9-2022

Happiness From a Different Perspective

Suparna Das

HAPPINESS FROM A DIFFERENT PERSPECTIVE

SUPARNA DAS

A master's capstone project submitted to the Graduate Faculty in Data Analysis and

Visualization in partial fulfillment of the requirements for the degree of Master of Science,

The City University of New York.

2022

HAPPINESS FROM A DIFFERENT PERSPECTIVE
by
Suparna Das

This manuscript has been read and accepted by the Graduate Faculty in Data Analysis and Visualization in satisfaction with the capstone project requirement for the degree of Master of Science.

_____

Date

_____

Timothy Shortell

Capstone Project Advisor

_____

Date

_____

Matthew K. Gold

 Program Director

THE CITY UNIVERSITY OF NEW YORK

ABSTRACT

HAPPINESS FROM A DIFFERENT PERSPECTIVE
by
Suparna Das

Advisor: Timothy Shortell

United Nations Sustainable Development Solutions Network publishes the World Happiness Report.
It started with the UN General Assembly's resolution in 2011, adopting a holistic definition of
development and encouraging the member countries to measure their people's happiness. The report
ranks the countries based on a Happiness Index. This index rates countries' happiness on a scale from
0 to 10. The scores are based on answers to the main life evaluation question asked in the poll. The
World Happiness Report recognizes certain key factors that likely explain the variance in happiness.
However, none of these factors are comprehensive or exhaustive. These factors do not measure
individual satisfaction. This Capstone Project intends to explore the factors that increase and decrease
the quality of life and an individual's well-being. This project uses machine learning algorithms and
data visualizations to explore how these factors correlate to the happiness index. The code repository
is available at the following GitHub site: https://github.com/dassuparna/Capstone-Project.git

Table of Contents

List of Tables

List of Figures

Digital Manifest

1. **Capstone Project Whitepaper (PDF)**

2. **Software Code and Data Files:**

   a. Happiness.ipynb
      Software codes in the jupyter notebook containing the machine learning algorithms

   b. EducationData.csv
      The input data file containing the list of countries with the education score

   c. Living Standards.csv
      The input data file containing the living standard rank of the listed countries

   d. Pol Stab.csv
      The input data file containing the political ranking of the listed countries

   e. Time-Spent-on-Leisure.xlsx
      The input data file containing the time spent on different activities by the population of the listed countries

   f. Gender_development.
      The input data file containing the Gender Development score of the listed countries

   g. relig_iso.csv
      The input data file containing the religion ranking of the listed countries

   h. 2019.csv
      This input data file is from World Happiness data (year 2019)

3. **GitHub repository for Code and other deliverables:**

   - The software code and the data files are uploaded in the following GitHub repository at the time of deposit.
     https://github.com/dassuparna/Capstone-Project.git

Note on Technical Specifications

The Machine Learning algorithms, visualizations, and data are uploaded to the following GitHub location: https://github.com/dassuparna/Capstone-Project.git. The repository contains the following:

(i)　Software Code and Data Files:

- Software Code File:

  o Happiness.ipynb

- Input Data Files

  o EducationData.csv

  o Living Standards.csv

  o Pol Stab.csv

  o Time-Spent-on-Leisure.xlsx

  o Gender_development.

  o relig_iso.csv

  o 2019.csv

(ii)　Readme File:

- README.md file provides information on the project

The Happiness Project works with Python 3.7x. Python environment can be installed easily using any distribution platform like Anaconda. Users can download Anaconda from the following site: https://www.anaconda.com/products/distribution. After the installation of the package, the users will have the Anaconda Navigator, Jupyter Notebook, and Python installed on the local computer or the virtual environment.

Anaconda is a Python distribution with Jupyter Notebook embedded in it. The Jupyter Notebook is an open-source web application that allows users to create and share documents that contain software code for data cleaning, data transformation, numerical simulation, statistical modeling, data visualization, and machine learning. Jupyter supports running Python codes.

To run the model, users will need to download the source code file (Happiness.ipynb) and the above-mentioned input data files on the local computer. The source code file (Happiness.ipynb) needs to be kept in Python's current working directory, and the input data files under the subdirectory names NewData under Python's current working directory.

Narrative

Project Description: Happiness from a different perspective:

In Bhutan, happiness encompasses environmental, social, economic, and personal circumstances impacting a person's life. This can be seen as synonymous with a holistic approach to sustainability. Focusing on happiness and wellbeing beyond GDP metrics should be the government's ultimate goal. Happiness should be made the purpose of government. It should not be treated as a distraction that falls outside the domain of governmental policies. It is high time that the government found out what will improve lives and how to improve the standard of living. It cannot be done only by measuring gross domestic product. GDP is an incomplete way of measuring a country's progress. In the World Happiness Report, gross domestic product (GDP) forms an important factor in making life evaluations. Some of the world's happiest countries have high GDP per capita, and most of the least happy are very poor. But the correlation is far from perfect. One major shortcoming of traditional utility theory is that because it relies on observed market prices, quantities, and incomes, it cannot account for people's enjoyment of goods, services, activities, or amenities outside of markets. Factors outside of economic output need to be considered. If the ultimate end goal is the reality of human happiness, then just boosting output per person might cause us to fall painfully short. Higher incomes make people happier, but all richer countries don't seem to be happier in aggregate as a result of such higher incomes. So, therefore economic growth isn't the only secret to the desired increase in happiness.

Given the changing nature of society's relation to production, distribution, and its relation to the environment and wellbeing, today, we can go beyond the annual output of a country and look at wealth in its entirety. This project will track the quality of life based on education, use of time,

psychological wellbeing, good governance, cultural diversity and resilience, ecological diversity and resilience, community vitality, living standards, climate, religion, and gender equality. All of those determinants of happiness are positively correlated with economic growth. These factors will show that the physical and mental health of a population is important for economic growth. Contrary to the World Happiness Report, where too much importance is given to economic growth, this project will take a holistic approach towards notions of progress and give equal importance to non-economic factors as well. We shouldn't have economic growth but should instead concentrate on what makes us happy would be the main claim of this project.

Project Methodology:

This project methodology is divided into the following phases:

- Collecting the data,

- Preparing data for machine learning algorithms and analyzing and interpreting results, fine-tuning parameters, creating a score to get comparisons

- Presenting results using data visualization tools and techniques

I have researched and collected the data, keeping an eye on the factors that enhance the quality of life.

My research would explore the following factors:

- Education: Correlation between the quality of a country's educational system, general economic status, and overall wellbeing.

- Use of time: How do people across the world spend their time, and what does this tell us about living conditions?

- Psychological wellbeing: How psychological wellbeing contributes to happiness.

- Political Stability: How the form of the governance or the quality of a government improves the wellbeing of people

- Cultural diversity and resilience: How cultural differences and culture's capacity to maintain its uniqueness shape one's happiness

- Ecological diversity and resilience: The capacity of a system to absorb disturbance and re-organize while undergoing change

- Community vitality: How communities collaborate and work effectively in identifying the problems and needs of the community

- Living standards: How improved standard of living correlates to wellbeing and happiness.

- Climate: Climatic changes and their influence.

- Religion: Whether religion plays a role in the happiness of an individual

- Gender equality: Gender equality means that all genders are free to pursue whatever career, lifestyle choice, and abilities they want without discrimination.

Practices followed to realize the Project goal:

I searched for data by country scores and rankings for each factor. This way, I could gather datasets based on most of the abovementioned factors. After collecting the data, I prepared the data for processing by machine learning algorithms.

My project is divided into two panels: analyzing the dataset and training the linear regression model. I have used Python's NumPy and Panda library to clean and process the datasets. NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Correlation of Happiness and the measured factors:

My analysis will define how the factors mentioned above correlate with happiness scores.

Education:

"Education is the most powerful weapon you can use to change the world." — said Nelson Mandela[19].

While education levels vary from country to country, there is a clear correlation between the quality of a country's educational system and its general economic status and overall wellbeing. In general, developing nations tend to offer their citizens a higher quality of education than the least developed nations, and fully developed nations provide the best quality of education. Education is a vital contributor to any country's overall health.
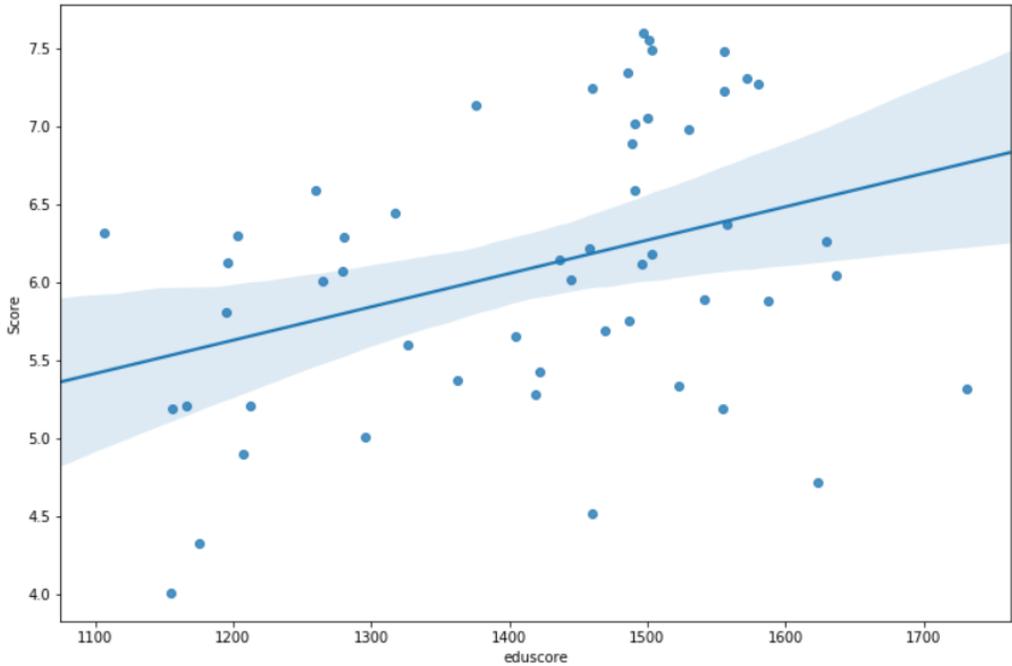
Figure 1: Education Ranking

Political Stability:

A country is stable if the laws and regulations are abided by the people, the government works without any pressure and threat of being removed, and the political conditions of the government are stable. These are the most important and basic aspects of political stability. If a government has strong connections and relationships with its citizens, its political conditions also affect the people in various ways. When some proper laws and regulations ensure every aspect of the country is peaceful, this increases its citizens' satisfaction and happiness levels. So overall, people living in a peaceful country are happier than in other countries that are not peaceful. If people are more optimistic, they also support the government to become stable and contribute to the growth and development of their country.
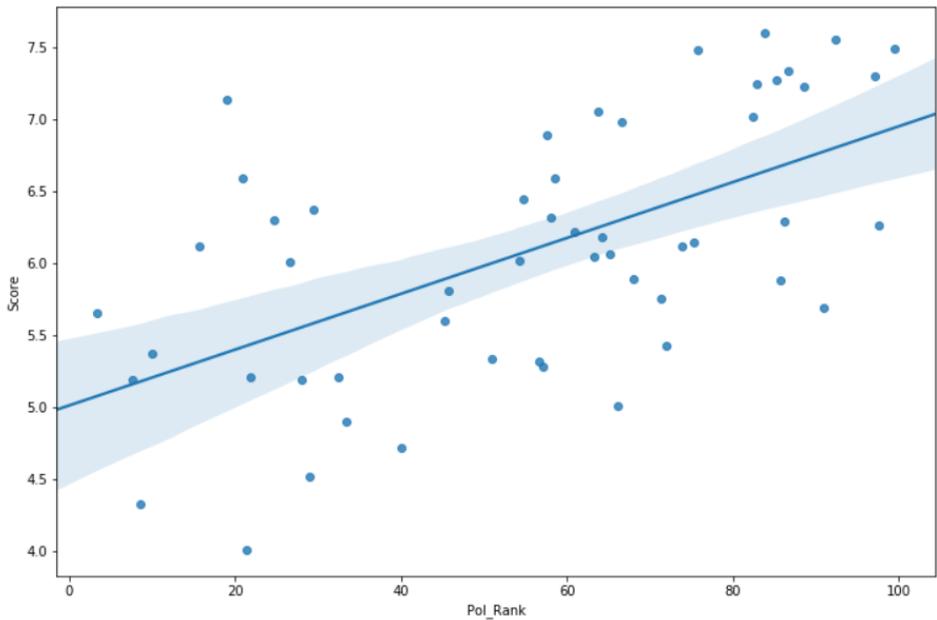
Figure 2: Political Ranking

Gender equality:

Living in an equal society where one can choose the circumstances of one's life would presumably lead to greater happiness. Gender equality led to much higher rates of life satisfaction

among residents of more equal countries, while countries with less equality reported being less satisfied with their lives. Suppose one truly wants to increase happiness and wellbeing among all country residents. In that case, policies promoting equal pay, fair hiring, and equal representation of women in government and upper-level positions in the private sector can improve people's lives.
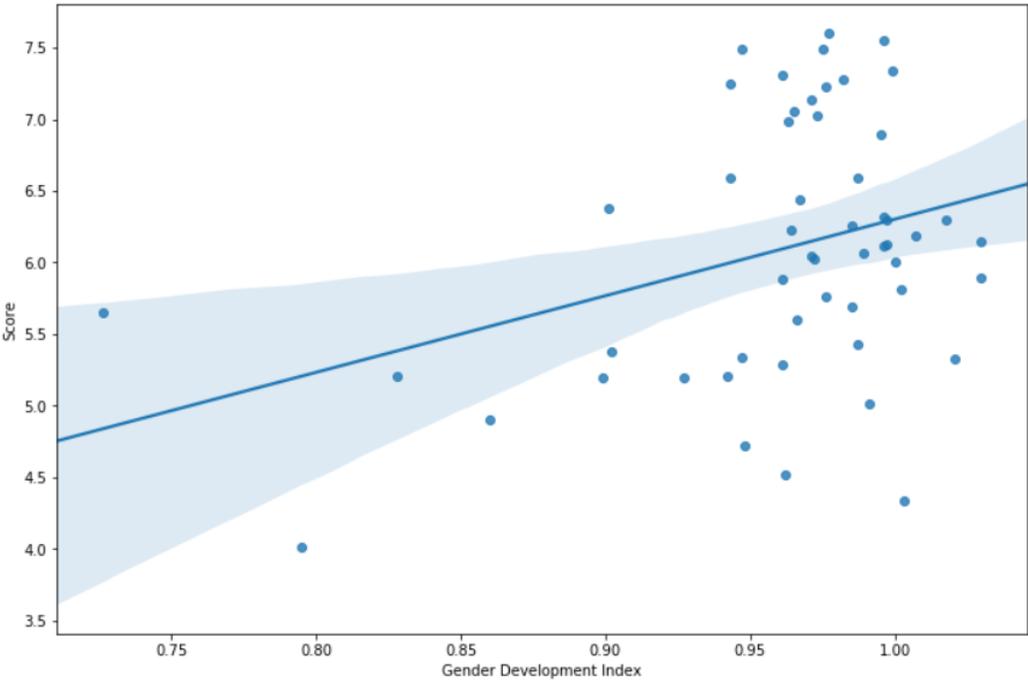
Figure 3: Gender Development Index

Living standards:

The standard of living refers to a population's quantifiable, material wellbeing. It has been historically determined by a nation's economic output, as measured by real gross domestic product (GDP) per capita. This variable is a ranking, and a low rank indicates a higher living standard for the people living in the country. This variable helps suggest whether sufficient goods and services are available to the people of a nation and whether they likely have enough money to afford them.
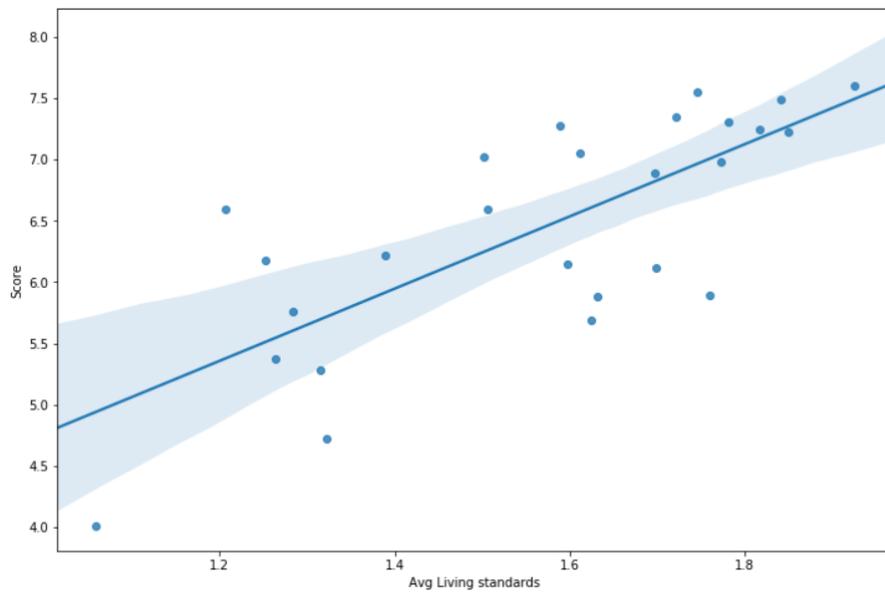
Figure 4: Average Living Standard

Average Time Spent on Leisure:

In Psychology Today, Michael W. Austin says that leisure " is a mental and spiritual attitude. It is not laziness, but rather an inner silence that enables one to see reality"[20]. Different leisure activities (e.g., listening to music, meeting with friends, and traveling) have different impacts on happiness, as some are associated with a higher level of happiness. Happiness is obtained through rest, which enables recuperation from anxiety and exhaustion from work
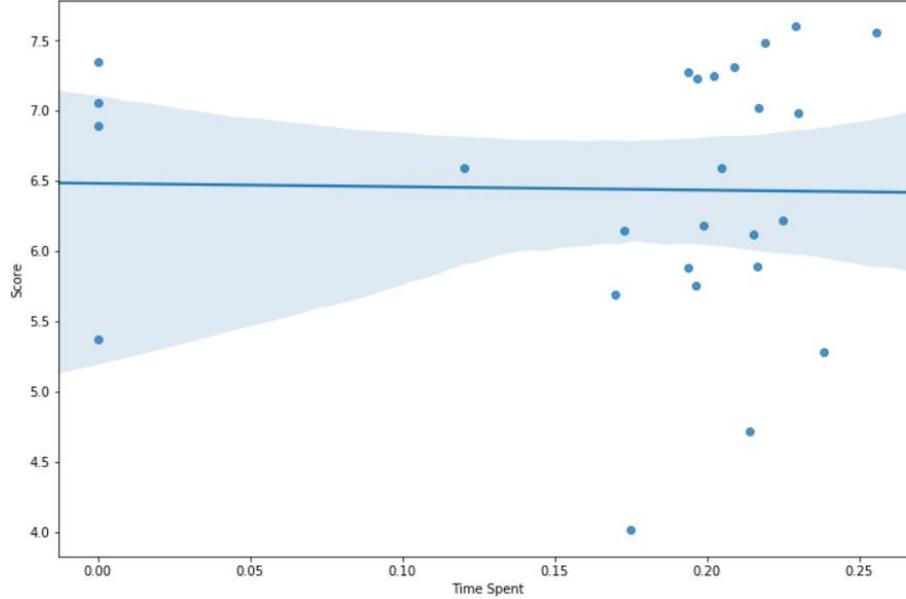
Figure 5: Time Spent on Leisure

Religion:

GPI Score or Religion rank depicts a country's religious standing. Religion ranking lower denotes that country is more religious. The relationship between religion and happiness and between autonomy and happiness varied depending on where people lived and the conditions within their country. In more economically developed, democratic countries where personal freedom was highly valued, religiousness was much less tied to happiness than individual autonomy. In contrast, the reverse was true in less economically developed nations that are religiously conservative and value

collectivism.
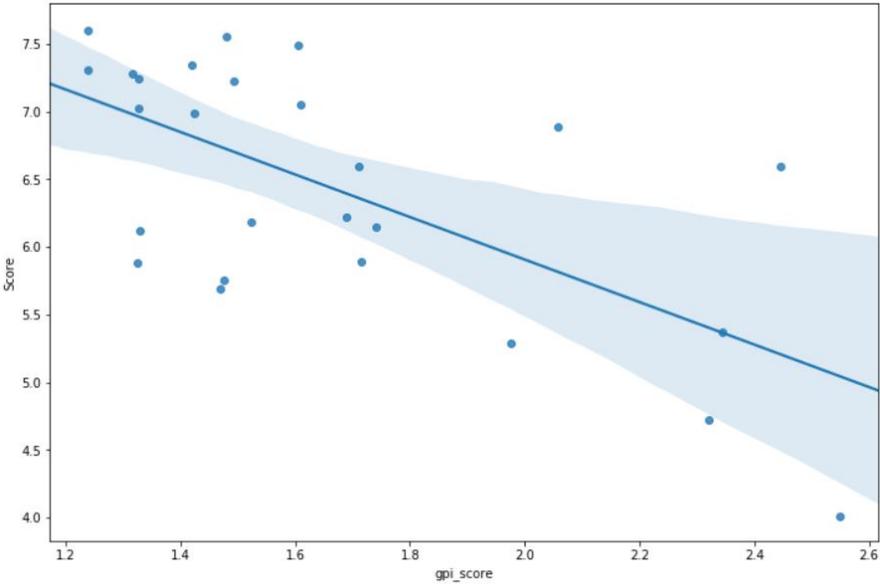
Figure 6: Religion Ranking

There is indeed a strong linear relationship between GDP and Happiness, and countries that top the happiness list tend to be wealthy. Other factors like education, political stability, and gender equality play a significant role in making the citizens happy, as the above charts show a strong linear relationship with these factors.

Recommended Policy Changes towards Happiness:

Policymakers must focus on improving mental health and human relationships, not just the economy. My project is to persuade policymakers to adopt the happiness of their people as a goal because that is the way forward for society. But policymakers can't make good policy if they can't provide evidence of what will make a difference in people's happiness. So, I tried to assemble comprehensive evidence to explain the variation in happiness within different populations—in particular, how much happiness would change if different circumstances prevailed—to give policymakers specific numbers they could use to make decisions. The data focuses on happiness

9

levels in a normal population, and I have information on the circumstances of the people—their income, employment, education, religion, physical health, and (an important one) their mental health. I am looking simultaneously at the effect of all of these things and explaining the variation in happiness. And, on a deeper level, it reveals that income explains very little of that variation. Yes, money has a positive impact; but it only explains 1 percent of the variance of happiness in the population.

We would all be much better off if countries measured success by the happiness of their people than by making economic growth the central objective of public policy and the main measure of success. We should learn from the Scandinavian countries, which are uniformly happier than, for example, the UK or the US. There are important lessons to be learned: It is not that economic progress should not be given importance, but it is not the be-all-end-all. Human relationships are extremely important and need to be given much attention—we shouldn't sacrifice them in the name of economic efficiency. Neither should we sacrifice human relationships at work, give up our work-life balance, or drive our children crazy at high school.

Time spent working:

Everybody needs to design things to preserve their happiness and, even more, that of others. We won't have a happy society unless people start counting their success in terms of how they're contributing to other people's happiness rather than just what they are getting out of the system for themselves. The evidence presented here comes from decades of work from economic historians and other researchers. Of course, the data is not perfect measuring working hours with accuracy is difficult, and surveys and historical records have limitations, so estimates of working hours spanning centuries necessarily come with a margin of error. But for any given country, the changes across time are much larger than the error margins at any point in time
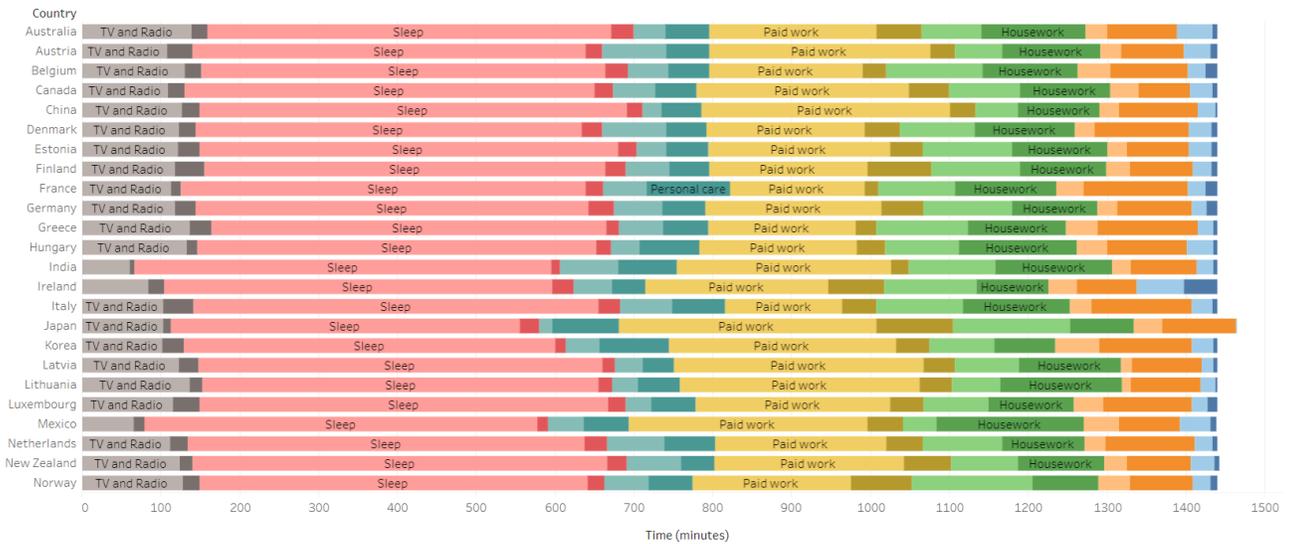
Figure 7: Time Spent on Different Activities

A more holistic framework for measuring 'progress' needs to consider changes in how people can allocate their time over multiple activities, among which paid work is only one.

There are huge inequalities within and across countries, but substantial progress has been made. Zooming in and looking at other countries beyond those that industrialized early, the data reveals a continued decline in working hours for many countries but also large differences between countries.

For some countries, such as Germany, working hours have continued their steep historical decline, while for other countries, such as the US, the decline has leveled off in recent decades. In China, for example, hours rose in the 1990s and early 2000s before leveling off in recent years. Now, what does that mean? As the working people work less, they can afford more things they enjoy, including more leisure and less time spent working and spending more time with their family. Parents need to spend more time with their kids, and this matters because parent-child interactions are important for childhood development.

Mental health: an incredibly important factor in human happiness

In his book "Thrive: The Power of Psychological Therapy," Richard Laylard described the anguish of poor mental health, "Mental pain is as real as physical pain. It is experienced in the same brain areas as physical pain and is often more disabling."[21] Yet, even in rich countries, less than a third of mentally ill people are in treatment. Good, cost-effective treatments exist for depression, anxiety disorders, and psychosis, and the world's happiness would be greatly increased if they were more widely available. The first thing we should do is provide more help to the people who are currently suffering—to treat them by offering therapies that work. Of the one out of six people with anxiety and depression disorders, only about a quarter are receiving treatment. We need to develop a massive workforce capable of delivering evidence-based therapies, supported by a proper financial arrangement through insurance so that people can get treatment for mental illness in the same way they can get treatment for physical illness. It's just extraordinary that people automatically get treated for physical illness, which is often trivial compared to depression and crippling anxiety.

We should and can do a lot to prevent the emergence of mental illness. And the most salient lever we have is the public school. Schools play a huge role in happiness; they play nearly as big a role in how a person develops emotionally as intellectually. A happy adult, their mental health at 16 is a better predictor than the whole of their academic performance, right up to getting a Ph.D. Yet most schools are not as mental health-conscious as they should be and could be. Schools need to do a lot more than provide lunches. We must get schools to be much more oriented toward happiness and to do that systematically, using evidence.

The World Health Assembly has approved the updated WHO Comprehensive Mental Health Action Plan (2021-2030). It reflects the advocacy by mental health campaigners calling for policy changes at local, national, and international levels. The policy recommends "involve people with mental disorders and psychosocial disabilities in the assessment and monitoring of all public and

private mental health services including psychiatric hospitals and social care homes."[22] There is an emphasis on integrating mental health and social care into family health & wellbeing programs and incorporating mental health and social care into disease-specific programs and services such as those for HIV/AIDS and tuberculosis. There is an initiative to promote more responsible media reporting concerning suicide.

While there is a great deal of work to be done to see the WHO Comprehensive Mental Health Action Plan implemented at the country level, advocates and campaigners can use the Plan to leverage greater commitments and action by decision-makers. They use this to drive momentum between now and 2030. A starting point is for policyholders to write to their Ministries of Health and other relevant government departments to highlight the Plan's agreement by their government and ask them what actions they intend to take to fulfill their agreed targets. The options for implementation provide a starting point for persuading policymakers to take actions that will result in meaningful change for millions worldwide.

Education:

The school, which is the primary institution for providing education, should be the prime area to which policymakers should give attention to.
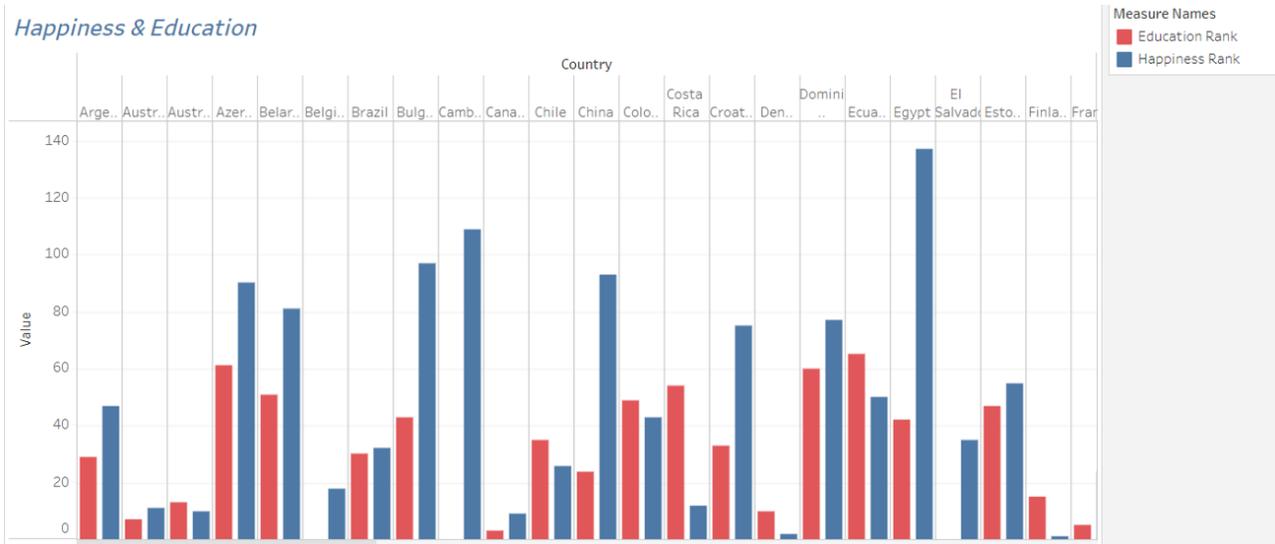
Figure 8: Happiness and Education Rank

This is a side-by-side bar graph showing the relation between education and happiness. The blue bar depicts a country's happiness rank, a higher bar on the scale indicates a lower ranking on the Happiness scale, and the lower line signifies a higher ranking. Similarly, the red bars indicate the education ranking of the countries, where the lower bar indicates higher education rank while the higher bar means lower education rank.

A basic scheming of the graph shows that a happier country has a higher education rank. In addition to higher income among individuals, education promotes gender equality, fosters peace, and increases a person's chances of having more and better life and career opportunities. Our world in data also suggests that " learning outcomes tend to be much higher in richer countries…"[23]. The graph developed in Tableau shows how government expenditure has increased over time in richer countries.
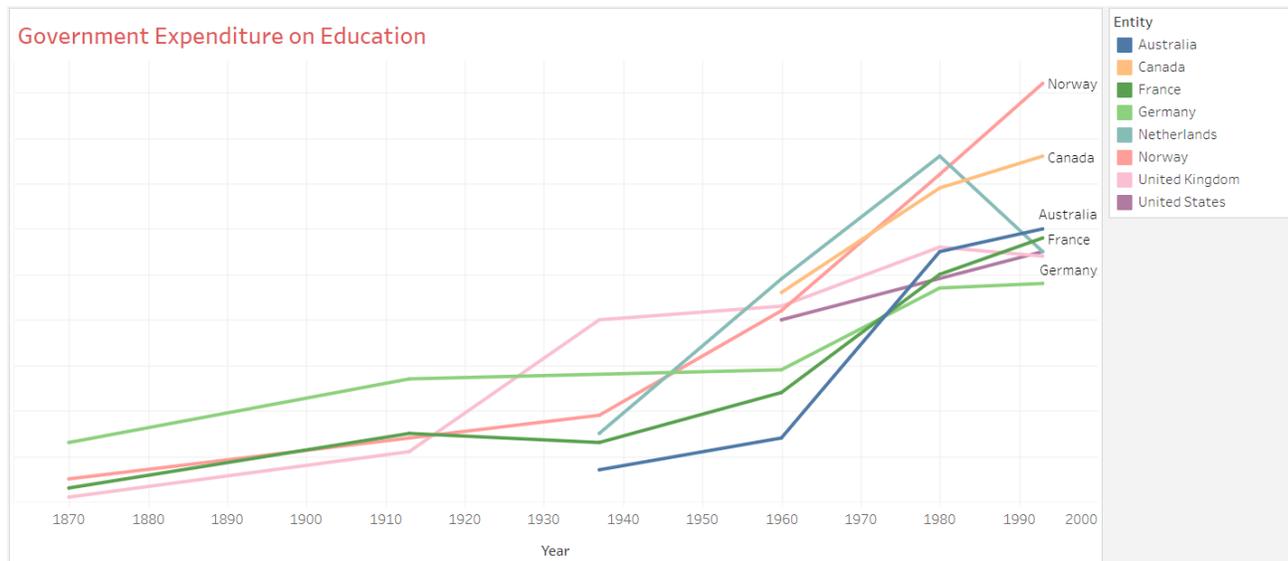
Figure 9: Government Expenditure on Education

Bridging the education gap between the rich and middle to lower-income countries is important. Alice Albright points out in her article The global education challenge: Scaling up to tackle the learning crisis that "In an era when youth are the fastest-growing segment of the population in many parts of the world, new data from the UNESCO Institute for Statistics (UIS) reveals that an estimated 263 million children and young people are out of school, overwhelmingly in LDCs (least developed countries) and LMICs (lower-middle-income countries)"[24]. The lack of education and related employment opportunities in these countries presents national, regional, and global security risks. Highlighted below are actions and reforms that could lead the way toward solving the crisis:

Make funding schools a priority: Economists found that investing in education impacts the country's overall economic health by increasing the gross domestic product (GDP). So, transforming countries' currently weak education systems will require sustained top-level political leadership, accompanied by substantial new donors and developing country investments. To ensure sustained attention for this initiative over multiple years, the US administration will need to designate senior officials in the State Department, USAID, the National Security Council, the Office of Management

15

and Budget, and elsewhere to form a whole-of-government leadership response that can energize other governments and actors. Also, local and federal governments could afford to bolster the public education system by taxing wealthy citizens and corporations their due. To positively disrupt and uncover new solutions, it is important to engage community-level non-state actors to provide education services in marginal areas where national systems do not reach the population. Related to this, federal governments' increased financial and technical support are required to strengthen their non-state actor regulatory frameworks. Such frameworks must ensure that non-state actors operate without discrimination and prioritize access for the most marginalized.

Raise standards for teachers: Underqualified teachers are tied to poor outcomes for students. Policymakers must clarify standards for teachers seeking licenses and raise standards in areas where student outcomes are lowest. Confirm the appropriate roles for technology in equitably advancing access and quality of education, including in the initial and ongoing training of teachers and administrators, delivery of distance education to marginalized communities and assessment of learning, strengthening of basic systems, and increased efficiency of systems. This is not primarily about how various gadgets can help advance education goals.

Apart from trained teachers, availability of appropriate learning materials for every child —the right level, right language, and right subject matter. Lack of books and other learning materials is a persistent problem throughout education systems—from early grades to teaching colleges. Teachers need books and other materials to do their jobs. A good example is how the USAID-hosted Global Book Alliance is working to address costs, supply chain issues, and distribution challenges.

The problem of overcrowding must not be overlooked. Overcrowded classrooms are less effective as students don't get the attention or personalization they require, and as a result, students lose interest, which plants the seeds for dropping out. Teachers and students feel increased stress. Policymakers can begin to avoid this problem by drafting master plans that refuse to tolerate even

slight overcrowding. This process must be ongoing, and maintenance will be necessary, as new housing developments can force shifts in school capacities.

Put classroom-running and curriculum-building decisions in the hands of the community: Policymakers who are aware of this pattern can push for a move away from standardized control and toward community-based mechanisms, such as community-elected school boards, that have the power and authority to make decisions about how their students are educated. Involving parents in their children's education can also contribute to a student's achievement.

Happiness, where education is concerned, does not mean pampering children with less rigorous curricula. Instead, the curriculum should challenge children to think creatively about topics not found on standardized tests. One outcome of this would be to nurture children's interests rather than dulling these interests with routine work. Tolerance, empathy, violence prevention, and perhaps most importantly, critical thinking should be the prime skills that educational policymakers should concentrate on. "To be happy," ... "we need to understand ourselves and the groups to which we belong."

Gender Equality:

The main purpose of improving gender equality is to create a fairer society. In highly developed industrialized nations, the large majority of people and policymakers support a fairer society.

Women make up half the world's population but generate 37 percent of global GDP, reflecting the fact that they do not have equal access to labor markets, opportunities, and rights. Gender inequality is not only a pressing moral and social issue but also a critical economic challenge. There are six areas where policymakers can intervene to bridge gender gaps: laws, policies, and regulation; financial incentives and support; technology and infrastructure; creation of economic

opportunity; capability building; and advocacy and shaping attitudes.

Laws, policies, and regulations:

Laws, policies, and regulations that create a gender-neutral environment are the bedrock of efforts to further women's equality. In India, for instance, there are laws to address domestic violence and sexual harassment, women have the right to inherit property, and paid maternity leave was raised from 12 to 26 weeks. In the UK, the government started requiring all large companies to publish gender pay data in 2018. The United States remains one of only nine advanced Organization for Economic Co-operation and Development (OECD) economies that does not offer paid parental leave. Many governments have used the tax system effectively to open up opportunities for women. For instance, the introduction of 12 months of paid leave in Germany led to an increase in women's workforce participation one year after a child's birth and an increase in the fertility rate. The United Kingdom provides free childcare for two-year-olds from lower-income backgrounds to support mothers to work for pay. Another key role of government is in education and training, an increasingly vital part of the effort to open doors for women in the digital age.

Finance:

Public money can be a powerful weapon for governments seeking to reduce gender inequality. Cash transfers can help incentivize behavioral change in families and communities. Morocco, for instance, put in place a program of cash transfers to families to pay for an education that helped reduce dropout rates by about 75 percent. Another key role for governments is as an investor in public infrastructure. If the state provides clean running water, more effective cooking fuel, and sanitation, the number of time women spend on household chores can be reduced.

Employment:

Turning the lens back on the advancement of a sustainable world, having women in positions of power matters greatly, not only in the name of gender equality and representation but because women's experiences and roles in society and households bring invaluable insight into how to protect important resources and deal with change. Government is a major employer in many countries and, as such, can provide good jobs for women and send a signal to broader society. Policymakers should partner with the private sector and see that the firms are maximizing work opportunities for women.

Statistical Model

Using Statistical Models:

Statistical models help to concisely summarize and make inferences about the relationships between the variables. Predictive modeling is based on an understanding of these relationships. I will explain how I fit and analyzed quantitative (linear regression) statistical models on the target variables.

Machine Learning Models:

The Machine learning models have been used to implement the statistical models to analyze where something belongs or what combination of features will work best to know what will happen next. I have used multiple machine learning models for implementing statistical methods like linear regression. I have leveraged the Stats models library for statistical modeling.

Linear Regression Models:

Regression is a statistical method for establishing relationships between the independent

(feature) and the dependent variable (predictor). Specifically, linear regression establishes a relationship between the features and dependent variable that a straight line can best represent. Simply put, this is an attempt to make a straight line through the data where the line is close to as many input data points as possible. I have run multiple linear regression models on the independent features and the predictor. The goal is to produce a model that represents the 'best fit' to some observed data, according to my chosen evaluation criterion. One advantage of the OLS model is that you are estimating effects of one factor, controlling for the rest of the factors. I tried to predict the Happiness Score or Score basis other variables such as 'GDP per capita,' 'Gender Development Index,' 'Relative Score,' 'Avg Living standards,' 'gpi_score,' and 'Pol_Rank.'

Standardized Coefficient for Happiness Score

Table 1: Standardized Coefficient for Happiness Index

	Coefficient	**P>|t|**
GDP per capita	2.7531	0.000
Gender Development Index	1.7127	0.118
Relative Score(Edu score)	-2.2881	0.068
Average Living standards	1.5662	0.002
GPI Score (Religion Rank)	0.4372	0.222
Political Rank	0.0208	0.978

R-squared (uncentered): 0.992

Adj. R-squared (uncentered): 0.992

Interpretation of the models

Understanding the coefficient (especially coefficient of determination and P-value) is important for model interpretation.

Coefficient of determination:

R-squared, or the coefficient of determination, indicates how good the model is in predicting an outcome. Essentially, it conveys how well the data fit the used linear regression model. It is a statistical measure to determine the proportion of variance in the predictor that the feature can explain. The outcome is represented by the model's dependent variable. The range of values for the coefficient of determination is 0 to 1. The closer its value is to 1, the better the model is at making predictions. The value of R-squared in our model is 0.992. This implies that now 99.2% of the variation in 'Score' is explained by the six independent variables.

P-value:

P-value helps us understand how likely it is to get a particular result when we assume the null hypothesis is to be true. In other words, it indicates the probability of getting a similar sample to the ones used in the model or more extreme than the sample when the null hypothesis is correct. The fitted model implies that, when comparing two countries whose 'Score' differs by one unit, the country with the higher 'Gender Development Index' will, on average, have 1.71 units higher 'Score .' Similarly, Avg Living Standards depict the country with higher living standards will, on average, have a 1.51 units higher score. This difference is statistically significant for Avg Living Standards because the p-value is less than the significance value of 0.05. This means there is strong evidence of a linear association between the variables 'Score' and 'Avg Living Standards.' Again, for GDP, the p-value is 0.00, which means there is strong evidence of a linear association. Average Standard of Living

is a broader term than GDP. While GDP focuses on production that is bought and sold in markets, standard of living includes all elements that affect people's well-being, whether they are bought and sold in the market or not.

Limitations

Finally, I would like to point out the limitations of the approaches presented above:

Omitted variables:

Although intuitively relevant given the topic, the variables used to explain happiness might not be enough. Their correlation might reflect some other "unobserved" factor not included in the analysis. There are some factors that I was unable to get data on, but these factors play an important role in happiness. Such factors are:

- Psychological wellbeing.

- Cultural diversity and resilience.

- Ecological diversity and resilience.

- Community vitality.

I have data for Climate and Time Use, but the data format is different, and integrating them into my dataset will affect my consolidated data.

Reverse Causality:

There is also a risk of bidirectional causality. This means that happiness can cause changes in one or more explanatory variables. For instance, are people happy because they are healthy, or is their sentiment of happiness that makes them feel healthy? Are people happy because they are wealthy, or is the feeling of happiness that makes them more dynamic and ambitious in their professional lives?

Mismeasurement:

Many variables analyzed are subjective and represent more people's perceptions than reality. For example, people from a country with a long political tradition of democracy might strongly feel corruption while it remains weaker and less widespread than in other countries.

Sample Size:

The data size was limited as I wanted to have the same countries for all the given factors. This resulted in a small dataset. I have collected eleven different sample data. Of these, I have been able to use six data sets for constructing the model. In merging the datasets, there was possible data loss resulting in a small sample size. We cannot deny that a good economy is instrumental to a county's prosperity. Still, other factors like the Gender development index, Political stability also have a positive linear relationship to the happiness score.

Relationship to the Capstone Project to the

Course of Study

Constructing a data story that moves a person to take action can be a very powerful tool. Coming into the Data Analysis and Visualization program, I not only mastered storytelling but also learned how to provide the added benefits of deeper insights and supporting evidence through graphs and charts. Through data storytelling, I wanted to simplify the complicated information and offer a human touch so that the audience could engage in the content and make critical decisions quicker with confidence. Various courses undertaken during my career at The Graduate Center in CUNY have culminated in my work. Aside from Visualization and Design: Fundamentals DATA 73000, another course that added to the development of this project was Working with Data: Fundamentals DATA 73500, taught by Prof. Timothy Shortell during the Spring 2020 semester. It was in this course I came across the World Happiness data. I worked on the data as it was available. It intrigued me to analyze the data further to bring new insights to the established conclusions.

Data Analysis Methods: DATA 71000 helped me analyze data using Python. I learned how to manipulate data using machine learning algorithms in this course. Interactive Data Visualization: DATA 73200 further enhanced my visualization and storytelling skill. Uploading the project to the GitHub repository was a very useful learning experience that I have used in my Capstone Project. Throughout my time in the Data Analysis And Visualization program, I have had the opportunity to think critically about what kind of data should be shared, how to represent data in a visually pleasing and understandable way, and how to find different ways to express things via code. Thinking critically and simplifying the data was one topic I encountered a lot in my courses and has always stayed with me when working on my different projects. I have applied this skill and experience to my analysis of 'Happiness From A Different Perspective.' I collected data from a wide

variety of available public sources. Different ways to deal with code and visuals also helped with this project. I came up with a different perspective for the World Happiness data. I have analyzed the happiness index from a human angle in this capstone project. I have focused on exploring the factors that impact the quality of life and an individual's well-being. This project uses machine learning algorithms and data visualizations to explore how these factors correlate to the happiness index.

Evaluation

The Happiness Index can be used to measure: the impact of social injustice, climate injustice, income, inequality, disengagement from the democratic process, loneliness, isolation, ill health, and other aspects of human suffering within a population or specific demographics of a population. The data gathered by the index provides a measurement of often-excluded concepts such as social justice, where objective data does not always give a complete picture. Moreover, analyses of varying demographic aspects of a population often reveal unexpected information about who is suffering and who is thriving within a population. The survey can be used and has been used by communities to measure gaps in wellbeing according to race, income level, zip code, education, age, gender, and household characteristics. Finally, summarized data and recommendations can be, and have been, shared with policymakers and used to inform public conversations and policy makers' decisions about budgeting.

To answer some of the questions posed throughout this report, we will need to uncover additional data that could help us explore some of these relationships and try and distinguish causality from correlation. Uncovering which aspects are drivers can tell us about some of the social benefits of strengthening our economies and prioritizing health and wellbeing.

The most central of those points is: what can the most vulnerable countries teach us about how humans connect and rely on one another? Why are their contributors to happiness so different from the happiest countries? What can they teach us about the shared experience of living in a country with high insecurity?

Could it be true that the citizens of those countries prioritize each other more and don't take the blessings they do have for granted? Could hardship, in turn, create more happiness due to a greater sense of purpose? Could the top countries' tendencies show us that comfort and opportunity breed

further individualism, loss of social dependence, and complacency?

Continuation of the Project

Research Proposal Outline

The Problem:

There is confusion over which aspects of world happiness we looked at are causing certain relationships or if they have a more complex relationship. Understanding more about which of the studied metrics contribute more to the happiness of the countries included in our dataset would help us perpetuate happiness for citizens in these countries in the future. We know that happier citizens in countries would do much to boost wellbeing and even productivity in ways that are innumerable, qualitative, and often behind the scenes. While this is a nebulous undertaking, if we can understand these relationships, we can get closer to quantifying some of the previously unseen dynamics.

The potential solution:

One potential way we can gauge causality is to administer a survey to those that originally provided answers to the UNDSC explicitly asking for causality so that we may gather enough data on the contributing factors to happiness specifically. Without more exploration into the driving factors most directly linked to an increase in happiness, we wouldn't be able to determine causality, so this could be a natural next step to determining causality.

Rather than understanding these relationships through the context of which factors are most active in their happiness, we should ask the citizens these questions:

- How satisfied are you with your life nowadays?

- To what extent do you feel the things you do in your life are worthwhile?

- How happy did you feel yesterday?

- How anxious did you feel yesterday?

This would allow us to quantify which factors specifically would increase happiness for those surveyed.

Appendix

Table 2: Python Libraries Used

Library Name	Description
IPyPlot	IPyPlot is a small python package offering fast and efficient plotting of images inside Python Notebooks cells.
Matplotlib	A comprehensive library for creating static, animated, and interactive visualizations in Python.
NumPy	It is the fundamental package for scientific computing with Python.
Pandas	Open-source data analysis and manipulation tool, built on top of the Python programming language.
plotlyjs	Plotly JavaScript Open-Source Graphing Library.
SciPy	SciPy in Python is an open-source library used for solving mathematical, scientific, engineering, and technical problems.
Seaborn	Python data visualization library based on matplotlib

Table 3: Data Dictionary

Variable	Descriptions
Avg Living Standards	Average Living Standard Score
country	List of country selected for analysis
GDP per Capita	Gross Domestic product per person in the selected list of countries
Gpi Score	Religion Score
init_notebook_mode	Constructors are used to initializing the object's state.
MAE	Mean absolute error
MSE	Mean squared error
Pol_Rank	Political rank
Relative Score	Education score of the countries
RMSE	Root mean squared error
Score	Happiness score of the selected countries
Time Spent	Time spent on different activities

Table 4: Glossary of Functions

Function Name	Function Description
barh()	Function helps to make a horizontal bar plot.
corr()	Function to find the correlation among the columns in the data frame
drop()	Dropping the columns from the data frame
getcwd()	Function to get the path of current working directory

head()	Function to Read the first five lines of the data frame
hist()	Function (in pyplot module of matplotlib library) is used to plot a histogram
linear_model.LinearRegression()	This is Ordinary least squares Linear Regression from sklearn.linear_module
merge()	Merging different dataset
Ordinary Least Squares(OLS)	A linear regression model establishes the relation between a dependent variable(y) and at least one independent variable(x)
predict()	The Python predict() function predicts the labels of data values based on the training model.
RandomForestRegressor()	Random forest is a supervised learning algorithm that uses an ensemble learning method for classification and regression.
read excel()	Function to Load the excel file
read_csv()	Function to Load the csv file
regplot()	Function from the seaborn data visualization library to plot a logistic regression curve in Python
rename()	Renaming the column
StandardScaler()	Python sklearn library offers us with StandardScaler () function to standardize the data values into a standard format.
train_test_split()	Train Test split activity is done to measure the performance of the machine learning algorithm when they are used to predict the new data which is not used to train the model.

Works Cited

1. Venugopal, Abhishek. "*Is Your Country Happy in 2021? Check out* !" *Medium*, Medium, 5 July 2021, https://datascienceworks.medium.com/is-your-country-happy-in-2021-check-out-a6626d0b265a. (Pg 7-8)

2. Cornelis, Jan. "*Good Governance and Happiness in Nations: Technical Quality Precedes Democracy and Quality Beats Size*" (Pg 11)

3. Yanchao, Yang. "*The Economics of Psychological Well-Being: Evidence From the United States Using Machine Learning Method*" (Pg18)

4. Tov, ―William, et al. "How Cultural Differences Shape Your Happiness." *Greater Good*, https://greatergood.berkeley.edu/article/item/how_cultural_differences_shape_your_happiness.

5. *(PDF) The Economics of Happiness - ResearchGate*. https://www.researchgate.net/publication/237809673_The_Economics_of_Happiness. (Pg 7)

6. Faik, Lina. "Understanding Happiness Dynamics with Machine Learning (Part 2)." *Medium*, Towards Data Science, 21 Aug. 2021, https://towardsdatascience.com/understanding-happiness-dynamics-with-machine-learning-part-2-4df36e52486. (Pg 26-27)

7. Faik, Lina. "*Understanding happiness dynamics with data (part 1)*" , towardsdatascience.com/understanding-happiness-dynamics-with-data-part-1-ab58984a715a

8. Ortiz-Ospina, Esteban. Giattino, Charlie. Roser, Max. " *Time use",*ourworldindata.org/time-use (PG 17)

9. Bratsis, Irene. "Trends, Analysis, Explorations and Further Research Proposal for the Most

Recent World Happiness...” *Medium*, Towards Data Science, 7 Jan. 2021,

https://towardsdatascience.com/trends-analysis-explorations-and-further-research-proposal-

for-the-most-recent-world-happiness-9728cf0ac343.

10. Cris, et al. “Happiness Index: What Is It and How Does It Work?” *Tracking Happiness*, 11

Feb. 2021, https://www.trackinghappiness.com/happiness-index-2018/.

11. Ortiz-Ospina, Esteban, et al. “Time Use.” *Our World in Data*, 29 Nov. 2020,

https://ourworldindata.org/time-use. (PG 18)

12. Cris, et al. “Happiness Index: What Is It and How Does It Work?” *Tracking Happiness*, 11

Feb. 2021, https://www.trackinghappiness.com/happiness-index-2018/.

13. “In a Lamentable Year, Finland Again Is the Happiest Country in the World.” *In a

Lamentable Year, Finland Again Is the Happiest Country in the World*, 19 Mar. 2021,

https://worldhappiness.report/news/in-a-lamentable-year-finland-again-is-the-happiest-

country-in-the-world/.

14. “Climate Change Impacts.” *Climate Change Impacts | National Oceanic and Atmospheric

Administration*, https://www.noaa.gov/education/resource-collections/climate/climate-

change-impacts (Pg 20)

15. Worstall, Tim. “World Happiness Report: Even Jeff Sachs and Richard Layard Don't Really

Believe It.” *Forbes*, Forbes Magazine, 18 Apr. 2012,

https://www.forbes.com/sites/timworstall/2012/04/04/world-happiness-report-even-jeff-

sachs-and-richard-layard-dont-really-believe-it/?sh=56eacf96191b.

16. About the Author Jill Suttie Jill Suttie, and Jill Suttie Jill Suttie. “How Does Religion Affect

Happiness around the World?” *Greater Good*,

https://greatergood.berkeley.edu/article/item/how_does_religion_affect_happiness_around_t

he_world. (Pg 15)

17. "Comprehensive Mental Health Action Plan." *United for Global Mental Health*, 5 July 2022, https://unitedgmh.org/knowledge-hub/comprehensive-mental-health-action-plan/. (Pg 17)

18. "5 Ways Policy Makers Can Improve the Quality of Education." *American University*, https://soeonline.american.edu/blog/5-ways-policy-makers-can-improve-the-quality-of-education. (Pg 20)

19. Strauss, Valerie. "Nelson Mandela on the Power of Education." *The Washington Post*, WP Company, 30 Nov. 2021, https://www.washingtonpost.com/news/answer-sheet/wp/2013/12/05/nelson-mandelas-famous-quote-on-education/.

20. "Leisure and Happiness." *Psychology Today*, Sussex Publishers, https://www.psychologytoday.com/us/blog/ethics-everyone/201605/leisure-and-happiness.

21. Layard, Richard, and David Clark. *Thrive: The Power of Evidence-Based Psychological Therapies*. Penguin Books, 2015. (Pg 29)

22. "Comprehensive Mental Health Action Plan." *United for Global Mental Health*, 5 July 2022, https://unitedgmh.org/knowledge-hub/comprehensive-mental-health-action-plan/.

23. Roser, Max, et al. "Quality of Education." *Our World in Data*, 17 July 2013, https://ourworldindata.org/quality-of-education.

24. Albright, Alice. "The Global Education Challenge: Scaling up to Tackle the Learning Crisis." *Brookings*, Brookings, 9 Mar. 2022, https://www.brookings.edu/research/the-global-education-challenge-scaling-up-to-tackle-the-learning-crisis/.