BREADTH OF THE WILD: THE RELATIONSHIP BETWEEN DIVERSE EXPERIENCES, ANALOGY USAGE, AND CREATIVE PERFORMANCE

by

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ABSTRACT

A significant amount of anecdotal and theoretical evidence suggests breadth of experience is an important variable for creative performance. The present study was the first to empirically examine this relationship. Breadth of experience was hypothesized to positively predict creative performance in a problem-solving task where participants provide solutions to one of three vignettes. This relationship was hypothesized to occur via a mediated model, where breadth of experience impacts creative performance through usage of analogies. Lastly, depth of experience was posited to moderate the relationship between breadth of experience and usage of analogies. A measure of breadth of experience was developed and tested within the present study. Breadth of experience was shown to negatively predict creative performance. No support was found for mediation of analogy usage, but analogy usage did positively predict creative performance. Support was found for the moderation of depth of experience on the relationship of breadth of experience to analogy usage. Overall, this study provides initial support for the relevance of breadth of experience as well as further replication for analogy usage's importance on creative performance. Recommendations and future directions are provided.

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CHAPTER I: INTRODUCTION

Introduction

Creativity is defined as a novel and useful solution to the situation at hand (Rietzschel & Ritter, 2018). Given this, creativity is intrinsically tied to ideas and opportunity. This implies something which is creative in one domain may be banal or useless in another. Furthermore, something considered creative to a novice in a field may also be standard to an expert. Put simply, creativity is always contextual.

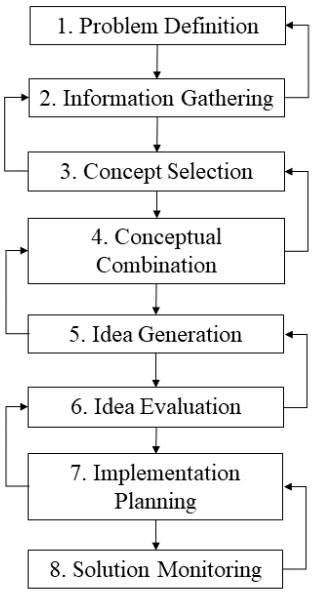
Innovation is colloquially interchanged with the term creativity. However, innovation refers to the refinement and actualization of a creative idea (Rietzschel & Ritter, 2018). This is an important distinction because while creativity and innovation are related, they require different, and sometimes opposing, skillsets (Rietzschel & Ritter, 2018). As an example, someone who is more creative may be able to conceptually picture how a new idea will function broadly within a domain, but someone who is more innovative may be able to materialize the details to ensure it works upon release. Each process works reflexively with each other, but they are often nurtured in differential ways.

This is also reflected within process models of creativity. Many process models of creativity exist, but Mumford and colleagues' (2018) has been researched the most, shown in Figure 1. The model demonstrates the recursive nature of the creative process, moving forward through stages and iteratively backwards to previous stages when necessary (Mumford et al., 2018). Holistically, these stages are known as problem definition, information gathering, concept selection, conceptual combination, idea

generation, idea evaluation, implementation planning, and solution monitoring (Mumford et al., 2018).

Figure 1

Mumford and Colleagues' (2018) Creative Process Model



During the first stage of problem definition, the current situation is examined, and the issue is understood more in-depth, evaluating the potential consequences of the issue (Mumford et al., 2018). Once the problem is defined, the next stage is gathering available information (Mumford et al., 2018). Due to the nature of problems requiring creativity generally being ill-defined, there may be difficulty at this stage finding relevant information (Mumford et al., 2018). Since most creative solutions fail, it is vital to not

only find situations where a solution worked, but also situations where solutions failed (Mumford et al., 2018). Doing so allows a convergence around potential solutions.

After information is gathered, it must be organized into broad, conceptual categories in the stage known as concept selection (Mumford et al., 2018). This stage is important because it further provides depth and nuance to the problem at hand. Organizing the compiled knowledge will help to understand the problem's place within a broad system, allowing for an understanding of how it will alter and be altered by different inputs and outputs (Mumford et al., 2018). Following this, those broad, organized concepts are shapeshifted to create broad new ideas in the fourth stage of conceptual combination (Mumford et al., 2018). Important to note, there are not any tangible solutions produced at this point (Mumford et al., 2018). These ideas simply provide a general framework from which to draw solutions because each broad concept will narrow the pool of acceptable solutions (Mumford et al., 2018).

Once broad conceptual categories have been identified, specific solutions to the problem are created in the fifth phase of the process known as idea generation (Mumford et al., 2018). This stage is what most people typically think of as encompassing the entirety of creativity. Meta-analytic results on creativity training shows effective idea generation is critical for performing highly in creative endeavors (r = .27; Scott et al., 2004). After ideas are generated, they are judged in the formal stage of idea evaluation to determine their future viability on several dimensions (Mumford et al., 2018; Watts et al., 2019). Generally, leaders are the primary evaluators of ideas in the workplace (Watts et al., 2017).

Once ideas have been evaluated, planning the chosen idea's implementation is the next step (Mumford et al., 2018). Even though this stage is one of eight, it does not mean one-eighth of time invested into a creative solution is spent here. There is a significant portion of work to be done, and it may be discovered selected solutions do not work as planned after pilot testing. Individuals will need to move back to other stages to solve problems encountered in implementation planning when necessary (Mumford et al., 2018). Lastly, after the idea has been implemented, it must be monitored effectively (Mumford et al., 2018). Even after fixing imperfections from pilot testing, solutions may still not perform as planned (Mumford et al., 2018). Given this, there will be more iterative progress made by moving back to previous stages in the creative process (Mumford et al., 2018).

The creative process is ultimately about making, testing, re-making, and re-testing repeatedly until a viable output prevails. Much of this difficulty comes from the embedded ambiguity of solving an ill-defined problem while unable to rigorously test solutions. Put plainly, creativity and innovation are hard work, and they are not responsible strategies to pursue for every problem. Fortunately, a large portion of creativity research has investigated idea generation processes and ways to improve their success.

Openness to experience is related to creativity and idea generation, as demonstrated comprehensively through the literature (Conner & Silvia, 2015; Mumford et al., 2018; Nusbaum et al., 2014). Hammond and colleagues' (2011) meta-analysis on individual predictors of innovation at work also shows openness to experience is critical for success ($\rho = .24$). Openness also interacts with emotion regulation in creative

endeavors, such that emotion regulation becomes a statistically significant predictor of creativity the more open someone is (Ivcevic & Brackett, 2015). Other research suggests that openness to experience is an important moderator for intelligence's impact on creativity where the more fluid intelligence someone has, openness to experience becomes more important to creative performance (Harris et al., 2019).

Intrinsic motivation, defined as direction and intensity of behavior towards something one does simply for the enjoyment of the task, is important for creativity and innovation (Hammond et al., 2011). Radical creativity is shown to be related to intrinsic motivation, as opposed to incremental creativity (Gilson & Madjar, 2011; Malik et al., 2017). Students' creativity tends to be more impacted by intrinsic motivation than those in work contexts (Hammond et al., 2011). Intrinsic motivation has been shown to mediate openness to experience's impact on creative performance, as well as lead to more engagement during creative tasks (Tan et al., 2016). Having intrinsic motivation to act creatively in a particular task is likely an important mechanism for increasing relevant knowledge and skills (Amabile, 1997).

Another important factor for creative performance is domain expertise (Baer, 2015; Mumford et al., 2018). A large amount of research argues for the domain specificity of creativity, even if there are some covariates and common processes that assist creativity functions in general (Baer, 2015; Kaufman, 2016). Creative work in different domains may require different skills or processes (Baer, 2015). Having domain expertise does not immediately lend itself to being creative, however. An example of this is someone with domain expertise may only be interested in routine functions of their area of expertise and not be invested in developing creative solutions, thus not exhibit

creative performance (Tett & Burnett, 2003). In addition, role expectations and autonomy are both integral for creative performance, such that if one's role does not require creativity or does not offer freedom to be creative, creativity will not be sought after by the individual (Scott et al., 2004). Because creativity and innovation reflect a large process, each stage requires both skills and abilities that are general to all functions and specific to individual stages regardless of domain (Mumford et al., 2018). Another aspect hindering experts is a cognitive phenomenon called functional fixedness, an issue where it is difficult to generate new alternatives due to past priming (e.g. routine solutions an expert frequently uses hinders their ability to perceive other solutions that may work; Baer, 2015). Fixedness and entrenchment are problems organizations frequently wrestle with and spawned the necessity for internal and external consultants. Naturally, this lends itself to the idea that external expertise from other domains may be useful to solving within-domain issues. It follows that individuals increasing breadth of experience would increase ability to generate more creative solutions on their own (Baer, 2015; Epstein, 2019). Domain experts that also have a significant amount of breadth of experience would likely not encounter this bias, as they would naturally have other fields of experience to draw upon when they reach a point of functional fixation. In addition, Amabile (1997) argues someone lacking domain expertise may use their breadth of experience to be creative, especially if they are intrinsically motivated.

Life naturally provides opportunities to be involved in a broad range of experiences. Some people may have more breadth of experience than others, such as (a) those who took a significant amount of general education credits in college, (b) those who switched majors or career fields, (c) those with higher socioeconomic status, (d)

those who moved frequently, (e) those working a job outside of their expertise for extra money, or (f) those who have friends with experience in any number of these categories. Through breadth of experience, one can tap into distal connections from other fields which are seemingly unrelated at first but may provide a critical piece to solving a novel problem, as problems encountered within one field may mimic the problems in another. This introduces the need for creative problem solvers to draw upon quasi-available resources, such as drawing an analogy from a different field.

Scott and colleagues' (2004) meta-analysis shows one of the most effective ways to train creativity is through usage of analogies (r = .28). Analogies vary in how much they reflect the target of comparison, as near analogies hold both surface and structural similarity to the new problem, while far analogies seem unrelated on the surface but hold deep, structural similarity to the target (Dahl & Moreau, 2002). Because of this, near analogies lead to incremental innovation while far analogies lead to radical innovation (Dahl & Moreau, 2002). Put more simply, near analogies reference the same domain as the problem or one that is very similar, while far analogies reference unrelated domains. A good example of a far analogy is when biomimicry is used in product design (Kennedy et al., 2018). Biomimicry involves using biological models, such as animals, plants, or natural environments, as analogies for designing or implementing a product or service (Kennedy et al., 2018). It follows that more breadth of experience should bolster one's ability to draw analogies into the target domain because the probability of having connecting knowledge and skills increases through sheer volume.

It is important to note that simple cursory knowledge of other fields is not sufficient for breadth of experience. The individual must have developed at least a

minimal amount of depth in the other domain for it to be useful in drawing an analogy to the target domain. Generally, expertise is developed through deliberate practice, an intentional effort to improve through training activities (Ericsson et al., 1993). Deliberate practice likely occurs with engaging in hobbies and work, which will develop significant breadth and depth of experience.

Engaging in deliberate practice is one way to develop expertise, but intentionality is not always necessary to gain enough knowledge and skill to draw an effective analogy. People working in groups, even if their role requires significant depth, likely requires the individual to work with others of skill in different domains. The individual then must understand their teammates' work in order to integrate how their expertise integrates with their own. Separately, public school education largely focuses on producing droves of generalists, sampling many different fields to provide a general framework. Collegiate education until the graduate level provides both specialized and non-specialized education, as most universities require general education credits to graduate. Social connections naturally build breadth of experience into someone's life. Families and friendships often have members with varying career paths and hobbies such that any individual will passively vicariously learn through others. Lastly, hobbies provide significant opportunities to build breadth passively, such that it naturally allows one to build a mental model of more than the direct skill they are practicing. An example of this is shown through someone who makes clay jewelry for fun. They not only understand the process of making and forming the jewelry itself with that specific clay, but they can build a general understanding of the material properties of a ceramic object such as its heat tolerance and plasticity. Taking this a step further, if this individual decides to sell

their jewelry, they implicitly and explicitly learn about general business processes such as pricing, marketing, and customer service. All of this experience then passes on to that individual's roommates, partner, and family as they spend time together.

The ultimate question is what domains are most important to learn for experts of specific domains. Unfortunately, it is difficult to infer what experiences will eventually lead to success because solving ill-defined problems introduces a significant amount of ambiguity. One domain may complement another, but it would be impossible to know this until a problem arises that requires distal knowledge. Problems within domains can vary as well, such that one problem may require specific breadth of experience to solve, while another problem within the same domain may not need this breadth at all. Because it would be impossible to forecast every potential new issue, it is likely that the more breadth of experience one has, the probability increases of any piece of it being relevant to solving a particular problem. Therefore, it follows:

Hypotheses

Hypothesis 1

Breadth of experience in other domains positively predicted idea generation performance.

Hypothesis 2

Breadth of experience positively predicted analogy usage during idea generation.

Hypothesis 3

Analogy usage positively predicted idea generation performance.

Hypothesis 4

Depth of experience within the domain of the problem moderated breadth of experience's impact on analogy usage, such that those with more breadth of experience and more depth of experience performed better than those without.

CHAPTER II: METHOD

Method

Participants

Data was gathered using Amazon Mechanical Turk (MTurk) workers. Participants received monetary compensation for their participation. Participants were required to be over the age of 22 and live in the United States of America at the time of taking the survey. These restrictions were done in order to get variability on measures within the study, which required being old enough to have a broad range of experiences. This sample reflected a range of work experience and age, which was necessary to test the hypotheses. A total of 106 responses were able to be used.

Design

The entirety of the study took place virtually and unproctored. This study used a non-experimental survey design with covariates. The covariates were openness to experience, age, intrinsic motivation, divergent thinking, convergent thinking, narcissism, and socioeconomic status. Users on MTurk signed up to be participants for the study. They filled out an informed consent form then answered all pre-measures. Then, participants were randomly assigned to generate ideas for one of three vignettes as the primary study task. They were then given post-measures and debriefed on the study.

Measures

Measures are ordered in the way they were taken by participants in the survey. Measures included the Swetz Breadth of Experience Scale, openness to experience measured by the Big Five Inventory (BFI; John et al., 1991, 2008), the Remote Associate's Test to measure convergent thinking (Bowden & Jung-Beeman, 2003), the

Consequences AI Task (Christensen et al., 1958), the Single Item Narcissism Scale (SINS; Konrath et al., 2014), the vignette study task providing ratings of quality and originality, and Harackiewicz and colleagues' (1987) task interest and enjoyment measure (1987). Subheadings of individual measures providing background information and reliability are listed below.

Swetz Breadth of Experience Scale

The breadth and depth scale was created for the purposes of this study, measuring one's breadth and depth of experience across a broad range of fields, industries, and activities (see Appendix A). The measure contains biodata questions relating to important categories of experiences: (a) demographics, (b) work history, (c) education history, (d) hobbies, and (e) social connections. Breadth of experience refers to having a broad range of experiences, outside of the domain of expertise for the given vignette.

Scoring the measure was as follows. Higher scores represented more experience, while lower scores represented less experience. First, the area of depth was determined by referencing the problem statement within the study. For the incarceration vignette, the depth items were (a) industry experience with health care and social assistance, (b) administration of justice, (c) criminal justice, (d) criminology, (e) forensic science, (f) law, (g) public policy, (h) biobehavioral health, (i) health policy and administration, (j) pharmacology, (k) psychology, (l) rehabilitation and human services, (m) social work, (n) political science, (o) sociology, and (p) economics. For the youth obesity vignette, the depth items were (a) industry experience with health care and social assistance, (b) public policy, (c) K-12 education, (d) biobehavioral health, (e) food science, (f) health policy and administration, (g) kinesiology and athletic training, (h) psychology, (i) social work,

(j) economics, (k) human development, (l) sociology, and (m) culinary arts. For the opioid vignette, the depth items were (a) industry experience with health care and social assistance, (b) administration of justice, (c) criminal justice, (d) criminology, (e) forensic science, (f) law, (g) public policy, (h) biobehavioral health, (i) immunology and infectious disease, (j) health policy and administration, (k) medicine, (l) pharmacology, (m) psychology, (n) rehabilitation and human services, (o) social work, (p) biology, (q) economics, (r) human development, and (s) sociology.

Then, any experiences the participant had within the depth categories was added together into a holistic depth score. A z-score was calculated for each depth category to account for different amounts of included items to calculate depth per problem. Any experiences not directly relevant to the problem domain are scored as breadth of experience. The more diverse experiences one had, the more breadth of experience they had. These were added together and represented a "breadth" score. Then, z-scores were calculated to account for the differing amount of items represented in the measure. Both breath of experience and depth of experience were independent variables.

Big Five Inventory (BFI)

Personality variables were measured using the BFI (John et al., 1991, 2008), relating to the Five Factor Model of personality. This measure was used to gather data on the participant's openness to experience, which was assumed to be a covariate of breadth of experience and has previously extensively been studied as a covariate to creative performance. Other personality factors measured, including agreeableness, conscientiousness, emotional stability, and extraversion may be used for exploratory purposes in the future. Strong internal consistency was found with each of the scales in a

previous study (Benet-Martinez & John, 1998). In the past study, extraversion (α = .83), agreeableness (α = .79), conscientiousness (α = .82), neuroticism (α = .84), and openness (α = .81) all showed acceptable levels of reliability for usage in the present study. Within the present sample, openness to experience achieved an acceptable level of reliability as well (α = .78).

Remote Associate's Test (RAT)

The RAT (Bowden & Jung-Beeman, 2003) is a commonly used measure of convergent thinking. The measure involved presentation of three words which the participant generates a fourth word that links them all together. Because the RAT was used as a covariate and was not the primary focus of the study, only 15 remote associate problems were selected from a larger list. The list of 15 remote associates were chosen based on difficulty. Three remote associates of similar difficulty were selected for each difficulty level. The difficulties chosen reflect five distinct levels of difficulty. Participants were given 15 seconds to complete each remote associate, as the difficulty was based on timing given to solve the problem. Participants were scored on how many correct answers they had within the 15 prompts, such that one correct response added one point to their total score.

Consequences AI Task

The Consequences AI Task (Christensen et al., 1958) is a commonly used measure of divergent thinking. The Consequences Task asks participants to generate ideas of what would happen if a specific event occurred. Generally, these events question basic fundamentals of life that are typically not questioned, such as the necessity to eat food. Prompts then ask what would happen if that element changed. Each prompt

provides sample responses. Participants were scored based on the number of responses they provided that were different than the sample responses.

Single Item Narcissism Scale (SINS)

The SINS was developed to serve as a shorter measure of narcissism (Konrath et al., 2014). The authors suggested using the measure only when it is advantageous to, such as in a situation where there are many other measures in a study and narcissism is not the focal variable. The SINS has shown good convergent validity with other narcissism measures, correlations ranging from .28 to .50, all statistically significant ($p < .001$). In addition, the SINS has acceptable test-retest reliability, showing correlations of .79 and .78, both statistically significant ($p < .001$). Given this, the SINS was appropriate for the purposes of the present study.

Vignette Study Task

Vignettes of current issues were developed for the purposes of this study (see Appendix B). Participants answered one of three vignettes assigned at random, which instructed them to provide creative and useful solutions to problems in the social work/public policy domain using analogies. Participants read their vignette and then provided an answer to the problem. They had the ability to re-read the prompt if they wished to. After providing their solution, they were asked how many analogies they used during the process and were asked to describe what analogies they used.

Participant solutions were rated manually on their quality and originality. Industrial/Organizational psychology graduate students at a large southeastern university served as quasi-expert raters. The scoring procedure was as follows. Raters received the seminal article on the Consensual Assessment Technique (CAT; Amabile, 1982) and

were instructed to read it prior to meeting in-person to score responses. Raters then met in-person and were formally trained on the process, which was developed using guidance from prior codebooks (L. Watts, personal communication, May 7, 2020). The training included providing a common frame of reference by showing low, medium, and high examples of both quality and originality responses. In addition, raters were given information on common rating errors in order to reduce potential bias. These included recency bias, contrast error, and similar-to-me error. Following formal training, raters were given a chance to ask questions about the original article and the training to clear ambiguity. Then, raters participated in a guided, active training session where each rater scored multiple responses. After raters showed acceptable inter-rater reliability and understood the process, they began rating each solution for quality and originality on 7-point scales. After 10% of the responses were scored, interrater reliability was assessed by having raters compare their answers. Raters then discussed why they provided the ratings they did and were given a chance to re-correct their ratings for the initial 10% of responses. This was done to build a stronger shared mental model of accurate ratings. Acceptable inter-rater reliability was achieved (equal to or over .70 agreement), so raters scored the rest of the responses in isolation. These ratings on each participant's quality and originality served as dependent variables for the study, showing their creative performance. Vignettes showed differences in difficulty, so z-scores were calculated to correct for that difference.

Participants then answered questions regarding analogy usage. Usage of analogies refers to the participant's ability to solve problems in one domain using an analogy to

another domain. Analogy usage was measured by counting how many were used, which was self-reported.

Harackiewicz and colleagues' (1987) Task Interest and Enjoyment Measure

The Task Interest and Enjoyment measure has previously been used to measure intrinsic motivation when participating in research tasks (Harackiewicz et al., 1987). It is given to participants after they complete the study task to determine their level of intrinsic motivation. It consists of five questions asking about their experiences during the task. Harackiewicz and colleagues (1987) provide guidelines on the dimensions, and individual items were developed for the purposes of this study. Within the present study, acceptable internal consistency reliability was found between the items (α = .88).

Covariates

Openness to Experience

Openness to experience was a potential covariate of breadth of experience measured by the BFI (John et al., 1991, 2008). Openness is commonly referred to as the most important personality trait for creative performance, so it was important to measure this variable to isolate the effects of the independent variables if necessary. In addition, if one was more open to experience, they may have also experienced a broader swath of activities than someone who was less open. Because of both of these reasons, openness to experience was measured as a covariate. A higher score on the BFI's openness to experience questions indicated a higher openness to experience.

Socio-economic Status (SES)

Measuring SES is common practice within psychological research as it is a potential covariate of a variety of other measures. For the purposes of this study, SES was

a variable with potential to influence breadth of experience greatly. The more opportunities one has access to through financial resources, the more likely they will participate in them. It was measured within the Swetz Breadth of Experience scale determining current SES and analyses were run to determine its importance.

Age

Age was a potential covariate for breadth of experience. As logically follows, those with older age may have had more opportunities to experience more things than someone who is younger. For this study in particular, older age allowed for more years of work experience, which could have contributed to one's breadth and depth of experience. Age was measured using self-report of participants listing their age within the study as a part of answering demographic questions within the Swetz Breadth of Experience Scale.

Divergent Thinking

Divergent thinking performance was a potential covariate of creative performance in the study task. It is measured using the Consequences Task AI (Christensen et al., 1958), which asks participants to list different usages for common objects or speculation on how circumstances would change if a certain common fact of life changed. Number of responses were counted to determine performance on the measure. The more responses one provided, the higher their divergent thinking score was.

Convergent Thinking

Convergent thinking performance was a potential covariate of creative performance in the vignette study task. Creativity often requires some level of both divergent thinking to create different solutions and convergent thinking to home in on a viable solution. This may therefore impact creative performance and was tested as a

covariate, tested using the RAT (Bowden & Jung-Beeman, 2003). Convergent thinking was scored as adding the number of correct responses indicated by the participant. The more correct responses provided, the higher their convergent thinking score.

Narcissism

Narcissism was a potential covariate for the study as participants will be self-reporting their competence within multiple domains of expertise. Measuring narcissism is important as narcissists may overinflate their competence. Therefore, narcissism is measured using the SINS (Konrath et al., 2014). The SINS was embedded within the Swetz Breadth of Experience Scale. A higher score on the SINS indicates the participant was more narcissistic.

Intrinsic Motivation

Lastly, intrinsic motivation was a potential covariate of creative performance in the study. Past research supports intrinsic motivation may impact creative performance, and it is measured by asking participants about their enjoyment during the task using Harackiewicz and colleagues' (1987) task enjoyment measure. After reverse scoring items four and five, participants' scores were added, such that a higher score on the measure indicates a higher level of intrinsic motivation.

Procedure

Participants signed up for the study through Amazon Mechanical Turk (MTurk). Participants will be linked to an online Qualtrics survey. They read and agreed to an informed consent form to continue with the study. Participants then took pre-measures for the study. This includes the Swetz Breadth of Experience Scale, the BFI (John et al., 1991, 2008), Consequences Task AI (Christensen et al., 1958), and the RAT (Bowden &

Jung-Beeman, 2003). Participants were then randomly assigned to one of three vignettes and began generating ideas for the primary study task. When participants completed generating ideas to solve the issue presented, they answered questions regarding analogy usage during the problem-solving task. Participants then answered Harackiewicz and colleagues' (1987) Task Interest and Enjoyment measure. This concluded participant involvement. Participants were debriefed and provided with contact information for any questions they may have. Once all responses were collected, quasi-expert raters blind to participant information rated responses. Six Industrial/Organizational Psychology graduate students at Middle Tennessee State University served as raters. Each response was rated twice for quality and originality.

CHAPTER III: RESULTS

Results

Data was cleaned and analyzed using SPSS in a secure location. After the data was cleaned, removing bots and those who failed attention checks, regression analyses were run on the remaining sample (N = 106). Remaining participants ranged from age 22 to age 69. The modal age was 22. Descriptive statistics are presented in Table 1.

Interrater Reliability

Six total raters scored responses to the vignette study task. Because there were three vignettes, pairs of raters were assigned to each vignette. Therefore, intraclass interrater reliability was calculated for each pair. Incarceration response raters achieved acceptable levels of reliability for both quality (p < 001; α = .85) and originality (p < .001; α = .70). Youth obesity response raters achieved acceptable levels of reliability for both quality (p < .000; α = .79) and originality (p = .003; α = .60). Opioid epidemic response raters achieved acceptable levels of reliability for quality (p = .002; α = .67) and originality (p = .024; α = .52).

Covariates

All potential covariates were measured against both the dependent variable (creative performance) and the independent variable (breadth of experience). Findings are presented in Table 2.

Table 1

Descriptive Statistics

Metric	Breadth of Experience	Creative Performance	Analogy Usage	Openness	SES
Mean	-0.29	0.23	1.36	35.43	3.1
SD	0.59	1.66	1.02	7.19	0.94

Table 1 (continued)

Descriptive Statistics

Metric	Age	Divergent Thinking	Convergent Thinking	Narcissism	Intrinsic Motivation
Mean	37.05	21.08	6.80	2.30	25.95
SD	11.40	12.31	4.07	1.56	6.35

Table 2

Covariate Correlation with Creative Performance and Breadth of Experience

Measure	Openness	SES	Age	Div. Thinking	Conv. Thinking	Narcissism	Intrinsic Mot.
Creative Perf.	.11	.27**	.13	.36***	.19	-.26**	.17
Breadth of Exp.	.24*	.08	-.11	-.10	-.27**	.32***	.04

*$p < .05$. **$p < .01$. ***$p < .001$.

Openness to Experience

Acceptable reliability was achieved within the openness battery of the BFI (α = .78). Openness to experience did not predict creative performance on the vignette task (p = .258; r = .11). However, openness to experience did predict breadth of experience (p = .014; r = .24).

Socio-economic Status (SES)

SES predicted creative performance on the vignette task (p = .005; r = .27). However, SES did not predict breadth of experience (p = .448; r = .08).

Age

Age did not predict creative performance on the vignette task (p = .180; r = .13). Similarly, age did not predict breadth of experience (p = .272; r = -.11).

Divergent Thinking

Strong reliability was achieved with the Consequences Task (α = .93). Divergent thinking performance on the consequences task predicted creative performance on the vignette study task ($p < .001$; $r = .36$). Divergent thinking performance did not predict breadth of experience ($p = .320$; $r = -.10$).

Convergent Thinking

Strong reliability was achieved with the RAT (α = .88). Convergent thinking performance on the RAT approached statistically significantly predicting creative performance on the vignette study task ($p = .057$; $r = .19$). However, convergent thinking performance predicted breadth of experience ($p = .005$; $r = -.27$).

Narcissism

Narcissism negatively predicted creative performance on the vignette study task ($p = .008$; $r = -.26$). In addition, narcissism positively predicted breadth of experience ($p < .001$; $r = .32$).

Intrinsic Motivation

High reliability was achieved within the intrinsic motivation battery of questions (α = .88). Intrinsic motivation during the vignette study task approached statistically significantly predicting creative performance ($p = .080$; $r = .17$). Intrinsic motivation did not predict breadth of experience ($p = .663$; $r = .04$).

Hypotheses 1-4

Breadth of experience statistically significantly predicted creative performance ($p = .024$), such that as breadth of experience increased, creative performance decreased ($r = -.22$). Because this did not predict in the expected direction, this finding shows that hypothesis 1 was not supported.

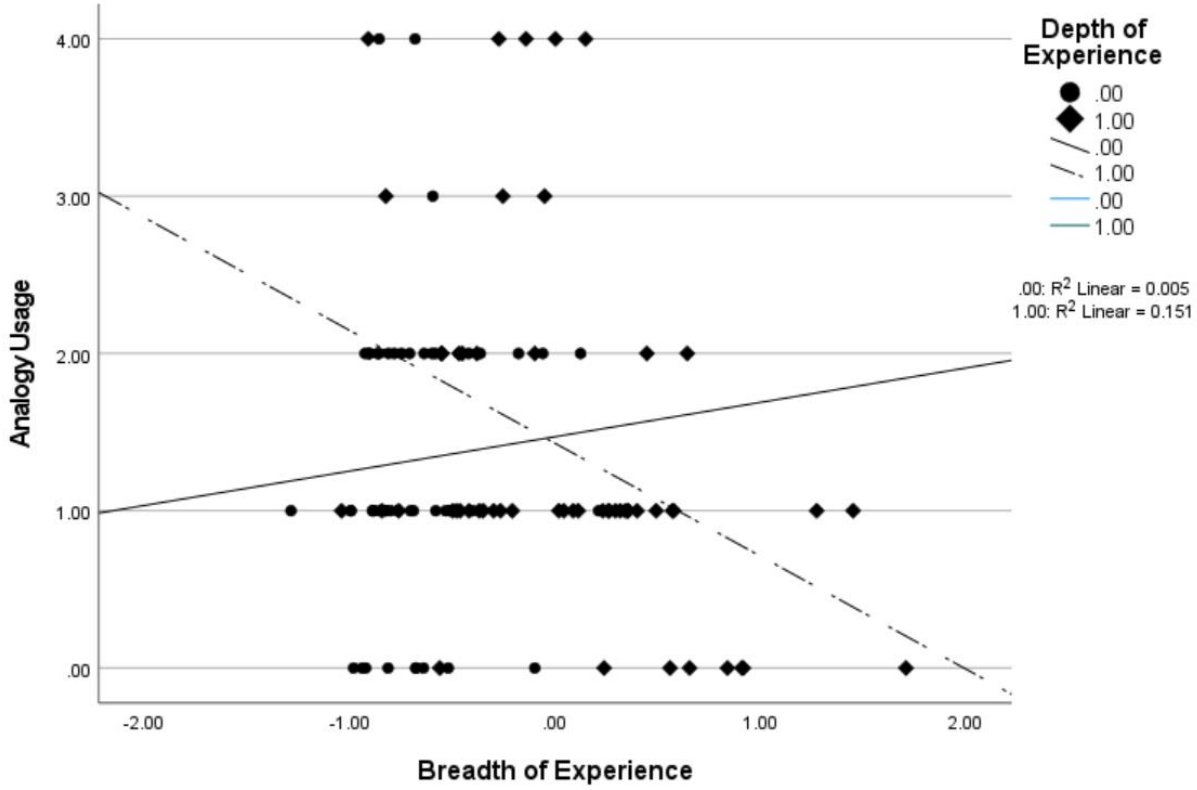
Breadth of experience approached statistically significantly predicting analogy usage (p = .061). As breadth of experience increased, analogy usage decreased (r = -.18). Because this did not predict in the expected direction nor reach statistical significance, this finding shows that hypothesis 2 was not supported.

Usage of analogies statistically significantly predicted creative performance (p < .001). As more analogies were used to solve the vignette, creative performance increased (r = .33). Therefore, support for hypothesis 3 was found.

To test hypothesis 4, depth of experience was coded as a dichotomous variable which was split at the median score (*Med* = -.168). Values below and including the median were coded as a 0, while all other values were coded as a 1. Depth of experience approached statistically significantly moderating the relationship between breadth of experience and usage of analogies (p = .077). This finding is shown in Figure 2. For those with low depth of experience, breadth of experience showed a positive relationship with analogy usage. For participants with high depth of experience, breadth of experience showed a negative relationship with analogy usage. Because the relationship is the opposite of what was predicted and did not reach statistical significance, this finding shows hypothesis four was not found.

Figure 2

Depth of Experience Moderating Relationship Between Breadth of Experience and Analogy Usage



CHAPTER IV: DISCUSSION

Discussion

This study was the first to empirically examine the relationship between breadth of experience and creative performance. There has been a significant amount of anecdotal and theoretical evidence regarding this relationship, so providing empirical support was the necessary next step. The results of this study indicate the only hypothesis that was found was hypothesis 3. Hypotheses 1 and 4 were statistically significant, but the results were found in the opposite direction as predicted. Hypothesis 2 approached statistical significance (p = .061), and it would likely be statistically significant if the study had more power. However, the direction would still be opposite of what was predicted, meaning the hypothesis would still not be found within the present study. The study had a relatively low sample size (N = 106), so finding nearly all hypotheses as statistically significant was of note. It begs other researchers and future studies to cross-validate this information and further contribute to the investigation of how past experiences change one's creative performance.

Interpreting the effect sizes of the results paints a complicated story. Breadth of experience showed a negative correlation with creative performance, which was the opposite direction of what was expected. There are many possible explanations for this result. The first is that this is the true direction and effect of breadth of experience on creative performance. Having participants answer batteries of questions regarding their past experiences may prime irrelevant information and cloud their judgment when solving the vignettes. In addition, breadth of experience was measured as any experience that was not visibly relevant depth of expertise for a given vignette. Given the seminal

and exploratory nature of this study, this is entirely possible. However, it is important to follow this study with replications that can cross-validate that information. Future studies should focus on using a larger sample, using a different subject pool, use similar measures, and manipulate order of the study materials. Placing the breadth of experience measure at the end of the study may be the most important change in order, as participants would not prime information until they have already completed all other study tasks. In addition, spacing the breadth of experience and the vignette portion of the study by multiple weeks of time would diminish the effect of relevant priming.

Another interpretation of breadth of experience negatively predicting creative performance is the nature of the measure confounds its ability to predict properly. The measure requires participants to self-report their experiences across a variety of dimensions. This is typically not an issue for determining verifiable information that is factual, such as asking what states one has lived in. However, it is well known that people tend to inflate their ratings of their own competence. This becomes a multiplicative issue when the participant is also a narcissist. Narcissistic individuals statistically significantly scored themselves higher on breadth of experience ($p < .001$; $r = .32$), while also performing worse on the vignette study task ($p = .008$; $r = -.26$). In addition, narcissists tended to spend less time on the vignette study task ($p = .003$; $r = -.29$). All this combined indicates that narcissists inflated their ratings, provided worse responses to the vignettes, and were also overconfident about their responses' quality and originality. Even non-narcissistic participants may have answered the Swetz Breadth of Experiences Scale honestly and felt overconfident after seeing their magnitude of experience. Therefore, a different relationship between breadth of experience and creative performance may be

found if other measurements of past experience were utilized or if the current measure was made to ask questions that are more verifiable.

A similar relationship was found between breadth of experience and analogy usage. As breadth of experience increased, usage of analogies decreased, although this finding was not statistically significant. One explanation for this finding is that the more breadth of experience one had, the less they needed to rely on analogies to solve the vignette study. They may have understood more relationships between variables than someone without breadth of experience, and therefore did not need to use an analogy to understand the relationships. Furthermore, those that had more breadth of experience could have used a lower amount of analogies, yet the analogies they did elect to use may have been of higher quality than those who had less breadth of experience. Follow-up studies should measure the quality of analogies used to solve the vignettes to reveal more information about this relationship. Lastly, it is also important to recognize the overconfidence of narcissists in this context. Although narcissism did not statistically significantly predict analogy usage ($p = .090$), there was still a negative relationship between the two variables ($r = -.17$). Given the low power of the data, this relationship could potentially be statistically and practically significant if the sample was larger. It is possible narcissists felt more inclined to ignore the directions of the vignette which instructed the participant to use analogies. They could have then preferred to use their own problem-solving method, showing a smaller relationship. Future studies should investigate this relationship further.

Analogy usage showed value within the study, as they positively predicted creative performance. This replicates past studies showing analogies can improve

creative performance (Dahl & Moreau, 2002). Given the measure of analogy usage is a simple count of analogies, it is of note to see a strong relationship between the two variables. Quality of the analogies should be determined in future studies to see if the relationship is different than a simple count. This relationship could also be explained by raters viewing responses with more analogies as being more creative. Although this could be an issue, it is likely not as raters were instructed to not rate quality and originality on the basis of an analogy being present, but rather to focus on the dimensions of quality and originality themselves. Hopefully, this finding will spark future studies investigating the relationship between analogies and creativity.

Finally, it is shown that depth of experience moderates the impact of breadth of experience on analogy usage. Finding this moderation recontextualizes the findings within hypothesis 2. Akin to hypotheses 1 and 2, this effect also occurred in the opposite direction as expected. Whenever the participant had low depth of experience, their breadth of experience predicted their usage of more analogies. Conversely, if the participant had high depth of experience, their breadth of experience predicted less analogy usage. This could be explained by those who had less depth required more reliance on analogies to solve the vignette prompt. This provides further credence to the argument that those with higher breadth of experience may understand more relationships than those with less breadth of experience. It is important to note that different conceptualizations of depth of experience may provide different results. Categories of relevant experience were selected, but others may change how the results are interpreted. Future studies should cross-validate categories of depth and determine their statistical relevance to dependent variables.

Limitations

The implementation of the study on Amazon MTurk limited the ability to properly interpret the results. When posting the study, the time set for participants to complete the study was not conservative enough. Timing was determined based off pilot test results, but many participants indicated struggling to finish the study within the bounds of the time provided. This may have hindered many participants' ability to properly complete the survey, as they were feeling rushed by the end of it. This could have also bred more fatigue than was anticipated. All of this is bolstered by the time spent on the vignette task was the strongest predictor of creative performance ($p < .001$; $r = .39$) and was a strong predictor of analogy usage ($p = .006$; $r = .26$). Vignettes were placed as one of the final aspects of the survey, further supporting this notion. Participants on MTurk may have been more concerned in ensuring they would receive payment for their work, rather than providing quality and original responses. Together, this indicates that future replications of the same survey should provide more time to complete the study.

Another issue within the present study was the low sample size. As previously indicated, there was still evidence for the existence of each relationship as each finding was either statistically significant or approached statistical significance. Future studies should gather more data and determine how the relationships change across similar and different samples.

A key limitation was the development of many different materials for the purpose of this study. The breadth of experience scale and vignettes were developed to examine key variables of interest across different settings. However, their lack of replicated

validation and usage may have provided challenges to finding various results. Improvement, refinement, and validation of each is necessary to properly investigate them in the future. Current results were of note, given that breadth of experience negatively predicted creative performance and approached negatively predicting analogy usage. In addition, divergent thinking performance on the Consequences Task AI predicted creative performance on the vignette problem-solving task ($p < .001$; $r = .36$), which provided initial evidence of convergent validity.

Finally, although interrater reliabilities reached acceptable levels, it is advised for future examinations of the vignettes to include more raters and provide a more extensive frame of reference training. Potentially, different results could occur as a result of this change. Steps were taken to properly train raters, but this may not have been sufficient for the purposes of the vignette study. Given the vignettes were developed for the purposes of the present study, it was difficult to provide in-depth training given the lack of previous responses to construct behaviorally-anchored rating scales. These should be developed for future studies in order to provide raters with more detailed and helpful rating scales.

Future Directions

For the future, the most important recommendation is to continue replication, validation, and refinement of the newly developed measure and vignettes. Different, statistically robust scoring methods should be implemented to help further determine the relationship between breadth of experience and key variables of interest. These include using empirical keying and factor analyses. Empirical keying would provide the ability to understand which items are most important, while factor analysis would reduce the

dimensions to common factors. Both would provide more information on how the measure and different experience categories function. Eventually, structural equation modeling (SEM) should be used to analyze data. SEM is an extremely robust statistical method which could control for rater error, providing better evidence regarding relationships.

More vignettes should be explored. The goal of making multiple separate vignettes was to create ill-defined problems that could be solved effectively in multiple different ways, while being difficult enough to provide variability. Two other vignettes were created for this study but were not used given pilot test results. They should potentially be revisited or new vignettes should be developed that reflect a broad domain of relevant experience required to solve them effectively. Having a range of vignettes would provide the ability to test if breadth of experience is relevant for a broad range of problems. This is important to know for the future, as broader ranges of issues more accurately reflect daily life. Validating across problems would therefore provide stronger external validity for further findings.

Conclusion

The present study was the first empirical investigation of breadth of experience's impact on creative performance. Minimal support was found for nearly all hypotheses, except hypothesis three, which linked analogy usage to creative performance. Hypothesized relationships, except for hypothesis 2, occurred in the opposite direction as expected. Potential explanations of these results included breadth of experience potentially not being helpful for creative problem solving, narcissism covaried with key variables, and measurement of the relevant variables. Further replication and refinement

is required to fully investigate these relationships, but this study provides initial evidence to continue investigating this topic area.

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APPENDICES

Appendix A: Swetz Breadth of Experience Scale

You will now be asked multiple questions related to your past experiences. Please answer each question to the best of your ability. This is the first time the measure is being used and was developed for the purposes of my master's thesis as well as future research. It took me over a year to develop, and I am extremely excited to finally implement it. I would be extremely appreciative if you complete the measure as thoughtfully and honestly as you can. Thank you in advance!

For questions asking "to what extent" you have or do something, please use the following guidelines to make your best judgment.

No experience, skill, knowledge, or frequency: You do not participate in this or know anything substantial about it. You may have heard of it before.

Moderate, average, or amateur level: You have some proficiency, but are not an expert. There is significant room to grow.

I am an expert: You have mastered this skill and are viewed as such by your peers.

Please indicate the answer that indicates your entire household income before taxes. If your income has changed radically due to the pandemic, please list the household income you had before the pandemic.

- ○ Below $14,999
- ○ Between $15,000-$31,999
- ○ Between $32,000-$69,999
- ○ Between $70,000-$129,999
- ○ Over $130,000

What is your father's (or 1st parental guardian's) educational attainment?

- ○ I did not have this parent or guardian present when I was growing up
- ○ Did not graduate from high school
- ○ Graduated from high school
- ○ Received some post-high school education/training
- ○ Graduated from college or received their bachelor's degree
- ○ Received advanced training beyond a bachelor's degree

What is your mother's (or 2nd parental guardian's) educational attainment?

- ○ I did not have this parent or guardian present when I was growing up
- ○ Did not graduate from high school
- ○ Graduated from high school
- ○ Received some post-high school education/training
- ○ Graduated from college or received their bachelor's degree
- ○ Received advanced training beyond a bachelor's degree
- ○ I did not have this parent or guardian when growing up.

Which racial categories best describe you? Select all that apply to you:

- ☐ Native Hawaiian or Other Pacific Islander - For example, Native Hawaiian, Samoan, Chamorro
- ☐ Hispanic, Latino, or Spanish Origin - For example, Mexican or Mexican American, Puerto Rican, Cuban
- ☐ White or Caucasian - For example, German, Irish, English
- ☐ Native American or Alaskan Native - For example, Navajo Nation, Blackfeet Tribe, Mayan
- ☐ Asian - For example, Chinese, Asian Indian, Vietnamese
- ☐ Middle Eastern or North African - For example, Lebanese, Iranian, Egyptian
- ☐ Middle/Southern African or Black - For example, African American, Kenyan, South African
- ☐ Other, please specify _____
- ☐ I prefer not to answer.

List the gender you identify with.

- ○ Agender
- ○ Nonbinary
- ○ Gender Fluid
- ○ Woman
- ○ Man
- ○ If none of these describe you, please enter your gender identity here. _____

Do you identify as intersex?

- ○ No
- ○ Yes

Do you identify as transgender?

- ○ No
- ○ Yes

What is your sexual orientation?

- ☐ Asexual
- ☐ Bisexual
- ☐ Gay
- ☐ Heterosexual
- ☐ Lesbian
- ☐ Pansexual
- ☐ Queer
- ☐ If none of these describe you, please indicate what describes you:

  _____

- ☐ I prefer not to say.

Choose the country you were raised in. (NOT born in.) If you were raised in multiple countries, please indicate the country you lived in the most.

▼ Afghanistan ... Zimbabwe

Please list your age.

_____

In which state do you currently reside?

▼ Alabama ... I do not reside in the United States

Indicate to what extent you have worked in each industry.

	I have not worked in this industry	-	-	I have a moderate amount of experience	-	-	I am an expert
Accommodation and Food Services	○	○	○	○	○	○	○
Administrative and Support Services	○	○	○	○	○	○	○
Agriculture, Forestry, Fishing, and Hunting	○	○	○	○	○	○	○
Arts, Entertainment, and Recreation	○	○	○	○	○	○	○
Construction	○	○	○	○	○	○	○
Educational Services	○	○	○	○	○	○	○
Finance and Insurance	○	○	○	○	○	○	○
Government	○	○	○	○	○	○	○

Health Care and Social Assistance	○	○	○	○	○	○	○
Information	○	○	○	○	○	○	○
Management of Companies and Enterprises	○	○	○	○	○	○	○
Manufacturing	○	○	○	○	○	○	○
Military	○	○	○	○	○	○	○
Mining, Quarrying, and Oil and Gas Extraction	○	○	○	○	○	○	○
Professional, Scientific, and Technical Services	○	○	○	○	○	○	○
Real Estate, Rentals and Leasing	○	○	○	○	○	○	○
Retail Trade	○	○	○	○	○	○	○
Transportation and Warehousing	○	○	○	○	○	○	○
Utilities	○	○	○	○	○	○	○
Wholesale Trade	○	○	○	○	○	○	○

How many unique job titles have you held?

▼ 0 ... 30+

What is the longest you have ever held one job?

▼ 0 years ... 20+ years

How many times have you radically shifted your career field?

▼ 0 ... 20+

What extent have you ever taught others in a professional setting?

- I have never taught a class
- -
- -
- I have often taught others
- -
- -
- I have taught others very frequently

How many businesses have you started?

▼ 0 ... 20+

Indicate the extent that you have supervised others' work.

- ○ I have not supervised others
- ○ -
- ○ -
- ○ I have supervised others a moderate amount
- ○ -
- ○ -
- ○ I have supervised others significantly

How many organizations have you volunteered for?

▼ 0 ... 20+

List your highest level of education.

▼ Did not complete high school ... Doctorate Degree (or any post-graduate education requiring more investment than Master's degree)

What was your major(s) in college? If none, put N/A.

_____

What was your minor(s) in college? If none, put N/A.

_____

Please indicate to what extent you have knowledge of or experience with each facet of **art:**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Acting	○	○	○	○	○	○	○
Architecture	○	○	○	○	○	○	○

Comparative Literature	○	○	○	○	○	○	○
Creative Writing	○	○	○	○	○	○	○
Culinary Arts	○	○	○	○	○	○	○
Digital Multimedia Design	○	○	○	○	○	○	○
Film Production	○	○	○	○	○	○	○
Graphic Design	○	○	○	○	○	○	○
Interior Decorating	○	○	○	○	○	○	○
Landscape Architecture	○	○	○	○	○	○	○
Music	○	○	○	○	○	○	○
Musical Theatre	○	○	○	○	○	○	○
Philosophy	○	○	○	○	○	○	○
Photography	○	○	○	○	○	○	○
Visual Arts	○	○	○	○	○	○	○
Video Game Design	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **business.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Accounting	○	○	○	○	○	○	○
Actuarial Science	○	○	○	○	○	○	○
Business Consulting	○	○	○	○	○	○	○
Customer Service	○	○	○	○	○	○	○
Entrepreneurship	○	○	○	○	○	○	○
Finance	○	○	○	○	○	○	○
Human Resources and Labor Relations	○	○	○	○	○	○	○
International Business	○	○	○	○	○	○	○
Leadership	○	○	○	○	○	○	○
Management	○	○	○	○	○	○	○
Marketing	○	○	○	○	○	○	○
Risk Management	○	○	○	○	○	○	○
Sales	○	○	○	○	○	○	○
Supply Chain Management	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **communications.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Advertising	○	○	○	○	○	○	○
Corporate Communications	○	○	○	○	○	○	○
Journalism	○	○	○	○	○	○	○
Media Studies	○	○	○	○	○	○	○
Public Relations	○	○	○	○	○	○	○
Strategic Communications	○	○	○	○	○	○	○
Telecommunications	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **computer science.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Computer Science	○	○	○	○	○	○	○
Computer Engineering	○	○	○	○	○	○	○
Cybersecurity	○	○	○	○	○	○	○
Data Science	○	○	○	○	○	○	○
Information Systems	○	○	○	○	○	○	○

Software Engineering	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **criminal justice or law?**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Administration of Justice	○	○	○	○	○	○	○
Criminal Justice	○	○	○	○	○	○	○
Criminology	○	○	○	○	○	○	○
Forensic Science	○	○	○	○	○	○	○
Law	○	○	○	○	○	○	○
Public Policy	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **education.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Arts Education	○	○	○	○	○	○	○
K-12 Education	○	○	○	○	○	○	○
Collegiate Education	○	○	○	○	○	○	○
Linguistics	○	○	○	○	○	○	○
Special Education	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **engineering**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Aerospace Engineering	○	○	○	○	○	○	○
Architectural Engineering	○	○	○	○	○	○	○
Biomedical Engineering	○	○	○	○	○	○	○
Chemical Engineering	○	○	○	○	○	○	○
Civil Engineering	○	○	○	○	○	○	○
Computer Aided Design (CAD)	○	○	○	○	○	○	○
Electrical Engineering	○	○	○	○	○	○	○
Industrial Engineering	○	○	○	○	○	○	○
Materials Sciences and Engineering	○	○	○	○	○	○	○
Mechanical Engineering	○	○	○	○	○	○	○
Nuclear Engineering	○	○	○	○	○	○	○
Petroleum and Natural Gas Engineering	○	○	○	○	○	○	○
Rail Transportation Engineering	○	○	○	○	○	○	○
Renewable Energy Engineering	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each facet of **history:**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
African History	○	○	○	○	○	○	○
North American History	○	○	○	○	○	○	○
Ancient History	○	○	○	○	○	○	○
Art history	○	○	○	○	○	○	○
Asian History	○	○	○	○	○	○	○
European History	○	○	○	○	○	○	○
Latin or South American History	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each section of **mathematics:**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Algebra	○	○	○	○	○	○	○
Calculus	○	○	○	○	○	○	○
Geometry	○	○	○	○	○	○	○
Statistics	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each **medical or clinical practice.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Biobehavioral Health	○	○	○	○	○	○	○
Communication Sciences and Disorders	○	○	○	○	○	○	○
Immunology and Infectious Disease	○	○	○	○	○	○	○
Food Science	○	○	○	○	○	○	○
Health Policy and Administration	○	○	○	○	○	○	○
Kinesiology and Athletic Training	○	○	○	○	○	○	○
Medicine	○	○	○	○	○	○	○
Nursing	○	○	○	○	○	○	○
Pharmacology	○	○	○	○	○	○	○
Psychology	○	○	○	○	○	○	○
Rehabilitation and Human Services	○	○	○	○	○	○	○
Social Work	○	○	○	○	○	○	○
Veterinary Sciences	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each **natural or hard science.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Agricultural Science	○	○	○	○	○	○	○
Animal Science	○	○	○	○	○	○	○
Archeological Science	○	○	○	○	○	○	○
Astronomy	○	○	○	○	○	○	○
Biochemistry	○	○	○	○	○	○	○
Biology	○	○	○	○	○	○	○
Biotechnology	○	○	○	○	○	○	○
Chemistry	○	○	○	○	○	○	○
Geosciences	○	○	○	○	○	○	○
Meteorology	○	○	○	○	○	○	○
Microbiology	○	○	○	○	○	○	○
Physics	○	○	○	○	○	○	○
Plant Sciences	○	○	○	○	○	○	○
Wildlife and Fisheries Sciences	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each **social science.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Anthropology	○	○	○	○	○	○	○
Economics	○	○	○	○	○	○	○
Environmental Science	○	○	○	○	○	○	○
Human Development	○	○	○	○	○	○	○
Political Science	○	○	○	○	○	○	○
Sociology	○	○	○	○	○	○	○

Please indicate to what extent you have knowledge of or experience with each **trade.**

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Aircraft Piloting	○	○	○	○	○	○	○
Automotive Maintenance	○	○	○	○	○	○	○
Boilermaker	○	○	○	○	○	○	○
Construction	○	○	○	○	○	○	○
Cosmetology	○	○	○	○	○	○	○
Electrician	○	○	○	○	○	○	○

Farming	○	○	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○	○	○
Groundskeeping	○	○	○	○	○	○	○
Housekeeping	○	○	○	○	○	○	○
HVAC	○	○	○	○	○	○	○
Janitor	○	○	○	○	○	○	○
Land Surveying	○	○	○	○	○	○	○
Landscape Contracting	○	○	○	○	○	○	○
Manufacturing	○	○	○	○	○	○	○
Mining	○	○	○	○	○	○	○
Pest Control	○	○	○	○	○	○	○
Plumbing	○	○	○	○	○	○	○
Waste-Water Management	○	○	○	○	○	○	○
Welding	○	○	○	○	○	○	○

Do you have experience playing any sport or physical activity?

○ No

○ Yes

Indicate the extent you have skill in each sport/physical activity.

	I have no skill	-	-	I have average skill	-	-	I am an expert
Archery	○	○	○	○	○	○	○
American Football	○	○	○	○	○	○	○
Badminton	○	○	○	○	○	○	○
Baseball/softball	○	○	○	○	○	○	○
Basketball	○	○	○	○	○	○	○
Boating	○	○	○	○	○	○	○
Bobsleigh	○	○	○	○	○	○	○
Boxing	○	○	○	○	○	○	○
Canoeing	○	○	○	○	○	○	○
Climbing	○	○	○	○	○	○	○
Corn Hole	○	○	○	○	○	○	○
Cricket	○	○	○	○	○	○	○
Curling	○	○	○	○	○	○	○
Cycling	○	○	○	○	○	○	○
Dancing	○	○	○	○	○	○	○

Diving	○	○	○	○	○	○	○
Equestrian	○	○	○	○	○	○	○
Fencing	○	○	○	○	○	○	○
Golf	○	○	○	○	○	○	○
Gymnastics	○	○	○	○	○	○	○
Hockey	○	○	○	○	○	○	○
Luge	○	○	○	○	○	○	○
Martial Arts	○	○	○	○	○	○	○
Rugby	○	○	○	○	○	○	○
Shooting	○	○	○	○	○	○	○
Skateboarding	○	○	○	○	○	○	○
Skiing	○	○	○	○	○	○	○
Snowboarding	○	○	○	○	○	○	○
Soccer/Football	○	○	○	○	○	○	○
Skating	○	○	○	○	○	○	○
Surfing	○	○	○	○	○	○	○

Swimming	○	○	○	○	○	○	○
Table Tennis	○	○	○	○	○	○	○
Tennis	○	○	○	○	○	○	○
Track and Field	○	○	○	○	○	○	○
Trampoline	○	○	○	○	○	○	○
Volleyball	○	○	○	○	○	○	○
Water Polo	○	○	○	○	○	○	○
Weightlifting	○	○	○	○	○	○	○
Wrestling	○	○	○	○	○	○	○

Do you or a close friend (you interact at least once a week or more often) watch professional sports or esports?

○ No

○ Yes

Indicate the extent to which you have knowledge or experience with each sport or esport.

	I have no knowledge of it	-	-	I know a moderate amount	-	-	I am an expert
American Football (NFL, Collegiate)	○	○	○	○	○	○	○
Apex Legends	○	○	○	○	○	○	○

Badminton	○	○	○	○	○	○	○
Baseball (MLB, Collegiate)	○	○	○	○	○	○	○
Basketball (NBA, Collegiate)	○	○	○	○	○	○	○
Call of Duty	○	○	○	○	○	○	○
Counter-Strike	○	○	○	○	○	○	○
DOTA 2	○	○	○	○	○	○	○
Fighting Games (Street Fighter, Tekken, DBFZ, etc.)	○	○	○	○	○	○	○
Fortnite	○	○	○	○	○	○	○
Golf	○	○	○	○	○	○	○
Halo	○	○	○	○	○	○	○
Hockey (NHL, Collegiate)	○	○	○	○	○	○	○
League of Legends	○	○	○	○	○	○	○
Motor Sports (NASCAR, Formula 1, etc.)	○	○	○	○	○	○	○
Overwatch	○	○	○	○	○	○	○
PlayerUnknown's Battlegrounds (PUBG)	○	○	○	○	○	○	○

Rainbow 6: Siege	○	○	○	○	○	○	○
Rocket League	○	○	○	○	○	○	○
Smite	○	○	○	○	○	○	○
Soccer/European Football	○	○	○	○	○	○	○
Speedrunning Video Games	○	○	○	○	○	○	○
Sports video games (Madden, NBA 2K, FIFA, etc.)	○	○	○	○	○	○	○
Starcraft	○	○	○	○	○	○	○
Super Smash Bros.	○	○	○	○	○	○	○
Tennis	○	○	○	○	○	○	○
Valorant	○	○	○	○	○	○	○
World of Warcraft	○	○	○	○	○	○	○
Wrestling	○	○	○	○	○	○	○

Do you play video games, party games, or board games?

○ No

○ Yes

Indicate the extent to which you play each genre of game.

	I never play this	-	-	I play this an average amount	-	-	I play this routinely
Action	○	○	○	○	○	○	○
Adventure	○	○	○	○	○	○	○
Casual	○	○	○	○	○	○	○
Indie	○	○	○	○	○	○	○
Horror	○	○	○	○	○	○	○
Massively Multiplayer Online	○	○	○	○	○	○	○
Open-World	○	○	○	○	○	○	○
Party	○	○	○	○	○	○	○
Racing	○	○	○	○	○	○	○
Role-playing	○	○	○	○	○	○	○
Rogue-like/lite	○	○	○	○	○	○	○
Sandbox	○	○	○	○	○	○	○
Simulation	○	○	○	○	○	○	○
Sports	○	○	○	○	○	○	○
Strategy	○	○	○	○	○	○	○

Do you make arts and crafts?

- ○ No
- ○ Yes

Indicate your skill level with each corresponding arts and crafts project.

	I have never done this	-	-	I am an amateur	-	-	I am an expert
Ceramics and Glasswork	○	○	○	○	○	○	○
Fashion	○	○	○	○	○	○	○
Flowers	○	○	○	○	○	○	○
Furniture crafts	○	○	○	○	○	○	○
Houseware	○	○	○	○	○	○	○
Leatherwork	○	○	○	○	○	○	○
Metalworking	○	○	○	○	○	○	○
Needlework	○	○	○	○	○	○	○
Painting	○	○	○	○	○	○	○
Resin and other Polymers	○	○	○	○	○	○	○
Sketching	○	○	○	○	○	○	○
Stoneworking	○	○	○	○	○	○	○

Sculpture	○	○	○	○	○	○	○
Textiles	○	○	○	○	○	○	○
Woodworking	○	○	○	○	○	○	○

Indicate how frequently you currently or have read or watch(ed) this genre of book, movies, TV shows, or YouTube videos.

	Never	-	-	Moderately	-	-	Very frequently
Action and Adventure	○	○	○	○	○	○	○
Biographies	○	○	○	○	○	○	○
Classics	○	○	○	○	○	○	○
Comic Book/Graphic Novel	○	○	○	○	○	○	○
Detective and Mystery	○	○	○	○	○	○	○
Educational	○	○	○	○	○	○	○
Fantasy	○	○	○	○	○	○	○
Historical Fiction	○	○	○	○	○	○	○
Historical Nonfiction	○	○	○	○	○	○	○
Horror	○	○	○	○	○	○	○
Romance	○	○	○	○	○	○	○

Science Fiction	○	○	○	○	○	○	○
Thrillers/Suspense	○	○	○	○	○	○	○
Poetry	○	○	○	○	○	○	○
Self-help	○	○	○	○	○	○	○
Shonen Anime	○	○	○	○	○	○	○
Slice-of-Life	○	○	○	○	○	○	○
True Crime	○	○	○	○	○	○	○
Young Adult	○	○	○	○	○	○	○

Do you play a musical instrument?

- ○ No
- ○ Yes

Indicate your skill level with each musical instrument or technique you have played or currently play.

	I have no skill	-	-	I am an amateur	-	-	I am an expert
Accordian	○	○	○	○	○	○	○
Banjo	○	○	○	○	○	○	○
Bass	○	○	○	○	○	○	○

Bassoon	○	○	○	○	○	○	○
Bells	○	○	○	○	○	○	○
Celesta	○	○	○	○	○	○	○
Cello	○	○	○	○	○	○	○
Chimes	○	○	○	○	○	○	○
Clarinet	○	○	○	○	○	○	○
Contrabassoon	○	○	○	○	○	○	○
Drum Machine/Sampler	○	○	○	○	○	○	○
Drums (full kit, snare, bass, cymbals)	○	○	○	○	○	○	○
English Horn	○	○	○	○	○	○	○
Flute	○	○	○	○	○	○	○
French Horn	○	○	○	○	○	○	○
Glockenspiel	○	○	○	○	○	○	○
Guitar	○	○	○	○	○	○	○
Harmonica	○	○	○	○	○	○	○
Harp	○	○	○	○	○	○	○

Harpsichord	○	○	○	○	○	○	○
Kalimba	○	○	○	○	○	○	○
Maracas	○	○	○	○	○	○	○
Marimba	○	○	○	○	○	○	○
Oboe	○	○	○	○	○	○	○
Ocarina	○	○	○	○	○	○	○
Organ	○	○	○	○	○	○	○
Piano/Keyboard	○	○	○	○	○	○	○
Piccolo	○	○	○	○	○	○	○
Recorder	○	○	○	○	○	○	○
Saxophone	○	○	○	○	○	○	○
Singing	○	○	○	○	○	○	○
Synthesizer	○	○	○	○	○	○	○
Tambourine	○	○	○	○	○	○	○
Timpani (Kettledrums)	○	○	○	○	○	○	○
Triangle	○	○	○	○	○	○	○

Trombone	○	○	○	○	○	○	○
Trumpet	○	○	○	○	○	○	○
Tuba	○	○	○	○	○	○	○
Ukelele	○	○	○	○	○	○	○
Vibraphone	○	○	○	○	○	○	○
Viola	○	○	○	○	○	○	○
Violin	○	○	○	○	○	○	○
Wood block	○	○	○	○	○	○	○
Xylophone	○	○	○	○	○	○	○

Indicate the level of knowledge you have about each music genre.

	I have no knowledge	-	-	I know a moderate amount	-	-	I am an expert
Acapella	○	○	○	○	○	○	○
African	○	○	○	○	○	○	○
Alternative Rock	○	○	○	○	○	○	○
Ambient	○	○	○	○	○	○	○
Bluegrass	○	○	○	○	○	○	○

Blues	○	○	○	○	○	○	○
Classical	○	○	○	○	○	○	○
Concert Band	○	○	○	○	○	○	○
Country	○	○	○	○	○	○	○
Dance	○	○	○	○	○	○	○
Disco	○	○	○	○	○	○	○
Drum and Bass	○	○	○	○	○	○	○
Electronic Dance Music (EDM)	○	○	○	○	○	○	○
Folk	○	○	○	○	○	○	○
Funk	○	○	○	○	○	○	○
Gospel	○	○	○	○	○	○	○
Grunge	○	○	○	○	○	○	○
Heavy Metal	○	○	○	○	○	○	○
Hip Hop	○	○	○	○	○	○	○
House	○	○	○	○	○	○	○
Indie	○	○	○	○	○	○	○

Instrumental	○	○	○	○	○	○	○
Jazz	○	○	○	○	○	○	○
Latin American	○	○	○	○	○	○	○
Orchestral	○	○	○	○	○	○	○
Movie/TV Scores	○	○	○	○	○	○	○
Musical Theater	○	○	○	○	○	○	○
New Wave	○	○	○	○	○	○	○
Pop	○	○	○	○	○	○	○
Punk Rock	○	○	○	○	○	○	○
Reggae	○	○	○	○	○	○	○
Rock	○	○	○	○	○	○	○
Ska	○	○	○	○	○	○	○
Soul	○	○	○	○	○	○	○
Swing	○	○	○	○	○	○	○
Techno	○	○	○	○	○	○	○
Trance	○	○	○	○	○	○	○

Video Game	○	○	○	○	○	○	○

How many hobbies do you actively pursue at the same time?

▼ 0 ... 10+

Growing up, how many different school districts did you attend?

▼ 1 ... 10+

List the countries you have lived in (only indicate if you lived in a country for 2 or more months).

_____

If you live or have lived in the United States, list all the states you have lived in (for 2 or more months).

- [ ] Alabama
- [ ] Alaska
- [ ] Arizona
- [ ] Arkansas
- [ ] California
- [ ] Colorado
- [ ] Connecticut
- [ ] Delaware
- [ ] District of Columbia (D.C.)
- [ ] Florida
- [ ] Georgia
- [ ] Hawaii
- [ ] Idaho
- [ ] Illinois
- [ ] Indiana
- [ ] Iowa
- [ ] Kansas

- [ ] Kentucky
- [ ] Louisiana
- [ ] Maine
- [ ] Maryland
- [ ] Massachusetts
- [ ] Michigan
- [ ] Minnesota
- [ ] Mississippi
- [ ] Missouri
- [ ] Montana
- [ ] Nebraska
- [ ] Nevada
- [ ] New Hampshire
- [ ] New Jersey
- [ ] New Mexico
- [ ] New York
- [ ] North Carolina
- [ ] North Dakota

- [ ] Ohio
- [ ] Oklahoma
- [ ] Oregon
- [ ] Pennsylvania
- [ ] Puerto Rico
- [ ] Rhode Island
- [ ] South Carolina
- [ ] South Dakota
- [ ] Tennessee
- [ ] Texas
- [ ] Utah
- [ ] Vermont
- [ ] Virginia
- [ ] Washington
- [ ] West Virginia
- [ ] Wisconsin
- [ ] Wyoming

How many of your immediate family members (up to and including grandparents) were immigrants?

▼ 0 ... 10+

List the extent you can speak each language.

	I can't speak or comprehend it at all	-	-	I can comprehend and speak simple sentences	-	-	I am fluent
English	○	○	○	○	○	○	○
French	○	○	○	○	○	○	○
German	○	○	○	○	○	○	○
Hindi	○	○	○	○	○	○	○
Italian	○	○	○	○	○	○	○
Japanese	○	○	○	○	○	○	○
Korean	○	○	○	○	○	○	○
Latin	○	○	○	○	○	○	○
Mandarin	○	○	○	○	○	○	○
Portugese	○	○	○	○	○	○	○
Russian	○	○	○	○	○	○	○
Spanish	○	○	○	○	○	○	○

Other (please indicate, N/A if none)	○	○	○	○	○	○	○

List the number of your close friends or family members that you interact with on a weekly or more frequent basis.

▼ 0 ... 20+

How many of those close friends and family members have different hobbies than you?

▼ 0 ... 20+

How many of those close friends and family members have a **different career than you**?

▼ 0 ... 20+

How many of those close friends and family members have a **similar career as you**?

▼ 0 ... 20+

How many of those close friends and family members **live in different geographic locations than you**?

▼ 0 ... 20+

How many of those close friends and family members have a different gender than you?

▼ 0 ... 20+

How many of those close friends and family members are a **different sexual orientation than you**?

▼ 0 ... 20+

Do you have or did you have a step-parent when you were a child? If so, how many?

▼ 0 ... 9 or more

Appendix B: Study Task Vignettes

Common instructions (across vignettes):
You are acting as a member of a committee for your county's government. Your task is to generate solutions to address the problems your county is having. Your boss desires solutions that are creative and able to be implemented. Previous work in your department has shown that using analogies when solving problems leads to solutions of higher creativity and quality. **You have been instructed to use analogies during this process.** For reference, an analogy refers to making comparison or connection between two separate ideas or processes based on their similarities. The original ideas and processes may differ on how similar they are. They could be extremely similar, but they could also be dissimilar.

Vignette 1:
Incarcerating mentally ill people in your county costs millions of dollars per year and does not improve their situation.
Background:
Approximately 10,000 times each year in your county, adults who have serious mental illnesses are booked into jails. 7,500 of these adults also have drug and alcohol use problems. In comparison with inmates without mental illnesses, imprisoned individuals with mental illnesses tend to have longer jail stays and are at a higher risk of returning to jail upon release. The human toll of this problem—and its cost to taxpayers—is staggering. Jails spend 2 to 3 times more on adults requiring intervention because of their mental illness than those without a mental illness, yet improvements in public safety, health or quality of life are rarely observed.

New research on people with mental illnesses in the justice system shows that it is caused by multiple problems. These include:

- Untreated mental illness
- Drug and alcohol use disorders
- Criminal risk factors
- Homelessness

The lack of stability in their lives causes them to cycle repeatedly through jail, hospitals, shelters, and crisis centers. These have a considerable cost to the community, but the community's current investment hasn't helped the hurt individuals' health and well-being. **Without change, large numbers of people who are homeless and mentally ill will continue to cycle through the criminal justice and healthcare systems. The citizens of your county are relying on you to provide a new solution.**

Please provide your solution to assisting imprisoned individuals with mental illness in your county.

_____

Vignette 2:
Youth obesity is a growing issue in your county.

Background:
Approximately 38% of the children living in your county are obese, which is much higher than the national average. Childhood obesity is a severe health concern as it causes many other health problems, including:

- High blood pressure
- High cholesterol
- Cardiovascular disease
- Type 2 diabetes
- Breathing problems
- Fatty liver disease
- Anxiety and depression
- Poor quality of life
- Adulthood obesity
- Cancer

Additional information about your county shows:

- County population is 300,000 people total and 100,000 children
- There are 60 grocery stores and 220 fast food restaurants
- 90,000 people have difficulty accessing or affording food
- 30,000 children live in poverty
- There is access to many public parks, but they are not used frequently
- The percent of people receiving food stamps in your county is double the national average

Without your help, the youth obesity rates in the county are projected to grow even larger. The citizens of your county are relying on you to provide a new solution.

Please provide your solution to the youth obesity issue in your county.

_____

Vignette 3
The opioid epidemic in the United States has led to significant loss of life and destruction in your county.

Background:
In the late 1990s, big pharmaceutical companies informed the public certain opioids were effective, yet not addictive. More medical professionals began to prescribe opiates at higher rates, and doctors in your county did so. Those seeking prescription opiates could be seen by a doctor and be prescribed opiates nearly every time. Due to wide availability of opiates, chronic users were created who actively increased their dosage. Eventually, prescription opiates no longer satisfied their addiction. Some turned to stronger opioid drugs, such as heroin or fentanyl, which are life-threatening. Health concerns of opioid usage include:

- Overdosing
- Transfer of Hepatitis C, HIV, or aids through sharing dirty needles
- Death

The opioid epidemic has severely stricken your county, leaving many suffering each day. Some information on your county is provided:

- The county is a rural area with a population of 50,000 people
- 38 fatal overdoses in 2020
- 331 nonfatal overdoses in 2020
- Numbers of overdoses are increasing each year
- Heroin usage is increasing
- Cases of Hepatitis C and HIV are increasing
- 15% of county citizens are living in poverty
- The county currently funds a drug abuse clinic

Without your help, more and more citizens of your county will overdose and die. Your citizens are relying on your solutions to the problems.

Please provide your solution to opioid issue within your county.

_____

Common questions (following each vignette):
Q127 How many analogies did you use to solve the problem?
▼ 0 (1) ... 10+ (11)

Q129 What were the analogies you used? Please use as much detail as possible.

_____
_____
_____
_____
_____