You may also choose to stop doing the test at any time if you want. With your permission I would like to record this session for the purposes of this study only. I won’t share or disclose the recordings made. Could you please sign this consent form for me?

Background Questionnaire

Before having you look at the iPad app, I would like to ask a few simple questions:

1. What’s your major?
   a. What year are you?
2. Do you own an iPad?
   a. How often do you use it?
2. Have you ever used an iPad before?
3. When was the last time that you had to work on a group project?
   a. What was it for?
   b. What were the challenges your group faced in terms of collaboration?
   c. How did you overcome these challenges?

Acknowledgements

First of all, I would like to make it clear that I’m testing the application itself, not you. Also don’t worry about hurting my feelings, I need your honest feedback so I can improve it.

As we continue, I’m going to ask you to think out loud as you use the app, expressing your thoughts, questions and concerns as they come up. This will help me understand what’s going on in your mind.

Lastly, I would like to acknowledge some of the limitations of this app. It is actually just a prototype with several images that have hotspots simulating the interactions. Therefore, you won’t be able to actually type or change values. Still, I would like you to interact with it as you would normally do with a working app. Also, I’m going to ask you to avoid using the swipe gesture because it automatically skip screens and that might confuse you. So please just tap to navigate.

Pre-task

First, I would like you to go over the intro screens of this app and sign up for a new account. You can stop when you feel you have successfully logged in.

1. What do you think of this app so far?
2. What would say this app is about?
3. What can you do here?
Ok, so now I’m going to give you some tasks for you to do with the app:

**Task 1:** You would like to change the email you used to create your account.

**Task 2:** Imagine that you took an elective outside your major in an interdisciplinary class. Your first assignment was to do a group project. After forming the teams, your professor handed out one iPad per group and suggested that you used Team Igniter’s default process to guide your new project. He wants you to do some icebreaking in class using the app.

**Task 3:** After using Team Igniter for the first time, you thought you could improve one of their methods you used called Brainwriting. Make edits to this method and then send it to your team members.

**Task 4:** Another component of this toolkit are decks of cards that complement the methods that are presented by the app. For example, your team might be going over a method and it will instruct you to pick one of the decks like this one (show Creative Thinking deck) and use it. Now, imagine you want to create a new card that you would like to add to your Creative Thinking deck. After you make it, send it to your email so you can print it at home.

**Task 5:** After familiarizing with Team Igniter default methods, you want to create your own process methodology with a different set of methods. Make sure to test it in a new group project to see if it works well.

**Task 6:** One year after you did that group project in that interdisciplinary class, you wanted to contact one of your team members. Find the email of a person you have collaborated with.

**Post Questionnaire**

Now I would like you to fill these quick feedback forms about what you experienced here today. (Hand SUS form and post-questionnaire)

1. Name three words or characteristics that describe this app.
2. What are the three things you like best about Team Igniter?
3. What are the three things you like least about Team Igniter?
4. If you could make one significant change to this app, what change would you make?
5. Would you recommend Team Igniter to a colleague or friend? Why?

**Debrief**

Do you have any final questions or comments about the app? Thanks again for your participation.
### Appendix H — SUS Scores

**System Usability Scale**

<table>
<thead>
<tr>
<th>Please circle your immediate response to each item below</th>
<th>Strongly disagree</th>
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Appendix I — Post-Questionnaire Responses

Post Questionnaire

1. Name three words or characteristics that describe this app.
   - Interesting
   - Beneficial
   - Helpful

2. What are the three things you like best about Team Igniter?
   1. Can create your own process list/methodology to get a better interaction & feedback.
   2. Card system is interesting and a good approach.
   3. Tech - visual style is good & refreshing.

3. What are the three things you like least about Team Igniter?
   1. The microcopy library must be simplified and reduce the learning time for users.
   2. The "purr" button for one simple meaning is confusing.
   3. Some exam tab/scope could be simplified.
   4. If you could make one significant change to this app, what change would you make?
   1. I’d keep the current interaction, but something to reduce the learning time for people who use the app (first time).

5. Would you recommend Team Igniter to a colleague or friend? Why?
   - Yes, I think it has potential to make a better interaction and notworthy experience.
1. group project, methodology, ideas

2. find previous projects and people, see ideas of methods to use, timing some steps

3. create instructions for the new method, required information about number of sessions and time available (I don't know that yet), print cards at home

4. I would ask the professor to complete some informations, like available weeks/time. I would add a way to connect contact my team members.

5. Yes, it seems that it brings a lot of new ideas to the projects. It is easy to get team members in the same page.
Post Questionnaire

1. Name three words or characteristics that describe this app.
   
   Clean, easy-to-learn, great for inter-disciplinary work/group dynamics.

2. What are the three things you like best about Team Igniter?
   
   Great for determining group dynamics, very clean, colors are calm and not distracting.

3. What are the three things you like least about Team Igniter?
   
   A little wordy at the beginning, help icons hard to find, method screen has too many info all at once.

4. If you could make one significant change to this app, what change would you make?
   
   I don't think I would.

5. Would you recommend Team Igniter to a colleague or friend? Why?
   
   Yes, it could be useful for group settings and getting people competitive with one another.
Post Questionnaire

1. Name three words or characteristics that describe this app.
   - Visually appealing
   - Clean and neat
   - Consistent

2. What are the three things you like best about Team Igniter?
   - Icons design are really cool and fresh.
   - Home interface is simple and elegant.
   - Navigation bar is always on the bottom, which is clear and convenient.

3. What are the three things you like least about Team Igniter?
   - The icons for female and male look like restroom icons, which is cute but a little bit not suit with the serious topic of the app.

4. If you could make one significant change to this app, what change would you make?
   - Make profile photos clickable and show basic info of that person.

5. Would you recommend Team Igniter to a colleague or friend? Why?
   - Yes. It’s gonna save a lot of time for group project and it looks very trendy and neat.
Appendix J — Imagine RIT Survey Responses

Imagine RIT Feedback Survey

1 What are you?
   a) Student  b) Professor  c) Alumni  d) Visitor

2 How useful do you think Team Igniter toolkit would be for college students and faculty?
   a) Extremely useful  
   b) Very useful  
   c) Somewhat useful  
   d) Not so useful  
   e) Not at all useful

3 How visually appealing is the app?
   a) Extremely appealing  
   b) Very appealing  
   c) Somewhat appealing  
   d) Not so appealing  
   e) Not at all appealing

4 What words come to mind when you look at the app’s design?
   TECH, SCI, COOL

5 What do you like most about Team Igniter?
   COMBINATION APP & REAL OBJECT

6 What do you dislike most about Team Igniter?
   CARDS NEED MORE WEIGHT & DURABILITY

7 How satisfied are you with the app’s overall ease of use?
   a) Extremely satisfied  
   b) Very satisfied  
   c) Somewhat satisfied  
   d) Not so satisfied  
   e) Not at all satisfied

8 Do you have any other comments about how I can improve this concept?
Imagine RIT Feedback Survey

1 What are you?
   a) Student    b) Professor    c) Alumni    d) Visitor

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   d) Not so appealing
   e) Not at all appealing

4 What words come to mind when you look at the app’s design?

Looks very good, very professional - great

5 What do you like most about Team Igniter?

The process to help teams be more effective

6 What do you dislike most about Team Igniter?

Nothing

7 How satisfied are you with the app’s overall ease of use?
   a) Extremely satisfied
   b) Very satisfied
   c) Somewhat satisfied
   d) Not so satisfied
   e) Not at all satisfied

8 Do you have any other comments about how I can improve this concept?

The process can help teams to be more effective
In the future, team leaders to work better and
over time the issue of how to reach
Imagine RIT Feedback Survey

1. What are you?
   (a) Student,  (b) Professor,  (c) Alumni,  (d) Visitor

2. How useful do you think Team Igniter toolkit would be for college students and faculty?
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3. How visually appealing is the app?
   (a) Extremely appealing
   (b) Very appealing
   (c) Somewhat appealing
   (d) Not so appealing
   (e) Not at all appealing

4. What words come to mind when you look at the app's design?
   Technology, convergence

5. What do you like most about Team Igniter?
   Accru and resume post projects, have suggestions of methods

6. What do you dislike most about Team Igniter?
   Hard to predict how many hours we need for the project when we start
   out

7. How satisfied are you with the app's overall ease of use?
   (a) Extremely satisfied
   (b) Very satisfied
   (c) Somewhat satisfied
   (d) Not so satisfied
   (e) Not at all satisfied

8. Do you have any other comments about how I can improve this concept?
   Love the cards
Imagine RIT Feedback Survey

1. What are you?
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   c) Alumni
   d) Visitor

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3. How visually appealing is the app?
   a) Extremely appealing
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   e) Not at all appealing

4. What words come to mind when you look at the app's design?
   Simple & useful, consistent & simple

5. What do you like most about Team Igniter?
   The holistic approach to the design as well as the facilitation of design thinking & creativity

6. What do you dislike most about Team Igniter?
   You didn't include me 😞

7. How satisfied are you with the app's overall ease of use?
   a) Extremely satisfied
   b) Very satisfied
   c) Somewhat satisfied
   d) Not so satisfied
   e) Not at all satisfied

8. Do you have any other comments about how I can improve this concept?
   Add meshes' profile 😊
Imagine Rit Feedback Survey

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   d) Not so appealing
   e) Not at all appealing

4 What words come to mind when you look at the app's design?
   TECHIE, SYSTEMIC

5 What do you like most about Team Igniter?
   GREAT IDEA, NEED DEFINITELY A NEED

6 What do you dislike most about Team Igniter?
   MIGHT BE A LITTLE TOO SCRIPTED, CAN YOU NOT DO THE TASKS IN AN EXACT ORDER?

7 How satisfied are you with the app's overall ease of use?
   a) Extremely satisfied
   b) Very satisfied
   c) Somewhat satisfied
   d) Not so satisfied
   e) Not at all satisfied

8 Do you have any other comments about how I can improve this concept?
   MAYBE MAKE THE INTERFACE A LITTLE FRIENDLY, BUT THIS IS JUST AN AESTHETIC ISSUE.
Imagine RIT Feedback Survey

1. What are you?
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3. How visually appealing is the app?
   (a) Extremely appealing  (b) Very appealing  (c) Somewhat appealing  (d) Not so appealing  (e) Not at all appealing

4. What words come to mind when you look at the app's design?
   clean, simple, well designed

5. What do you like most about Team Igniter?
   Collaboration among individuals, use of an app and cards

6. What do you dislike most about Team Igniter?

7. How satisfied are you with the app's overall ease of use?
   (a) Extremely satisfied  (b) Very satisfied  (c) Somewhat satisfied  (d) Not so satisfied  (e) Not at all satisfied

8. Do you have any other comments about how I can improve this concept?


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   (c) Somewhat appealing
   (d) Not so appealing
   (e) Not at all appealing

4 What words come to mind when you look at the app’s design?
   Edgy, hip, bright, catchy

5 What do you like most about Team Igniter?
   The idea, how it facilitates teams, ideas, innovation.

6 What do you dislike most about Team Igniter?
   Vinicius Hakei 3K.

7 How satisfied are you with the app’s overall ease of use?
   (a) Extremely satisfied
   (b) Very satisfied
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8 Do you have any other comments about how I can improve this concept?
   None.
Imagine RIT Feedback Survey

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4 What words come to mind when you look at the app’s design?  
(game, board, interactive, group collaboration, challenge)

5 What do you like most about Team Igniter?  
I like that it addresses a complicated issue (group collaboration) with innovative and relevant research on group collaboration, and the cognitive nature of creativity.

6 What do you dislike most about Team Igniter?  
Some groups might want to be part of the tool, but not the entire method would benefit from a quick-start version.

7 How satisfied are you with the app’s overall ease of use?  
(a) Extremely satisfied  
(b) Very satisfied  
(c) Somewhat satisfied  
(d) Not so satisfied  
(e) Not at all satisfied

8 Do you have any other comments about how I can improve this concept?  
Ease people in who are unfamiliar with the process with a progress bar and overview.
Imagine RIT Feedback Survey

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4. What words come to mind when you look at the app’s design?
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5. What do you like most about Team Igniter?
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6. What do you dislike most about Team Igniter?
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Imagine RIT Feedback Survey

1. What are you?  
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   b) Professor  
   c) Alumni  
   d) Visitor  

2. How useful do you think Team Igniter toolkit would be for college students and faculty?  
   a) Extremely useful  
   b) Very useful  
   c) Somewhat useful  
   d) Not so useful  
   e) Not at all useful  

3. How visually appealing is the app?  
   a) Extremely appealing  
   b) Very appealing  
   c) Somewhat appealing  
   d) Not so appealing  
   e) Not at all appealing  

4. What words come to mind when you look at the app’s design?  
   
5. What do you like most about Team Igniter?  
   the tactile aspect + the app.  

6. What do you dislike most about Team Igniter?  
   It’s a great idea  

7. How satisfied are you with the app’s overall ease of use?  
   a) Extremely satisfied  
   b) Very satisfied  
   c) Somewhat satisfied  
   d) Not so satisfied  
   e) Not at all satisfied  

8. Do you have any other comments about how I can improve this concept?  
   More of a tutorial
   Excellent!
Imagine RIT Feedback Survey

1 What are you?
   a) Student
   b) Professor
   c) Alumni
   d) Visitor

2 How useful do you think Team Igniter toolkit would be for college students and faculty?
   a) Extremely useful
   b) Very useful
   c) Somewhat useful
   d) Not so useful
   e) Not at all useful

3 How visually appealing is the app?
   a) Extremely appealing
   b) Very appealing
   c) Somewhat appealing
   d) Not so appealing
   e) Not at all appealing

4 What words come to mind when you look at the app’s design?
   clear, effective

5 What do you like most about Team Igniter?
   The project setup

6 What do you dislike most about Team Igniter?
   Add warm color instead of all of the gray and green. I like all of them.

7 How satisfied are you with the app’s overall ease of use?
   a) Extremely satisfied
   b) Very satisfied
   c) Somewhat satisfied
   d) Not so satisfied
   e) Not at all satisfied

8 Do you have any other comments about how I can improve this concept?
   Only the color combination
Imagine RIT Feedback Survey

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4. What words come to mind when you look at the app's design?
   ______________________

5. What do you like most about Team Igniter?
   ______________________

6. What do you dislike most about Team Igniter?
   ______________________

7. How satisfied are you with the app's overall ease of use?
   a) Extremely satisfied
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8. Do you have any other comments about how I can improve this concept?
   ______________________
Imagine RIT **Feedback Survey**

1. **What are you?**
   a) Student  
   b) Professor  
   c) Alumni  
   d) Visitor

2. **How useful do you think Team Igniter toolkit would be for college students and faculty?**
   a) Extremely useful  
   b) Very useful  
   c) Somewhat useful  
   d) Not so useful  
   e) Not at all useful

3. **How visually appealing is the app?**
   a) Extremely appealing  
   b) Very appealing  
   c) Somewhat appealing  
   d) Not so appealing  
   e) Not at all appealing

4. **What words come to mind when you look at the app's design?**
   Professional  Chic  Fashion  Organized

5. **What do you like most about Team Igniter?**
   User friendly  Useful

6. **What do you dislike most about Team Igniter?**
   Some tasks burdensome  Too many features to follow

7. **How satisfied are you with the app's overall ease of use?**
   a) Extremely satisfied  
   b) Very satisfied  
   c) Somewhat satisfied  
   d) Not so satisfied  
   e) Not at all satisfied

8. **Do you have any other comments about how I can improve this concept?**
   Sell it on  elsewhere

Imagine RIT Feedback Survey

1 What are you?
   a) Student  b) Professor  c) Alumni  d) Visitor

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   __________________________

5 What do you like most about Team Igniter?
   __________________________

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   __________________________

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8 Do you have any other comments about how I can improve this concept?
   __________________________
   __________________________
   __________________________
Imagine RIT Feedback Survey

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   a) Student  b) Professor  c) Alumni  d) Visitor

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   a) Extremely useful  b) Very useful  c) Somewhat useful  d) Not so useful  e) Not at all useful

3. How visually appealing is the app?
   a) Extremely appealing  b) Very appealing  c) Somewhat appealing  d) Not so appealing  e) Not at all appealing

4. What words come to mind when you look at the app’s design?
   MODERN SLEEK INNOVATIVE

5. What do you like most about Team Igniter?
   LOTS OF RESEARCH INTO INNOVATIVE THINKING AND CREATIVITY

6. What do you dislike most about Team Igniter?

7. How satisfied are you with the app’s overall ease of use?
   a) Extremely satisfied  b) Very satisfied  c) Somewhat satisfied  d) Not so satisfied  e) Not at all satisfied

8. Do you have any other comments about how I can improve this concept?
   DON’T GIVE IT AWAY!
Bibliography

Books


Books


Online Articles


Online Articles


Journal Articles


**Journal Articles**


**Websites**


**Websites**
