THE IMPACT OF IMPROVISATION TRAINING IN ARTS ENTREPRENEURSHIP EDUCATION ON CREATIVE CAPACITIES

Monika Herzig, Jam Music Lab Private University, Vienna
Stan Renard, The University of Oklahoma

ABSTRACT

This research investigated the impact and effectiveness of sustained improvisation training. Improvisational skills are critical for identifying problems and entrepreneurial success and have been recognized as valuable tools for managing turbulence and change within organizational contexts. Notably, there is a strong connection between high scores on creativity assessments and entrepreneurial intentions, and it is widely acknowledged that creativity can be both cultivated and assessed. This research revealed that participants experienced a significant increase in their creative capacities by the addition of regular improvisation exercises in the Arts Entrepreneurship classroom and shares recommendations for effective teaching strategies.

Keywords- Improvisation Training, Creative Capacity, Jam Session Model, Ordinal Data, Wilcoxon, Arts Entrepreneurship, Measuring Creativity.

INTRODUCTION

Entrepreneurship education is a relatively new addition to academia often traced to early courses taught at Harvard in 1947. However, Kuratko (2005) dated the serious beginnings of Entrepreneurship Education as 1971 with the launch of the first Masters of Business Administration (MBA) concentration in Entrepreneurship at the University of Southern California. The field has grown rapidly to more than 2,200 courses at 1,600 schools in 2005. Callander (2019) argued that making Art is a form of Entrepreneurship and positions Arts Entrepreneurship within the field of art creation rather than the frequent utilitarian perception as a promotional tool alongside the Arts. Similarly, White (2021) defines Arts Entrepreneurship as "the systematic practice of art innovation, art market creation, and art value exchange". Parallel to the growth of entrepreneurship education programs, there has been a significant increase in arts entrepreneurship offerings over the past decades with an estimated 168 institutions and 372 offering arts entrepreneurship courses in the US alone (Essig & Guevara, 2016). However, research on content and effectiveness of curricula is still in its infancy. Furthermore, Levie (1999, p.4) observed a focus on teaching about entrepreneurship through formal lessons with little focus on practical exercises. It seems there is not even a clear definition of the term arts entrepreneurship and arts entrepreneur (Essig, 2017). However, Collins et al., (2006) identified a set of traits held by successful innovators and entrepreneurs. They all displayed vision, creativity, intuitive decision-making, creative problem-solving, risk-taking and the ability to learn from their mistakes.

Citation Information: Herzig, M & Renard, S (2024). The impact of improvisation training in arts entrepreneurship education on creative capacities. *Journal of Entrepreneurship Education, 27*(S4),1-33**.**

Furthermore, Keith Sawyer [2003a] attributed entrepreneurial success to a problem-finding approach rather than problem-solving techniques. He defined the problem-finding approach as the process of searching for interesting problems in an improvisatory manner rather than starting with a detailed plan and then working towards successful completion. Similarly, entrepreneurship curricula promote the concept of a growth mindset defined as the belief that personal characteristics, such as intellectual abilities, can be developed. This belief is opposite to a fixed mindset assuming that abilities are set traits and unchangeable (Dweck, 1999; Dweck & Leggett, 1988; Yeager & Dweck, 2012).

The jazz metaphor as a tool to develop improvisational capacities and an entrepreneurial mindset is a frequent topic in the entrepreneurship literature (Barrett 1998; Hatch 1999; Lewin 1998; Weick 1998; Diasio 2016; Eisenhardt 1997; Kamoche & Kunha 2001; Walzer & Salcher 2003; Zack 2000). Duxbury (2014) identified improvisation in organizations as a coping alternative in situations of extreme change and turbulence. During the process of improvisation, decisions need to be made quickly and intuitively, drawing from a person's emotions, values, insights, creativity, and imagination. Groves & Vance (2015) identified these traits as components of non-linear thinking in contrast to drawing on external data and facts processed through analysis and logic or linear thinking. Improvisational skills in the sense of Groves & Vances, 2015 definition of non-linear thinking may be drawn from art forms that regularly engage in such behavior, i.e. jazz or improvisational theater, and capacity for improvisation can be trained. Limb & Braun (2008) provided evidence that certain parts of the brain get activated through improvisational activity, a process that can improve through deliberate practice.

All traits identified previously in successful innovators (Collins et al.,2006) are integral to the process of improvisation (Herzig, 2015) and thus may be trained effectively by regular and deliberate engagement in the process of improvisation. Hence we document in this article that consistent training of improvisational capacities in the entrepreneurship classroom helps develop non-linear thinking and strengthen essential traits for entrepreneurial success.

Teaching and Assessing Creativity

Guilford (1950) first proposed the concept of divergent thinking, defined as generating many unique ideas, followed by the process of convergent thinking, defined as evaluating those ideas towards the best solution, as the main components of creativity. Specifically, he defined the traits fluency (the ability to produce great number of ideas or problem solutions in a short period of time); flexibility (the ability to simultaneously propose a variety of approaches to a specific problem); originality (the ability to produce new, original ideas); and elaboration (the ability to systematize and organize the details of an idea in a head and carry it out). Theorists contend that alternating between divergent and convergent thinking is important as there is a role for both, creating new ideas and validating these ideas (Amabile, 1996; Bronson & Merryman, 2010). Creativity tests are focused on measuring divergent thinking capacities, while intelligence tests measure convergent thinking (Atherton, 2010). Thus, creativity tests, unlike IQ tests, require a multitude of responses rather than a single response (Hocevar, 1981).

The principles of divergent and convergent thinking guide Sternberg and Lubart's definition (1999) of creativity as the ability to produce work that is both novel and appropriate. Treffinger, Young, Selby, and Shepardson (2002) add "openness and courage to explore ideas" and "listening to one's inner voice" as specific traits of creative entrepreneurs. These personality

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traits relate to interests, experiences, attitudes and self-confidence, problem sensitivity, curiosity, sense of humor, risk-taking, tolerance for ambiguity, and adaptability. Furthermore, the ability to listen to one's inner voice includes a personal view of self and involves self-reflection, vision, and the traits of perseverance, concentration, energy, and work ethic.

High scores on creativity tests have been associated with entrepreneurial intentions (Golshekoh et al., 2010) and Yar Hamidi, Wennberg and Berglund (2008) contended that creativity should be considered in models of entrepreneurial capacity. Several studies identified links between creativity and motivation, innovation, and entrepreneurial success (Fillis and Rentschler, 2010; Baum et al., 2000; Stewart & Roth, 2001).

Although researchers differ in approaches, they do agree that creativity can be taught and measured (Treffinger, et.al. 2002; Bronson & Merryman, 2010; AMA, 2010). The most common divergent thinking tests are the Torrance test¸ the alternative uses tests (in which subjects are asked to think of alternate uses for a variety of common objects such as a shoe, pencil, etc.), plot title tests (in which subjects are asked to generate clever titles to two stories), and the picture-word test (in which subjects are shown a picture and asked to write as many reactions to the picture as they can in one minute). Divergent thinking can be taught through many creative exercises such as mind mapping, brainstorming, and fish-boning (Hocevar, 1981). Convergent thinking ability is often measured with ratings of peers, instructors, judges or by rating portfolios produced by an individual or group (Lindstrom, 2006). The most common techniques for teaching convergent thinking are the examination of cases and biographies of successful people and developments (Fillis and Rentschler, 2010; Kidane & Harvey, 2009). Personality traits such as the previously mentioned "openness" and "listening to one's inner voice" can be measured through inventories of interests, personalities, and self-reports/reflections. Other useful measures are leadership inventory tests, personality tests, problem-solving inventories or creative attitude survey tests. Journaling about one's experiences can enhance self-awareness.

Innovative ideas often come from making connections between ideas, problems, and disciplines that seem unrelated, thus constructing meaning from information (Karakas, 2011). Creative ideas that can lead to innovation are born from cognitive processes that combine the ability to make associations with behaviors such as observation, questioning and risk-taking (Dyer, Gregerson & Christensen, 2011). Schmidt et al (2012) investigated the impact on students' levels of creativity in the entrepreneurship classroom with a curriculum that included such association exercises. Findings indicated increases in idea generation and self-perceived level of creativity for entrepreneurship students who regularly engaged in creativity exercises. Similarly, Bruton (2010) employed a mix of individual and group projects exploring creative problem-solving techniques in a course in creative thinking with the goal of improving creativity in students of various disciplines. Measures of creativity, specifically fluency of idea generation, tolerance of ambiguity, originality of ideas, and ability to elaborate with detail identified significant improvements. These findings seem to confirm the hypothesis that creativity can be taught and should be incorporated into the Entrepreneurship classroom (Morrison and Johnston, 2003)

Improvisation, Creativity and Teamwork

"*You can't improvise on nothing; you've gotta improvise on something*"(Charles Mingus as cited in Kernfeld, 1995, p. 119)

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Improvisation requires spontaneous action without the opportunity for correction and time for preparation (Lewis & Lovatt, 2013). Creativity, specifically fluency in generating ideas, is expressed in improvisatory engagement. However, improvisation is not just a seat-of-your-pants, create-something-from-nothing performance. Successful improvisation is the result of a chosen activity, a theme, a headline, an exercise that enables spontaneous creation with some constraints to facilitate the process (Crossan, 1998; Kanter, 2002; Weick, 1998; Sawyer, 2000). Thus, improvisers need to have skills and competencies acquired through frequent practice. For example, musical improvisers have to be able to play their instruments and usually work with certain stylistic or group parameters. In order to effectively cope with unexpected situations, improvisers need certain skills and knowledge that they can access in the moment of crisis. The readiness and skill to adequately react to the unexpected are obtained through active and repetitive practical training rather than theoretical learning (Bertinetto & Bertram, 2020). During the improvisation process, the plan for action is shaped by the action itself and the improviser has to learn how not to know what to do rather than knowing the solution.

Bertinetto & Bertram, (2020) cited the example of "Sully" Sullenberger, the pilot who in January 2009 was able to come up with a way to save the passengers of US Airways Flight 1549, which encountered an unpredictable accident. If the pilot had followed the routine emergency procedures by trying to land at a nearby airport, the plane would have crashed. Instead, the pilot decided to ditch the plane in the Hudson River thus saving all passengers. He had to improvise a solution based on knowing and not knowing simultaneously when realizing that routine emergency instructions were unsuitable for that situation. Of course, this is an extreme situation, but it demonstrates the interaction of skills and knowledge and the willingness to take risks towards finding solutions through improvisation in uncertain situations. The key to the production of improvisation is the concept of the unknown (Hargreaves, 1999; Lockford & Pelias, 2004; Sawyer, 2003).

Furthermore, improvisation is a collaborative effort. Lemons (2006) reported the following elements of improvisation that emerged from interviews with educators who use improvisation in their classrooms: communication, community/teamwork, risk/challenge, safety, honest emotional expression, self-actualization, and joy. Similar elements can be observed in jazz jam sessions (Herzig & Baker, 2014) and the recent increase of improvisational techniques in fields as diverse as education (Kelly et al., 2000; Lobman, 2002; Rice, 1985), music (Sawyer, 2003a, 2003b; Weisberg, 1999), psychotherapy (Ringstrom, 2001; Wiener, 2000), theater (Johnstone, 1980; Spolin, 1963), dance (Banes, 1980; Lord, 2001), and business (Crossan, 1998; Kanter, 2002; Palmer, 1996; Weick, 1998) match increased demands of creativity and teamwork in the workplace.

Improvisation in the Entrepreneurship Classroom

Borgo (2006) argued that musical improvisation teaches the values of collaboration, compromise, and change. It cultivates a sense of trust or empathy among group members and requires a certain egoless state for optimal teamwork. He further noted that organizational design increasingly looks to the sciences of complexity and jazz music as domains that emphasize adaptation, perpetual novelty, value variety and experimentation, and decentralize authority. Specifically in the entrepreneurship classroom with the goal of developing problem-finding and collaboration skills, improvisational training promises to be an effective teaching tool. Lin and

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Nabergoj (2014) insisted that entrepreneurs need improvisation to deal with lack of resources or the need to redesign products or services.

Kumar & Kogut (2006) argued that cognitive abilities that promote creativity and innovation are cultivated in constructivist learning environments. Such constructivism employs experiential learning methods, transforming experience into knowledge. However, the traditional classroom relies heavily on dissemination of information through lectures and emphasis on single option answers. Thus, students have little opportunity to develop the critical thinking capacities needed for innovative ideas (Michel, Cater & Varella 2009). Research findings confirm relationships between improvisational training and divergent thinking capacities. Schmidt, Goforth, and Drew (1975) found that children, approximately six years of age, who had undergone eight weeks of verbal improvisational activities in comparison to children who had not undergone improvisation tasks, scored higher on creativity tests. After taking a creative drama course that focused on verbal improvisation over a period of ten weeks, adults were able to increase their divergent thinking scores according to Karakelle (2009). However, in both studies, no control group was compared to the improvisation conditions.

Martinsuo (2009) reports that key innovative behaviors emerge when students are taught tools and methods for idea generation in addition to course readings and lectures. Schmidt et al (2012) reported higher performance on divergent thinking tests of students in entrepreneurship versus non-entrepreneurship classes, suggesting that the teaching of innovative solutions foster fluency of flexibility. Dweck (2006) found that students who perceive mistakes as learning opportunities rather than fixed traits demonstrated a higher level of perseverance and resilience needed for creativity and innovation. A systematic literature review on developing growth mindsets in engineering students (Campbell et al, 2021) had mixed results. Based on a small number of significant results, the authors recommended to introduce growth mindsets through online tutorials or lectures rather than readings, create opportunities to discuss and reflect on the importance of growth mindsets for learning, and make students feel that their written reflections will be of value to others, either as advice for future students, or as part of graded coursework.

These findings are in line with the theory of improvisation and schemas, suggesting that improvisation helps people break away from set patterns of thinking such that they are either able to switch between schemas more efficiently or to update slot information more efficiently, or both (Lewis & Lovatt, 2013). Assuming that one goal of entrepreneurship education is to help students create value and positively impact their organizations and the marketplace, then it is important to examine how the skills learned in the classroom transfer to business applications. However, a recent study disclosed that convergent thinking approaches were more likely to be utilized than divergent approaches emphasizing problem solving over problem finding (Schmidt et al., 2013). Fillis and Rentschler (2010:73) caution: "Entrepreneurial creativity should be concerned with continual creation of alternative solutions to problem solving and identification of new opportunities as a competitive strength and portfolio of competencies".

Unfortunately, there is an emphasis in K-12 education on a standards-driven curriculum that focuses on skills and aptitudes measured by national and state tests (Sisk, 2010). By the time students get to college they are programmed to focus on the right answers, not "novelty and nuance" (Ahy, 2009). Hence there is a lack of teaching principles of communication, collaboration and teamwork, critical thinking, problem solving, and creativity throughout the entire curriculum (Perkins, 2002; Sisk, 2010). The need to foster creativity and improvisation in

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the classroom, especially in entrepreneurship education has been emphasized by many scholars (Boyle, 2007; Gibb, 2007; Ko & Butler, 2007; Lourenço, 2011; D. M. Rae, 1997).

Sarasvathy (2015) confirmed students' fear of failure and doubt about the value of their ideas, as well as resistance to the uncertainty of the entrepreneurial process. The "causal" mindset, believing that the route to success is through the traditional business planning process, gets stronger with older students thus creating a need to unlearn to engage in effectual experimentation towards discovering possibilities. Whitaker et al (2022) argued for the democratization of creative educational experiences, especially in the arts field, where 84% of Arts School Graduates are still white. Comparing the artistic process to the entrepreneurial concept of effectuation as defined by Sarasvathy (2001), Whitaker et al believed that access to building critical and independent thinking skills as associated with the arts can facilitate a more democratic access to entrepreneurship.

Assenza (2017) suggested that educators consider these four strategies when designing entrepreneurial curricula:

1. Breaking the frame
2. Imposing constraints
3. Offering rewards based on goals
4. Working in teams

Kolb & Kolb (2005) confirmed that negative emotions such as fear, and anxiety can inhibit learning. Dweck (2006) recommened teaching the perception of mistakes as learning opportunities rather than judgment of fixed traits, which fosters learning the perseverance and resilience needed for creativity and innovation.

One does not have to be particularly gifted to be creative (Cropley, 1997, Keegan, 1996; Parkhurst, 1999; Runco, 2003; Weisberg, 1986), in fact all of us have the abilities to create and improvise but we lose the willingness to utilize our abilities over time due to the standards-driven education. Lemons (2005) recommends the following strategies to teach the concepts and tools of improvisation at any level: Listen, tolerate error, be comfortable with ambiguities and unresolved issues, and practice improvisation exercises. Furthermore, Anthony Davis stressed in an interview with Borgo (2006) the difference between listening and following, avoiding mimicry, and rather working towards knowledgeable reaction and co-construction. Thus, effective teaching of a growth mindset and divergent thinking capacities does not easily translate into a final grade but rather supports autonomy and self-reflection. "More than anything else, the purpose of entrepreneurship education should be to let students be entrepreneurial so that they can make an informed decision about when starting a business is right for them". (Kuratko & Hiskonson, 2017:11). Thus, our hypothesis is that there is a significant difference in self-perception of creativity after implementing regular improvisation exercises in the entrepreneurship classroom.

Data and Approach

This study included the implementation of regular improvisation exercises in two Arts Entrepreneurship classrooms with a total of 41 students, taught at two different Universities during the Spring Semester 2021, framed by a pre- and post-survey. The methodology is based on the foundational research conducted by Groves et al., 2011, in which the authors compared

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linear and non-linear thinking styles across various groups, including professional actors, accountants, frontline managers, and senior executives. Their findings indicated that professional actors exhibited significantly stronger non-linear thinking capabilities compared to their counterparts. This non-linear thinking, in the creativity literature discussed above also referred to as divergent thinking, was seen as a facilitator of entrepreneurial cognition and decision-making. Additionally, the actors displayed a heightened sense of intuition, superior creative thinking abilities, a knack for perceiving the "big picture," and a strong connection to their emotions. In line with this prior research, we aimed to introduce survey instruments that could further substantiate the significance of non-linear thinking in promoting an entrepreneurial mindset.

The participant sample included 41 students enrolled in Arts Entrepreneurship courses who completed both survey instruments. Student participants who did not complete both surveys were excluded from our analysis. The participants were diverse in terms of gender, consisting of 20 male students, 20 female students, and 1 self-identified as non-binary (refer to Figure 1). Please note that in order to not skew our data we only reported the single non-binary participants as part of the overall results. Additionally, among the participants, 7 were enrolled as graduate students, while 34 were pursuing undergraduate degrees. Those participants actively engaged in improvisational exercises with the aim of enhancing their creative capacities for idea generation and entrepreneurial risk-taking. To assess the impact of these improvisation activities, all students completed identical pre- and post-surveys during the first and last weeks of the course.

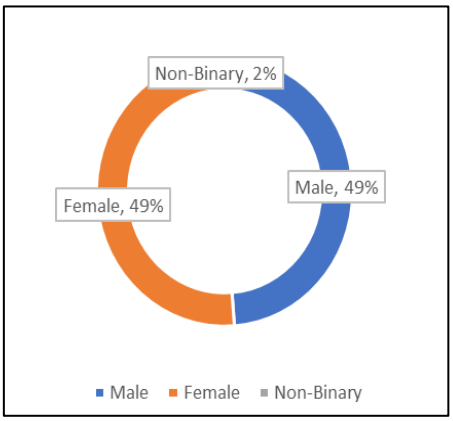

FIGURE 1
PARTICIPANTS DISTRIBUTION BY GENDER

The improvisation exercises used in our study drew inspiration from the research and insights of several experts in creativity and entrepreneurship, including Seelig (2012), Neck, Greene, and Brush (2014), Madson (2010), and Lehrer (2012). These exercises were structured in accordance with the Jam Session Model framework, as developed by Herzig & Baker (2014), implemented in organizational research by Belitski and Herzig (2017) and Audretsch et al (2022).

This framework pinpoints seven factors identified in creative group settings:

1. Individual competency and expertise in the respective field.
2. The practice of improvisation.
3. The establishment of mentoring systems and role models.
4. Encouraging democracy and collaboration.

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5. The roles of leaders and sidemen.
6. Community support.
7. The implementation of continuous evaluation systems.

Collectively, these factors were recognized as pivotal in facilitating "the process of collaborative creativity and innovation" (Audretsch et al. 2015). Appendix A includes the specific exercises that were employed.

The surveys comprised 73 questions designed to facilitate a deeper understanding of the effectiveness of improvisation exercises and guided learning activities in an academic context (see Appendix A, B, and C for details). Our primary aim was to assess any residual increase or decrease in the students creative capacity by the end of the semester. The survey instrument utilized a straightforward 5-point Likert Scale (Preedy & Watson, 2010), resulting in the collection of ordinal data (see Table 1 for reference) and was distributed through the Qualtrics platform, to be completed in under 10 minutes. We adapted our 73-question survey from three main sources, namely Hmieleski & Corbett (2006), Runco, Plucker, and Lim (2001), and the AULIVE Test.

Specifically, 27 of our questions were drawn from the foundational work of Hmieleski & Corbett (2006). These questions were developed to measure an individual's inclination for improvisation, covering three dimensions:

1. Creativity and bricolage, partly influenced by Tierney, Farmer, and Graen (1999), with its roots in the work of Vera (2002);
2. The ability to perform and excel in high-pressure and stressful environments; and
3. A dimension of spontaneity and persistence, partially adapted from Unger and Kernan (1983) and Moorman and Miner (1998), again building on the research of Vera (2002).

Moreover, we incorporated 23 standard questions from the Runco Ideational Behavior Scale (RIBS), a recognized measure for assessing creative ideation. Finally, our survey instrument was further complemented with 31 standard questions from the AULIVE Test, a product of the AULIVE corporation, that has conducted extensive research and development in the field of innovation, creativity, and value creation, with over 20 years of expertise in this domain (Table 1).

Table 1
LIKERT SCALE SCHEMA

Never	Almost Never	Sometimes	Often	Very Often
1	2	3	4	5

Finally, the survey was structured around five distinct measurement categories, each addressing specific aspects. The list below features the questions that the participants were asked to rate from 1 to 5 (see Appendix C for further details and results):

Creativity/abstraction measure (questions 1-10)

1. I am inventive
2. I serve as a good role model for creativity
3. I demonstrate originality in my work
4. I am creative when asked to work with limited resources

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5. I identify ways in which resources can be recombined to produce novel products
6. I find new uses for existing methods or equipment
7. I think outside of the box
8. I take risks in terms of producing new ideas in completing projects
9. I identify opportunities for new services/products
10. New experiences increase my creative output

Pressure/stress measure (questions 11-19)

11. I think creatively when I am outside of my comfort zone
12. I perform better under time pressure
13. I need pressure in order to focus
14. I enjoy taking risks
15. I respond to problems in a spur of the moment way
16. I seek out pressure-filled environments
17. I wait until the last moment to complete projects
18. I live in the moment
19. I think on my feet when carrying out actions

Persistence measure (questions 20-31)

20. I am not easily distracted
21. I am a persistent person
22. I don't let past failures hinder future performance
23. I am action oriented
24. I am an optimist
25. I don't easily get frustrated when things don't go my way
26. During a catastrophe, I am likely to adopt a leadership role
27. I am a person who forms a plan and sticks to it
28. I am a person who can always dig their way out of a hole
29. I am a person who is thorough
30. Nothing is more important than the achievement of my goals
31. I am good at solving logic problems

Perspective/boldness measure (questions 32-45)

32. I am a person who laughs more than most people
33. I am a person who likes to be a part of the system
34. I am a person who likes to take charge of a situation
35. I am a person who can always see both sides of an argument
36. I am a person who likes to work on one thing at a time
37. I am a person who believes history repeats itself
38. I am a person who believes rules exist for good reasons
39. I am a person who gets angry when they see things that are not as well done as they should be
40. I am a person who is eager
41. I am a person who aims for stability
42. I am a person who is good at getting their own way
43. I am a person who likes to make controversial statements just to provoke a response
44. I am a person who others regularly turn to for advice
45. I am a person who likes to see concrete proof before they believe what they are told

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Ideation/curiosity/complexity measure (questions 46-73)

46. I have many wild ideas
47. I think about ideas more than most people
48. I get excited by my own new ideas
49. I come up with a lot of ideas or solutions to problems
50. I come up with an idea or solution other people have not thought of
51. I like to play around with ideas for the fun of it
52. It is important to be able to think of bizarre and wild possibilities
53. I would rate myself highly in being able to come up with ideas
54. I have always been an active thinker and I have lots of ideas
55. I enjoy having leeway in the things I do and room to make up my own mind
56. My ideas are considered impractical or even wild.
57. I would take a college course which was based on original ideas
58. I am able to think about things intensely for many hours
59. I get so interested in a new idea that I forget about other things that I should be doing
60. I have trouble sleeping at night, because so many ideas keep popping into my head
61. When writing papers or talking to people, I have trouble staying with one topic because I think of so many things to write or say
62. I find that one of my ideas has led me to other ideas that have led me to other ideas, and I end up with an idea and do not know where it came from
63. Some people might think me scatterbrained or absentminded because I think about a variety of things at once
64. I try to exercise my mind by thinking things through
65. I am able to think up answers to problems that haven't already been figured out
66. I am good at combining ideas in ways that others have not tried
67. Friends ask me to help them think of ideas and solutions
68. I have ideas about new inventions or about how to improve things
69. I am a person who likes to operate on the basis of instinct and 'gut-feel'
70. I am a person who likes to see the bigger picture
71. I am a person who likes crossword puzzles
72. I am a person who likes frequent change
73. I am a person who enjoys working with people from different disciplines and skills

We acknowledge that our study has some limitations, including potential unknown influences related to the shift to online teaching modalities during the Covid-19 pandemic. The use of Zoom for teaching was relatively new to most of us, and there was limited data available on the effects of virtual teaching modalities during a crisis on the learning process. To address this, we conducted a duplicate study during the Fall semester of 2022, using a similar curriculum at both universities with in-person instruction. Preliminary data from this study shows similar improvements and self-reported increases in creative capacities, suggesting that the influence of the teaching modality is minimal.

We also recognize that our data was collected through self-reporting surveys using the Likert Scale methodology. Consequently, there are inherent limitations in self-reported data, including issues related to honesty, the ability to assess oneself accurately, misinterpretation of questions, rating scales, and potential response bias. To strengthen our results in future research, we recommend the inclusion of common standardized creativity measures, such as the Torrance Tests of Creative Thinking. However, it is worth noting that self-reports offer a straightforward and comprehensive way to collect data while maintaining anonymity and confidentiality of the respondents.

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RESULTS

Our survey instruments gathered ordinal data and as such the need to test whether the data gathered from our pre- (before) and post-surveys (after) was significantly different. Of the statistical methods assessed, the Wilcoxon test seemed to be the best fit for our data set because it evaluates the difference between two treatment conditions using data from a repeated-measures design. The Wilcoxon test only requires to rank the difference scores and thus, there is no need to measure how much difference exists for each subject, or to compute a mean or variance for the difference scores. Thus, the calculation of the Wilcoxon T statistic requires that you

1. Observe the difference between treatment 1 and treatment 2 for each subject,
2. Rank order the absolute size of the differences without regard to sign (increases are positive and decreases are negative),
3. Find the sum of the ranks for the positive differences and the sum of the ranks for the negative differences, and
4. Observe the Wilcoxon T as the smaller of the two sums. If there is a consistent difference between the two treatments, the difference scores should be consistently positive or consistently negative.

If there are no negative differences, then ΣRanks = 0 for the negative differences, which is not the case in our dataset. Thus, a small value for T indicates a difference between treatments, which is what we are seeing. In addition, to determine whether the obtained T value is sufficiently small to be significant, you must consult the Wilcoxon table (Figure 2). Finally, for large samples (n>50), the obtained T statistic can be converted to a z-score and the critical region can be then determined using the unit normal table or one can calculate the normal approximation using the Mann-Whitney Test , which yields similar results. Thus, we chose to perform a two-tailed Wilcoxon Signed-Ranks Test for Paired Samples with $\alpha = .05$ to test the following null hypothesis:

Null Hypothesis (H0): p-value > 0.05. This null hypothesis posits that there is no statistically significant difference in self-perception of creativity after the implementation of regular improvisation exercises in the entrepreneurship classroom.

Alternative Hypothesis (H1): p-value < 0.05. The alternative hypothesis suggests that there is a statistically significant difference in self-perception of creativity after the implementation of regular improvisation exercises in the entrepreneurship classroom.

	alpha values						
n	0.001	0.005	0.01	0.025	0.05	0.10	0.20
5	--	--	--	--	--	0	2
6	--	--	--	--	0	2	3
7	--	--	--	0	2	3	5
8	--	--	0	2	3	5	8
9	--	0	1	3	5	8	10
10	--	1	3	5	8	10	14
11	0	3	5	8	10	13	17
12	1	5	7	10	13	17	21
13	2	7	9	13	17	21	26
14	4	9	12	17	21	25	31
15	6	12	15	20	25	30	36
16	8	15	19	25	29	35	42
17	11	19	23	29	34	41	48
18	14	23	27	34	40	47	55
19	18	27	32	39	46	53	62
20	21	32	37	45	52	60	69
21	25	37	42	51	58	67	77
22	30	42	48	57	65	75	86
23	35	48	54	64	73	83	94
24	40	54	61	72	81	91	104
25	45	60	68	79	89	100	113
26	51	67	75	87	98	110	124
27	57	74	83	96	107	119	134

	alpha values						
n	0.001	0.005	0.01	0.025	0.05	0.10	0.20
28	64	82	91	105	116	130	145
29	71	90	100	114	126	140	157
30	78	98	109	124	137	151	169
31	86	107	118	134	147	163	181
32	94	116	128	144	159	175	194
33	102	126	138	155	170	187	207
34	111	136	148	167	182	200	221
35	120	146	159	178	195	213	235
36	130	157	171	191	208	227	250
37	140	168	182	203	221	241	265
38	150	180	194	216	235	256	281
39	161	192	207	230	249	271	297
40	172	204	220	244	264	286	313
41	183	217	233	258	279	302	330
42	195	230	247	273	294	319	348
43	207	244	261	288	310	336	365
44	220	258	276	303	327	353	384
45	233	272	291	319	343	371	402
46	246	287	307	336	361	389	422
47	260	302	322	353	378	407	441
48	274	318	339	370	396	426	462
49	289	334	355	388	415	446	482
50	304	350	373	406	434	466	503

FIGURE 2
FIGURE PROVIDING CRITICAL VALUES FOR TWO-TAILED WILCOXON TESTS

Citation Information: Herzig, M & Renard, S (2024). The impact of improvisation training in arts entrepreneurship education on creative capacities. *Journal of Entrepreneurship Education, 27*(S4),1-33**.**

Subsequently, we devised a percentage measure to determine whether a participant had witnessed an increase or decrease in their creative capacity throughout the semester. To accomplish this, we adopted a two-step methodology. First, we calculated the sum of the Likert Scale values for each participant. Appendix B provides the summed values for both "*before*" and "*after*". Appendix B displays the increased and decreased capacity for each participant. We then applied the following formula to ascertain the percentage change in overall creative capacity for each participant:

$$Overall\ \%\ Creative\ Capacity\ Increase\ or\ Decrease = \frac{Sum\ After - Sum\ Before}{Sum\ Before}$$

Additionally, we offer a breakdown of our findings, categorized by gender, and the participants' overall program level (Figure 2, Appendix B for reference). Finally, we wanted to ascertain if there was by any chance a huge range at the individual level regarding the self-reporting behavior for both surveys.We then calculated the mean and standard deviation for each individual. The results alleviate any concern that our summing methodology should flatten the data due to the Likert scale use. Instead, we observe that survey data behavior is rather constant (Figures 3-6& Table 2).

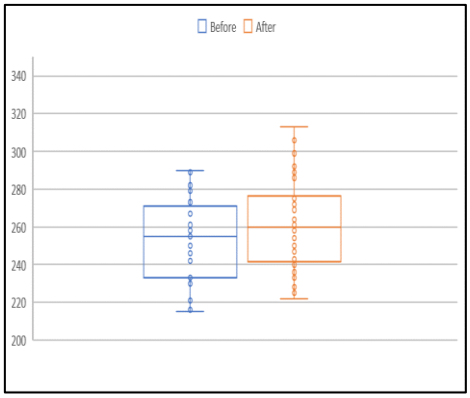

FIGURE 3
BEFORE AND AFTER SURVEY SUMS FOR OUR PARTICIPANTS SAMPLE (N=41)

TABLE 2 SUMMARY STATISTICS OF DATA COMPOSITION AND CREATIVE CAPACITY INCREASE (IN %)	
Sample (n=41)	3.6%
Male (n=20)	2.2%
Female (n=20)	4.8%
Undergraduate (n=34)	3.6%
Graduate (n=7)	3.5%

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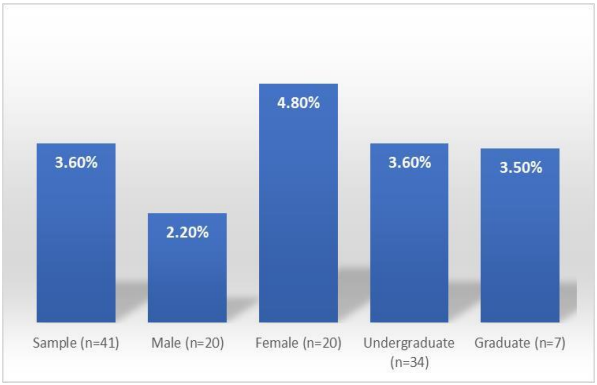

FIGURE 4
SAMPLE DEMOGRAPHICS AND CORRESPONDING REPORTED CREATIVE CAPACITY INCREASE (IN %)

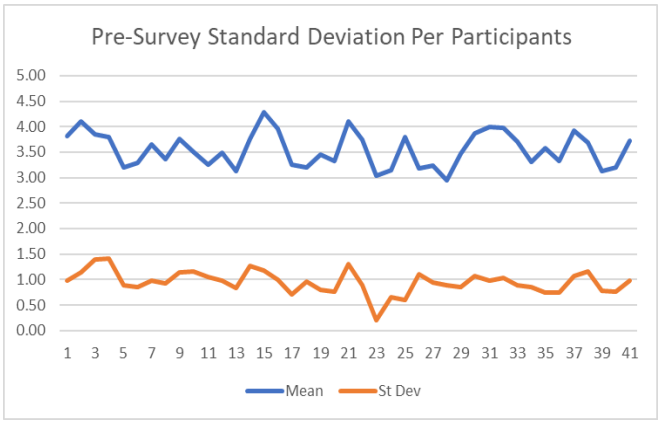

FIGURE 5
PRE-SURVEY STANDARD DEVIATIONS PER PARTICIPANT BASIS

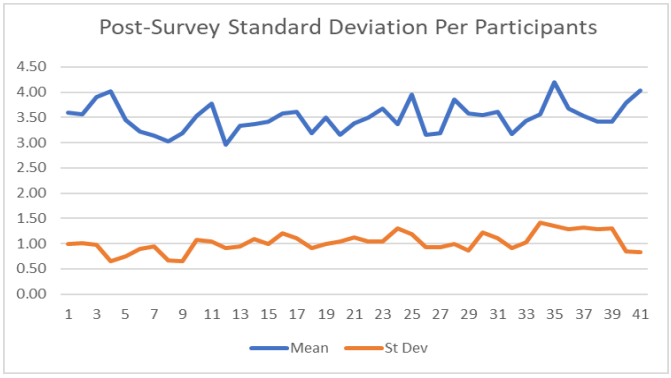

FIGURE 6
POST-SURVEY STANDARD DEVIATIONS PER PARTICIPANT BASIS

We reorganized the data to evaluate our participants on a question-by-question basis (refer to Appendix C). In a similar manner, we once again summed the ordinal data for each question across our sample of participants (Figure 5 and Appendix C). We then computed the percentage change in creative capacity, both increases and decreases. Appendix C displays the individual scores of the entire participant sample (n=41) for each of the 73 questions and how

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each question was self-reported by our sample of participants, which provided granular information on a question by question basis (Figure7-9).

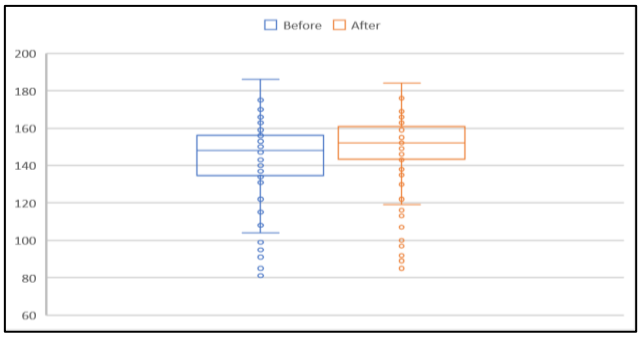

FIGURE 7
BEFORE AND AFTER SURVEY SUMS FOR OUR QUESTIONNAIRE SAMPLE

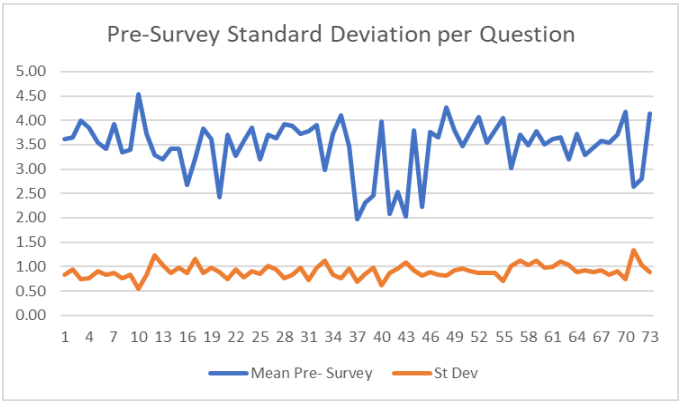

FIGURE 8
PRE-SURVEY STANDARD DEVIATIONS ON PER QUESTION BASIS

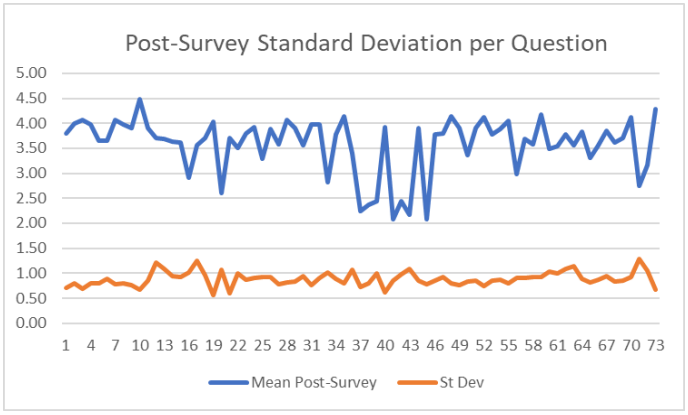

FIGURE 9
POST-SURVEY STANDARD DEVIATIONS ON PER QUESTION BASIS

Both the Wilcoxon T-Test table lookup and the calculated Mann-Whitney Test method validate the presence of a significant difference between the pre-survey (before) and the post-survey (after) results of the students who engaged in creativity exercises, thereby rejecting the null hypothesis H0 (see Table 3 for details).

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Table 3 WILCOXON T-TESTS FOR SAMPLE (N=41)		
α	0.05	Notes
tails	2	
n	41	
T	233	
T-crit	279	*Table Lookup (Cf. Table 2)*
mean	430.5	
variance	5955.25	
std dev	77.17027	
T-Crit	279.1991	*Calculated*
z-score	2.559276	
p-value	0.010489	
significant	yes	

The same pattern was observed when analyzing our transposed data of the questions of our survey, further confirming the existence of a significant difference in self-perception of creativity among students after their participation in regular improvisation exercises in the entrepreneurship classroom, as evidenced from a question-by-question perspective.

It is noteworthy that our participants, on average, experienced an overall increase in creative capacity of 3.6%. Moreover, we observed that female participants seem to more than double their creative capacity increase (4.8%) compared to their male counterparts (2.2%), as indicated by their self-perception. There was minimal deviation between the overall creative capacity increase of undergraduate (3.6%) and graduate students (3.5%) (Table 4). Furthermore, it's important to highlight that the overall creative capacity percentage increase remains consistent when examining our data on a question by question basis (compare Appendix B and C).

Table 4 WILCOXON T-TESTS FOR QUESTIONNAIRE SAMPLE (CF. APPENDIX C)		
α	0.05	Notes
tails	2	
n	69	*73-4(zero values)=69*
T	422	
mean	1207.5	
variance	27973.75	
std dev	167.25355	
T-Crit	879.6390656	*Calculated*
z-score	4.696462346	
p-value	2.64706E-06	
significant	yes	

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We also identified seven outliers within our sample (n=41) with either substantial increase or decrease in their creative capacity across the duration of the semester. These outliers are identified by Participant IDs: 7 (-17.1%), 13 (18.1%), 17 (12%), 23 (16.3), 27 (12.5%), 33 (17.5%), and 38 (17.7%). It indicates that some of our participants self-reported a tremendous change in entrepreneurial mindset after practicing improvisational thinking exercises with an open mind, thus showing the most growth. Improvisation exercises can be daunting and by accessing some of the journaling that the students were also asked to do during that semester, we learned that those students particularly enjoyed the process and were particularly mindful with the exercises. Five of these participants are undergraduate students, and two are graduate students. Each of them demonstrated a double-digit increase or decrease in creativity, which deviates significantly from the rest of the sample (see Appendix B). Only one of our participants, Participant ID #7, showed a substantial decrease in creative capacity (-17.1%) based on their self-perception at the beginning and end of the semester. Based on additional reflections taken by each participant, we further learned that this participant was resistant to taking part in the improvisational exercises and did not see value in the process, which resulted in poor self-reported scores as a result. Nevertheless, 6 of the participants greatly benefited from the creativity exercises they engaged in, while another 23 participants derived a more moderate benefit, and 12 participants displayed a marginal decrease in their self-reported scores. In summary, 29 out of our 41 (70%) students experienced either significant or moderate benefits from participating in the experiment.

Upon dissecting the data in Appendix C, we notice that 56 out of the 73 questions in our survey (77%) show either a moderate increase in capacity or no significant change, which is encouraging as it shows that for the most part our survey questions were positively received by our participants. However, this implies that 17 of the questions (23.3%) indicate a moderate decline. Of particular interest, our participants performed less favorably in questions associated with the perspective/boldness measure, with only 50% of those questions (Q32-Q45) showing positive results and thus, an increase in creative capacity. Consequently, 43% of the questions within the perspective/boldness measures, or 6 questions, display negative results, while one question shows neither a negative nor positive improvement (Table 5). The six statements participants had to rate are: (Q33 – Inverted Results) I am a person who likes to be a part of the system, (Q36) I am a person who likes to work on one thing at a time, (Q39 – Inverted Results) I am a person who gets angry when they see things that are not as well done as they should be, (Q40) I am a person who is eager, (Q42) I am a person who is good at getting their own way, and (Q45 – Inverted Results) I am a person who likes to see concrete proof before they believe what they are told. Q33, Q39, and Q45 have inverted results on our Likert Scale, meaning that the stronger our participants agreed with those statements, the lower their scores.

Table 5
MEASURES CATEGORIES OVERALL POLARITY COUNTS AND PERCENTAGES (CF. APPENDIX C).

Measure Categories	Overall (+) Count	%	Overall (-) Count	%	(0) Count	%	Overall Count	%
Creativity/Abstraction	9	90%	1	10%	0	0%	10	14%
Pressure/Stress	8	89%	1	11%	0	0%	9	12%
Persistence	9	75%	2	17%	1	8%	12	16%
Perspective/Boldness	7	50%	6	43%	1	7%	14	19%

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	Ideation/Curiosity/Complexity	19	68%	7	25%	2	7%	28	38%
	Total (Mean)	52	(74%)	17	(21%)	4	(5%)	73	100%

An examination of the responses from our participants, categorized by gender and college matriculation, reveals noteworthy distinctions based on the level of matriculation (Undergraduate versus Graduate). Specifically, graduate students exhibit a number of negative results, some of which are in the double digits, scattered throughout our survey, exemplified by responses to questions such as Q10, Q51, Q58, Q61, Q62, and Q67. Indeed, the seven graduate students express strong disagreement with the following statements:

1. New experiences enhance their creative output,
2. Nothing is more important than the achievement of their goals,
3. They enjoy exploring ideas purely for the enjoyment of it,
4. They have the ability to intensely contemplate topics for extended periods,
5. They encounter difficulty in staying focused on a single topic when writing or speaking because their mind generates a multitude of ideas to convey,
6. They often find that one idea leads to another, creating a chain of interconnected thoughts, and they end up with an idea without knowing its origin,
7. Friends seek their assistance in generating ideas and solutions.

Table 6
MEASURE CATEGORIES BY GENDER (CF. APPENDIX C).

Measure Categories	Male (+) Count	in %	Male (-) Count	in %	Male (0) Count	in %	Female (+) Count	in %	Female (-) Count	in %	Female (0) Count	in %
Creativity/Abstraction	6	60%	3	30%	1	10%	10	100%	0	0%	0	0%
Pressure/Stress	7	78%	2	22%	0	0%	8	89%	1	11%	0	0%
Persistence	6	50%	6	50%	0	0%	10	83%	2	17%	0	0%
Perspective/Boldness	5	36%	7	50%	2	14%	5	36%	4	29%	5	36%
Ideation/Curiosity/Complexity	15	54%	12	43%	1	4%	21	75%	5	18%	2	7%
Total/(Mean)	39	(55%)	30	(39%)	4	(6%)	54	(77%)	12	(15%)	7	(9%)

Additionally, we note a significant difference in performance between female and male participants across various categories, including creativity, pressure, persistence, and ideation, with female participants achieving positive answers at rates of 100%, 89%, 83%, and 75%, respectively, resulting in an overall mean of 77% (refer to Table 6). A discussion about the interpretation of these observations follows with some concluding thoughts.

DISCUSSION

The hypothesis of our study, to detect a difference in self-perception of creativity after implementing regular improvisation exercises in the entrepreneurship classroom, was confirmed with a demonstrated overall average growth of 3.6% measured through self-reported survey responses. The calculated Mann-Whitney Test method validated the presence of a significant

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difference between the pre-survey (before) and the post-survey (after) results of the students who engaged in regular improvisation exercises. Toscher (2019) asked for a reframing of the meaning of entrepreneurship from the traditional profit-seeking and value creation mentality towards helping students in achieving their goals. He suggested a conceptual framework that is context-specific, places the center of learning with the student, and encourages explorative behavior. In our experiment, the inclusion of regular, open-ended exercises, encouraging improvisation and exploration produced significant results, thus supporting implementation of improvisation exercises in the contemporary entrepreneurship classroom with the goal of fostering creativity and non-linear thinking. In line with Sawyer's observations (2021), we argue that improvisational thinking exercises can further enhance non-linear thinking in making connections and jumping between ideas in a more fluid and flexible manner. This type of thinking is often associated with creativity, innovation, and the ability to see relationships between seemingly unrelated concepts particularly useful in complex problem-solving and artistic creation.

Furthermore, results from journals and classroom observations also indicated that the majority of the students who took part in regimented improvisational thinking exercises felt that they did improve their growth mindset and students who enjoyed the process of improvisational thinking did better in their self-reported scores than those who did not. Whatanakom et al (2020) found that innovativeness and attitude effectively predict entrepreneurial intention. Similarly, a positive attitude and openness to the improvisation process supported effective learning outcomes in our study. In fact, the same study (Whatnakon et al, 2020) identified the most relevant indicator for innovativeness among undergraduate students as constant learning from new ideas by completing actions differently. Key components in expanding innovative thinking are thus frequent and regular engagement supported by enjoyment and a positive attitude.

The effects of motivation and attitude were also observed in a double digit decrease of self-reported creativity levels by one of the participants. Participant ID #7 showed a substantial decrease in creative capacity (-17.1%) in comparison to their self-perception at the beginning and end of the semester. Based on additional journaling exercises completed by each participant, we further learned that this participant was resistant to taking part in the improvisational exercises and did not see value in the process, which resulted in poor self-reported scores as a result. On the other hand some of our participants self-reported a tremendous change in entrepreneurial mindset after practicing improvisational thinking exercises with an open mind, thus showing the most growth. By accessing the journaling of these students, we learned that they greatly enjoyed the process and were particularly mindful with the exercises. Five of these participants were undergraduate students, and two were graduate students. Thus the links between motivation and entrepreneurial success identified in various studies were confirmed (Fillis and Rentschler, 2010; Baum et al., 2000; Stewart & Roth, 2001).

While attitudes can be adapted and knowledge can be learned, personality traits tend to be more constant and influence decision making processes and learning readiness. One of the "*Big Five*" personality factors, as defined by Goldberg (1990), is Culture or the openness to experience. Thus the small improvements or negative results on several of the questions measuring traits of perspective and boldness might be indicators of personality traits that remain constant. For example Q33 implies a lack of entrepreneurial intent. Q39, Q40, and Q42 indicate a lack of boldness, a characteristic often associated with successful entrepreneurs (Diamantis and Kotler, 2015; Kirzner, 1999). We question whether these individuals reported personality traits

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that conflict with entrepreneurial competencies necessary to pursue the life of a creative entrepreneur. A low score in Q45 suggests a lack of faith in others and trust in effective teamwork as well as brainstorming. This question might correlate to Goldberg's (1990) personality factor of Surgency or extroversion, meaning the tendency of introverted individuals preferring to work by themselves and more extroverted individuals enjoying teamwork can't easily be changed through pedagogical interventions (Agresti, 2013).

Gender, age, having entrepreneurial parents, self-efficacy, risk tolerance, and environmental characteristics were identified as the main drivers for students' entrepreneurship in a literature review by Schimperna et al (2021). Concerning the factor of age, Álvarez-Herranz et al. (2011) noted that younger people, display a more energetic, dynamic, enthusiastic attitude, eager to realize their ambitions while older people may be more resolved, more determined , and more experienced, but less inclined to take risks. Similarly, our self-reported survey findings suggested that especially graduate students appeared less inclined to embrace new experiences, more resistant to ideation, reluctant to step out of their comfort zones, and less open to alternative teaching methods. However, there was minimal deviation between the overall creative capacity increase of undergraduate (3.6%) and graduate students (3.5%) (refer to Table 3). Hence, while age might be a factor in attitude and openness for alternative teaching methods, effective learning can take place at any level.

Concerning the factor of gender, we observed that the increase in overall creative capacity by female participants seemed to be twice as high (4.8%) compared to their male counterparts (2.2%), as indicated by their self-perception values. This meant that female participants self-reported greater benefits from the structured creativity exercises in the entrepreneurship classroom. Interpreting these results is not as easy as comparing the total numerical values. Henry et al (2016) noted that recent studies on gender in entrepreneurship highlight the complexity of the female entrepreneurship experience with regards to the influence of specific cultural, legislative, and economic frameworks on women's entrepreneurial endeavors. This is a marked shift from the initial static, quantitative approaches, and as many have argued, context does matter (Ahl, 2002; Brush et al., 2009; De Bruin et al., 2007; Welter, 2011). In fact, Henry et al (2016) asked to move towards more focused qualitative and innovative methodologies such as in-depth interviews, life histories, case studies, ethnography or discourse analysis. Hence, instead of assuming that quantitative results by our female participants twice as high as their male counterparts meant twice as much increase in creative capacities or twice as much learning, we can only speculate about factors that might influence the self-evaluation process in relation to gender in this case. Wehr (2016) investigated the unusually low participation of women in instrumental jazz and found that over a wide age range, women consistently scored significantly lower on confidence ratings for improvisation, were more anxious about improvisation, and had poorer attitudes about improvisation than men. However no significant differences were reported in girls' ability to improvise compared to boys in music education research (Bash, 1984; Madura, 1999). Self-efficacy has been identified as the best predictor of jazz improvisation achievement (May, 2003) and possible implications might be that the structured exercises in a safe environment as presented during our study might have an additional positive effect on self-efficacy and thus on self-reported results of creativity levels.

However, it is important to highlight that both female and male participants exhibited equally poor performance in the perspective/boldness section of our survey, with only 36% of those questions generating positive results. Boldness is a quality that holds great significance in

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the realm of entrepreneurship as it implies the willingness and courage to take risks, make daring decisions, and embrace uncertainty in order to pursue new opportunities and achieve ambitious goals. The entrepreneurial career usually means self-employment and uncertain income structures. The majority of students in our Arts Entrepreneurship classrooms were majoring in Arts Administration and similar Management fields, thus aiming for salaried positions after graduation rather than self-employment as indicated in class discussions, which could partially explain low self-reported increases on boldness measures.

CONCLUSION

The primary objective of this study was to assess the impact of integrating regular improvisation exercises into the entrepreneurship classroom on self-reported levels of creativity. Our findings reveal an overall increase of 3.6% in creative capacity among the study participants, aligning with prior research that has demonstrated enhanced creativity through routine classroom exercises (Schmidt et al., 2012). Golshekoh et al. (2010) speculated that higher scores on creativity tests may fuel entrepreneurial intentions, thereby emphasizing the effectiveness of entrepreneurship education. Many scholars have recommended fostering creativity and improvisation in entrepreneurship education (Boyle, 2007; Gibb, 2007; Ko & Butler, 2007; Lourenço, 2011; Rae, 1997) and promoting a growth mindset through creativity exercises (Morrison and Johnston, 2003). Our results substantiated the effectiveness of implementing regular exercises, offering valuable insights for curriculum strategies in the entrepreneurship classroom.

However, as noted by Bertinetto & Bertram (2020), the readiness and skill to improvise adequately and find creative solutions should also be built upon a foundation of adequate training in skills and knowledge. We observed only moderate to negative results in the measures of boldness and perspective, suggesting the need to strike the right balance between creativity exercises and skills training. Graduate students, in particular, expressed hesitancy when stepping out of their comfort zone, and having a solid knowledge and skill base can counter such reluctance. The moderate findings regarding increased creativity levels for graduate students may also be influenced by the extended years of schooling, which can discourage divergent and non-linear thinking and increase the fear of failure (Ahy, 2009).

Notably, strong correlations between gender and increased levels of self-reported creativity were identified. These gender differences may suggest that female students benefit more from guided creativity exercises in the entrepreneurship classroom. In fact, they outperformed their male counterparts in the categories of creativity, pressure, persistence, and ideation. Jennings & Brush (2013) documented significantly higher scores among females on traits related to autonomy and change, but lower scores on aspects of energy level and risk-taking. Buttner & Rose (1988) found that female entrepreneurs received lower evaluations on dimensions associated with leadership, autonomy, risk-taking propensity, readiness for change, endurance (energy level), and low need for support (succorance). This discrepancy between public perception and actual traits perpetuates stereotyping effects. Our study contradicts these lingering perceptions and underscores the potential for effective training.

Building on the results of this study, we have designed a follow-up investigation to validate our findings of significantly increased levels of creativity following regular participation in improvisation exercises in the entrepreneurship classroom. Similar exercises have been

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implemented throughout a second semester of classroom teaching, with the addition of assigning detailed weekly journals on learning and ideas. The hypothesis of the study was that results on creativity measures will remain consistent with those reported in this article. Additionally, the journals will be analyzed using sentiment scores (ranging from -1, completely negative, to +1, completely positive) for each exercise, calculated using the VADER (Valence Aware Dictionary for Sentiment Reasoning) Sentiment Intensity Analyzer from the NLTK package in Python. VADER is a model used for text sentiment analysis that is sensitive to both polarity (positive/negative) and intensity (strength) of emotion and is particularly effective for social media posts (Hutto & Gilbert, 2014). Results from this analysis will provide insights into the efficacy of specific exercises.

Arts entrepreneurship educators can seamlessly integrate the exercises detailed in this study into their teaching methodologies. These exercises not only offer a richly enjoyable and engaging experience but also equip students with practical, hands-on exposure to the art of improvisational thinking. Educators across disciplines and institutions have the flexibility to emulate our methodology, thereby contributing to the ongoing validation of our findings. We anticipate that educators will find this approach not only compelling but also a valuable addition to their curriculum. By infusing elements of improvisation, they can invigorate their students' creative capacities, nurture entrepreneurial thinking, and ready them for the ever-evolving challenges of the modern world. This innovative approach is versatile and adaptable, making it well-suited to a variety of learning environments. Its potential to empower students with indispensable skills and a growth mindset positions them for success in their future pursuits.

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Appendix A: Improvisation Exercises categorized by Factors of the Jazz Jam Session Model for Group Creativity

1. Individual Competence and Knowledge of the Field (ICKF)
2. Engage in the habit of journaling by starting reflections after each class session and expanding into daily reflections, thoughts, ideas.

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3. Passion Cubes - take six cards: 1 = your passion, 2 and 3 = why are your passionate about your passion, 4-6 = what are your strengths/ skills, mix cards face down, tape like a cube, pick a random corner and come up with a random business/ career idea that puts together the sides intersecting at the corner - on a regular basis write down a venture created from one of the corners.
4. Find 100 solutions to one problem (Group Project)
5. Attend to one thing at a time, avoid multitasking - if your mind wanders, get it back.
6. Create a simple ritual - think about changing a habit and what would make the task more pleasurable, find a time every day to prepare the more pleasurable environment for the new task.
7. Take a topic suggestion for a talk and produce an 'expert talk' on the topic for 2-3 minutes.

Practicing Improvisation as the Ability to Overcome Self-Consciousness

8. Start each class with a short improv exercise drawn from here https://www.theatrefolk.com/blog/improv-games-for-collaboration/
9. For one day say yes to everything, write a reflection.
10. Imagine the gift - unwrap the imaginary box and describe your present, your mind has always content, ideas, just trust your instincts.
11. Improvise a monologue - if there were four more hours in the day how would you spend them.
12. Don't try to be perfect - pick a gift for a friend that's an everyday item.
13. Make up new words to a tune you know and sing it.
14. Pick a simple household item/ object and come up with as many uses as possible.
15. Word associations - say a word, next person says first associated word that comes to mind - switch directions.
16. Walk around the room and label objects, but not with their real name.
17. Network in a virtual world such as https://www.gather.town/.

Establishing a Mentoring System and Role Models

18. Interviewing an entrepreneur.
19. Log interesting cases/ ventures.
20. Video Book Review (15 mi.) of a book of your choice. Book topics could include but are not limited to Artist Biographies, Arts Management, Art Forms, Creativity, Intersect of Arts/Music and Religion/Spirituality, Arts Entrepreneurship, and Arts Marketing.

Democracy and Collaboration

21. Divide students into pairs and have one person state an idea and the other person respond with the reply "Yes, and." The "Yes, and" principle does not allow for the negative words such as "no" and "but" as the following conversation illustrates. The goal of the exercise is to have each pair try to build off of the proposed idea.
22. Change frames by analyzing jokes (Meme).
23. Use New Yorker Cartoons without captions - create captions.
24. Create metaphors and analogies between unrelated people, places, objects.
25. Experiment with your new ventures (this is a group assignment after the 100 ideas assignment seen in exercise number 3)
26. Actors pair up and one is the 'mirror'. The actor makes physical movements, and the mirror has to mirro them exactly so the actor feels as if he-she is looking in a mirror.
27. One word at a time story - 3 or 4 actors line up on stage and make a suggestion for a story title, one that is not real, has never been told before. The actors must then construct a story one word at a time. - can also be conducted by an audience member who points at actors for periods of time when they must be the storytellers.
28. Create an innovative name tag: Students will create a fun and inspirational nametag to improve networking in an online setting.
29. Craft a face mask based on a mission statement.

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30. GIS Art Tour Project: Map your Art Tour Project using the data you collected in Excel on either Google Map or ArcGIS Online. Plan to include the necessary data into each node including but not limited to the name of the art organization or art display, address, cost of entry if any, website, etc.

Leaders and Sidepeople (LS)

31. Puzzle vs Quilts.
32. Six-word memoir (Describe You in 6 words - sentence aka. Tweet)

Community Support (CS)

33. Change the location of a familiar activity, change places during class, change the spot of your virtual meeting.
34. Find new things in a familiar environment, what haven't you noticed that has been there all along?
35. Random acts of kindness - do something nice a day, develop empathy.
36. Give away smiles to anyone you encounter.

Continuous Evaluation Systems

37. Walk home a different route or just take a different route not taken before - observe something you haven't seen before.
38. Focused Observation - Activities, Environment, Interactions, Objects, Users (Observe with Open mindset).
39. Go to a new restaurant, order something you haven't tried before.
40. Embrace mistakes - keep a tally of mistakes every day, after you noticed one take a bow and say "tah-dah" like a circus clown and with your head up move forward, admitting a mistake shows character.
41. Pitch Deck role play - create different scenarios for a possible investor pitch and make a pretend pitch.

Appendix B.: Summary Statistics with Signed-Ranks and Creative Capacity Percentage Increase for the Participants Sample (n=41)

ID	Grade	Gender	Before	After	Diff	Abs Diff	Rank of Abs Diff	Positive Ranks (T+)	Negative Ranks (T-)	% Increase
1	U	F	279	299	20	20	26	26		7.2%
2	U	F	281	277	-4	4	6		6	-1.4%
3	U	M	233	240	7	7	10	10		3.0%
4	G	F	267	245	-22	22	30		30	-8.2%
5	U	F	256	275	19	19	23.5	23.5		7.4%
6	U	M	255	238	-17	17	19		19	-6.7%
7	U	M	275	228	-47	47	41		41	-17.1%
8	U	F	289	313	24	24	32	32		8.3%
9	G	F	233	238	5	5	8.5	8.5		2.1%
10	U	F	243	252	9	9	12	12		3.7%
11	U	F	273	299	26	26	33	33		9.5%
12	G	M	230	222	-8	8	11		11	-3.5%
13	G	M	232	274	42	42	38	38		18.1%
14	G	F	215	236	21	21	28	28		9.8%
15	G	M	282	254	-28	28	35		35	-9.9%
16	U	F	290	292	2	2	2.5	2.5		0.7%
17	U	M	242	271	29	29	36	36		12.0%

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18	U	NB	243	261	18	18	21.5	21.5		7.4%
19	U	F	269	286	17	17	19	19		6.3%
20	U	M	233	229	-4	4	6		6	-1.7%
21	U	M	262	272	10	10	14	14		3.8%
22	U	M	282	260	-22	22	30		30	-7.8%
23	G	F	252	293	41	41	37	37		16.3%
24	U	F	235	225	-10	10	14		14	-4.3%
25	U	F	221	233	12	12	16	16		5.4%
26	U	M	258	276	18	18	21.5	21.5		7.0%
27	U	F	216	243	27	27	34	34		12.5%
28	U	M	246	250	4	4	6	6		1.6%
29	U	M	261	264	3	3	4	4		1.1%
30	U	F	233	255	22	22	30	30		9.4%
31	U	M	230	247	17	17	19	19		7.4%
32	U	F	255	269	14	14	17	17		5.5%
33	U	M	246	289	43	43	39	39		17.5%
34	U	M	231	233	2	2	2.5	2.5		0.9%
35	U	M	281	261	-20	20	26.0		26	-7.1%
36	U	F	259	264	5	5	8.5	8.5		1.9%
37	U	F	232	251	19	19	23.5	23.5		8.2%
38	U	M	260	306	46	46	40	40		17.7%
39	U	F	268	258	-10	10	14		14	-3.7%
40	U	M	250	249	-1	1	1		1	-0.4%
41	U	M	274	294	20	20	26	26		7.3%
							Total	**628**	**233**	**3.6%**

Appendix C: Summary Statistics with Signed-Ranks and Creative Capacity Percentage Increases for the Sample of Questions

Q ID	Questions & Measure Categories	Before	After	Diff	Abs Diff	Rank of Abs Diff	Positive Ranks (T+)	Negative Ranks (T-)	Overall % Increase	M	F	U	G
	Creativity/Abstraction Measure												
Q1	I am inventive	148	156	8	8	54	54		5.4%	1.4%	9.9%	4.8%	8.3%
Q2	I serve as a good role model for creativity	150	164	14	14	64.5	64.5		9.3%	5.3%	12.5%	10.4%	4.0%
Q3	I demonstrate originality in my work	164	167	3	3	23.5	23.5		1.8%	-1.2%	5.1%	0.7%	8.0%
Q4	I am creative when asked to work with limited resources	158	163	5	5	37.5	37.5		3.2%	-2.6%	9.2%	2.3%	8.0%

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Q5	I identify ways in which resources can be recombined to produce novel products	145	150	5	5	37.5	37.5		3.4%	2.9%	2.7%	5.0%	-4.0%
Q6	I find new uses for existing methods or equipment	140	150	10	10	60.5	60.5		7.1%	2.9%	11.6%	6.8%	9.1%
Q7	I think outside of the box	161	167	6	6	45	45		3.7%	0.0%	8.1%	3.7%	3.7%
Q8	I take risks in terms of producing new ideas in completing projects	137	163	26	26	73	73		19.0%	13.0%	26.6%	18.1%	23.8%
Q9	I identify opportunities for new services/products	139	160	21	21	72	72		15.1%	7.2%	20.6%	17.7%	3.8%
Q10	New experiences increase my creative output	186	184	-2	2	15.5		15.5	-1.1%	-5.4%	3.4%	1.3%	-12.9%
	Pressure/Stress Measure												
Q11	I think creatively when I am outside of my comfort zone	153	160	7	7	50	50		4.6%	-1.3%	10.1%	3.8%	9.1%
Q12	I perform better under time pressure	135	152	17	17	69.5	69.5		12.6%	11.8%	12.5%	10.5%	23.8%
Q13	I need pressure in order to focus	131	151	20	20	71	71		15.3%	18.0%	13.4%	16.8%	8.3%
Q14	I enjoy taking risks	140	149	9	9	58	58		6.4%	4.1%	7.9%	7.6%	0.0%
Q15	I respond to problems in a spur of the moment way	140	148	8	8	54	54		5.7%	5.6%	4.5%	5.0%	10.0%
Q16	I seek out pressure-filled environments	110	119	9	9	58	58		8.2%	17.0%	-1.9%	10.0%	0.0%
Q17	I wait until the last moment to complete projects	132	146	14	14	64.5	64.5		10.6%	11.1%	10.6%	11.0%	8.7%
Q18	I live in the moment	157	152	-5	5	37.5		37.5	-3.2%	-11.3%	5.5%	-2.3%	-7.4%
Q19	I think on my feet when carrying out actions	148	165	17	17	69.5	69.5		11.5%	1.3%	24.6%	11.2%	13.0%
	Persistence Measure												
Q20	I am not easily distracted	99	107	8	8	54	54		8.1%	8.0%	8.5%	1.2%	43.8%
Q21	I am a persistent person	152	152	0	0	0			0.0%	-1.4%	1.4%	1.6%	-7.7%
Q22	I don't let past failures hinder	134	144	10	10	60.5	60.5		7.5%	4.5%	10.9%	8.2%	4.2%

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	future performance												
Q23	I am action oriented	147	156	9	9	58	58		6.1%	3.9 %	7.5 %	7.3 %	0.0 %
Q24	I am an optimist	158	161	3	3	23.5	23.5		1.9%	-2.5 %	5.3 %	-0.7 %	17.4 %
Q25	I don't easily get frustrated when things don't go my way	131	135	4	4	30	30		3.1%	-1.5 %	8.1 %	-4.4 %	52.9 %
Q26	During a catastrophe, I am likely to adopt a leadership role	152	159	7	7	50	50		4.6%	1.3 %	8.5 %	7.1 %	-7.7 %
Q27	I am a person who forms a plan and sticks to it	149	147	-2	2	15.5		15.5	-1.3%	-5.4 %	2.8 %	0.0 %	-6.9 %
Q28	I am a person who can always dig their way out of a hole	161	163	2	2	15.5	15.5		1.2%	-2.4 %	5.3 %	0.0 %	8.3 %
Q29	I am a person who is thorough	159	160	1	1	7.5	7.5		0.6%	2.8 %	-1.2 %	1.5 %	-3.7 %
Q30	Nothing is more important than the achievement of my goals	153	146	-7	7	50		50	-4.6%	-7.5 %	-1.4 %	-2.4 %	-14.3 %
Q31	I am good at solving logic problems	155	163	8	8	54	54		5.2%	4.1 %	6.5 %	6.3 %	0.0 %
	Perspective/Boldness Measure												
Q32	I am a person who laughs more than most people	160	163	3	3	23.5	23.5		1.9%	5.6 %	-1.2 %	0.7 %	8.0 %
Q33	I am a person who likes to be a part of the system	122	116	-6	6	45		45	-4.9%	0.0 %	-10.9%	-5.8 %	0.0 %
Q34	I am a person who likes to take charge of a situation	153	155	2	2	15.5	15.5		1.3%	-2.7 %	4.0 %	1.6 %	0.0 %
Q35	I am a person who can always see both sides of an argument	168	170	2	2	15.5	15.5		1.2%	0.0 %	1.2 %	1.4 %	0.0 %
Q36	I am a person who likes to work on one thing at a time	142	139	-3	3	23.5		23.5	-2.1%	-2.9 %	-1.4 %	-2.6 %	0.0 %
Q37	I am a person who believes history repeats itself	81	92	11	11	62	62		13.6%	21.1 %	10.0%	12.3 %	18.8 %
Q38	I am a person who believes rules exist for good reasons	95	97	2	2	15.5	15.5		2.1%	15.6 %	-10.6%	-2.4 %	30.8 %
Q39	I am a person who gets angry when they see things that are not as well	101	100	-1	1	7.5		7.5	-1.0%	-2.0 %	0.0 %	-10.1 %	66.7 %

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	done as they should be												
Q40	I am a person who is eager	163	161	-2	2	15.5		15.5	-1.2%	-2.5%	0.0%	-0.7%	-3.8%
Q41	I am a person who aims for stability	85	85	0	0	0			0.0%	-6.8%	7.9%	-2.9%	11.8%
Q42	I am a person who is good at getting their own way	104	100	-4	4	30		30	-3.8%	-5.7%	0.0%	-4.7%	0.0%
Q43	I am a person who likes to make controversial statements just to provoke a response	83	89	6	6	45	45		7.2%	15.0%	0.0%	4.4%	20.0%
Q44	I am a person who others regularly turn to for advice	156	160	4	4	30	30		2.6%	2.9%	2.4%	0.8%	12.0%
Q45	I am a person who likes to see concrete proof before they believe what they are told	91	85	-6	6	45		45	-6.6%	-13.3%	0.0%	-8.0%	0.0%
	Ideation/Curiosity/Complexity Measure												
Q46	I have many wild ideas	154	155	1	1	7.5	7.5		0.6%	-3.9%	4.1%	0.0%	4.0%
Q47	I think about ideas more than most people	150	156	6	6	45	45		4.0%	-2.7%	11.0%	5.7%	-3.6%
Q48	I get excited by my own new ideas	175	170	-5	5	37.5		37.5	-2.9%	-5.7%	-1.2%	-2.1%	-6.9%
Q49	I come up with a lot of ideas or solutions to problems	156	160	4	4	30	30		2.6%	-1.3%	6.7%	4.7%	-7.1%
Q50	I come up with an idea or solution other people have not thought of	142	138	-4	4	30		30	-2.8%	-9.9%	4.4%	-2.5%	-4.2%
Q51	I like to play around with ideas for the fun of it	155	160	5	5	37.5	37.5		3.2%	-1.3%	6.8%	7.9%	-17.2%
Q52	It is important to be able to think of bizarre and wild possibilities	167	169	2	2	15.5	15.5		1.2%	-1.2%	3.7%	2.1%	-3.7%
Q53	I would rate myself highly in being able to come up with ideas	142	155	13	13	63	63		9.2%	9.2%	8.1%	11.0%	0.0%
Q54	I have always been an active thinker and I have lots of ideas	156	159	3	3	23.5	23.5		1.9%	0.0%	2.5%	0.8%	8.3%

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Q55	I enjoy having leeway in the things I do and room to make up my own mind	166	166	0	0	0			0.0%	-4.9%	5.0%	-0.7%	3.8%
Q56	My ideas are considered impractical or even wild.	124	122	-2	2	15.5		15.5	-1.6%	-6.6%	5.1%	-5.7%	21.1%
Q57	I would take a college course which was based on original ideas	152	151	-1	1	7.5		7.5	-0.7%	5.5%	-6.7%	-0.8%	0.0%
Q58	I am able to think about things intensely for many hours	143	147	4	4	30	30		2.8%	6.3%	1.3%	8.8%	-20.7%
Q59	I get so interested in a new idea that I forget about other things that I should be doing	155	171	16	16	68	68		10.3%	19.7%	2.5%	14.2%	-7.1%
Q60	I have trouble sleeping at night, because so many ideas keep popping into my head	144	143	-1	1	7.5		7.5	-0.7%	1.5%	-2.7%	-0.8%	0.0%
Q61	When writing papers or talking to people, I have trouble staying with one topic because I think of so many things to write or say	148	145	-3	3	23.5		23.5	-2.0%	1.4%	-5.3%	0.8%	-15.4%
Q62	I find that one of my ideas has led me to other ideas that have led me to other ideas, and I end up with an idea and do not know where it came from	150	155	5	5	37.5	37.5		3.3%	-4.3%	10.4%	7.4%	-14.3%
Q63	Some people might think me scatterbrained or absentminded because I think about a variety of things at once	131	146	15	15	66.5	66.5		11.5%	10.9%	12.7%	10.8%	15.0%
Q64	I try to exercise my mind by thinking things through	153	157	4	4	30	30		2.6%	1.3%	2.7%	4.7%	-7.7%
Q65	I am able to think up answers to problems that haven't already been figured out	135	136	1	1	7.5	7.5		0.7%	1.5%	-1.5%	2.7%	-8.0%

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Q66	I am good at combining ideas in ways that others have not tried	141	146	5	5	37.5	37.5		3.5%	6.1 %	1.4 %	2.5 %	9.1 %
Q67	Friends ask me to help them think of ideas and solutions	147	155	8	8	54	54		5.4%	9.5 %	1.2 %	9.8 %	-16.7 %
Q68	I have ideas about new inventions or about how to improve things	142	148	6	6	45	45		4.2%	7.7 %	1.4 %	2.5 %	13.0 %
Q69	I am a person who likes to operate on the basis of instinct and 'gut-feel'	152	152	0	0	0			0.0%	-2.6 %	2.8 %	-2.3 %	14.3 %
Q70	I am a person who likes to see the bigger picture	171	169	-2	2	15.5		15.5	-1.2%	-2.3 %	0.0 %	0.0 %	-6.9 %
Q71	I am a person who likes crossword puzzles	108	113	5	5	37.5	37.5		4.6%	9.5 %	0.0 %	2.2 %	17.6 %
Q72	I am a person who likes frequent change	115	130	15	15	66.5	66.5		13.0%	23.6 %	3.6 %	13.3 %	11.8 %
Q73	I am a person who enjoys working with people from different disciplines and skills	170	176	6	6	45	45		3.5%	2.4 %	4.8 %	1.4 %	16.7 %
					Total	**69**	**2269**	**422**	**3.6%**				

Received: 1-April-2024, Manuscript No. AJEE-24-14725; **Editor assigned:** 3-April-2024, PreQC No. AJEE-24-14725(PQ); **Reviewed:** 19-April-2024, QC No. AJEE-24-14725; **Revised:** 23-April-2024, Manuscript No. AJEE-24-14725(R); **Published:**29-April-2024

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