Create or Innovate? Can an innovation training program enhance the development of new ideas beyond creativity training?

By
Rachael Jones-Chick

A Thesis Submitted to
Saint Mary's University, Halifax, Nova Scotia
In Partial Fulfillment of the Requirements for
the Degree of MSc Applied Psychology (Industrial/Organizational Psychology).

July, 2019, Halifax, Nova Scotia

Approved:	Dr. Kevin Kelloway Supervisor
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Date:	July 16, 2019

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Abstract: The current study intended to answer the question of whether there is a difference between creativity-only training and innovation training in the quality of solutions generated by training participants. To answer this question, differences between three groups were examined to compare the quality of solutions generated by participants who completed the creativity training, the creativity plus innovation training, and a control group. The solutions generated by the three groups were evaluated for novelty, practicality, ease of implementation, and potential effectiveness. Pre- and post-test measures of creative self-efficacy, general self-efficacy, and motivation to innovate were also examined. Results indicate that the creativity plus innovation training group and the creativity-only group generated ideas that were more novel, practical, easier to implement, and had higher potential effectiveness than the control group. Ideas produced by the creativity plus innovation group also had higher potential effectiveness than the creativity-only group.

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Create or Innovate? Can an Innovation Training Program Enhance the Development of New Ideas Beyond Creativity Training?

The world is becoming increasingly complex, and CEOs from around the world have identified creativity as a crucial factor in future business success (IBM, 2010). According to the IBM 2010 Global CEO study, industry transformation was rated as a top factor contributing to organizational uncertainty, indicating that innovative solutions will be required to manage the future of organizational structures, finances, people, and strategies. From a theoretical standpoint, the literature on creativity and innovation in the workplace has also identified the connection to business success. Researchers have found innovation and creativity to be significant determinants of organizational performance, success, and long-term survival (Anderson, Potocnik, & Zhou, 2014). According to O*NET (occupational network database), there are 966 occupations listed as requiring the ability of originality - defined as "The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem" (O*NET, 2018). Similarly, creativity has generally been defined as, the generation of novel and useful ideas (Anderson et al., 2014). With so many occupations requiring the ability of creativity, in addition to the need for creativity and innovation for the current state of industry transformation, training employees to be more creative and innovative may be essential to organizational success. Studies have already identified the link between creativity training and creative performance outcomes for employees (Scott, Leritz, & Mumford, 2004).

Much of the extant work in this area conflates "creativity" with "innovation" (Hughes, Lee, Wei Tian, Newman, and Legood, 2018). The focus of my research was to separate these two different constructs and to assess whether there was a difference

between creativity-only training and innovation training in the quality of solutions generated by training participants. I addressed this question by examining the effectiveness of the IDEAS creativity training and CLEAR IDEAS innovation training (Birdi, 2016) programs.

Creativity and Innovation

Creativity – the ability to develop original or novel concepts - has been the focus of empirical attention for well over 50 years. For the most part creativity had been defined in terms of personality traits belonging to creative individuals (Torrance, 1962; Amabile, 1982), or in terms of characteristics distinguishing a creative product (Amabile, 1982). Thus, individuals were either innately creative or not with little prospect for change. Amabile (1983) provided the first operational definition of creativity to include both personality and cognition. In doing so, she raised the possibility of training creativity. She says that:

> "A product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated. Thus, creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers, and it can also be regarded as the process by which something so judged is produced" (Amabile, 1983, p. 2).

Along with the operational definition of creativity, Amabile also provided a conceptual definition, "A product or response will be judged as creative to the extent that a) it is both a novel and appropriate, useful, correct, or valuable response to the task at hand and b) the task is heuristic rather than algorithmic" (Amabile, 1983, p. 4). The

theory behind these definitions is a three-step framework suggesting that creativity requires domain-relevant skills, creativity-relevant skills, and task motivation. Therefore, for creativity to occur, the individual must have cognitive abilities and knowledge of the domain in which they wish to be creative; they must have experience in idea generation and certain personality characteristics that promote creativity; and finally, the individual must have intrinsic motivation toward the task at hand and the ability to disregard extrinsic constraints (Amabile, 1983). These definitions, with their basis in social psychology set the foundation for the research in creativity that has motivated the current proposal.

Building on Amabile's work on individual characteristics and creativity, in their meta-analysis, Hammond, Neff, Farr, Schwall, and Zhao (2011) found that creative personality and the Big Five 'openness' personality trait had moderately strong positive correlations with individual innovative behaviour. Assessments of creative personality measure creativity-relevant personality traits using adjectives, such as original, inventive, insightful, and clever (Hammond et al., 2011). Developed by Gough in 1979, the Creative Personality Scale has been applied to the work setting to examine topics such as the role of employee creative personality in the interaction between leadership behaviours and employee task creativity (Zhou, 2003). Gough's 1979 scale is one of the most widely used measures of creativity, with one study using the measure to assess employee creativity being cited in 3600 articles on Google Scholar and 1128 articles on Web of Science (Oldham & Cummings, 1996).

In terms of the Big Five personality trait of openness, this trait has been linked to features such as intellectual curiosity, imagination, and independence, which may be why people with this trait are more likely to engage in innovative endeavors, rather than shy

away from the potential risk of failure (Hammond et al., 2011; McCrae, 1987). One influential study by George and Zhou (2001) confirmed the link between openness to experience and creativity in the workplace. George and Zhou found that employees were most creative when they were also high in openness to experience. The study also identified certain work characteristics that promoted the manifestation of creative behaviours in conjunction with openness to experience.

While there has been ample research addressing individual differences in creativity and how to measure these characteristics, the construct of innovation has generally been used interchangeably with creativity and rarely receives isolated interest. Historically, there has been a lack of clarity in the definitions and the boundaries that divide creativity from innovation (Anderson et al., 2014). Oldham and Cummings (1996) applied the concept of creativity to the work context and defined creativity as, "products, ideas, or procedures that satisfy two conditions: 1) they are novel or original and 2) they are potentially relevant for, or useful to, an organization" (p. 3). Furthermore, these authors suggested that creativity occurs at the individual level in the production of novel ideas, while innovation occurs at the organizational level through successful implementation of those ideas within the organization (Oldham & Cummings, 1996).

Oldham and Cummings tested their theory with a sample of employees working in technical equipment manufacturing facilities. Scores were obtained from each participant on creative personality using Gough's 1979 scale, job complexity, and supervisor style (supportive and controlling). The results indicated that employees were most creative when they held creativity-relevant characteristics (creative personality), worked in complex, challenging positions, and had supportive, noncontrolling supervision (Oldham & Cummings, 1996).

In 1998, West and Anderson validated their hypothesized Team Climate Inventory (TCI) by applying it to innovation, which resulted in a successful multidimensional measure of proximal workgroup climate for innovation. Applied to climate for innovation, the TCI consists of five factors: vision, participative safety, support for innovation, task orientation, and interaction frequency. Using the TCI as a foundation, in 2002, West developed an integrative model of creativity and innovation in work groups. In the newer model, West suggests that innovation is a two-part process that encompasses both creativity as the development of new ideas, and innovation implementation, which is the application of those creative ideas for new or improved products, services, and processes (West, 2002).

Applying this definition to group processes, West provided a framework to determine the level of group innovation, which includes: task characteristics, group knowledge diversity and skills, external demands, and integrating group processes. Ultimately, for groups to achieve high levels of innovation, West concluded that the context of the group task must be demanding, but with the presence of strong group integration processes such as clarifying objectives, encouraging participation, constructive controversy, reflexivity, and support for innovation; and intra-group psychosocial safety (West, 2002).

While the level of group innovation is an important attribute important for innovative group outcomes, the individual-level innovation within the group has also been suggested to play an important role. Kirton (1976) proposed the hypothesis of an adapter-innovator personality continuum and developed a measure with which individual-level innovativeness or adaptiveness can be located. On Kirton's continuum, 'innovative' is the label used for the ability to 'do things differently', and 'adaptive' is the label used for the ability to 'do things better' (Kirton, 1976). Kirton describes the phenomenon by which

adaptors are more likely than innovators to identify events that "originate within the currently guiding paradigm", while innovators are more likely to identify events "emanating from outside the system" (Kirton, 1976). It may be difficult for adaptors to recognize and accept the more radical solutions proposed by innovators, and so these individual-level differences may play an important role in either facilitating or discouraging group-level innovation.

Haner (2005) explored the attributes of the physical workplace environment that contribute to the promotion of creativity and innovation. Haner's descriptions of creativity and innovation do not directly align with the constructs described in the current study, as Haner's constructs only encompass idea generation up to the selection of a solution rather than continuing to the implementation phase for innovation. Using the lens of the current study's definition of creativity as idea generation and selection, it is still interesting to explore Haner's work in the context of creativity promoted through the physical workplace environment. Haner described four phases of an office setting designed for a work environment that supports creativity and innovation, called the Interactive Creativity Landscape (ICL). The four phases of the ICL are: 'preparation', which involves problem cognition and information generation; 'incubation', which includes the combination of information and the choice of problem solving approach; 'insight/illumination', which is described as a flash of thought; and lastly, 'elaboration and evaluation', which is the verification of the solution and further specification (Haner, 2005). From the perspective of convergent and divergent thinking, Haner described creativity as occurring through convergent thinking in the initial 'preparation' phase, while innovation occurs through divergent thinking in the 'incubation' and 'insight' phases, as well as through convergent thinking in the 'elaboration and evaluation' phase

(Haner, 2005). These creativity and innovation tasks are further described as falling into the categories of single-focused (requiring a single answer), which embodies convergence and multi-focused (allowing for openness and ambiguity in the outcome), which embodies divergence. While Haner applied these characteristics to the physical environments of organizations to explore ways to improve creativity and innovation, the consideration of different thinking methods (convergent and divergent) being required at different times throughout the creativity and innovation process occurs throughout the literature on this topic.

More recently in 2014, Anderson, Potocnik, and Zhou conducted a review of the organizational creativity and innovation literature, resulting in a guiding framework and integrative definition. For their integrative definition, Anderson et al. (2014) suggest that,

> "Creativity and innovation at work are the process, outcomes, and products of attempts to develop and introduce new and improved ways of doing things. The creativity stage of this process refers to idea generation, and innovation refers to the subsequent stage of implementing ideas toward better procedures, practices, or products. Creativity and innovation can occur at the level of the individual, work team, organization, or at more than one of these levels combined but will invariably result in identifiable benefits at one or more of these levels of analysis". (p. 2)

This integrative definition addresses the conflicting definitions found in the preceding literature. While some authors have defined creativity and innovation as two entirely different processes and others have defined them as one entirely fused process, Anderson et al. indicate that while creativity and innovation can occur independently of one another and are by no means identical, they are certainly related processes.

In comparing the definition provided by Anderson et al. (2014) with Haner's phases of workplace creativity and innovation, it appears that there is compatibility between the two views with some exceptions. While Haner describes creativity as occurring at the 'preparation' phase through convergent thinking, if the definition of creativity from Anderson et al. is taken into account, it could be expected that divergent thinking would occur first (before Haner's phase of preparation). Divergent thinking would be required for idea generation to occur and then convergent thinking would come into place at the preparation phase in order to select the idea on which to focus. Divergent thinking during Haner's phases of 'incubation' and 'insight/illumination' appears to be in line with the 'idea implementation' definition of innovation provided by Anderson et al., as many ideas would need to be considered before returning to convergent thinking at Haner's last stage of 'elaboration and evaluation' in order to select the final solution.

Most recently, Hughes, Lee, Wei Tian, Newman, and Legood (2018) conducted a critical review on creativity and innovation. The review highlights an issue that embroils the majority of definitions in the creativity and innovation research, and that is the focus on the antecedents and outcomes of creativity and innovation rather than focusing on the phenomenon itself. The two main problems that the authors identify in the typical definitions of creativity and innovation are that they can lead to poor measure development due to misconceptions, and that they cause challenges in distinguishing the phenomenon from its effects (Hughes et al., 2018). Specifically, Hughes et al. (2018) believe that a creative or innovative process can exist before the effects are known, however, with a definition focusing on the successful outcome of an idea to deem it creative, it would not be possible to evaluate an idea's creativeness or innovativeness until after the implementation and subsequent measurement of the outcome. Therefore,

these authors remove a common attribute of previous definitions of creativity and innovation: usefulness. The removal of this attribute results in the following definition,

> Workplace creativity concerns the cognitive and behavioural processes applied when attempting to generate novel ideas. Workplace innovation concerns the processes applied when attempting to implement new ideas. Specifically, innovation involves some combination of problem/opportunity identification, the introduction, adoption or modification of new ideas germane to organizational needs, the promotion of these ideas, and the practical implementation of these ideas (Hughes et al., 2018, p. 3).

Based on this review in my research I defined creativity as the generation of ideas and innovation as the inclusion of specifications for how ideas can be implemented.

Creativity and Innovation Training

There is a strong and expansive literature on what characteristics and environments are ideal to facilitate creativity, however the question that remains is how to promote creativity in the absence of innate skills and supportive environments. Specifically, can people be trained to be more creative, regardless of their baseline creative abilities? Creativity training has predominantly been explored in the field of engineering for the purpose of creating new products (Birdi, Leach, & Magadley, 2012; Mann, 2001). In fact, Birdi et al. (2012) made the suggestion that future studies should examine the use of creativity and innovation training among samples that do not stereotypically require creativity in their jobs, since the typical engineer samples did require some level of creativity in their daily work prior to these interventions. According to Birdi (2016), "the underlying aim of all creativity training is to help participants generate more novel ideas to deal with challenges they are facing" (p. 1). Common methods of creativity training

include Creative Problem Solving (Osborne, 1957), the Theory of Inventive Problem Solving (Altshuller, 1956) and Birdi's (2008) CLEAR IDEAS framework with the latter being the focus of my research.

Creative Problem Solving (CPS). This early method of creativity training was developed by Osborn (1957) and is based on the idea of 'brainstorming'. This theory posits that by taking note of every possible solution that one can think of, and reserving judgement and selection of a final solution until the end of the process, one will result in a more creative final product (Parnes & Meadow, 1959). One study using the CPS model found that participants generated significantly more and better-quality solutions when given brainstorming instructions than when given non-brainstorming instructions (Meadow, Parnes, & Reese, 1959).

While Creative Problem Solving based on brainstorming provided a foundation for the notion of training people to generate more creative ideas, the method of brainstorming has since been shown to have a negative effect on the idea generation process. For example, Diehl and Stroebe (1987) found that brainstorming reduced group productivity due to group member free riding by not contributing ideas, having evaluation apprehension, and blocking production of ideas. The authors suggest, however, that idea generation in groups may be more effective if members first develop their ideas individually, and then come together as a group to evaluate rather than produce ideas. This modified form of brainstorming is used in the Birdi's CLEAR IDEAS program, discussed below.

Theory of Inventive Problem Solving (TRIZ). Developed in the 1950s by Genrich Altshuller, TRIZ is the theory of inventive problem solving (Mann, 2001; Birdi et al, 2012). This early conception of creativity training involves four distinct pillars that are

intended to facilitate the problem-solving process. According to Mann (2001), the pillars include: contradictions (non-conventional solutions), ideality (beginning the problem solving process with the ideal final result in mind rather than starting from the current situation), functionality (the notion that 'solutions change, functions stay the same'), and use of resources (in TRIZ, resources are described as 'anything in the system which is not being used to its maximum potential').

Birdi, et al. (2012) applied the TRIZ framework to an organizational field study of creativity in design engineers. Participants in this study attended a one-day TRIZ creative problem-solving training and were compared to employees who did not attend the training on measures of number of patent submissions, idea submissions, self-reported idea suggestion and idea implementation at work, as well as creative problem-solving skills. The measure of creative problem-solving assessed idea generation and evaluation skills by incorporating the theory of Basadur et al. (1982), which suggests that convergent thinking facilitates problem definition and idea selection, while divergent thinking facilitates idea generation (Birdi et al., 2012). Overall, participants who attended the TRIZ training had better problem-solving skills and motivation to innovate, which resulted in more idea generation at work when compared to the group of employees who did not attend the training (Birdi et al., 2012).

CLEAR IDEAS. Birdi developed the CLEAR IDEAS innovation training model in 2005 by integrating the previous literature on creative thinking and problem-solving, including six creativity thinking approaches: brainstorming, synectics, lateral thinking, morphological analysis, TRIZ, and design thinking (Birdi, 2016). The CLEAR IDEAS framework focuses the causes of the problem in order to generate creative solutions, clarify ways to implement the solution, and confirm fit of the solution to ensure long term

benefit. Therefore, the model trains the skills necessary both to generate and implement ideas (Birdi, 2016).

The ‘CLEAR IDEAS’ name is an acronym and each letter represents a different function in the creativity and innovation process. The word ‘ideas’ stands for illuminate, diagnose, erupt, assess, and select. As mentioned earlier in the current proposal, divergent and convergent thinking have roles in the creativity process, and this ‘ideas’ part is meant to facilitate these skills for creative thinking and problem-solving. The word ‘clear’ stands for commit, lead, engage, align, and review. This process addresses five factors that have been identified in the literature as being necessary for the successful implementation of new ideas (Birdi, 2016). According to common definitions in the literature, the ‘ideas’ part of this model represents creativity training, while the ‘clear’ part represents innovation.

The CLEAR IDEAS training program is a problem-solving method that is rooted in the creativity-training literature and is one of the only training programs to include a specific innovation training component. Due to the integration of multiple types of creativity training and the novel addition of idea implementation training, the CLEAR IDEAS model was selected for use in the current study. There are currently no published articles evaluating the CLEAR IDEAS framework, thus the current study also purports to provide an initial validation of the model for facilitating the development of creative and innovative ideas.

Evaluating Creativity and Innovation

For many years, the focus in the creativity evaluation literature was on the assessment of individual creative ability and self-reported creativity (Amabile, 1982; Carson et al.,

2005; Runco, Plucker, & Lim, 2001). Plucker and Makel (2010) identified that most assessments of creativity fall into two categories: tests of intelligence and tests of personality. These assessments receive a great deal of criticism however, as they often rely on assessments of past creative achievement or generate domain-specific scores (Carson et al., 2005). One early article by Amabile (1982) provides a consensual assessment technique (CAT) for creativity, which is a general method for subjective judgements of creativity and is one that continues to receive validation as one of the most powerful creativity assessment methods available (Kaufman, Baer, & Cole, 2009). The CAT is based on the product, rather than the process or the person, which are often the focus of creativity assessments (Amabile, 1982). The two assumptions underlying the CAT are that reliable assessments of creative products can be obtained through an appropriate group of judges, and that creativity does exist on a continuous dimension where some products are more creative than others (Amabile, 1982). In terms of the assessment procedure required for the CAT, there are also two assumptions. First, judges must be familiar with the domain in which the product for evaluation was developed, and second, assessments made by judges must be completed independently as judges should be subjective and not trained by the experimenter (Amabile, 1982). Amabile (1982) incorporated the CAT to create a Reliable Subjective Assessment Technique, which was used for idea evaluation in the current study. According to Amabile (1982), this method involves judges rating the products (in this case, ideas about how students can study more effectively) independently on a set of criteria. The judges make their ratings of the products relative to the other products being rated, as the participants will likely have lower ratings in comparison to the best product/solution available from experts in the domain. Finally, judges rate the products in a different and random order from the other

judges to reduce false inter-rater reliability effects due to ratings being made in the same order.

Using the methodology of the CAT as a foundation, I had expert judges assess the participants' proposed solutions based on overall novelty, practicality, ease of implementation, and potential effectiveness.

Creativity and Innovation Training Outcomes

Self-efficacy. Creative self-efficacy and general self-efficacy were important measures for the current study. Defined as an individual's "belief in one's capabilities to organize and execute the courses of action required to produce given attainments (p.3), Bandura (1997) suggests that self-efficacy plays an important role in motivation. Previous research has identified the role of self-efficacy as being increased by training (Colquitt, Le Pine, & Noe, 2000; Saks, 1997). Therefore, it was important to assess whether the addition of the innovation process improves general self-efficacy, as this could be related to the transfer of knowledge to future problem-solving. Conversely, creative self-efficacy is defined as "the belief one has the ability to produce creative outcomes" (Tierney & Farmer, 2002, p. 2). The construct of creative self-efficacy is distinctive from general self-efficacy theoretically due to the specification of creative ability attributes such as, confidence in adopting non-conforming perspectives, taking risks, and acting without dependence on social approval (Tierney & Farmer, 2002). The constructs are also distinctive statistically, as Tierney and Farmer (2002) found that creative self-efficacy positively predicted creativity and explained variance in creativity beyond that provided by general job self-efficacy.

Motivation. Birdi et al. (2016) found that intrinsic motivation to innovate was positively and uniquely related to idea implementation. Given that the definition of innovation includes idea implementation, whereas creativity does not include this step, motivation to innovate was expected to be an outcome of the CLEAR IDEAS training due to its innovation guiding process. It was important to measure motivation to innovate for the current study because it was expected that the addition of innovation training to the training program (CLEAR IDEAS rather than IDEAS only) would promote implementation of generated ideas. Birdi et al. (2016) suggested that higher intrinsic motivation should ensure that individuals put in enough effort to guarantee that their ideas are followed through. Previous studies, such as Anderson et al. (2014) have suggested that motivation is also a strong predictor of idea generation (creativity), thus distinguishing between the post-training motivation of the three groups in the current study was important to determine the added benefit of the innovation training.

The Current Study

Currently, there are no known studies evaluating the use of the CLEAR IDEAS model in improving innovative problem solving. I used a sample of online participants to compare the quality of solutions between participants who followed the IDEAS (creativity) program, the CLEAR IDEAS (creativity and innovation) program, and a treatment as usual control group who received no training. Additionally, the criteria of creative self-efficacy, general self-efficacy, and motivation to innovate were evaluated as outcomes of the training program.

Hypotheses

H1A: Use of the CLEAR IDEAS (creativity and innovation) program will result in the generation of ideas that are evaluated as significantly more novel, more practical, easier to implement, and more potentially effective than those generated by the control group.

H1B: Use of the CLEAR IDEAS program will result in the generation of ideas that are evaluated as significantly easier to implement, and more potentially effective than those generated using the IDEAS (creativity) program alone.

H1C: Use of the IDEAS program alone will result in the generation of ideas that are evaluated as significantly more novel, more practical, easier to implement, and more potentially effective than those generated by the control group.

H2A: Use of the CLEAR IDEAS program will result in significantly higher creative and general self-efficacy than the IDEAS program alone and the control group.

H2B: Use of the IDEAS program alone will result in significantly higher creative and general self-efficacy than the control group.

H3A: Use of the CLEAR IDEAS program will result in significantly higher motivation to innovate than the IDEAS program only and the control group.

H3B: Use of the IDEAS program alone will result in significantly higher motivation to innovate than the control group.

Method

The current study aimed to evaluate the differences between participants who completed creativity training, creativity plus innovation training, or no training on self-report measures of creative self-efficacy, general self-efficacy, motivation to innovate,

and objectively-measured quality of ideas generated. Participants were randomly assigned to either the creativity group (using the IDEAS method), the creativity and innovation group (using the CLEAR IDEAS method) or the control group. In addition to completing the study first with no training, the control group also completed the CLEAR IDEAS training after completing the study as the control group.

Participants

In total, 150 participants were recruited from the Mechanical Turk online survey platform. Participants were compensated with USD $6.00. Data from 39 participants was removed due to a failure to respond to the open response questions in the idea generation activity. This led to a final sample of 111, with 32 participating in the CLEAR IDEAS group, 47 participating in the IDEAS group, and 32 participating in the control group. Of the 111 participants, 58.6% were male, 40.5% were female, and 0.9% identified as another gender. The average age was 34.30 with a range of 19 to 64 years of age. The average number of years of post-secondary education completed by participants was 3.30 years, with a range of zero to 10 years completed.

Design and Procedure

Participants were randomly assigned to either the creativity group (using the IDEAS method), the creativity and innovation group (using the CLEAR IDEAS method), or the control group. For an exploratory analysis to examine the differences in ideas generated without any problem-solving framework compared to those generated by the same participants after receiving the CLEAR IDEAS framework, within-group data was collected for the control group. The control group completed the study measures again

and subsequently received the CLEAR IDEAS training before participating in the problem-solving activity for a second time. See Appendix A for process details.

Lecture/training. The participants watched a video lecture, which was a condensed version of Birdi's training program for the assigned problem-solving method. The video lectures included PowerPoint slides using the content from Birdi's IDEAS and CLEAR IDEAS training programs and I narrated them with audio to keep training delivery consistent across the two types of training. The content of Birdi's training, as well as the content of the videos addressed each of the steps in the problem-solving activity "quick template" (see below and Appendix C). This content familiarized participants with the steps that they would be asked to follow to generate ideas during the activity stage of the study, and it provided tips and anecdotes used by Birdi in his full training program. Both videos contained the same content for the creativity portion, however, the CLEAR IDEAS video contained an additional set of innovation-related content. The IDEAS video was 10 minutes long and included information and tips surrounding ways to diagnose the causes of the problem, how to come up with many new ideas without judging their practicality first, followed by a method that could be used to assess the ideas in order to select the best one to carry forward. The CLEAR IDEAS video and the IDEAS video were identical, with the exception of the last 5 minutes of the CLEAR IDEAS video, which contained content to add the innovation training portion. The innovation portion helped participants identify stakeholders who would be needed to help put the idea into place, asked participants to consider the role of the leader of the innovation, the skills, strategies, and other tools that would be needed to deliver the innovation, and additionally, it guided participants through the process of reviewing the innovation to encourage sustainability (see Appendix B).

Solution workbook. For the problem to be solved in the solution workbook, participants were asked, 'how can I improve my own health?'. Participants in all conditions received an online survey containing the study measures and the designated problem-solving framework to follow in order to generate their solutions. The problem-solving framework activity used Birdi's original "quick template" (see Appendix C). It was recommended that participants take about twenty minutes to complete the activity. The survey restricted participants from moving to the next page of the survey until they had spent at least 20 minutes on the solution workbook page to facilitate the expected amount of time to be put into the task.

Evaluation of solutions. Final solutions were entered into a common database for all groups by copying the responses provided in the online surveys, with codes to link the solution to the study conditions so that reviewers were blind to the condition of the idea they were judging. Subject matter experts (SMEs) rated the ideas on a one to five Likert type scale on the criteria of novelty, practicality, ease of implementation, and potential effectiveness. Subject matter experts were three graduate students from the Saint Mary's University Psychology program. Prior to rating the solutions, SMEs rated a set of sample solutions to reach a baseline for expectations of responses they may be scoring. After rating the solutions individually, a discussion was held to examine any differences in scores. The raters discussed any differences and decided on a set of standards for each criterion being scored in order to calibrate the ratings. Raters were blind to the participant conditions. Each solution generated from the participants was evaluated by all three SMEs and scores of inter-rater reliability were assessed to ensure that there was agreement between the raters. Intraclass Correlations (ICCs) were computed to determine if there was agreement among the three SMEs' ratings of participant ideas on novelty,

practicality, ease of implementation, and potential effectiveness. There was strong agreement among the three SMEs' ratings for novelty, ICC = .95 (95% CI, .94, .96), $p < .001$, practicality, ICC = .90 (95% CI, .87, .92), $p < .001$, ease of implementation, ICC = .91 (95% CI, .88, .93), $p < .001$, and potential effectiveness, ICC = .91 (95% CI, .88, .93), $p < .001$.

Measures

Demographic and control variables. Demographic variables including age, gender, and years of postsecondary school completed were collected (see Appendix D). Additionally, a measure of affect was collected (see Appendix E).

Efficacy. Creative self-efficacy was assessed pre- and post-training using Tierney and Farmer's (2002) three-item Creative Self-Efficacy Measure (see Appendix F). An example item is, "I have confidence in my ability to solve problems creatively". General self-efficacy was measured using Chen, Gully, and Eden's (2001) eight-item New General Self-Efficacy Scale (see Appendix G). An example item is, "I will be able to achieve most of the goals that I have set for myself" (Chen, Gully, & Eden, 2001).

Motivation to innovate. Motivation to innovate was assessed pre- and post- training using Birdi et al.'s (2016) Intrinsic Motivation to Innovate measure (see Appendix H). An example item is, "I always try to come up with new ways of dealing with problems".

While the efficacy and motivation to innovate measures could also be evaluated in a mediated model, the current study was interested in evaluating their effect only as outcomes of the training.

Results

Main Study Analyses

Descriptive statistics and correlations for all study variables are presented in Table 1A and B.

Table 1A

Descriptive Statistics and Correlations for all Study Variables: Between-Subject Design (N = 111)

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Age	-														
2. Gender	.30**	-													
3. Years Post-Secondary	.08	.10	-												
4. Negative Affect	.19	-.08	.05	-											
5. Positive Affect	.09	-.24*	.14	.22*	-										
6. Creative SE T1	-.06	-.28**	.26**	.02	.35**	-									
7. General SE T1	.09	-.06	.23*	.21*	.46**	.50**	-								
8. Motivation to Innovate T1	-.04	-.28**	.19	-.09	.38**	.76**	.54**	-							
9. Creative SE T2	.02	-.28**	.24*	.10	.39**	.86**	.58**	.78**	-						
10. General SE T2	.09	-.13	.21*	.26**	.44**	.52**	.91**	.55**	.63**	-					
11. Motivation to Innovate T2	.04	-.23*	.13	-.06	.36**	.72**	.45**	.92**	.79**	.52**	-				
12. Novelty	.15	.05	-.14	-.03	.08	.10	.05	.12	.06	-.01	.13	-			
13. Practicality	.22*	.02	-.09	.09	.10	-.07	-.01	-.11	-.11	-.04	-.11	.38**	-		
14. Ease of Implementation	.26**	.10	-.09	.07	.06	-.01	.04	-.04	-.02	.02	-.02	.72**	.65**	-	
15. Potential Effectiveness	.26**	.03	-.22*	.16	.07	-.04	.02	.01	-.00	.04	.06	.67**	.66**	.80**	-
M	34.40	1.42	3.30	5.96	3.63	4.23	3.87	3.56	4.20	3.87	3.61	2.29	3.45	2.95	3.08
SD	10.18	0.52	1.99	1.27	1.28	1.30	0.73	0.93	1.39	0.81	0.93	0.97	0.76	0.78	0.71

Note. *$p < .05$. **$p < .01$. SE = self-efficacy.

Table 1B

Descriptive Statistics and Correlations for all Study Variables: Within-Subject Design (N = 32)

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	-										
2. Gender	.47**	-									
3. Years Post-Secondary	.35	-.18	-								
4. Negative Affect	.13	-.18	.22	-							
5. Positive Affect	-.10	-.22	.04	.22	-						
6. Creative SE T1	.05	-.31	.26	.08	.34	-					
7. General SE T1	.17	.06	.23	.15	.41*	.46**	-				
8. Motivation to Innovate T1	.06	-.33	.08	-.15	.35*	.76**	.51**	-			
9. Creative SE T2	.07	-.36*	.21	.04	.35	.94**	.49**	.85**	-		
10. General SE T2	.18	.09	.18	.13	.39*	.53**	.94**	.54**	.55**	-	
11. Motivation to Innovate T2	.19	-.23	.06	-.03	.29	.77**	.45**	.94**	.85**	.53**	-
12. Creative SE T3	.18	-.26	.14	.10	.30	.76**	.40*	.64**	.80**	.53**	.75**
13. General SE T3	.23	.08	.14	.05	.33	.45**	.85**	.53**	.50**	.91**	.55**
14. Motivation to Innovate T3	.16	-.22	.02	-.02	.20	.65**	.55**	.82**	.76**	.62**	.85**
15. Novelty T1	-.04	-.21	-.22	.02	.25	-.03	-.02	.28	.08	.00	.23
16. Practicality T1	.10	.09	.22	-.21	.16	-.28	-.13	-.27	-.24	-.18	-.32
17. Ease of Implementation T1	.09	.05	.04	-.12	.02	-.23	-.01	-.04	-.16	-.08	-.14
18. Potential Effectiveness T1	.18	.17	.00	.05	.07	-.28	-.08	-.11	-.23	-.06	-.09
19. Novelty T2	.27	-.11	.42*	-.03	.17	.26	.14	.20	.25	.23	.25
20. Practicality T2	.35*	.22	-.07	-.01	-.01	-.06	-.06	.03	.05	.03	.11
21. Ease of Implementation T2	.35*	.10	.13	.07	-.01	.18	-.06	.11	.23	.04	.20
22. Potential Effectiveness T2	.39*	.03	.19	-.04	-.08	.05	-.06	.12	.10	-.02	.18
M	32.59	1.47	3.81	6.20	3.40	4.13	3.81	3.57	4.22	3.86	3.48
SD	8.14	0.51	2.18	1.02	1.21	1.42	0.86	0.97	1.39	0.88	0.96

Note. *$p < .05$. **$p < .01$. SE = self-efficacy.

Descriptive Statistics and Correlations for all Study Variables: Within-Subject Design (N = 32) (CONTINUED)

Variables	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
1. Age											
2. Gender											
3. Years Post-Secondary											
4. Negative Affect											
5. Positive Affect											
6. Creative SE T1											
7. General SE T1											
8. Motivation to Innovate T1											
9. Creative SE T2											
10. General SE T2											
11. Motivation to Innovate T2											
12. Creative SE T3	-										
13. General SE T3	.64**	-									
14. Motivation to Innovate T3	.80	.73**	-								
15. Novelty T1	.03	.01	.23	-							
16. Practicality T1	-.22	-.12	-.20	.09	-						
17. Ease of Implementation T1	-.17	.00	.11	.36*	.48**	-					
18. Potential Effectiveness T1	-.14	.05	.01	.50**	.55**	.56**	-				
19. Novelty T2	.46**	.30	.30	.10	-.01	-.10	.03	-			
20. Practicality T2	.15	.02	.11	-.17	.17	.13	.05	.14	-		
21. Ease of Implementation T2	.35	.02	.20	-.15	.09	.01	-.01	.41*	.85**	-	
22. Potential Effectiveness T2	.25	.04	.19	.05	.08	.10	.07	.68**	.56**	.75**	-
M	4.31	4.00	3.73	1.65	2.91	2.43	2.65	3.19	3.49	3.51	3.43
SD	1.55	0.85	1.04	0.59	0.62	0.57	0.54	0.92	0.71	0.72	0.64

Note. *$p < .05$. **$p < .01$. SE = self-efficacy.

All 111 participants began by completing measures of creative self-efficacy, general self-efficacy, and motivation to innovate. For the first analysis, these pre-training measures of creative and general self-efficacy and motivation to innovate were used as covariates to control for baseline scores. A one-way between subjects MANCOVA was used to analyze the data, with group membership as the independent variable, and time two measures of creative self-efficacy, general self-efficacy, motivation to innovate, and ratings of participant ideas on measures of novelty, practicality, ease of implementation, and effectiveness as the dependent variables.

Data conformed to the assumption of linearity of regression for creative self-efficacy and motivation to innovate, that is, a linear relationship was observed between the pre-training creative self-efficacy, general self-efficacy, and motivation to innovate covariates and the post-training dependent variables. The dependent variables correlated approximately .03-.74 with the creative self-efficacy covariate, .02-.81 with the general self-efficacy covariate, and .03-.80 with the motivation to innovate covariate. The data also met the assumption of homogeneity of regression at both the multivariate and univariate levels for creative self-efficacy and motivation to innovate, but not for general self-efficacy[1].

Bartlett's test of sphericity was statistically significant (approximate chi square = 377.37, $df = 27$, $p < .001$), indicating that the correlation of the adjusted dependent variables was sufficient to support the MANCOVA. In addition, Box's test of the equality of the variance-covariance matrices was not statistically significant [Box's $M = 72.54$,

[1] A MANOVA was also run (without the covariates) which revealed non-significant univariate effects for the survey variables (creative self-efficacy, general self-efficacy, and motivation to innovate), but a multivariate effect was retained, and results remained the same for the idea rating variables.

$F(56, 26986.87) = 1.17$, $p = .180$], suggesting that the matrices adjusted for the covariate were homogeneous.

The multivariate effects of the covariates of pre-training creative self-efficacy, Wilks' lambda = .51, $F(7, 99) = 13.79$, $p < .001$, pre-training general self-efficacy, Wilks' lambda = .23, $F(7, 99) = 47.73$, $p < .001$, pre-training motivation to innovate, Wilks' lambda = .38, $F(7, 99) = 22.80$, $p < .001$, and the independent variable of group, Wilks' lambda = .52, $F(14, 198) = 5.41$, $p < .001$, were statistically significant. It therefore appears that the group effect accounted for approximately 50% of the multivariate variance. Levene's tests of homogeneity of variance were statistically significant for post-training creative self-efficacy ($p = .008$), novelty ($p < .001$), and ease of implementation ($p = .031$), and so the univariate effects were evaluated with a more stringent Bonferroni corrected alpha.

The results indicated the following group differences. First, in support of hypothesis 1A, participants in the CLEAR IDEAS group generated ideas that were rated as significantly more novel ($M = 2.75$, $SE = 0.16$) than the control group ($M = 1.64$, $SE = 0.16$), more practical ($M = 3.89$, $SE = 0.12$) than the control group ($M = 2.91$, $SE = 0.12$), easier to implement ($M = 3.36$, $SE = 0.13$) than the control group ($M = 2.44$, $SE = 0.13$), and as having higher potential effectiveness ($M = 3.54$, $SE = 0.11$) than the control group ($M = 2.63$, $SE = 0.11$) (see Figure 1).

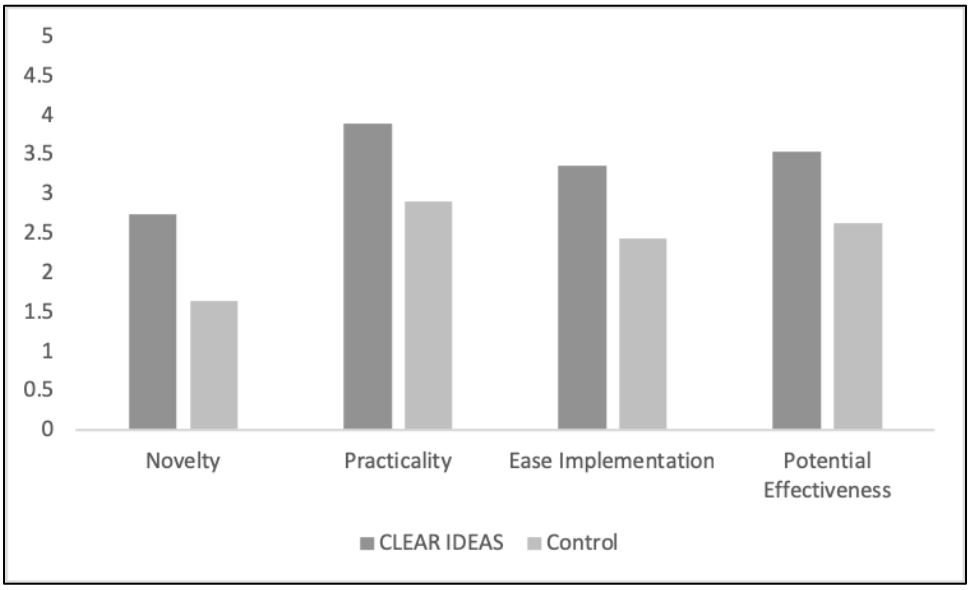

Figure 1. Significant between-group effects of the CLEAR IDEAS and control groups.

In partial support of hypothesis 1B, participants in the CLEAR IDEAS group generated ideas that were rated as having significantly higher potential effectiveness (M = 3.54, SE = 0.11) than participants in the IDEAS group (M = 3.09, SE = 0.09), but not significantly easier to implement than the IDEAS training group (see Figure 2).

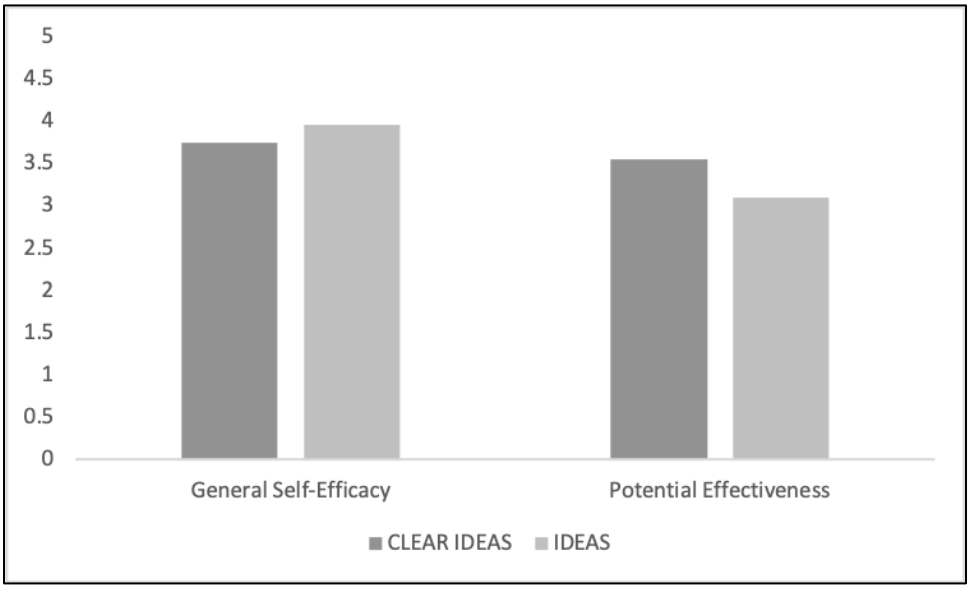

Figure 2. Significant between-group effects of the CLEAR IDEAS and IDEAS groups.

In support of hypothesis 1C, participants in the IDEAS group generated ideas that were rated as significantly more novel (M = 2.41, SE = 0.13) than the control group (M = 1.64, SE = 0.16), more practical (M = 3.55, SE = 0.10) than the control group (M = 2.91, SE = 0.12), easier to implement (M = 3.02, SE = 0.10) than the control group (M = 2.44, SE = 0.13), and as having higher potential effectiveness (M = 3.09, SE = 0.09) than the control group (M = 2.63, SE = 0.11) (see Figure 3).

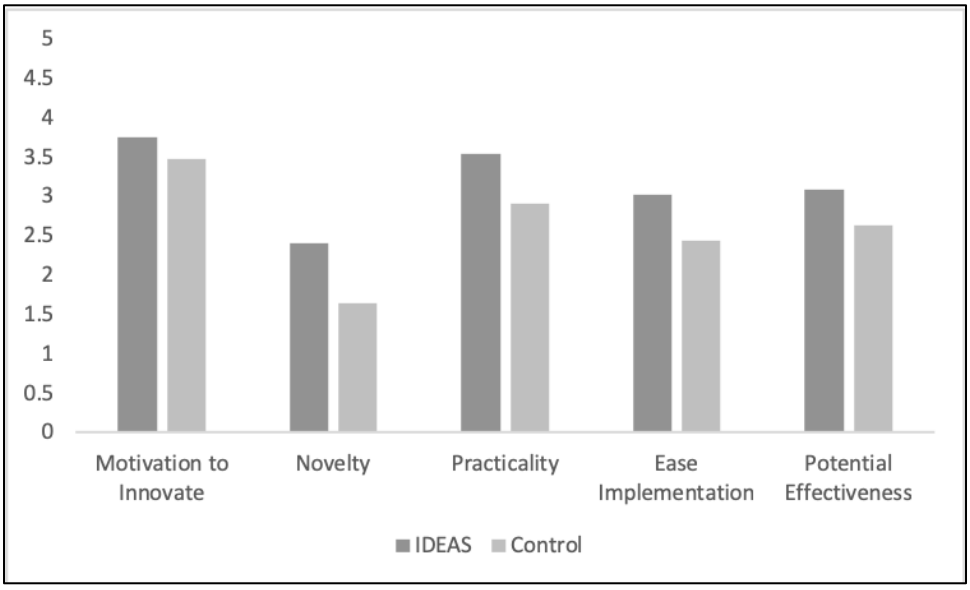

Figure 3. Significant between-group effects of the IDEAS and control groups.

Contrary to hypothesis 2A, participants in the CLEAR IDEAS group reported significantly lower post-training general self-efficacy (M = 3.74, SE = 0.06) than the IDEAS group (M = 3.95, SE = 0.05) (see Figure 2). Additionally, there was no significant difference in post-training creative self-efficacy between the CLEAR IDEAS group and the IDEAS or control groups. Support was not found for hypothesis 2B, as there were no significant differences between the IDEAS group and control group on post-training scores of creative self-efficacy and general self-efficacy.

Hypothesis 3A was not supported, as there were no significant differences between the CLEAR IDEAS and IDEAS groups on post-training motivation to innovate. In support of hypothesis 3B, the IDEAS group did report significantly higher post-training motivation to innovate (M = 3.75, SE = 0.06) than the control group (M = 3.48, SE = 0.07) (see Figure 3).

The univariate F ratios and eta squared values together with the means and standard errors of the groups for each dependent variable are shown in Table 2A.

Table 2A

Univariate Between Subjects Effects

			CLEAR IDEAS		IDEAS		Control	
Variable	$F(2, 105)$	Partial Eta^2	*M*	*SE*	*M*	*SE*	*M*	*SE*
Creative SE T2	1.72	.03	4.04	.11	4.29	.09	4.30	.11
General SE T2	3.85*	.07	3.74	.06	3.95	.05	3.91	.06
Motivation to innovate T2	4.30*	.08	3.58	.07	3.75	.06	3.48	.07
Novelty	12.80**	.20	2.75	.16	2.41	.13	1.64	.16
Practicality	18.77**	.26	3.89	.12	3.55	.10	2.91	.12
Ease of implementation	13.66**	.21	3.36	.13	3.02	.10	2.44	.13
Potential effectiveness	16.16**	.24	3.54	.11	3.09	.09	2.63	.11

Note. *$p < .05$. **$p < .001$. SE = self-efficacy.

Supplementary Analyses

Next, a one-way repeated measures MANOVA was used to analyze the data from the control group only. The dependent measures were assessed at three time points (pre-training, post-idea generation without training, and post-training).

Bartlett's test of sphericity was statistically significant (approximate chi square = 77.15, $df = 5$, $p < .001$), indicating that the correlations of the dependent variables were sufficient to support the MANOVA.

The multivariate effect of time was statistically significant, Wilks' lambda = .81, $F(6, 120) = 2.23$, $p = .045$. At a univariate level, there was not a significant difference between the three time points for creative self-efficacy, $F(2, 62) = 0.78$, $p = .464$. There was a significant difference between the three time points for general self-efficacy, $F(2, 62) = 4.17$, $p = .020$. Post-training, participants reported significantly higher general self-efficacy ($M = 4.00$, $SE = 0.15$) than either pre-training ($M = 3.81$, $SE = 0.15$) or post-idea generation without training ($M = 3.86$, $SE = 0.16$). Finally, there was a significant difference between the three time points for motivation to innovate, $F(2, 62) = 3.63$, $p = .032$. Post-training, participants reported significantly higher motivation to innovate ($M = 3.73$, $SE = 0.18$) than pre-training ($M = 3.57$, $SE = 0.17$) and post-idea generation without training ($M = 3.48$, $SE = 0.17$) (see Figure 4).

Since there were no significant differences in scores for the control group between pre-training and post-idea generation without training, analyses continued with two time points for all idea rating criteria. A one-way repeated measures MANOVA was used to analyze the data, with time as the independent variable assessed at two time points (post-idea generation without training and post-training) for ratings of participant ideas on measures of novelty, practicality, ease of implementation, and effectiveness.

Bartlett's test of sphericity was statistically significant (approximate chi square = 18.61, $df = 9$, $p = .031$), indicating that the correlations of the dependent variables were sufficient to support the MANOVA.

The multivariate effect of time was significant, Wilks' lambda = .19, $F(7, 25) = 15.55$, $p < .001$. At a univariate level, there was a significant difference between ideas generated pre-training and post-training for novelty, $F(1, 31) = 69.46$, $p < .001$. Post-training, participants generated ideas that were significantly more novel ($M = 3.19$, $SE = 0.16$) than

without training (*M* = 1.65, *SE* = 0.11). There was also a significant difference between ideas generated pre-training and post-training for practicality, $F(1, 31) = 14.64$, $p = .001$. Post-training, participants generated ideas that were significantly more practical (*M* = 3.49, *SE* = 0.13) than without training (*M* = 2.91, *SE* = 0.11). There was a significant difference between ideas generated pre-training and post-training for ease of implementation, $F(1, 31) = 44.50$, $p < .001$. Post-training, participants generated ideas that were significantly easier to implement (*M* = 3.51, *SE* = 0.13) than without training (*M* = 2.44, *SE* = 0.10). Finally, there was a significant difference between ideas generated pre-training and post-training for potential effectiveness, $F(1, 31) = 29.91$, $p < .001$. Post-training, participants generated ideas that had significantly more potential effectiveness (*M* = 3.43, *SE* = 0.11) than without training (*M* = 2.65, *SE* = 0.10) (see Figure 4).

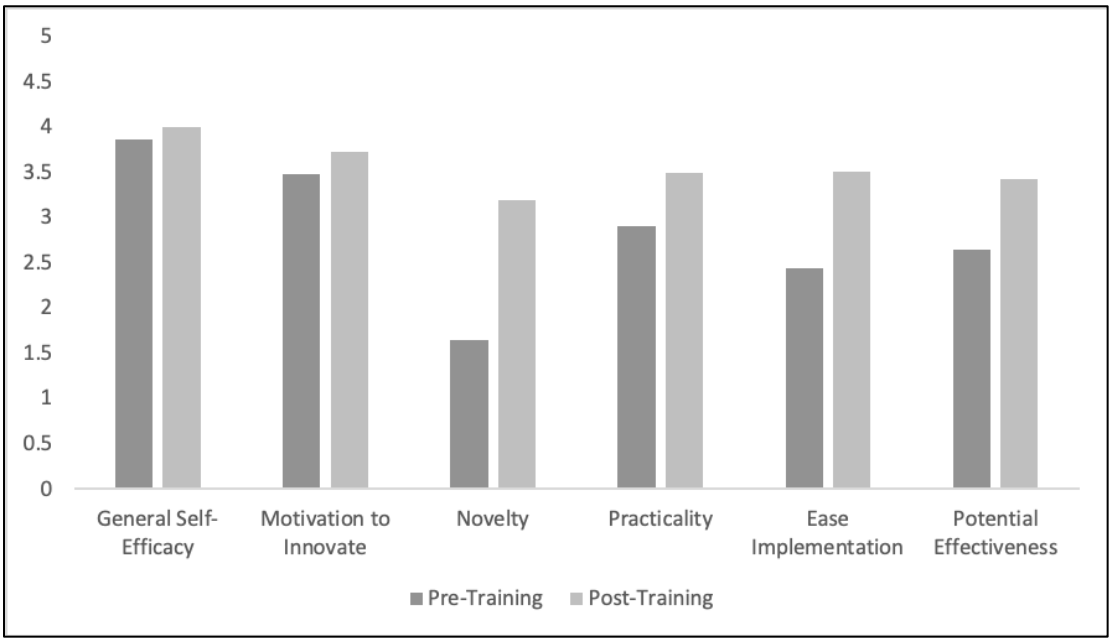

Figure 4. Significant effects for within-group analysis of study 1.

The univariate *F* ratios and eta squared values together with the means and standard errors of the groups for each dependent variable are shown in Table 2B.

Table 2B

Univariate Within Subjects Effects

Variable	*F*(1, 31)	Partial Eta^2	Pre-training		Post-training	
			M	*SE*	*M*	*SE*
Creative SE T2	0.32	.01	4.22	.25	4.31	.27
General SE T2	4.82*	.14	3.86	.16	4.00	.15
Motivation to innovate T2	6.01*	.16	3.48	.17	3.73	.18
Novelty	69.46**	.69	1.65	.11	3.19	.16
Practicality	14.64**	.32	2.91	.11	3.49	.13
Ease of implementation	44.50**	.59	2.44	.10	3.51	.13
Potential effectiveness	29.91**	.49	2.65	.10	3.43	.11

Note. *$p < .05$. **$p < .001$. SE = self-efficacy.

Discussion

This is the first known test of Birdi's CLEAR IDEAS training program (Birdi, 2005). The results of the current study provide support for Birdi's approach. Specifically, the groups that received the CLEAR IDEAS training generated ideas that were more novel, more practical, easier to implement, and had higher potential effectiveness than the groups that received no training.

The current study set out to evaluate whether the addition of innovation training to a creativity training program could result in the generation of ideas that are more novel, more practical, easier to implement, and potentially more effective than ideas produced after creativity training alone and whether both types of training would produce better ideas than no training. Additionally, the study intended to evaluate whether the addition of innovation training to a creativity training program could result in greater participant

creative self-efficacy, general self-efficacy, and motivation to innovate than creativity training alone and whether both types of training would result in higher scores than no training. The aforementioned hypotheses were evaluated using both a between-group design for the three training conditions, and a within-group design for no training compared to creativity training with the addition of innovation training for the control group.

As expected, the CLEAR IDEAS group generated ideas that were more novel, more practical, easier to implement, and had higher potential effectiveness than those generated by the control group. Also as expected, participants in the CLEAR IDEAS group generated ideas that had higher potential effectiveness than participants in the IDEAS group, but unexpectedly, their ideas were not easier to implement than the IDEAS training group. Additionally, as expected, participants in the IDEAS group generated ideas that were more novel, more practical, easier to implement, and had higher potential effectiveness than those generated by the control group.

For the between-group analyses, the CLEAR IDEAS group had lower general self-efficacy after receiving training than did the IDEAS group. This result was unexpected; however, it is possible that the additional training and activity content in the CLEAR IDEAS framework may have negated the increases in general self-efficacy that were obtained by the IDEAS group. Additionally, and unexpectedly, the CLEAR IDEAS, IDEAS, and control groups did not differ significantly in post-training creative self-efficacy. This result may have occurred due to an effect where the CLEAR IDEAS and IDEAS training causes participants to become more aware of their gaps in creativity and innovation. After receiving training, there were no differences between the CLEAR IDEAS and IDEAS groups on motivation to innovate, however, the IDEAS group did

report higher motivation to innovate after receiving training than the control group without training. This finding may be explained by the content of the CLEAR IDEAS framework, which encourages participants to consider all of the necessary steps that must be in place in order to make one's innovation a success. While this information is important to clarify one's ideas, it could reduce participant motivation to innovate, since they become more aware of the extra work that is needed at the implementation stage. In the IDEAS framework on the other hand, participants only need to select their best idea and do not need to consider the implementation process, which may allow them to have increased motivation due to their lack of awareness of the implementation process.

For the first supplementary within-group analysis of the control group before and after training, in line with the between group results, after the CLEAR IDEAS training, participants had higher general self-efficacy and motivation to innovate than they had prior to training. For the second within-group analysis, and in line with the between-group analysis, after receiving the CLEAR IDEAS training, participants generated ideas that were more novel, practical, easier to implement, and had higher potential effectiveness than the ideas they generated before receiving the training.

CLEAR IDEAS was expected to result in better outcomes for creative and general self-efficacy, motivation to innovate, and ratings of both ease of implementation and potential effectiveness when compared to the IDEAS group. In reality, CLEAR IDEAS only outperformed IDEAS for ratings on the criteria of potential effectiveness. These small differences between the two groups may have occurred due to a lack of practice and discussion during the innovation portion of the CLEAR IDEAS training. The full-length CLEAR IDEAS training program is typically run in groups and over a longer period of time. The participants in the online study may have required discussion in a group setting

or more time exploring the content in order to absorb the material from the innovation training before being able to apply it successfully. The results of this study are encouraging, as they do provide evidence that both types of training (CLEAR IDEAS and IDEAS) produced ideas that were more novel, practical, easier to implement, and potentially more effective than ideas produced with no problem-solving training. Furthermore, the results suggest that the addition of the innovation training to the creativity-only training program resulted in the generation of ideas that had higher potential effectiveness than ideas produced through creativity training alone. These results are promising for future use of the creativity and innovation training program because this set of results were obtained using objective measures of ratings of participant ideas, and therefore, should be replicable in other training groups and research samples.

The differences in the results of the self-report measures of creative and general self-efficacy and motivation to innovate between the within and between-group analyses may have occurred due to possible flaws in the study design, including a practice effect for the control group. Due to the design of the study, the control group had an opportunity for a mastery experience related to idea generation, as they developed an idea without any form of problem-solving training first and then completed the task again after receiving the training. By completing the task again after training, the participants in the control group may have been able to see their own development post-training, resulting in a mastery experience. According to Bandura (1997), mastery experiences are an influential source of efficacy information, as they provide evidence that one can succeed. This justification of a mastery effect may explain the lack of an effect in the self-reported efficacy between the training conditions, while there was a greater effect in the control group.

A common criticism in the assessment of self-efficacy is that efficacy measures often do not match the performance measure (Hodges, 2008). Therefore, one further explanation for the unexpected results of the self-report measures of efficacy could be that those measures did not match the performance measures of creativity and innovation based on idea ratings in the current study. It may have been more valuable to measure individual levels of creativity and to examine the potential interaction of creativity/innovation training and individual creativity.

Gough's (1979) Creative Personality Scale has been used successfully by other researchers to assess individual levels of creativity (Oldham & Cummings, 1996). Additionally, George and Zhou (2001) found that employees were most creative when they were also high in openness to experience. It would be interesting to see if individual differences in creativity or personality traits related to creativity increased along with self-efficacy post-training. The problem that would remain is the issue of a lack of measurement for innovation in isolation, meaning that only individual levels of creativity could be evaluated at this time. Assessments of innovation often occur at the group level, rather than at the individual level, such as in West and Anderson's (1998) Team Climate Inventory as a measure of proximal workgroup climate for innovation and in West's (2002) integrative model of creativity and innovation in work groups. If individual levels of creativity and innovation were assessed, it may have been interesting to evaluate whether individual differences in those areas could mediate the connection between self-efficacy and idea rating performance.

Future Research

Future research should seek to acquire similar quantitative data evaluating the outcomes of the CLEAR IDEAS framework in work settings. The CLEAR IDEAS program is most often used with employees to solve work problems, and so there may be important differences in these samples that were not found in the current sample. It is also anticipated that when employees apply this framework to a problem that they have identified as an issue in their workplace, they will be more likely to put forth more effort to generate solutions and to ensure that they can actually be implemented. It would be important to design future studies that would allow for participants to complete the full CLEAR IDEAS (full day) training to evaluate the comprehensive benefits of the program.

One specific area of interest for future research is to apply the CLEAR IDEAS framework to problems faced by employees working in long term care with the intention to improve safety and reduce accidents. This particular application for this area of research is important because in 2016, the health and social services sector in Nova Scotia saw the equivalent of 450 full-time employees off work for a full year due to work related injuries (Aware-NS, 2017). The sector had more than two and a half times as many time-loss injuries as the next closest sector (WCB Nova Scotia, 2016), suggesting an ideal application for the use of creativity and innovation training in order to address and solve the problems causing these safety challenges.

Another area for future research would be to conduct a study to identify mediators in order to unpack the process through which the CLEAR IDEAS training might improve the quality of ideas generated. For example, it would be interesting to evaluate affect as a mediator of training outcomes, as positive affect has been identified as promoting certain

aspects of creativity, while negative affect may hinder creativity (Amabile, Barsade, Mueller, & Staw, 2005).

Implications

Individual differences in creativity have been identified in literature (for example: Hammond et al., 2011; Oldham & Cummings, 1996, Zhou, 2003), however, there is little empirical evidence of the effectiveness of training programs or frameworks in improving the generation of ideas that can be applied to work problems. Furthermore, there has been no prior empirical study of the CLEAR IDEAS program. The current study provides initial evidence that the CLEAR IDEAS program may be able to increase the novelty, practicality, ease of implementation, and potential effectiveness of ideas produced when compared to ideas produced with no problem-solving framework. These findings provide implications mainly in the form of validating the necessity for further research on how the CLEAR IDEAS program affects the generation and implementation of ideas in the workplace and how the program affects individual levels of efficacy and motivation. If future research finds the CLEAR IDEAS program to be successful in improving creativity and innovation for problem-solving in organizations, there could be important implications to business success and safety improvements.

Limitations

As discussed above, there were certain methodological limitations that may have affected the results. In particular, the results of the self-report measures of creative self-efficacy, general self-efficacy, and motivation to innovate were somewhat confusing and inconclusive.

One limitation to the design of the control group is that the problem-solving activity used the same question for both the pre-training and post-training idea generation portion of the study. It would be a more rigorous design to use two different activity questions and to counterbalance which participants received each question pre- and post-training. This more rigorous design would help to prevent practice effects and fatigue related to idea generation for the same problem.

Another important limitation to the current study is that while participants followed the CLEAR IDEAS framework, they received a modified and significantly shorter training at the individual, rather than the typical group-level (10-15 minutes video and 20-minute activity rather than the full day typically allotted for the program). Therefore, an evaluation of the full CLEAR IDEAS training could not be achieved under the design of the study. That being said, the results of this study suggest that the CLEAR IDEAS training does have value for individual-level decision making, and that even brief training can result in significant improvements in the quality of ideas produced.

Conclusion

Researchers have found innovation and creativity to be significant determinants of organizational performance, success, and long-term survival (Anderson, Potocnik, & Zhou, 2014). The current research purported to answer the question of whether the CLEAR IDEAS problem-solving training could improve the quality of solutions generated by participants beyond the IDEAS (creativity-only) training participants and participants who completed no training. Ideas produced by participants in the creativity with the addition of innovation group were rated as having higher potential effectiveness than ideas produced in the creativity-only group. Additionally, ideas produced by both the

creativity with the addition of innovation group and the creativity-only group were rated as more novel, more practical, easier to implement, and had higher potential effectiveness than ideas produced by the control group. The current study offers one step forward in filling the gap that is currently present in the creativity and innovation training literature, with initial evidence for the improvement in problem-solving provided by the addition of innovation training. Additionally, the current study contributed interesting findings related to the effectiveness of a short online training program for improving individual-level problem-solving. With further research in the context of work, the results of the current study point to a potential benefit of creativity and innovation training to improve employee creativity and innovativeness, which may be essential to organizational success in the current state of industry transformation.

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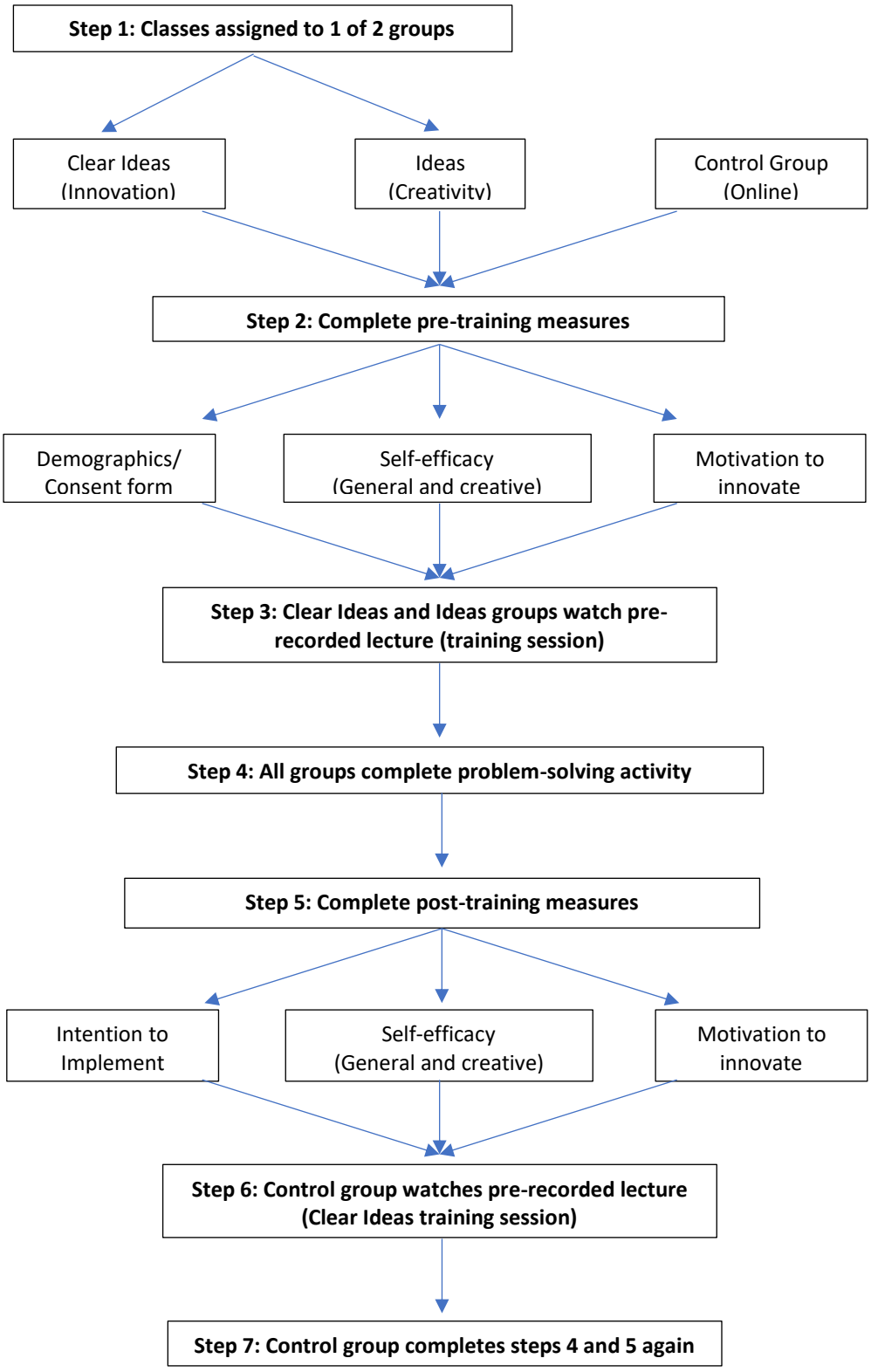
Appendix A

Thesis Process:



Appendix B

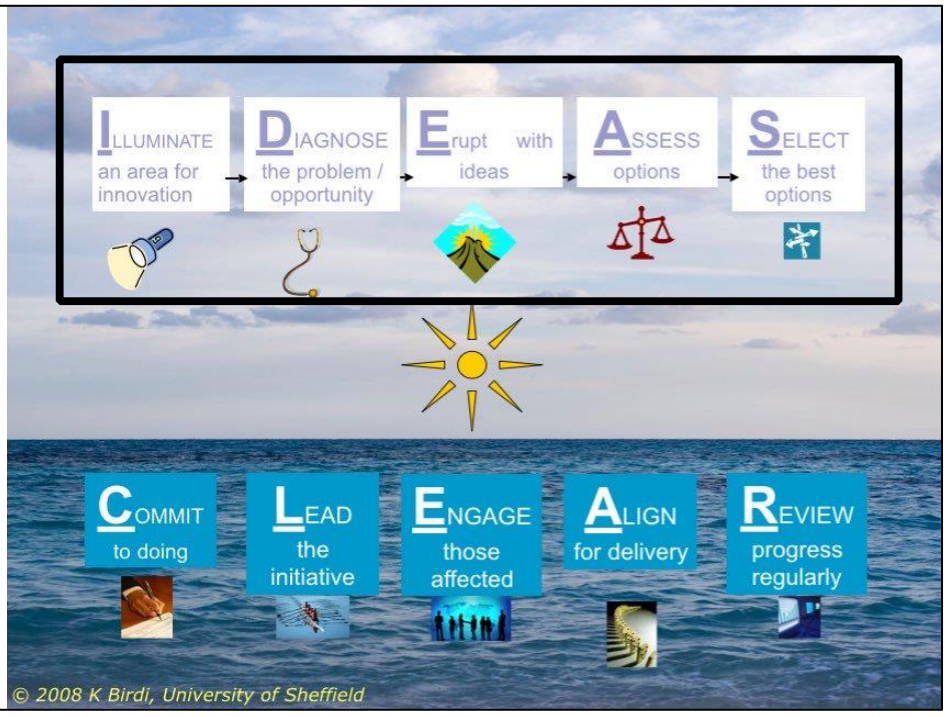
CLEAR IDEAS Lecture/Training

(Ideas would be only the 'Ideas' half of the presentation)

CLEAR IDEAS

(Slides are adapted from:
Birdi, K., 2008. University of Sheffield)

The Process



IDEAS

ILLUMINATE
an area where innovation is required

- **"How do we…?"**
- Product, process, goals, structure
- Strategic priority; current or future focus
- Does not have to be an existing problem
- Think about what could be done better

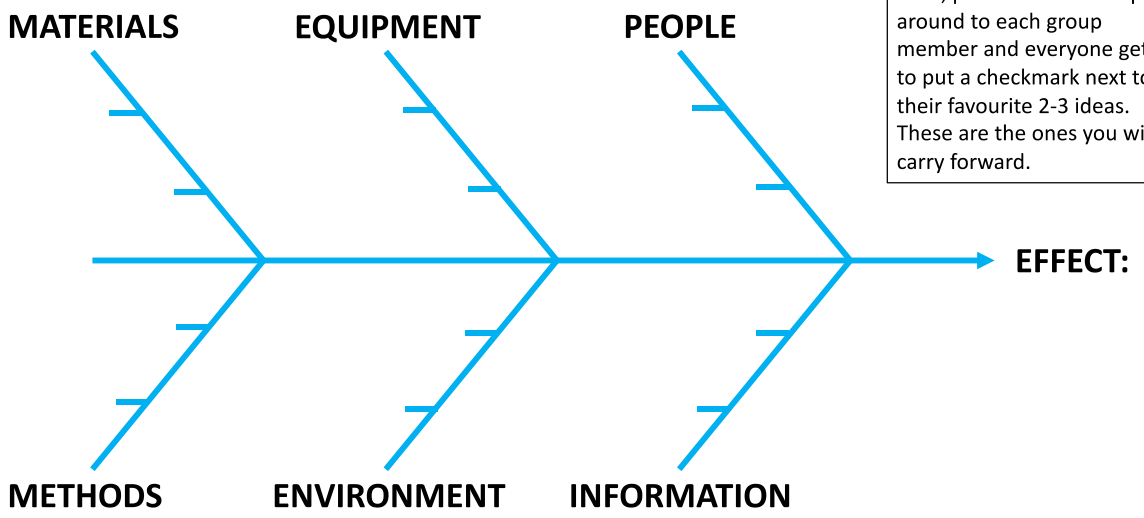
IDEAS

DIAGNOSE
the problem/ need/ opportunity

- Analyse the situation to identify the major causes
- Tools:
  - Fishbone Analysis
  - 5 Whys
- Prioritise most important causes
- Refocus challenge on most important cause
  - "Now, how do we…?"

Fishbone Analysis

Everyone in the group completes this separately. Then make a 'master copy' including everyone's ideas. Next, pass the master copy around to each group member and everyone gets to put a checkmark next to their favourite 2-3 ideas. These are the ones you will carry forward.



The 5 Whys

Problem:

Ex. Fanshawe staff are not engaged in professional development

Why? They don't know what is available	Why? They don't have time	Why? They don't see the benefit
Why? _____	Why? _____	Why? _____
Why? _____	Why? _____	Why? _____
Why? _____	Why? _____	Why? _____
Why? _____	Why? _____	Why? _____

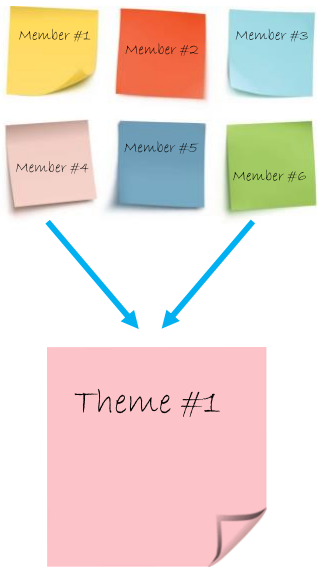
IDEAS

ERUPT with ideas

- Blocks to creativity:
  - Identifying the wrong problem
  - Negative mind set
  - Judging ideas too quickly
  - Failing to challenge assumptions
  - Too little (or too much!) information
  - Stopping with the first good idea
    - "You need a crop of good ideas to harvest the best ones"
- Think creatively = think differently
- Techniques
  - Brainstorming
  - Smart Little People
  - Analogies

Brainstorming

1. Have a well-defined and clearly stated problem
2. Have the right number and mix of people in the group (6-8)
3. Start with individual brainstorming (ex. each person writes their ideas on post-its) then move to group brainstorming (ex. put post-its on wall, organize ideas, add to them)
4. Have someone enforce the following guidelines:
   - Suspend judgement
   - Every idea is accepted and recorded
   - Encourage people to build on the ideas of others
   - Encourage way-out and odd ideas
5. Focus on generating a large number of ideas, then work on choosing the best ones



Smart Little People


- Imagine you had a team of smart little people (or big people!) who could do absolutely anything to deal with the issue
- Smart little people can do anything – they can sing, dance, co-operate, become super ninjas, read minds, even be unethical – just think about how your problem could be solved in 'fantasy land'
- After you have come up with as many ideas as possible for smart little people to solve the problem, take away the smart little people and see if there are any other ways you can make the same achievements (ethically of course)



Analogies

Ex. "Creating a healthy campus is like making the perfect cupcake"

Step 1: Describe the perfect cupcake	Step 2: Make connections to a healthy campus
• Assortment	• Variety, tailoring/fit of programs
• Moist	• Not dry/boring
• Sweet	• Be kind, addicting, moderation
• Gluten free	• Remove incivility/bad things
• Colourful	• Vibrant, branding, in your face, "pops"
• Tasty	• Palatable, bring people back, engaging
• Aesthetic appeal	• Finding what you want, tailor, branding/packaging
• Purpose/occasion	• Connect with outcomes, show value of participating
• Sharing	• Communication, community, connectedness
• Filling	• Substance, deep down culture, excitement/surprise
• Sprinkles	• Artifacts
	• "Sprinkles bring them in, but the filling keeps them engaged"

IDEAS

ASSESS
the ideas generated against standards for selection

- Each group member selects their top 2-3 ideas group generated, ideas with most 'votes' are assessed
- Select 3 criteria against which to judge quality of ideas
- Agree on the range of scores
  - but remember that higher scores always = better (higher cost = lower score)

Assessment Table

Ratings: 1 = poor to 5 = excellent

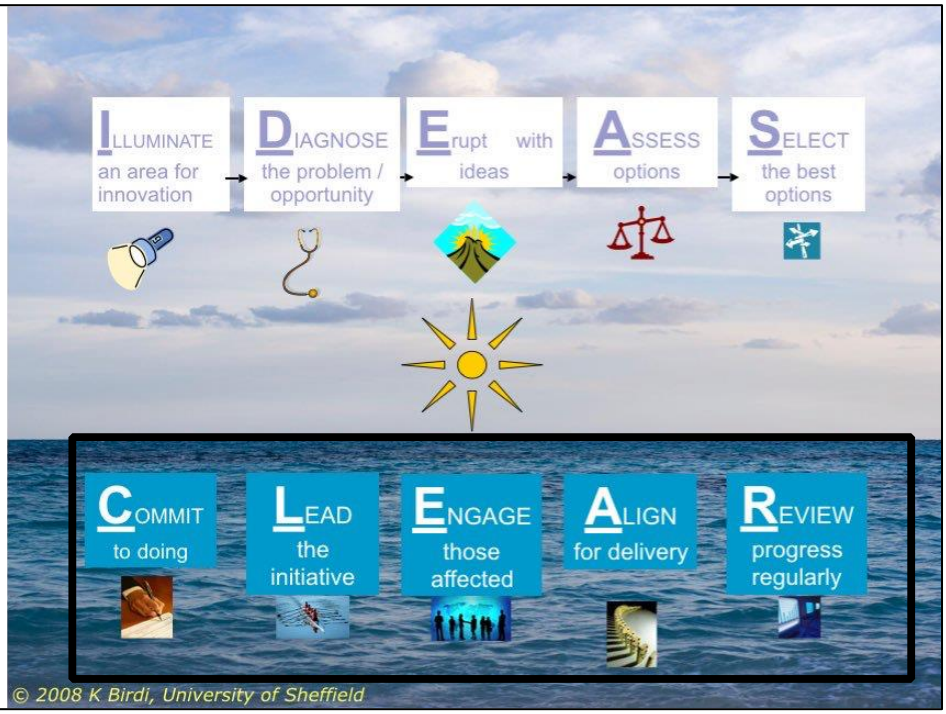
Ideas	Benefits	Cost	Time	Overall Rating
Shoe with heels that lift and drop	4	2	2	8/15
Shoe that can charge cellphone	4	4	4	12/15

IDEAS

SELECT the best options

- Rank ideas based on scores
- Reach consensus on preferred options using
  - Numerical score
  - Vote
- Keep other potentially useful ideas for revisiting later or sharing with others

The Process



CLEAR

COMMIT to the innovation

- Motivation (yours and others) is key to success
- Anticipate problems and ways of dealing with them ('relapse prevention')
- Whose buy-in do you need to make the innovation work? Project team, top management, users?
- Failure is an option – there is always an element of risk in being innovative so be prepared to learn from experience and to try again

Stakeholder Commitment Chart

Who are the key stakeholders you need to convince, why might they say no and how will you convince them to say yes?		
Stakeholder	Reasons they might say no	Arguments/strategies to convince them to say yes

CLEAR

LEAD
the innovation

- Strong leader/project champion needed who
  - Identifies and involves the stakeholders they need to persuade
  - Tailors arguments to each stakeholder
  - Conveys confidence and enthusiasm
  - Is ambidextrous (participative and directive)
- Other roles needed?
- Decide WHO should do WHAT

Role Allocation Chart

Who will be project leader and champion and why?	What other key roles need to be filled and who will take them on?	
Leader/champion	Role	Person

CLEAR

ENGAGE
those who will be affected by the innovation

- Identify key stakeholders and involve them in the process
- How can you best capture their views?
  - Interviews, surveys, focus groups, participant observations, etc.
- "How will you engage those affected by the initiative in helping implement the changes?"

CLEAR

ALIGN
strategies, systems, and resources to deliver the innovation

- How will you align your idea with your organization's strategy?
- How will you target the right market/audience?
- How will you get the right suppliers?
- How will you put the right people management practices in place (e.g. training, selection, reward, appraisal) to deliver the innovation?
- How will you get the right technology to deliver the innovation?
- How will you get enough finance to deliver the innovation?

CLEA**R**

REVIEW
and adapt the innovation regularly

- Plan!
- Are things going according to plan and has the need been met?
- Importance of monitoring goals and evaluation
- Evolve the idea (e.g. proposal to prototype to pilot to version 1 to version 2, etc.)
- Don't be afraid to revisit earlier steps to re-evaluate

Review/Develop Chart

What will be the key activities to develop your idea and when?		
What activity?	Who will be involved?	When will it happen?

Appendix C

CLEAR IDEAS Workbook Activity

(Ideas would be only the 'Ideas' half of the activity)

'CLEAR IDEAS' QUICK TEMPLATE

ILLUMINATE your challenge

How do I (improve my own health?)

DIAGNOSE the problem/challenge

What are the different causes of your problem? What is/are the most significant cause/s? Focus on dealing with these in the first instance SO NOW How do we/I ……?

ERUPT with ideas

What are your potential solutions? Remember NOT to judge the quality of your ideas yet! Try and come up with as many ideas as you can.

ASSESS the quality of the ideas

What criteria will you use to judge quality (e.g. cost, time, acceptability)? Score the ideas against the criteria.

SELECT the best ideas to take forward to form your innovative solution

COMMIT key stakeholders to taking this forward

Who do you need to convince and how will you convince each of them to use this idea? Do a No But Yes matrix.

LEAD the innovation

What role, responsibilities and characteristics would someone need to use this innovation? Who has them?

ENGAGE with stakeholders

How are you best going to get the views of recipients or deliverers of your intended innovation?

ALIGN for delivery of the innovation

Have you got the right finance, skills, technology, strategy, practices to deliver the innovation?

REVIEW progress regularly

What is your timescale for delivering the innovation and what will be your key milestones? Who is going to do what tasks? How are you going to get feedback?

Appendix D

Demographic Information

1. What is your age? _____

2. What is your gender? _____

3. How many years of post-secondary school have you completed (years of school after high school)? _____

Appendix E

IWP Multi-Affect Indicator

Please indicate how you feel right now. Everyone has a lot of overlapping feelings, so you'll have a total for all items that is much greater than 100% of the time.

		Intensity of feelings right now						
	I feel:	Not at all	A little bit	Somewhat	About half	Quite a bit	Very	A lot
		0%	1% to roughly 21%	Roughly 21% to 40%	Roughly 41% to 60%	Roughly 61% to 80%	Roughly 81% to 99%	100%
1	Enthusiastic							
2	Nervous							
3	Calm							
4	Depressed							
5	Joyful							
6	Anxious							
7	Relaxed							
8	Dejected							
9	Inspired							
10	Tense							
11	Laid-back							
12	Despondent							
13	Excited							
14	Worried							
15	At ease							
16	Hopeless							

Appendix F

Creative Self-Efficacy

(Tierney & Farmer, 2002)

1. I feel that I am good at generating novel ideas.

1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Slightly agree	5 Agree	6 Strongly agree

2. I have confidence in my ability to solve problems creatively.

1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Slightly agree	5 Agree	6 Strongly agree

3. I have a knack for further developing the ideas of others.

1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Slightly agree	5 Agree	6 Strongly agree

Appendix G

New General Self-Efficacy Scale

(Chen, Gully, & Eden, 2001)

1. I will be able to achieve most of the goals that I have set for myself.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

2. When facing difficult tasks, I am certain that I will accomplish them.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

3. In general, I think that I can obtain outcomes that are important to me.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

4. I believe I can succeed at most any endeavor to which I set my mind.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

5. I will be able to successfully overcome many challenges.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

6. I am confident that I can perform effectively on many different tasks.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

7. Compared to other people, I can do most tasks very well.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

8. Even when things are tough, I can perform quite well.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

Appendix H

Intrinsic Motivation to Innovate

(Birdi et al., 2016)

1. I put a lot of energy into coming up with new ideas.

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

2. I always try to come up with new ways of dealing with problems

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

3. I am always trying to do things differently from before

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree

4. I enjoy engaging in tasks that require creative thinking

1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree