An Implementation of Innovative Thinking in The Entrepreneurship Curriculum for Engineers

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An Implementation of Continuous Improvement in Instilling Innovative Thinking in The Entrepreneurship Curriculum for Engineers

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Entrepreneurship is increasingly being recognized as an important part of engineering education. However, it is also seen that establishing of a traditional business plan that was taught to engineers, is not considered as "the cutting edge" of doing entrepreneurship. Despite the business plan being a core element of most engineering entrepreneurship curricula, there are new concepts in entrepreneurship such as "The Lean Startup" which are being increasingly talked about. Along these lines, the faculty in The College of Engineering and Computer Science at California State University, Northridge are working with industry leaders and professionals to continuously improve the entrepreneurship curriculum being taught to the engineers of today & tomorrow.

One of the challenges that engineers have is to think outside the box and be innovative. As part of this effort to instill innovation and creative thinking in engineers as well as update the entrepreneurship curriculum, the authors have implemented various topics on innovative thinking into the curriculum. These topics include Lateral Thinking as well as 6 Thinking Hats Applications. These topics were included in the Fall 2013 entrepreneurship syllabus and have received positive feedback from the students. In this paper, the authors will talk about what aspects were included in the curriculum and how they can provide value by being included in the curriculum.

Introduction

With only approximately 8% of the engineering workforce, The United States finds it a challenge to compete with other countries like India and China who produce engineers in much larger quantities. Hence, in recent years the aim of American Universities and training programs has been to produce higher quality engineers who can bring better value to US organizations by being innovative and creative (Duderstadt, 2008). In line with this realization, there is an increased focus at US universities to offer entrepreneurship to the engineering majors. Universities have also realized that engineering students who take part in entrepreneurship programs gain insights not available from traditional engineering education such as understanding business basics and solving open ended problems (Epicenter, 2013). According to Professor Sheri Sheppard, a principal investigator at The Epicenter, this is crucial as today's engineers must possess an entrepreneurial mindset in order to be the innovators of tomorrow and keep America competitive in the global market.

Realizing the increasing importance of entrepreneurship for engineers, there is also a new field called “entrepreneurial engineering,” which is being offered by schools which are in the initial stages of offering entrepreneurship related courses to their engineering majors. Entrepreneurial Engineering can be considered as a subset of the more general field of entrepreneurship. While including the basic skills and knowledge required for successful entrepreneurship, entrepreneurial engineering focuses primarily on generating technology based opportunities and the particular challenges of effectively identifying, acquiring, developing and transferring technology into viable new products and services (Polczynski & Jaskolski, 2005). Due to this increase in focus on Entrepreneurial Engineering, at the upcoming 2014 International Annual Conference of The American Society of Engineering Management (ASEM), the theme of the conference is going to be “Entrepreneurship Engineering.”

Entrepreneurship is the process of creating or seizing an opportunity and pursuing it regardless of the resources currently controlled. It includes the willingness to take risks and develop, organize and manage a business venture in a competitive global marketplace that is increasingly dynamic (Bainbridge Graduate Institute, 2014). Entrepreneurship is also widely known to be good for economic activity and is considered to be a significant creator of new jobs (Acs, 2006). Entrepreneurship is primarily associated with innovative and change-oriented behavior (Davidsson, 2004). The end goal for any entrepreneur would be to come up with an innovative idea that gives him/her a competitive advantage which would enable him/her to create a business venture by virtue of providing value to a customer, by meeting a currently unmet need.

As part of California State University’s overall focus on Entrepreneurship, The College of Engineering and Computer Science at California State University, Northridge (CSUN) is also increasing its focus on entrepreneurship. Currently as part of their Master’s program in Engineering Management, a course on entrepreneurship and innovation management is mandatory for all students. The authors of this paper taught this course in Fall 2012 and Fall 2013.

The primary learning objectives of this course in Fall 2012 were:

(i) Understanding how to put together a business plan
(ii) Getting an in-depth analysis of identifying a target market
(iii) Evaluating intellectual property related to their project
(iv) Applying engineering economy concepts such as Rate of Return, Payback period, Sensitivity Analysis and Breakeven point.

Keeping in mind the philosophy of continuous improvement at CSUN, the faculty who has taught this course in Fall 2012, took student feedback into consideration, as well as talked to industry professionals who had experience in the entrepreneurship and innovation domain about improvements that could be made into the course syllabus that would help enhance entrepreneurship amongst engineering students. These suggestions were incorporated into the

revised syllabus of the entrepreneurship course in Fall 2013 and resulted in the course learning objectives being revised as well as new topics being added to the syllabus. The new topics introduced into the entrepreneurship curriculum in Fall 2013 included:

(a) Parallel Thinking
(b) Lateral Thinking
(c) Diversity of Thinking

The revised course learning objectives when the course was taught in Fall 2013 were as follows:

(i) Detailed understanding of sections involved in putting together a business plan
(ii) Getting an in-depth analysis of identifying and understanding the target market
(iii) Evaluating the intellectual property associated with their product and also the worth the IP associated with the product
(iv) Understanding of how the IP can increase the value of your company as part of your exit plan
(v) Comprehending what a lean startup is and its relevance to entrepreneurship in the 21st century
(vi) Helping the students think creatively and critically.

Each one of the new topics introduced in the course in Fall 2013 will be discussed in detail below:

Parallel Thinking

For many teams the need to "Think Together" becomes essential to working together to create new ideas, which is extremely important for innovation to occur. Traditional thinking, also called western thinking is based many times on analysis and argument. This thinking or method was developed by the "Greek Gang of Three", (de Bono, 1994, p. 2); Socrates, Plato, and Aristotle as a thinking system based on a single truth sought out by debate and defending your position. This dialectic thinking style is based on defending a current position or mindset rather than a collaborative perspective.

Parallel thinking is based on collaborative thinking where a group or team can explore a subject, discussion or create new ideas together exploring the natural synergy of multiple viewpoints. The *Six-Thinking Hats* method of parallel thinking, published by Edward de Bono in 1985 illustrates a style of parallel thinking where you are able to "separate ego from performance" (de Bono, 1993, p. 82) by organizing your thinking modes or cognitive styles into one of six imaginary metaphoric "hat" colors that are used to signal a specific thinking style.

By separating out different aspects of thinking the teams of students can engage in what is called "Full Color Thinking." This is represented by the predefined objectives and descriptions of the six unique colored hats:

- White Hat – information that is neutral and objective, facts and figures
- Red Hat – feelings, emotion, intuition and gut feelings
- Black Hat – logical negative, what could go wrong or be a risk
- Yellow Hat – logical positive, what are the advantages or benefits
- Green Hat – creativity, new ideas, concepts and perceptions
- Blue Hat – control hat that is responsible for thinking about the thinking

By switching modes of thinking where all the team members are thinking together they can establish a discipline of timed and focused directional thinking. Everyone thinking deliberately in a pre-defined thinking mode and switching thinking at the appropriate time allows the team members to create a thinking culture of exploration and discipline. This segregated thinking method and toolset allows teams and individuals to work together by thinking in parallel. The focused sequencing of these thinking styles can prevent adversarial dialog and create an opportunity for the brain to "Maximize its sensitivity in different directions at different times" (de Bono, 1985, p. 1).

Western Thinking is concerned with "what is" versus designing forward from parallel possibilities to create "what can be". Traditional thinking is also based on rock logic where you establish dichotomies and contradictions to force a choice based on search and discovery. De Bono's Six Thinking Hats uses the concept of water logic which flows to accept possibilities embracing both sides of a contradiction to design a way forward for everyone. Parallel Thinking is a practical system of thinking where you can lay ideas, concepts or opinions about a subject down next to each other without any clash, dispute, or initial arrogant true/false judgments being created. This Parallel Thinking collaborative directed behavior of the human brain allows the individuals on the team to be powerfully creative.

Lateral Thinking

Lateral Thinking is a systemic approach to creative thinking that employs formal techniques based directly of the patterning behavior of the human brain. The popular tool was developed in 1967 by Edward de Bono and is a deliberate process where the mind is used in a different way focusing on restructuring, escape and provocation of new patterns. The toolset is concerned with the development and generation of new ideas by breaking the attitude and approach of other creativity tools.

The Lateral Thinking tools are to be used in a parallel thinking mindset where the "Green Hat" (de Bono, 1985, pp. 116-144) helps to create a micro culture of creativity. Within this micro culture there are specific rules, guidelines, and objectives for the participants. Traditional "Black Hat" (de Bono, 1985, pp. 71-87) thinking is put to the side because of its connections to statements such as; That will never work - We tried that before and it failed - That's a stupid idea – We don't have the time, money, or resources to make that happen.

When working with the lateral thinking tools you focus on the actions of a child by asking "Why" over and over to clearly understand the problem or area new ideas are required in. Then through the use of a "movement technique" (de Bono, 1993, pp. 151-162) you allow the participant to be positive, playful, and prolific where there are no wrong or stupid answers or ideas.

The Lateral Thinking process starts with the Focus (need) statement, and then moves to an idea creating a provocation or movement technique. After the ideas are created it allows a harvesting, sorting, organizing, and affinitization series of process steps. Within the Lateral Thinking process there are idea creating tools that can easily be used for both product development (Random Entry) and process development (Challenge).

"PO" (de Bono, 1970, pp. 226-262), or more popularly identified as Provocation's are a arising collection of idea creating techniques that can be spontaneously created as an Escape, Reversal, Wishful thinking, or Exaggeration. This is in strong contrast to our normal thinking habits and is a logical necessity in any self-organizing system. The lateral thinking tools include:

- Focus – A "Purpose" focus (de Bono, 1993, p. 96) is used to identify the *WHY* required for a new idea(s). It is very directed and deliberate. An "Area" focus (de Bono, 1993, p. 95) is used to identify a more general *WHERE* area or subject that are required for a new idea(s).

- Random Entry – You identify a random item or word which is then identify 4-5 associations to that are related. That related association is verbally stated against the original focus or problem statement and the participants are asked how you can use that association to create a new idea.

- Challenge – A process is analyzed with three "timed" challenges to the steps. Cut C (removed what is not needed or wrong), Cut B (step is justified because…) and Cut A (new alternatives)

- Provocation (PO) – You move through the existing idea patterning mindset and set up a "stepping-stone" to help open a new pathway.

The effectiveness of the Lateral Thinking toolset comes from three main creativity objectives for Timing, Discipline, and Technique. Each of the tools is used in a predefined timed session that can be extended if required but if the idea creating session is planned for 15 minutes the team members would use the tool no matter what the results are. There is a discipline of following a predefined process and series of steps. The more proficient they become with the steps the more effective and efficient they can become with the Lateral Thinking tools.

The combination of these three required objectives allows participants to create new and unique ideas. There is no right order for which idea creating tool must be used and if one tool is not working you should move on and use another idea generating tool.

Diversity of Thinking

To understand the concept of the "Diversity of Thinking", requires the creation of a clear operational definition with clarity of two key terms and themes. The first is the term *Diversity* and its meaning for academic, organizational and enterprise environments. Diversity is the inclusion of different types of people (as people of different backgrounds, races or cultures) in a course, group or organization. The second term is *Thinking* and its meaning in the context of creativity and innovation. Thinking is the cognitive process and action of using your mind to produce new ideas, decisions, patterns and connections.

In an academic environment when we discuss diversity it is linked to the significance of multiple perspectives and experiences that the students bring to the classroom establishing a unique "community of practice" (Wenger, 1998, p. 6) when they interact as a team or group. This heterogeneous team or group contains students that may typically include:

- Different majors or disciplines
- Different student levels (i.e. freshman, sophomore, junior or senior)
- Different program representation (i.e. graduate or masters)
- Different ages ranging from 18-40
- Different genders including male and female
- Different ethnic or cultural backgrounds
- Different levels of professional experience

When working in a team or group, the team members surround yourself with other individuals that will look at problems through a different lens, perspective, paradigm, or mental model. But all team members have common objectives that typically include:

- Class assignments and goals
- A desire to learn
- A desire to succeed in the class
- A willingness to work together if required

This structured composition of students is usually temporary and only intact for the duration of a single course session. The students engage in a "Norming" (Tuckman, 1965) process over a period of time but their thinking styles and thinking preferences stay the same. These brain modality thinking preferences and styles can be broken into four separate categories:

- ***Concrete Sequential*** (left brained) – thinkers notice and recall details easily, need to organize tasks into step-by-step processes, and strive for perfection.
- ***Abstract Sequential*** (left brained) – thinkers like to think in concepts and analyze the information.

- ***Abstract Random*** (right brained) – thinkers organize information through reflection and thrive on unstructured, people oriented environments.
- ***Concrete Random*** (right brained) – thinkers are based in reality and have an experimental attitude.

This basic but flawed brain modality model has been used to describe learning styles and separations by many authors but most agree there is a flow between these styles and that everyone's thinking contains some level of all four descriptions. A higher or lower natural thinking preference will exist in everyone in each of the categories. This is what makes everyone unique and different in their natural thinking styles.

Thinking styles are a reference to describe the way individuals think, perceive and remember information. Additionally it is a key to determining if a person is naturally creative or if they will require focused thinking. Thinking styles can describe if a person is left brained, right brained, upper brained cognitive or lower brained visceral dominant (Herrmann, 1996, p. 23). Many times diversity of thinking (Woods, 2008) is not recognized or embraced because our natural tendency is to embrace and connect with people that share our views. It can be irritating, disturbing and disruptive to surround yourself with individuals that are opposite of you. It's also challenging to participate in a team that has members containing unique and different perspectives.

In a class or academic environment where students are challenged to use creativity and innovation tools and thinking methods to complete assignments, this may also require them to work in a team or group structure. Within this academic team structure, diversity of thinking is required to create new ideas or concepts. Many times creating a mini culture of creativity where this diversity of thinking can be used is not a positive experience for participants. The use of a thinking tool like parallel thinking (De Bono, 1994) can allow people to separate and direct their thinking into specific thinking modes. Utilizing these parallel thinking modes can allow students and teams to create a micro-culture creativity where they can use lateral thinking (De Bono, 1970) tools to effectively create new and unique ideas.

Survey Development for Data Collection of Student Learning Quantification

The above topics were taught to the students through guest lectures by industry professionals who have been involved in entrepreneurship in their organizations for over 2 decades. The lectures were very well received by the students, but the instructor wanted to attempt to quantify the learning by the students from the guest lectures that were conducted. For this purpose, a survey was designed and distributed to the students in the entrepreneurship and innovation management class. The survey is attached as an Appendix (Appendix A) at the end of this paper. The survey was distributed to the 32 students in the class on the day of their final presentation and the authors received a 100% response rate. Some of the statistical assumptions are as follows:

(a) The survey questions were graded on a 1-10 point scale where responses were interpreted as follows:
(10-9) = Very strongly helped the students develop concepts that provided a

positive assistance towards their final project & overall learning of entrepreneurship.
(8) = strongly helped
(6-7) = did help
(0-6) = did not help

(b) A "positive score" is indicated by a response graded at 7.0 or higher, a negative score was indicated by a score of 5.9 or lower.
(c) No outliers were identified in the date so all responses were seen as valid
(d) Any responses of N/A were not provided in the results
(e) All data and results were reviewed by Dale S. Deardorff and another unbiased person to make sure the interpretations were valid and acceptable.

Survey Data Analysis

The questions provided to the students to judge the effectiveness of the new topics introduced into the entrepreneurship class were evaluated individually and the data was analyzed as follows:

Q1 – How much did the "***innovation process***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.72) indicated that the innovation process did help the students in putting together their final project and their overall learning of entrepreneurship. Twenty four out of thirty two students (75%) also provided a positive response to an innovation process helping them put together the final project and contribute to their overall learning of entrepreneurship.

Q2 – How much did "***parallel thinking***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.78) indicated that parallel thinking did help the students in putting together their final project and their overall learning of entrepreneurship. Twenty six out of thirty two students (over 75%) also provided a positive response to parallel thinking helping them put together the final project and contribute to their overall learning of entrepreneurship.

Q3 – How much did the "***Blue Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.19) indicated that the Blue Hat thinking did help the students in putting together their final project and their overall learning of entrepreneurship. Nineteen out of thirty two students (over 50%) also provided a positive response to the Blue Hat thinking helping them put together the final project and contribute to their overall learning of

entrepreneurship. Additionally this means that over half of the class found that "Thinking about the Thinking" required was beneficial

Q4 – How much did the "***White Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (8.22) indicated that the White Hat thinking strongly helped the students in putting together their final project and their overall learning of entrepreneurship. Twenty six out of thirty two students (over 75%) also provided a positive response to the White Hat thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over 3/4 of the class found that developing basic, neutral information about what they know and understanding what they need to know was beneficial.

Q5 – How much did the "***Black Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.66) indicated that the Black Hat thinking did help the students in putting together their final project and their overall learning of entrepreneurship. Twenty three out of thirty two students (over 50%) also provided a positive response to the Black Hat thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over half of the class found that developing and understanding of the logical negative risks and what could go wrong was beneficial.

Q6 – How much did the "***Yellow Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.91) indicated that the Yellow Hat thinking did help the students in putting together their final project and their overall learning of entrepreneurship. Twenty six out of thirty two students (over 75%) also provided a positive response to the Yellow Hat thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over 3/4 of the class found that developing and understanding the logical positive benefits and advantages was beneficial.

Q7 – How much did the "***Red Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (6.69) indicated that the Red Hat thinking did not help the students in putting together their final project and their overall learning of entrepreneurship. Nineteen out of thirty two students (over 50%) also provided a negative response to the Red Hat thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over half of the class found that separation of thinking based on feelings and emotions were not beneficial.

Q8 – How much did the "***Green Hat***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (8.13) indicated that Green Hat thinking strongly helped the students in putting together their final project and their overall learning of entrepreneurship. Twenty six out of thirty two students (over 75%) also provided a positive response to Green Hat thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over 3/4 of the class found that developing a micro-culture of creativity to create new and unique ideas was beneficial.

Q9 – How much did "***Lateral Thinking***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (7.22) indicated that Lateral Thinking did help the students in putting together their final project and their overall learning of entrepreneurship. Twenty of thirty two students (over 50%) also provided a positive response to Lateral Thinking helping them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over half the class found that lateral thinking creativity tools such as random word, challenge and PO (Provocation) were beneficial.

Q10 – How much did "***Diversity of Thought***" help you in putting together your final project and with your overall learning of entrepreneurship?

The participant's average response (8.25) indicated that Diversity of thought strongly helped the students in putting together their final project and their overall learning of entrepreneurship. Twenty six of thirty two students (over 75%) also provided a positive response to Diversity of thought helped them put together the final project and contribute to their overall learning of entrepreneurship. Additionally this means that over 3/4 of the class found that Diversity of thought where using the thinking from everyone was beneficial.

Q11 – Which other concepts discussed in MSE 602 were useful to you?

The various other concepts discussed in MSE 602 that the students said were useful to them were: SWOT analysis, Sustainability, Target Market, 6-Thinking Hats, Intellectual property, Customer segmentation, Pricing strategies, Scenario analysis, 5P's of marketing, Exit plan, Risk analysis, Risk management, financial aspects of business, MVP, viewpoint of the VC, Elevator pitch, Brainstorming sessions, LEAN, CTQ, Customer demographics and Corporate social responsibility.

Q12 –What other entrepreneurial tools did you use for your project?

Most of the students responded that they used the excel file that was provided to them by the professor of the entrepreneurship class. This excel file required them to do research for several inputs, which would help them decide what the RoI was and to judge about the overall economic stability of the model.

Q13 -- What other entrepreneurial tools would have been beneficial to implement into your project and to enhance your understanding of entrepreneurship and innovation?

For this question the response rate was low. Out of the 32 students who took the survey, only 6-7 completed this question. Student responses included more applications of 6 hats for a clearer understanding of how to apply it, more emphasis on marketing tools and more of a focus on scenario analysis. More discussion about the 6-Thinking hats general model, group discussions and brainstorming techniques would be beneficial. Additional discussions about financing, marketing, risk management and sensitivity analysis would increase the students understanding. Finally, the opportunity to have an entrepreneur come in and engage in discussion with the class participants to explain how they became successful.

Q14 – Was the 6-Thinking Hats valuable to your learning experience?

Answer [n=28]: (Only 28 students responded to this question)

Twenty seven out of twenty eight respondents (96%) answered “Yes” and explained that it was useful in organizing and categorizing their thinking. Running a pro/con Yellow Hat/Black Hat sequence provided the opportunity to cover their thinking from different angles or viewpoints and perspectives. It was described that a structured way of “thinking about the thinking” opened new dimensions where they could “jump start an idea” and evaluate if the project was worth going ahead and proceeding further. It was seen as a systematic approach that allowed them to organize their thoughts, consider risks and gather information.

Q 15 – Was Lateral Thinking valuable to your learning experience?

Answer [n=28]:

Twenty five out of twenty eight respondents (89%) answered “Yes” and explained that systemic tools that enable creativity were valuable in establishing a framework to generate and control innovative projects. They explained that the lateral thinking tools allowed them to focus in each aspect singularly to become creative. They started to have “cool ideas” and it helped to improve problem solving and looking at problems from a perspective or different point-of-view. The lateral thinking tools were also seen as a way to work together to be creative instead of working against each other when creating ideas.

Conclusions and Recommendations:

Based on the analysis of the data collected from the survey conducted in class, the following recommendations are being made by the authors:

(a) The topic of 6 hats was extremely beneficial to the students in thinking of new ideas. Considering that this was the primary reason that the new topics were introduced into the syllabus, i.e., to help students come up with innovative ideas, the topic worked well and will be kept as part of the syllabus for future semesters when the course is taught.
(b) The shortcoming identified was that there should have been clearer instructions as to how to incorporate the 6 hats thinking into the project. This semester only about 50% of the students showed that they understood how to actually apply 6 Hats Thinking to their projects. To address this issue, in future semesters the projects should have a clearly defined section asking the students to explain their thought process regarding 6 Hats Thinking.
(c) The majority of the students understood what lateral thinking was but they did not grasp about how to actually apply or implement it as there wasn't a dedicated part of the project or exercise after the guest lecture to emphasize on this topic. This should be rectified in future semesters so that students can grasp this skill. Ideally, there should be HW assignments provided to the students after the topic is discussed so that they can grasp the skills and then be aware of how to apply it to their project.

Other schools should also implement a similar approach of continuous improvement to their entrepreneurship curriculum. Engineering students have to be exposed more to topics such as creative thinking and innovation and then understand how to convert these ideas to a business venture, as this is a field in which they typically lack expertise. Engineering majors typically focus primarily on learning the technical aspect of their project but are now increasingly realizing that understanding the overall picture to start a new business venture by virtue of their new development is the way to really reap the benefits of their intellectual property.

Lastly, it is important for academics to realize that a great way to "teach" entrepreneurship is by bringing entrepreneurs from industry to talk about their experiences so the students can see actual applications of what they learn in class. This higher level of collaboration between academia and industry is absolutely necessary in many engineering fields, including entrepreneurship engineering. For this purpose, universities should work increasing with their alumni office and also with the tech transfer office on campus.

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Appendix A

Survey for Continuous Improvement of MSE 602 (Entrepreneurship & Innovation Management)

Introduction:

As part of your MSE 602 class, at the start of the Fall 2013 semester, Dr. Dale Deardorff did a guest lecture on 6 Hats Thinking and Lateral Thinking. Based on that lecture, we would like to gather some feedback from the students so that we can work on continuously improving the MSE 602 class experience for future semesters when it is taught.

1. How much did each of the following concepts help you in putting together the final project and with your overall learning of entrepreneurship? Please use the following metrics and circle one option for each concept:

1 – 2 → Hardly used by the team
3 – 5 → Used by the team sometimes
6 – 8 →Used by the team much of the time
9 – 10 → Used all the time by the team

(a) The innovation process – A series of steps that show a front to back system of steps including the steps for creativity and new ideas

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(b) Parallel Thinking -- structured thinking broken down into specific desired thinking modes

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(c) Blue Hat -- Thinking about the thinking, the agenda for which thinking modes you want to use

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(d) White Hat – Neutral information and just the facts; no bias or spin

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(e) Black Hat – Logical Negative, Identify risks or negative features in a system

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(f) Yellow Hat -- Logical positive, identify the benefits or positive features in a system

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(g) Red Hat -- used for getting feelings to the surface, can be used for decision making and includes intuition

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(h) Green Hat -- creates a micro culture of creative thinking where you can use any creativity tool to create new ideas

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(i) Lateral Thinking Tools -- they are systemic and processed based innovation and creativity tools and methods

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

(j) Diversity of Thought -- working together as a small team or community of practice creating ideas by the use of collective synergy

Didn't use at all 1 2 3 4 5 6 7 8 9 10 Used completely

2. Which other concepts discussed in MSE 602 were beneficial to you? Please list and describe them in the space provided below

3. What other entrepreneurial tools did you use for your project?

4. What other entrepreneurial tools would have been beneficial to implement into your project and to enhance your understanding of entrepreneurship and innovation?

OPTIONAL INFORMATION: (If you would like the instructor to follow up with you about the feedback provided)
Name & Email:

Q5 -- Was the 6-Thinking Hats valuable to your learning experience? Please explain why you have said Yes/No

Q6 -- Was Lateral Thinking valuable to your learning experience? Please explain why or why not?