The Curiosity-Risk Nexus: Exploring the Relationship Between Different Domains of Curiosity and Risk-Taking Behavior

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Research Question

As humans, we have an insatiable desire to explore and discover the unknown, to push beyond the limits of our current knowledge and experience. However, with exploration comes risk, and the potential for danger or harm. Yet, despite this inherent risk, we continue to seek out new experiences, to take risks, in a quest to satisfy our curiosity. The intersection between curiosity and risk-taking is a complex and intriguing area of research, one that has room to develop. As both constructs are complex, even with previous research they have not been fully explored.

While curiosity can lead to new discoveries and growth, risk-taking can have negative or positive consequences. Thus, understanding the connection between these two domains is crucial in many areas, including education, psychology, and even public policy. In this study, I will explore the nexus between the domains of curiosity and risk, with a particular focus on the domains of curiosity.

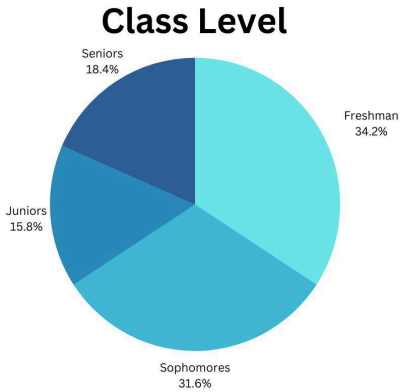
Specifically, I will analyze the results of two established measures of curiosity and risk-taking: the Five-Dimension Curiosity Scale (5DC) and the Domain-Specific Risk-Taking Scale (DOSPERT).

My research question is: What is the relationship between the domains of curiosity and risk-taking? Though I performed a hefty analysis to gauge the relationship, I refined my question further as I did more exploratory data analysis. Through principal component analysis, I also considered the following question: What underlying factors or components can be identified within the 5 dimensions of curiosity (5DC) using principal component analysis (PCA)?

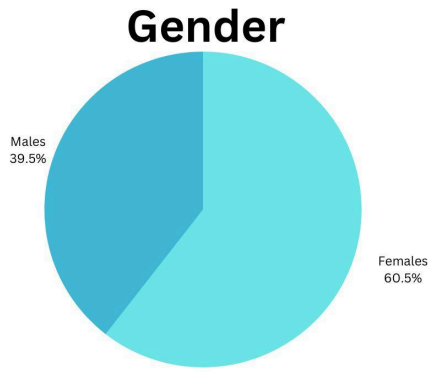
By investigating these questions, I hope to shed light on the complex relationship between curiosity and risk-taking and promote further research, which may help individuals, educators, health professionals, and policymakers.

Descriptive Statistics

In total, I had a sample size of 38 total respondents. For my survey, I originally intended to get information from a wider range of age groups. However, I ended up narrowing this down, so respondents are all ages 18-24 years old. I also asked whether or not the participant was still in college. If they selected yes, they are in college, then they were taken to a survey question that asked about their class level. Respondents could also choose that they did not attend college; however, all of my participants were either in college or graduated. The pie chart below is a visual representation of the class-level variation.



Additionally, I collected demographic information about gender. Gender was a demographic I was particularly interested in collecting because I predicted a relationship between gender and risk. The demographic questions included “non-binary/third gender” and “prefer not to say.” That being said, all of my participants ended up selecting either male or female. Another pie chart can be seen below as a visual representation of gender distribution.



Connection to Class Ideas

A wise man once said: “the fabric of experience is woven out of interaction with other people.” Following this insightful quote (but also the syllabus), I wanted to investigate the characteristics of human behavior and decision-making. In previous courses, I learned about risk and factors that can lead to dangerous decision-making. However, I have never been exposed to curiosity as a facet of humanity. I know it was mentioned in class that a possible research topic could be attempting to understand differences in curiosity. Before I conducted my survey, I asked a few friends several basic questions (like the ones covered in class, for example: “are you curious about complex machinery?”) and I noticed that there was a lot of variation in their responses. Even in class, we saw that females and males differed in the things they were curious about. That being said, I like the 5DC scale (described below) because it addresses this phenomenon and measures curiosity in separate domains. I was also intrigued by the exploration-exploitation trade-off that we discussed in class. The trade-off refers to the balance between exploring new options and exploiting known options to maximize reward. The balance between exploration and exploitation is a critical motivator for understanding the domains of curiosity alone and their association with risk, as curiosity is fundamentally linked to exploration.

With my prerequisite knowledge from lectures, I plan to study a potential relationship between the domains of curiosity and the domains of risk-taking to understand whether or not our curious nature is what can get us in trouble (or if it is beneficial). Motivated by my innate curiosity, I am driven to explore the reasoning behind why humans often choose the path of exploration, despite the potential risks involved. Did curiosity kill the cat? And why was the cat so curious in the first place? Through my analysis, I hope to find out.

Survey Creation and Format

To analyze the relationship between curiosity and risk, I decided to create a survey that could measure the two. Before creating the survey, I wanted to look into preexisting research. I figured that using scales that had been used and validated in previous studies would be my best option.

First, the risk survey is known as the "DOSPERT Scale."[1] The DOSPERT Scale is a 40-item "domain-specific risk-attitude scale," which measures risk-attitudes and risk perceptions. The domains included on the scale are financial decisions, health/safety, recreational, ethical, and social decisions. At first, I considered shortening the items in the scale for fear of respondents not fully completing it. However, I ultimately opted to leave all forty items to preserve the survey's validity. Within the survey, respondents see forty separate risky behaviors. For each behavior, they have the option to respond with a number, 1 through 5. On this scale, 1 is unlikely to engage in such behavior and 5 is very likely to do so.

As for curiosity, I also did research to find a preexisting scale. After looking online, I found the "five-dimensional curiosity scale," which I felt would be the most useful for my survey. The five-dimensional curiosity scale, or the "5DC," was also created and validated in previous research. The scale measures 5 domains of curiosity: joyous exploration, deprivation sensitivity, stress tolerance, social curiosity, and thrill-seeking. Joyous exploration is the "pleasurable facet" of curiosity. Deprivation sensitivity consists of statements "wrought with tension" that inquire about an individual's responsiveness to depriving their facilities to be curious. Stress tolerance measures how the respondent manages obstacles and unfamiliar stimuli. Social curiosity is related to an individual's curiosity in terms of the interpersonal world. Finally, thrill-seeking refers to curiosity that is satisfied through dangerous behavior. [2] In the survey, respondents see several statements and are encouraged to answer with their level of agreement/similarity. The scale offers choices 1-7, 1 being that the statement "does not describe me [the respondent] at all" and 7 that the statement "completely describes me."

Data Gathering

Before distributing my survey, I set a goal to reach 50 respondents. Luckily, after sending the link through numerous group chats and approaching people, I was able to reach my goal. Once I had enough responses, I exported the data into Excel and began the data-cleaning process.

Unfortunately, a few respondents did not consent for their data to be analyzed and a few completely missed many questions. Consequently, I ended with 38 useful responses. Though the sample size shrunk, I was still satisfied with these 38 responses and began data analysis.

First, I had to calculate the averages for each domain of curiosity and each domain of risk, which I did according to the preexisting scale descriptions.[3] With my data in Excel, I labeled

[1] Weber, E. U., Blais, A.-R., & Betz, N. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. Journal of Behavioral Decision Making, 15, 263-290.

[2] Kashdan, Todd B., et al. "The Five-Dimensional Curiosity Scale: Capturing the Bandwidth of Curiosity and Identifying Four Unique Subgroups of Curious People." *Journal of Research in Personality*, vol. 73, 1 Apr. 2018, pp. 130–149, www.sciencedirect.com/science/article/abs/pii/S0092656617301149, https://doi.org/10.1016/j.jrp.2017.11.011. Accessed 25 May 2020.

[3] Columbia Decision Sciences. "Scoring Instruction - Dospert." *Sites.google.com*, 2002, sites.google.com/a/decisionsciences.columbia.edu/dospert/scoring-instructions.; Kashdan, T.B., Stiksma, M.C., Disabato, D., McKnight, P.E., Bekier, J., Kaji, J., & Lazarus, R. (in press). The five-dimensional curiosity scale: Capturing the bandwidth of curiosity and identifying four unique subgroups of curious people. Journal of Research in Personality

each question response according to their appropriate domain. Then, I created 10 new columns for the five domains of both curiosity and risk. Each column was then designated for measurement of a specific domain (i.e. a person's financial riskiness was a number 1-5 that came from their average response to that type of question). Once the calculations were complete, I was left with five treatment variables (labeled in STATA as EAvg (ethical risk), Favg (financial risk), HSavg (health/safety risk), Ravg (recreational risk), and Savg (social risk)) and five outcome variables (labeled in STATA as JEAverage (joyous exploration), DPavg (deprivation sensitivity), STavg (stress tolerance), SCavg (social curiosity), TSavg (thrill-seeking)). It is important to note that the stress tolerance domain of curiosity was reverse-coded on the survey (so a high response value is attributed to low-stress tolerance).

With the variables prepared, I imported the Excel file into STATA to commence the data analysis.

Data Analysis

I had to destring several variables in STATA to convert to a numeric format. Once I did this for the variables STATA did not automatically convert, I began my analysis.

First, I generated a correlation table. I believed that generating the table would be a good starting point for looking at which dimensions might be associated with one another. I noticed that there were a few high correlations, but nothing above 0.7, which is the general magnitude for suggesting high correlation. The table is pasted below for reference:

	EAvg	Favg	HSavg	Ravg	Savg	JEAver~e	DPavg
EAvg	1.0000						
Favg	0.4450	1.0000					
HSavg	0.6420	0.3164	1.0000				
Ravg	0.2284	0.4148	0.3882	1.0000			
Savg	0.2701	0.4503	0.4639	0.4158	1.0000		
JEAverage	-0.0708	0.0420	0.2234	0.6068	0.4936	1.0000	
DPavg	0.2049	0.5219	0.1771	0.1573	0.3154	0.2066	1.0000
STavg	-0.0689	-0.2697	-0.1581	-0.5912	-0.3309	-0.4503	0.1762
SCavg	0.3347	0.3163	0.4433	0.1554	0.2962	0.3212	0.4937
TSavg	0.1317	0.4269	0.5018	0.6388	0.5089	0.4553	0.3389

	STavg	SCavg	TSavg
STavg	1.0000		
SCavg	0.1169	1.0000	
TSavg	-0.3146	0.3370	1.0000

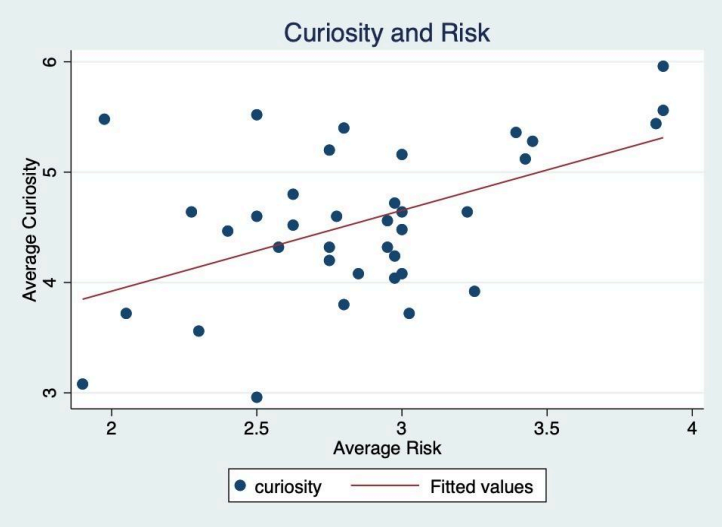
With a correlation table as a reference point, I was eager to begin running regressions. Instead of picking and choosing variables, I ran all x-variables against all y-variables. From this analysis, I found several non-significant results, which were between the following: thrill seeking curiosity against ethical risk (p=0.453; t=0.76; R^2=0162), joyous exploration curiosity against financial risk (p=0.808; t=0.25; R^2=0.002), joyous exploration curiosity against ethical risk (p=0.682; t=-0.41; R^2=0.005), joyous exploration curiosity against health/safety risk (p=0.190; t=1.34; R^2=0.050), deprivation sensitivity curiosity against ethical risk (p=0.231; t=1.22; R^2=0.042), deprivation sensitivity curiosity against health/safety risk (p=0.302; t=1.05; R^2=0.031), deprivation sensitivity curiosity against recreational risk (p=0.360; t=0.93; R^2=0.025) deprivation sensitivity curiosity against social risk (p=0.061; t=1.94; R^2=0.010), social curiosity against financial risk (p=0.064; t=1.91; R^2=0.094), social curiosity against recreational risk (p=0.437; t=0.79; R^2=0.017), social curiosity against social risk (p=0.081; t=1.79; R^2=0.084), stress tolerance curiosity against financial risk (p=0.089; t=-1.75; R^2=0.080), stress tolerance

curiosity against ethical risk (p=0.703; t=-0.38; R^2=0.004), and stress tolerance curiosity against healthy/safety risk (p=0.318; t=-1.01; R^2=0.029).

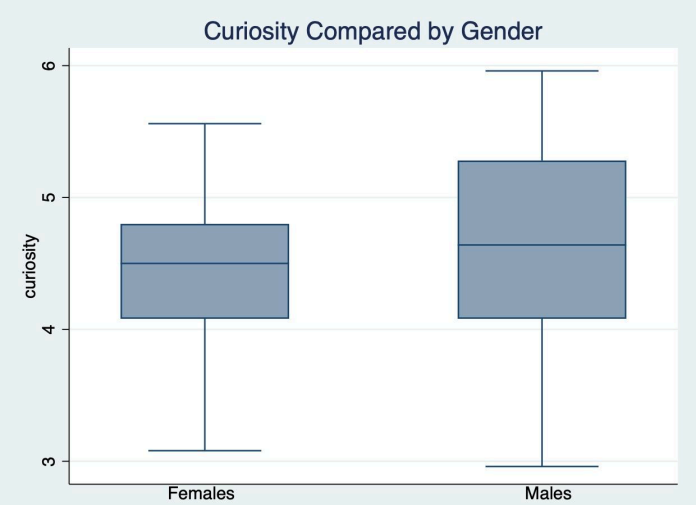
Though there were several non-significant relationships, there were also several significant results. Of the 25 regressions I ran, 11 were significant at the 5% level. The significant regressions in the thrill-seeking domain of curiosity were against: financial risk with slope 0.853 (p=0.007; t=2.87; R^2=0.190), health/safety risk with slope 1.03 (p=0.001; t=3.46; R^2=0.255), recreational risk with slope 1.10 (p<0.001; t=5.10; R^2=0.426), and social risk with slope 1.34 (p=0.001; t=3.52; R^2=0.262). Next, in the joyous exploration domain of curiosity, the significant regressions were against recreational risk with slope 0.735 (p<0.001; t=4.45; R^2=0.268) and social risk with slope 0.893 (p=0.002; t=3.31; R^2=0.244). Only one regression in the deprivation sensitivity curiosity was significant, which was against financial risk with a slope of 0.841 (p=0.001; t=3.57; R^2=0.272). Social curiosity was significant against ethical risk with slope 0.928 (p=0.043; t=2.10; R^2=0.112) and health/safety risk with slope 0.721 (p=0.007; t=2.87; R^2=0.191). Finally stress tolerance curiosity was significant against recreational risk with slope -0.852 (p<0.001; t=-4.57; R^2=0.374) and against social risk with slope -0.726 (p=0.041; t=-2.12; R^2=0.114).

From these results, the thing I found most interesting was that curiosity and risk seem to have a consistently positive relationship. Though the significant stress tolerance relationships are negatively correlated, this can be explained by the domain of curiosity being reverse coded. In general, this suggests that as a domain of risk-attitude increases there is an associated increase in a domain/domains of curiosity. Additionally, it is notable that thrill-seeking was significantly associated with the largest amount of risk domains. Thrill-seeking is defined as a curiosity that is satisfied through dangerous behavior. The multiple associations across domains point to the idea that those who have riskier perceptions have an increased association with a curiosity about dangerous activities.

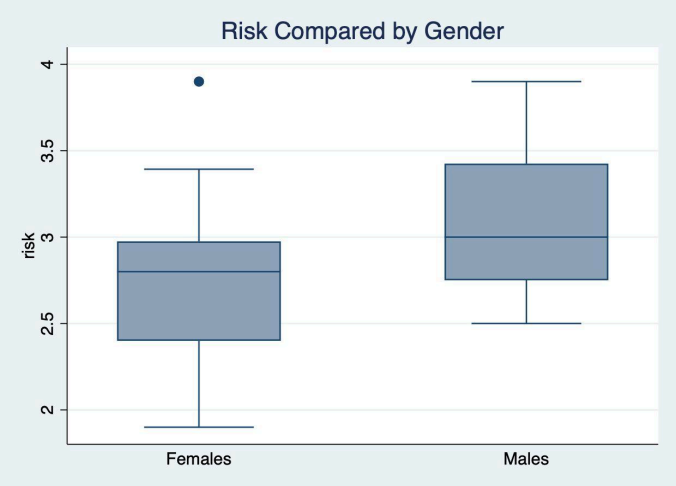
After I ran the domain-specific regressions, I wanted to analyze a general relationship between curiosity and risk. To do so, I combined the curiosity domains into one and the risk variables into one in STATA. Now, I had two variables: "curiosity" and "risk." Regressing curiosity against risk yielded significant results, with a slope of 0.732 (p=0.001; t=3.45; R^2=0.254). To visualize this relationship, I generated a scatter plot, which is shown below.



Once I had this regression complete, I considered that gender might be contributing to some of the variation. To see if this was true, I took my gender demographic and generated a dummy variable (1= ”Male” and 0= ”Female”). Before running the regression holding gender constant, I made boxplots to have another visual of gender’s role. One for curiosity, which suggests a few small differences but none that are significant.



Next, the boxplot for risk and gender is shown below. The median risk score for males is a bit higher than that of females. Additionally, the interquartile range for males is slightly higher than for females, suggesting that male risk scores are more spread out. Overall, this boxplot prompted me to run a regression in which I controlled for gender to further my understanding of the relationship between curiosity and risk.



The regression of curiosity against risk while controlling for gender was significant for the risk coefficient with a slope of 0.754 (p=0.002; t=3.31; R^2=0.256). However, the coefficient for gender is not significant (p=0.774; t=-0.29), which suggests that curiosity is not significantly associated with gender. From these results, I believe that gender is more associated with risk rather than curiosity. I ran additional regressions of curiosity against gender, which was not significant (p=0.453; t=0.76; R^2=0.0162), and risk against gender, which was significant (p=0.040; t=2.13; R^2=0.1121).

Factor Analysis of Curiosity (PCA)

Since I analyzed several domains of curiosity and risk, I wanted to analyze the specific variables to understand them. To highlight the most crucial underlying factors, I decided to use factor analysis. Factor analysis, or principal component analysis (PCA), is a statistical technique that can help identify the variables and show their contribution to the data's variation.

I was particularly interested in the domains of curiosity considering we discussed this in class. Consequently, I ran the PCA on curiosity first. The factor analysis yielded the following results:

```
Principal components/correlation                Number of obs    =         36
                                                Number of comp.  =          5
                                                Trace            =          5
    Rotation: (unrotated = principal)           Rho              =     1.0000
```

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.13554	.688366	0.4271	0.4271
Comp2	1.44717	.874727	0.2894	0.7165
Comp3	.572443	.104864	0.1145	0.8310
Comp4	.467579	.0903043	0.0935	0.9245
Comp5	.377274	.	0.0755	1.0000

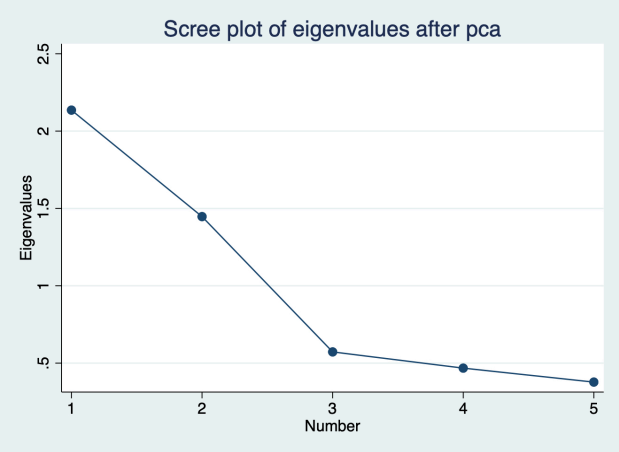
Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
JEAverage	0.5170	-0.3072	0.4765	-0.2877	0.5732	0
DPavg	0.4174	0.4893	-0.3163	-0.6714	-0.1884	0
STavg	-0.2411	0.6958	0.0199	0.1638	0.6561	0
SCavg	0.4619	0.4084	0.5088	0.4551	-0.3923	0
TSavg	0.5357	-0.1237	-0.6431	0.4822	0.2272	0

From this output, I first analyzed the eigenvalues and proportion of variance. I noticed that component 1 has the highest eigenvalue of 2.136 and also explains 42.71% of the variation in the data. Because this component has a larger eigenvalue it suggests that there is a dominant factor underlying the relationships between the domains of curiosity. This factor, component 1, is most likely a general curiosity. Essentially, component one is like the curiosity version of the g-factor (of intelligence). Likewise, component 2 has a large eigenvalue that prompts further analysis. Component 2 has an eigenvalue of 1.447 and explains 28.94% of the variation in the data.

To visualize the data, I generated a scree plot, which is shown below.[4]

[4]STATA. "Principal Components | Stata." *Www.stata.com*, www.stata.com/features/overview/principal-components/. Accessed 4 May 2023.



The scree plot further demonstrates the significance of components 1 and 2 as described before. The sharp drop in the eigenvalues between the first and second components and a smaller one between the second and third is telling. These drops signify that the first and second components are contributing to a majority of the variation in the data, which prompted further analysis into these two.

Though component 1 explained more variation, component 2 is perhaps more interesting. Considering that component 1 makes up general curiosity, that component 2 accounts for another significant proportion of variance is fascinating. To understand the characteristics of each component, the eigenvector table is useful. The table shows the loadings, which are the correlations between individual variables and the components.

For component one, all variables are positively correlated, besides stress tolerance. However, stress tolerance is reverse coded, which explains the opposite relationship. Joyous exploration, deprivation sensitivity, social curiosity, and thrill-seeking all have loadings greater than the absolute value of 0.4. A loading greater than |0.4| signifies a fairly strong positive correlation.[5] Because all of the individual variables are positively correlated with Component 1, this supports the proposition that Component 1 measures general curiosity. On the other hand, component 2 is correlated with deprivation sensitivity, (the reverse coded) stress tolerance, and social curiosity. This implies that individuals who have high deprivation sensitivity, low levels of stress tolerance, and relatively positive levels of social curiosity are likely to exhibit component 2. Though it is difficult to point to what exactly component 2 is based on this, it could be used to interpret our understanding of curiosity. Based on my understanding of the preexisting domains, I believe component 2 suggests a sector of curiosity characterized by vulnerability to stress and adversity, as well as a tendency to experience negative emotions and psychological distress in response to challenging situations.

Concluding Thoughts and Limitations

Overall, I aimed to analyze the association between separate domains of curiosity and risk. From our lectures, I knew I was interested in curiosity in particular, so I studied curiosity alone using principal component analysis. My survey used validated scales to obtain measures of both risk and curiosity domains. The data analysis revealed that there is a significant correlation

[5]UCLA: Statistical Consulting Group. "Principal Components (PCA) and Exploratory Factor Analysis (EFA) with SPSS." *Stats.oarc.ucla.edu*, stats.oarc.ucla.edu/spss/seminars/efa-spss/.

between the different domains of curiosity and risk-taking behaviors, with some domains being more strongly correlated than others. The results also showed that curiosity can be measured using PCA and that the variables related to each principal component can provide insight into the different aspects of curiosity.

My efforts provide valuable insights into the relationship between curiosity and risk-taking behaviors, which can be useful for designing interventions aimed at promoting curiosity in various domains. Risk behavior has many implications that should be mitigated to benefit society. For example, drug addiction or gambling are risky behaviors. If we continue to develop an understanding of characteristics that can explain these lifestyles, then we can be proactive about prevention.

The factor analysis tactic also proved to be a useful tool for studying curiosity. By using PCA I was able to highlight its capabilities for a better understanding of multidimensional variables. I was fascinated by this method, seeing that it provides a more nuanced understanding of this complex construct.

My results are limited in that I had a fairly small sample size, which means it may not fully capture the range of individual differences in curiosity and risk-taking. I also believe that it is always important to consider the validity of operational measures. Though the 5DC and DOSPERT scales are widely used and validated, there is still a chance that they do not capture the complexity of risk and curiosity. With both variables being linked to individuality and personality, it is difficult to ensure my study is a pure examination of curiosity and risk.

With some limitations but interesting results and analysis, I am left feeling hopeful for further research. In the future, I believe that studies can be conducted to explore the relationship between curiosity and other psychological constructs and to examine the impact of interventions aimed at promoting curiosity in different domains of risk-taking behaviors.

Works Cited

Columbia Decision Sciences. "Scoring Instruction - Dospert." *Sites.google.com*, 2002, sites.google.com/a/decisionsciences.columbia.edu/dospert/scoring-instructions. Accessed 4 May 2023.

Kashdan, Todd B., et al. "The Five-Dimensional Curiosity Scale: Capturing the Bandwidth of Curiosity and Identifying Four Unique Subgroups of Curious People." *Journal of Research in Personality*, vol. 73, 1 Apr. 2018, pp. 130–149, www.sciencedirect.com/science/article/abs/pii/S0092656617301149, https://doi.org/10.1016/j.jrp.2017.11.011. Accessed 25 May 2020.

OpenAI. (2020). ChatGPT (Version GPT-3.5) [Software]. Retrieved from https://openai.com/

STATA. "Principal Components | Stata." *Www.stata.com*, www.stata.com/features/overview/principal-components/. Accessed 4 May 2023.

UCLA: Statistical Consulting Group. "Principal Components (PCA) and Exploratory Factor Analysis (EFA) with SPSS." *Stats.oarc.ucla.edu*, stats.oarc.ucla.edu/spss/seminars/efa-spss/.