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CLEAR IDEAS: Can Idea Implementation Training Enhance the Development of New Ideas Beyond Idea Generation Training?

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Abstract

We evaluated an individually-focused version of the CLEAR IDEAS framework for innovation training. 150 online participants were randomly assigned to either an idea generation training (IDEAS), idea generation plus idea implementation training (CLEAR IDEAS), or a control group. Post-test ratings of the quality of ideas produced and pre- and post-test measures of creative self-efficacy, general self-efficacy, and motivation to innovate were gathered. Evaluation of the generated solutions by judges blind to condition showed that the idea generation plus implementation training group and the idea generation-only group produced ideas that were more novel, practical, easier to implement, and had higher potential effectiveness than the control group. Ideas produced by the idea generation plus implementation group also had higher potential effectiveness than the idea generation-only group.

Keywords: creativity, innovation, online training, CLEAR IDEAS

Public Significance Statement

Some people are naturally more creative than others and there is some evidence that training can improve creativity regardless of natural abilities. For organizations, having creative employees can be very valuable, but only if those creative ideas can be implemented successfully. The results of this study demonstrate the added value of idea implementation training delivered through a short online training program to improve idea quality.

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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. Puccio (2017) further validated this assessment with a review of nine sources citing creativity as a necessary workplace skill for success in the 21st century. Furthermore, the World Economic Forum continues to rank creativity as one of the top 10 job skills for the future (Whiting, 2020). 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, et al., 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 identified initial links between creativity training and creative performance outcomes for employees (Scott et al., 2004). However, the majority of studies evaluating the effects of creativity training have been conducted with children rather than

adults, leaving more to be discovered regarding the effectiveness of creativity training for adults and in organizational settings (Birdi, 2016).

Much of the extant work in this area conflates "creativity" with "innovation" (Hughes et al., 2018). Along with the conflation of these terms, there is a great deal of variability among training programs for creativity and innovation. The focus of our research was to separate out two commonly assessed competencies in these training programs: idea generation and idea implementation and to evaluate how they affect the quality of solutions generated by adult training participants. We addressed this question in the context of an individually adapted version of Birdi's (2016) IDEAS (idea generation) training and CLEAR (idea implementation) training 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 (Amabile, 1982; Torrance, 1962), 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 provided a conceptual definition of creativity, "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 Amabile's definition of creativity 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). This definition, with a basis in social psychology, set the foundation for the research in creativity that has motivated the current study.

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).

More recently, Anderson et al., (2014) 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) suggested 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. (2014) indicated that while creativity and innovation can occur independently of one another and are by no means identical, they are certainly related processes.

Hughes, et al. (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).

Idea generation and implementation are sometimes both included in the definition of creativity while other times idea generation is suggested to encompass creativity, with idea implementation being a distinctive attribute of innovation. Because of the interconnected nature of the terms creativity and innovation in the literature, the goal of the current study was to parse out the two common competencies of idea generation and idea implementation.

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? Outside of educational and laboratory settings, creativity training has been explored fields such as engineering for the purpose of creating new products (Birdi et al., 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 Brainstorming (Osborn, 1953), Creative Problem Solving (Osborn, 1957; Noller and Parnes, 1972), the Theory of Inventive Problem Solving (Altshuller &

Shapiro, 1956) and the CLEAR IDEAS framework (see Birdi, 2016) with the latter being the focus of the current research.

Brainstorming. When asked to describe creative thinking techniques, brainstorming is probably the approach that most people would mention i.e., producing ideas in a group context where judgment of ideas is done separately from their generation. It was initially popularized through the work of Alex Osborn in the 1940s and 1950s (e.g., Osborn, 1953). Unstructured brainstorming is not influenced by any form of guidelines while structured (classical) brainstorming typically is guided by four principles: criticism is not permitted; free-wheeling is encouraged to generate more wild and original ideas; the emphasis is on generating as many ideas as possible; and building on and modifying other member's ideas is encouraged. The use of brainstorming is widespread. For example, Sudhaman et al. (2012) surveyed 650 Public Relations professionals from more than 35 countries. About 38% said their organization provided training in creative techniques and approximately one third of that group reported using brainstorming.

Creative Problem Solving (CPS). This is one of the earliest process-based models of creativity training and based on the work of Osborn and Parnes (e.g., Osborn, 1953; Noller and Parnes, 1972) with subsequent development over the years (see Puccio et al., 2010 and Puccio et al., 2006 for details). The underlying approach to creative problem solving is presented as a series of processes or stages described as mess finding, problem finding, information finding, idea finding, solution finding and acceptance finding. These can also be subsumed under the three broader operations of problem understanding/clarification, idea generation/transformation and action planning/implementation. A key principle of the CPS approach is that a balance of divergent and convergent thinking is used. Participants are therefore trained during the program

in the skills required for each of the processes. The advantage of this approach compared to many other schools of creative thinking is that it not only develops more divergent thinking but also has some coverage of the other skills needed to implement ideas. Research has shown that CPS can improve idea generation in groups (e.g. Puccio et al., 2020).

Theory of Inventive Problem Solving (TRIZ). Developed in the 1950s by Genrich Altshuller, TRIZ is the theory of inventive problem solving (Birdi et al, 2012; Mann, 2001). 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.

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) and also incorporating newer research findings on factors influencing the successful implementation of creative ideas (Birdi, 2016). The CLEAR IDEAS framework focuses on analysing 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. 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).

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 isolated idea generation and idea implementation training components and which gives equal weight to both aspects. 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 to evaluate the added value of idea implementation training. Birdi (2020) published a study incorporating a longitudinal field evaluation the CLEAR IDEAS training program and validating

its benefit for improving trainee innovation competencies. Within the paper, Birdi (2020) suggested that future studies should employ a control group and objective individual measures of idea quality, thus the current study also extends the existing literature on this training program. See Figure 1 for a visual representation of the CLEAR IDEAS model.

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 et al., 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).

Amabile (1982) provided 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 et al., 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 one can improve their own health) 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 for evaluation, we had expert judges assess the participants' proposed solutions based on overall novelty, practicality, ease of implementation, and potential effectiveness.

H1A: Use of the CLEAR IDEAS (idea generation and implementation) 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 (no training program).

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 (idea generation) 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.

Creativity and Innovation Training Outcomes

We also collected self-report data from participants to assess training outcomes.

Self-efficacy. 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) suggested that self-efficacy plays an important role in motivation. Previous research has identified the role of self-efficacy as being increased by training (Colquitt et al., 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 empirically distinguishable, 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. Recent studies have identified other important attributes of creative self-efficacy. Royston and Reiter-Palmon (2019) found that creative self-efficacy acts as a mediator between creative mindset and creative performance for participants with both fixed and malleable mindsets, suggesting another benefit to improving creative self-efficacy through training.

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.

Motivation. Birdi et al. (2016) found that intrinsic motivation to innovate was positively and uniquely related to idea implementation. Motivation to innovate was expected to be an outcome of the CLEAR IDEAS training due to its idea implementation guiding process.

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 Amabile (1983) and Anderson et al. (2014) have suggested that motivation is also a strong predictor of idea generation, thus distinguishing between the post-training motivation of the three groups in the current study was important to determine the added benefit of the idea implementation training.

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.

The Current Study

We used a sample of online participants to compare the quality of solutions between participants who followed the IDEAS (idea generation) program, the CLEAR IDEAS (idea generation and implementation) program, and a treatment as usual control group who received no training. Independent expert judges rated the novelty, practicality, ease of implementation, and potential effectiveness of ideas. Additionally, we assessed participants' creative self-efficacy, general self-efficacy, and motivation to innovate as outcomes of the training program.

Method

Participants

In total, 150 participants were recruited from the Mechanical Turk online survey platform. A priori power analysis with G*Power (Faul et al., 2007) suggested 63 respondents would provide a power of .95 to detect a medium effect at $p < .05$. Participants were compensated with USD $6.00. Data from 39 participants were 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 idea generation group (using the IDEAS method), the idea generation and implementation group (using the CLEAR IDEAS method), or the control group. Participants in the training groups watched their designated lecture/training video first and then generated an idea using the corresponding solution workbook. Participants in the no training control group generated an idea without watching a training video or using the workbook first but were given the CLEAR IDEAS training after their initial idea generation.

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 were narrated 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. 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 the full training program.

Both videos contained the same content for the creativity portion, however, the CLEAR IDEAS video contained an additional set of idea implementation-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 idea implementation training portion. The idea implementation 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.

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", which involves a simple prompt for participants to respond to at each step of the framework. 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. Independent raters rated the ideas on a one (low) to five (high) Likert type scale on the criteria of novelty, practicality, ease of implementation, and potential effectiveness.

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. 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.

Efficacy. Creative self-efficacy was assessed pre- and post-training using Tierney

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

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

Results

Descriptive statistics and correlations for all study variables are presented in Table 1. All 111 participants began by completing measures of creative self-efficacy, general self-efficacy, and motivation to innovate. 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. All required assumptions for the analyses were met. The multivariate effect of the group variable, Wilks' lambda = .52, $F(14, 198) = 5.41$, $p < .001$, was statistically significant, suggesting that the group effect accounted for approximately 50% of the multivariate variance.

A post hoc analysis using Bonferroni correction for multiple comparisons was used to examine the between-group differences. 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, p < .001, d = 1.23), more practical (M = 3.89, SE = 0.12) than the control group (M = 2.91, SE = 0.12, p < .001, d = 1.45), easier to implement (M = 3.36, SE = 0.13) than the control group (M = 2.44, SE = 0.13, p < .001, d = 1.29), and as having higher potential effectiveness (M = 3.54, SE = 0.11) than the control group (M = 2.63, SE = 0.11, p < .001, d = 1.39).

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, p = .009, d = 0.64), but not significantly easier to implement than the IDEAS training group.

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, p = .001, d = 0.97), more practical (M = 3.55, SE = 0.10) than the control group (M = 2.91, SE = 0.12, p < .001, d = 1.05), easier to implement (M = 3.02, SE = 0.10) than the control group (M = 2.44, SE = 0.13, p = .002, d = 0.89), and as having higher potential effectiveness (M = 3.09, SE = 0.09) than the control group (M = 2.63, SE = 0.11, p = .006, d = 0.76).

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, p = .024, d = 0.26). 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 ($M = 3.48$, $SE = 0.07$, $p = .016$, $d = 0.19$).

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 2.

As an ancillary analysis, a one-way between subjects ANOVA was used to analyze any differences in the length of ideas generated by each group. There were no statistically significant differences between group means, $F(2, 107) = 2.60$, $p = .08$.

Discussion

The results of the current study provide support for the CLEAR IDEAS approach to innovation training. Specifically, the group that received the CLEAR IDEAS (i.e., idea generation and implementation) training generated ideas that were more novel, more practical, easier to implement, and had higher potential effectiveness than the group that received no training. Moreover, the group that received the IDEAS training only (i.e., idea generation training) also produced ideas that were rated as being more novel, practical, implementable, and potentially more effective than the ideas produced by a control group. These results support the effectiveness of a considerably shortened and individually-adapted, version of training based on the CLEAR IDEAS framework. Our results also suggest the effectiveness of the approach as an individual problem solving, as opposed to a group training, methodology.

Surprisingly, 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. Furthermore, the absence of an increase in self-efficacy for the CLEAR IDEAS training group may be explained by the lack of practice afforded to participants in the shortened version of this training program, which did not allow for a mastery experience. According to Bandura (1997), mastery experiences are an influential source of efficacy information, as they provide evidence that one can succeed. 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. Moreover, a review of the recent literature since the completion of the study corroborates the unexpected results related to creativity training failing to improve creative self-efficacy. Meinel et al. (2019) also did not find an effect of creativity training on participant creative self-efficacy. 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.

In terms of the rated quality of ideas, 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 our 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 idea implementation training to the idea generation-only training program resulted in the generation of ideas that had higher potential effectiveness than ideas produced through idea generation training alone.

The results of the ancillary analysis comparing the length of ideas generated by participants in each group are also promising. These results suggest that the ideas generated from the idea generation and implementation training did not achieve higher ratings on the creativity measures only due to the length of responses, but that the differences between the groups were related to the content of the ideas.

One 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.

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.

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. The separation of idea generation and implementation phases could also be evaluated in other types of creativity training interventions such as the Creative Problem Solving framework (Osborn, 1953; Noller and Parnes, 1972). 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 for organizational operation and performance improvements.

Conclusion

Researchers have found innovation and creativity to be significant determinants of organizational performance, success, and long-term survival (Anderson et al., 2014). Our research addressed whether or not the CLEAR IDEAS problem-solving training could improve the quality of solutions generated by participants beyond the IDEAS (idea generation-only) training and participants who completed no training. Ideas produced by participants in the idea generation with the addition of idea implementation training group were rated as having higher potential effectiveness than ideas produced in the creativity-only group. Additionally, ideas produced by both the idea generation with the addition of idea implementation group and the idea generation-only group were rated as more novel, more practical, easier to implement, and had higher potential effectiveness than ideas produced by the control group.

Our 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 idea implementation 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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Figure 1

A visual representation of the CLEAR IDEAS model of innovation development

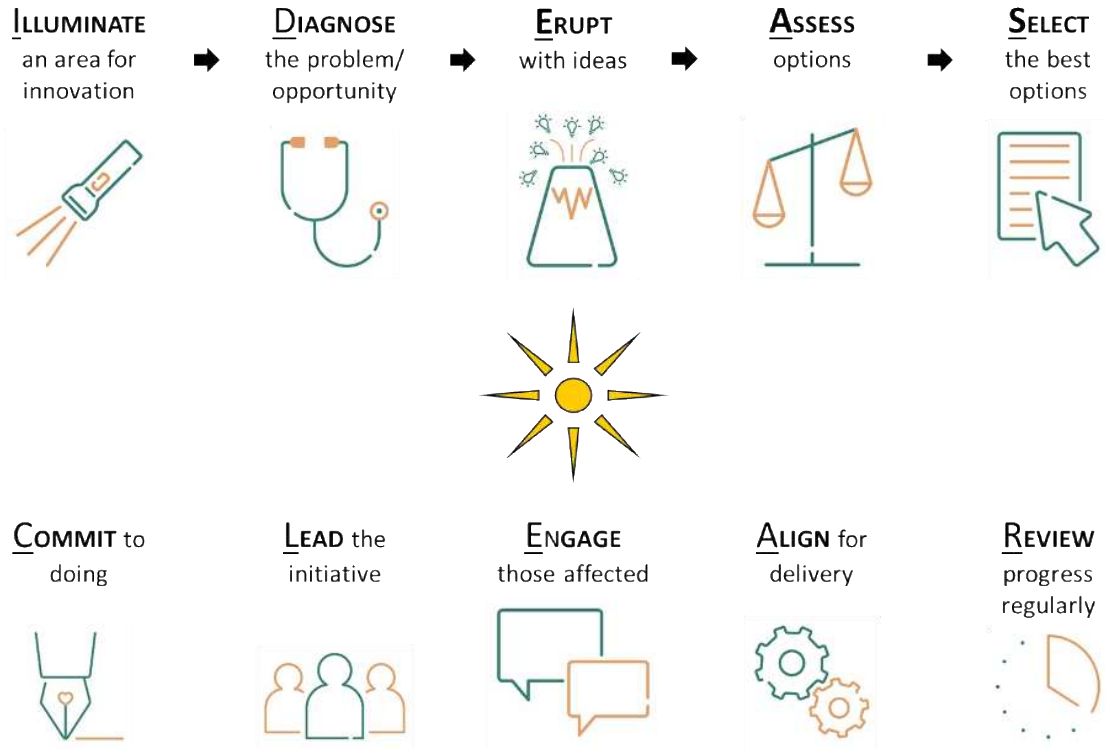

Table 1

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.
1. Age	-												
2. Gender	.30**	-											
3. Years Post-Secondary	.08	.10	-										
4. Creative SE T1	-.06	-.28**	.26**	(.95)									
5. General SE T1	.09	-.06	.23*	.50**	(.94)								
6. Motivation to Innovate T1	-.04	-.28**	.19	.76**	.54**	(.86)							
7. Creative SE T2	.02	-.28**	.24*	.86**	.58**	.78**	(.95)						
8. General SE T2	.09	-.13	.21*	.52**	.91**	.55**	.63**	(.95)					
9. Motivation to Innovate T2	.04	-.23*	.13	.72**	.45**	.92**	.79**	.52**	(.89)				
10. Novelty	.15	.05	-.14	.10	.05	.12	.06	-.01	.13	-			
11. Practicality	.22*	.02	-.09	-.07	-.01	-.11	-.11	-.04	-.11	.38**	-		
12. Ease of Implementation	.26**	.10	-.09	-.01	.04	-.04	-.02	.02	-.02	.72**	.65**	-	
13. Potential Effectiveness	.26**	.03	-.22*	-.04	.02	.01	-.00	.04	.06	.67**	.66**	.80**	-
M	34.40	-	3.30	4.23	3.87	3.56	4.20	3.87	3.61	2.29	3.45	2.95	3.08
SD	10.18	-	1.99	1.30	0.73	0.93	1.39	0.81	0.93	0.97	0.76	0.78	0.71

Note. SE = self-efficacy. T1 = pre-training, T2 = post-training. Gender: 1 = Male, 2 = Female, 3 = Other. Alphas are on diagonal
*$p < .05$. **$p < .01$.

Table 2

Univariate Between Subjects Effects (N = 111)

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