

# ChatGPT: The advancement of knowledge and incorporation for its users.

Date: July 2023

Research Study Title: ChatGPT: The advancement of knowledge and incorporation for its users.

## *Introduction*

My name is Louis Othen and this research forms part of my Master's study at Glyndŵr University. You are being invited to take part in this research. Before you agree to do so, it is important that you understand the purpose and nature of the research and what your participation will involve, if you agree. Please read the following information carefully, and please ask if anything is not clear, or if you want more information. Contact details are given at the end of this information sheet.

## *What is the purpose of the study and how will it be carried out?*

The research objectives are:

- If ChatGPT is previously or currently being used by the participant.
- If so, did it enhance a user's knowledge on what was prompted.
- Furthermore, has it been adopted for routine knowledge acquisition going forward.

The research methodology is (in outline);

A quantitative survey study via a questionnaire. The responses collected from this survey will be formatted before descriptive analysis is performed, to then present the results in descriptive, tabular and visual formats where applicable.

## *Why have I been invited to take part?*

The aim is to recruit participants who are of the general public, who may have come across and used ChatGPT in any setting.

## *Do I have to take part?*

Participation is entirely voluntary. It is up to you to decide whether or not to take part. If you agree to take part, you will be asked to consent digitally via a form. If you agree to take part, you may still withdraw, without giving a reason. If this happens, please note that you will not be able to withdraw your data after it has been anonymised. Data is usually made anonymous during and after data collection.

Please enter your email address and click 'Next' to see the rest of the participant information.

---

\* Indicates required question

## 1. Email \*

---

### Participant information (continued)

#### *What will taking part involve?*

All participants will be asked a series of questions relating to use of ChatGPT, followed by demographical questions about the participant. The survey should take no more than 5 minutes to complete and the survey will only need to be done once. All responses will be collected - and this survey will be available for input until Monday 31st July 2023.

#### *Will my participation be confidential?*

All information about you collected during the study will be kept strictly confidential and stored securely in accordance with the Data Protection Act. The only people who will know about you are the researcher and where necessary the dissertation supervisor and examiners. All data, whether electronic or paper or in any other form will be destroyed by spring 2024. There may be circumstances where data is held longer to be used in future research.

#### *What will you do with the results of the research?*

Data collected from the questionnaires will be analysed and will be incorporated into a Master's dissertation and potential follow up publications. No participant will be identifiable in the dissertation.

#### *What happens next?*

Thank you for reading this information sheet. If you agree to take part, there will be initial prompt to confirm you agree to participate in this study, before questions will be provided to answer. If you are not willing to participate, this survey will end thanking you for your time.

You can take a copy of this participant information or the consent form to keep by right clicking and selecting print.

If you wish to raise any concerns about any aspect of how you have been approached or treated in respect of this research study, please contact:

Frances Thomason: Head of Research Services (Frances.Thomason@glyndwr.ac.uk)

#### *Contact for further information*

If anything is not clear, or if you want more information, please contact me directly: s21002027@mail.glyndwr.ac.uk

The next section will ask for participant consent before the survey begins.

## Participant Consent

I confirm that I have read the WGU Research Participant Privacy

Notice: <https://glyndwr.ac.uk/media/marketing/policies-and-documents/info-governance/Research-Participant-Privacy-Notice.docx>

I confirm that I have read and understood the Participant Information for the study. If I have asked for clarification or for more information, I have received satisfactory responses.

I understand that my participation is voluntary and that I am free to withdraw without giving any reason. I understand that any data I have contributed cannot be withdrawn after it has been anonymised and that data collected from me is collected anonymously.

I understand that relevant sections of the data collected from me during the study may be looked at by the researcher as well as the dissertation supervisor and examiners where needed.

I consent to my anonymised data being retained for x years for use within future research and publications, etc., I consent to the anonymised data I have contributed being made available in the public domain for use within future research by other researchers

I agree to take part in the study.

2. Based on the above, please confirm that you are happy to provide consent and to proceed with this survey as a participant? \*

*Mark only one oval.*

☐ Yes

☐ I do not wish to participate - End of the form

## ChatGPT use

Next set of questions ask about how you have found the use of ChatGPT

3. Can you confirm if you have used ChatGPT previously? \*

*Mark only one oval.*

☐ Yes

☐ No      *Skip to question 11*

4. When you used ChatGPT - based on the prompt you entered - did the response help enhance your knowledge in that area? \*

*Mark only one oval.*

☐ Yes

☐ No

5. Based on the response you received from ChatGPT, how would you rate the response you were provided? \*

From 0 being not useful to 5 being exactly the information you needed.

*Mark only one oval.*

Not useful

0 ☐

1 ☐

2 ☐

3 ☐

4 ☐

5 ☐

Exactly what was needed

6. Can you describe - in a few words - what prompt you provided ChatGPT to answer based on above? \*

7. With the prompt you entered, do you believe you could of obtained the information you wanted elsewhere? \*

*Mark only one oval.*

- ☐ Yes
- ☐ No
- ☐ Maybe

8. If ChatGPT did enhance your knowledge, have you used it more into your day-to-day routine since? \*

*Mark only one oval.*

- ☐ Yes
- ☐ No
- ☐ Not Applicable

9. How many times approximately, have you used ChatGPT since you have been aware of it? \*

*Mark only one oval.*

- ☐ 0 - 5 Times
- ☐ 6 - 10 Times
- ☐ 11 - 15 Times
- ☐ 16 - 20 Times
- ☐ 21 Times or more

10. Based on previous ChatGPT use, how would you compare it with platforms such as Google, Youtube, or other method in terms of ease for acquiring knowledge on a particular topic? \*

From 0 being harder to gain this knowledge to 5 being easier to gain this knowledge.

*Mark only one oval.*

Harder

0 ☐

1 ☐

2 ☐

3 ☐

4 ☐

5 ☐

Easier

### About you

Thank you for completing the main sections of the survey. This last section with the proceeding questions are to ask about you to help inform the research conducted. Again, this information is anonymised and used for research purposes only.

## 11. Please confirm your occupational status \*

*Mark only one oval.*

- ☐ Student      *Skip to question 14*
- ☐ Working Professional      *Skip to question 13*
- ☐ Unemployed
- ☐ Retired
- ☐ Prefer not to say
- ☐ Other: \_\_\_\_\_

## 12. Please describe your level of education \*

*Mark only one oval.*

- ☐ Secondary School
- ☐ Higher Education
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Ph.D or higher
- ☐ Vocational
- ☐ Prefer not to say
- ☐ Other: \_\_\_\_\_

### Working professional questions

As you have selected that you are a working professional, some more information would be appreciated.

## 13. In a few words, what industry sector closely aligns with the sector you currently work within? \*

\_\_\_\_\_



## Student Questions

As you have selected that you are a student some more information would be appreciated.

14. In a few words, please describe the course you are studying? \*

---

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## Google Forms

# CONL718-Dissertation\_Analysis-LouisOthen

July 31, 2023

ChatGPT: The advancement of knowledge and incorporation for its users - Python code for data analysis

## 1 Introduction

This jupyter python notebook is used to perform the required data analysis needed as outlined in the research proposal generated in CONL717 - Applied Research Methods; to be applied to the data collection obtained as part of research in module CONL718 - Dissertation.

The code presented here shall be broken down into the following steps:

1. Introduction
2. Import of Initial Libraries and Configuration
3. Ingestion of data collected from survey responses
4. Data Pre-processing
5. Summary Statistics, Descriptive Analysis of Research questions
6. Pearson's Correlation Coefficient and Hypothesis Testing
7. Download output of formatted data and analysis (where applicable)
8. Additional insights where needed and uncovered from ydata-profiling report (Appendix C)

## 2 Import of Initial Libraries and Configuration

```
[ ]: #=====
# Import of relevant libraries needed
#-----
import os                as os          # System related activities.
import pandas            as pd          # Data analysis and manipulation.
import numpy             as np          # Operations on arrays.
import plotly.express    as px          # Interactive data visualisations.
import plotly.io         as pio         # Render plotly charts in VScode.
import nltk              as nltk        # Natural language toolkit.
import warnings          # Suppress warnings of deprecation.

from ydata_profiling     import ProfileReport # Generate ydata-profiler report.
from nltk.corpus         import stopwords    # Remove stopwords.
from scipy.stats         import binom_test  # Create binomial test
from scipy.stats         import pearsonr    # Pearson's Correlation Coefficient.
from IPython.display     import Image      # Bring saved images into notebook.
from tabulate            import tabulate    # Data presentation in pdf output.
```

```
[ ]: #=====
# Suppress deprecated warnings of functions used.
#-----
warnings.filterwarnings("ignore")
```

```
[ ]: #=====
# Allow plotly to render in VSCode.
#-----
pio.renderers.default = 'vscode'
```

```
[ ]: #=====
# Configure stopwords to use.
#-----
nltk.download('stopwords')
stop_words = stopwords.words('english')

# Extend stopword library with words based on this study.
#-----
stop_words.extend(['im', 'chatgpt'])
```

```
[nltk_data] Downloading package stopwords to
[nltk_data] C:\Users\lothe\AppData\Roaming\nltk_data...
[nltk_data] Package stopwords is already up-to-date!
```

```
[ ]: #=====
# Set where to locate csv file of collected responses.
#-----
```

```

folderPath = "C:/Users/lothe/OneDrive/Wrexham Uni (Masters)/CONL718 -
↳Dissertation/Data/"
filepath   = "C:/Users/lothe/OneDrive/Wrexham Uni (Masters)/CONL718 -
↳Dissertation/Data/Dissertation Survey - Louis Othen.csv"

# Condition changing current working directory if not to specified folder path.
#-----
if os.getcwd() != folderPath:
    os.chdir(folderPath)

# Confirm where folder path currently points.
#-----
print(os.getcwd())

```

C:\Users\lothe\OneDrive\Wrexham Uni (Masters)\CONL718 - Dissertation\Data

Now the libraries are applied to this script, the data collected from the survey, can now be uploaded.

### 3 Ingestion of Data Collected from Survey Responses

```
[ ]: # Ingest csv file of collected responses from survey.
#-----
data = pd.read_csv(filepath)
```

#### 3.1 Preview Dataset in Raw Format

```
[ ]: # Preview dataset in raw format.
#-----
col_w_s = 23
col_w = [col_w_s,col_w_s,col_w_s,col_w_s]
h_fmt = 'keys'
t_fmt = 'simple'
s_index = False

print(tabulate(
    data.iloc[:, :3].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = [26,col_w_s,col_w_s,col_w_s]
    ,
))
```

Timestamp	Based on the above, please confirm that you are happy to provide consent and to proceed with this survey as a participant?	Can you confirm if you have used ChatGPT previously?
-----	-----	-----
2023/07/04 4:59:44 pm CET	Yes	Yes
2023/07/04 6:29:44 pm CET	Yes	Yes
2023/07/04 6:37:15 pm CET	Yes	No
2023/07/05 2:26:17 am CET	Yes	Yes
2023/07/05 10:48:04 am CET	Yes	Yes

```
[ ]: # Preview dataset in raw format - part 2.
#-----
print(tabulate(
    data.iloc[:,3:6].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths= col_w
    ,maxcolwidths = col_w
))
```

When you used ChatGPT -  
based on the prompt you  
entered - did the  
response help enhance  
your knowledge in that  
area?

Based on the response  
you received from  
ChatGPT, how would you  
rate the response you  
were provided? From 0  
being not useful to 5  
being exactly the  
information you needed.

Can you describe - in a  
few words - what prompt  
you provided ChatGPT to  
answer based on above?

-----  
Yes

4 I asked to explain a  
principal of orbital  
mechanics to me in  
basic terms

Yes

4 Various prompts,  
generally on  
philosophical  
concepts/breakdown of  
these ideas.

No

1 none

Yes

4 i asked chat gpt to  
write me a story,  
produce code for Unity  
Games Engine in C# etc.

Yes

2 While the prompts  
usually give a decent  
indicator of what I  
want it is often  
riddled with mistakes  
and wrong information.

```
[ ]: # Preview dataset in raw format - part 3.
#-----
print(tabulate(
    data.iloc[:,6:9].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

With the prompt you entered, do you believe you could of obtained the information you wanted elsewhere?	If ChatGPT did enhance your knowledge, have you used it more into your day-to-day routine since?	How many times approximately, have you used ChatGPT since you have been aware of it?
-----	-----	-----
Yes	Yes	21 Times or more
Yes	Yes	21 Times or more
Yes	Not Applicable	0 - 5 Times
Yes	No	6 - 10 Times
Yes	Yes	21 Times or more

```
[ ]: # Preview dataset in raw format - part 4.
#-----
print(tabulate(
    data.iloc[:,9:12].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths= col_w
    ,maxcolwidths= col_w
    ))
```

Based on previous ChatGPT use, how would you compare it with platforms such as Google, Youtube, or other method in terms of ease for acquiring knowledge on a particular topic? From 0 being harder to gain this knowledge to 5 being easier to gain this knowledge.

Please confirm your occupational status

Please describe your level of education

4	Working Professional	Higher Education
5	Student	Bachelor's Degree
0	Student	Bachelor's Degree
5	Unemployed	Bachelor's Degree
3	Working Professional	Higher Education



```
[ ]: # Preview dataset in raw format - part 5.
#-----
print(tabulate(
    data.iloc[:,12:14].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

In a few words, what  
industry sector closely  
aligns with the sector  
you currently work  
within?

-----

Utilities
nan
nan
nan
nan
Software Development

In a few words, please  
describe the course you  
are studying?

-----

nan
Philosophy
I'm a biology teacher.
I teach highschool kids biology.
nan
nan

As the CSV has uploaded successfully and can see what the data looks like in its raw form, the next stage is perform pre-processing, into a version that can be applied as part of analysis in a later stage.

## 4 Data Pre-processing

```
[ ]: # Email addresses were manually removed from CSV file before import.
#-----
# Rename Columns based on the research question it relates to.
#-----
data = data.rename(columns = {'Can you confirm if you have used ChatGPT_
    ↳previously?': 'rq1_question'})
data = data.rename(columns = {'When you used ChatGPT - based on the prompt you_
    ↳entered - did the response help enhance your knowledge in that area? ':_
    ↳'rq2_question'})
data = data.rename(columns = {'If ChatGPT did enhance your knowledge, have you_
    ↳used it more into your day-to-day routine since?': 'rq3_question'})

[ ]: # Convert all research questions responses ready for analysis:
# Yes = 1, No = 0, for rq3 specifically - Not Applicable = -1.
#-----
data['rq1_question'].replace(['Yes', 'No'], [1, 0], inplace=True)
data['rq2_question'].replace(['Yes', 'No'], [1, 0], inplace=True)
data['rq3_question'].replace(['Yes', 'No', 'Not Applicable'], [1, 0, -1],_
    ↳inplace=True)

[ ]: # Rename remaining columns for conciseness - whilst keeping column definitions.
#-----
data = data.rename(columns = {'Based on the above, please confirm that you are_
    ↳happy to provide consent and to proceed with this survey as a participant? ':
    ↳'consent_obtained'})
data = data.rename(columns = {'Based on the response you received from ChatGPT,_
    ↳how would you rate the response you were provided? \n\nFrom 0 being not_
    ↳useful to 5 being exactly the information you needed.': 'rating_response'})
data = data.rename(columns = {'Can you describe - in a few words - what prompt_
    ↳you provided ChatGPT to answer based on above?': 'prompt_entered'})
data = data.rename(columns = {'How many times approximately, have you used_
    ↳ChatGPT since you have been aware of it? ': 'num_chatgpt_uses'})
data = data.rename(columns = {'Based on previous ChatGPT use, how would you_
    ↳compare it with platforms such as Google, Youtube, or other method in terms_
    ↳of ease for acquiring knowledge on a particular topic?\n\nFrom 0 being_
    ↳harder to gain this knowledge to 5 being easier to gain this knowledge.':_
    ↳'rating_comparison_other'})
data = data.rename(columns = {'Please confirm your occupational status':_
    ↳'occupation_status'})
data = data.rename(columns = {'Please describe your level of education':_
    ↳'education_level'})
data = data.rename(columns = {'In a few words, please describe the course you_
    ↳are studying?': 'student_course'})
```

```
data = data.rename(columns = {'In a few words, what industry sector closely
    ↳aligns with the sector you currently work within?': 'professional_sector'})
data = data.rename(columns = {'With the prompt you entered, do you believe you
    ↳could of obtained the information you wanted elsewhere? ':
    ↳'prompt_obtainable_elsewhere'})
```

```
[ ]: # Ensure all relevant variables are converted into their expected datatypes
#-----
data['Timestamp'] = data['Timestamp'].astype('datetime64[ns]')
data['consent_obtained'] = data['consent_obtained'].
    ↳astype('category')
data['prompt_entered'] = data['prompt_entered'].astype(str)
data['prompt_obtainable_elsewhere'] = data['prompt_obtainable_elsewhere'].
    ↳astype('category')
data['num_chatgpt_uses'] = data['num_chatgpt_uses'].
    ↳astype('category')
data['occupation_status'] = data['occupation_status'].
    ↳astype('category')
data['education_level'] = data['education_level'].astype('category')
data['professional_sector'] = data['professional_sector'].astype(str).
    ↳str.replace('nan', '')
data['student_course'] = data['student_course'].astype(str).str.
    ↳replace('nan', '')
```

```
[ ]: # Convert text in 'prompt_entered', 'professional_sector'
# and student_course variables to lowercase and remove punctuation.
    ↳Additionally, remove stop words.
#-----
data['prompt_entered'] = data['prompt_entered'].str.replace('[^\w\s]', '', regex=
    ↳True)
data['prompt_entered'] = data['prompt_entered'].str.lower().str.split()
data['prompt_entered'] = data['prompt_entered'].apply(lambda x: ' '.join([word
    ↳for word in x if word not in (stop_words)]))

data['professional_sector'] = data['professional_sector'].str.
    ↳replace('[^\w\s]', '', regex = True)
data['professional_sector'] = data['professional_sector'].str.lower().str.
    ↳split()
data['professional_sector'] = data['professional_sector'].apply(lambda x: ' '.
    ↳join([word for word in x if word not in (stop_words)]))

data['student_course'] = data['student_course'].str.replace('[^\w\s]', '', regex=
    ↳True)
data['student_course'] = data['student_course'].str.lower().str.split()
data['student_course'] = data['student_course'].apply(lambda x: ' '.join([word
    ↳for word in x if word not in (stop_words)]))
```

```
display(data.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 17 entries, 0 to 16
Data columns (total 14 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   Timestamp                            17 non-null    datetime64[ns]
1   consent_obtained                     17 non-null    category
2   rq1_question                         17 non-null    int64
3   rq2_question                         17 non-null    int64
4   rating_response                      17 non-null    int64
5   prompt_entered                      17 non-null    object
6   prompt_obtainable_elsewhere         17 non-null    category
7   rq3_question                         17 non-null    int64
8   num_chatgpt_uses                    17 non-null    category
9   rating_comparison_other              17 non-null    int64
10  occupation_status                    17 non-null    category
11  education_level                      17 non-null    category
12  professional_sector                  17 non-null    object
13  student_course                      17 non-null    object
dtypes: category(5), datetime64[ns](1), int64(5), object(3)
memory usage: 2.1+ KB

None
```

## 4.1 Preview dataset in pre-processed format

```
[ ]: # Preview dataset in pre-processed format.
#-----
col_w_s = 23
col_w = [col_w_s,col_w_s,col_w_s,col_w_s]
h_fmt = 'keys'
t_fmt = 'simple'
s_index = False

print(tabulate(
    data.iloc[:, :4].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

Timestamp	consent_obtained	rq1_question	rq2_question
-----	-----	-----	-----
2023-07-04 16:59:44	Yes	1	1
2023-07-04 18:29:44	Yes	1	1
2023-07-04 18:37:15	Yes	0	0
2023-07-05 02:26:17	Yes	1	1
2023-07-05 10:48:04	Yes	1	1

```
[ ]: # Preview dataset in pre-processed format - Part 2.
```

```
#-----
col_w_s = 17
col_w = [col_w_s,col_w_s,col_w_s,col_w_s]
h_fmt = 'keys'
t_fmt = 'simple'
s_index = False

print(tabulate(
    data.iloc[:,4:8].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

rating_response	prompt_entered	prompt_obtainable _elsewhere	rq3_question
-----	-----	-----	-----
4	asked explain principal orbital mechanics basic terms	Yes	1
4	various prompts generally philosophical conceptsbreakdown ideas	Yes	1
1	none	Yes	-1
4	asked chat gpt write story produce code unity games engine c etc	Yes	0
2	prompts usually give decent indicator want often riddled mistakes wrong information	Yes	1

```
[ ]: # Preview dataset in pre-processed format - Part 3.
```

```
#-----
col_w_s = 23
col_w = [col_w_s,col_w_s,col_w_s,col_w_s]
h_fmt = 'keys'
t_fmt = 'simple'
s_index = False

print(tabulate(
    data.iloc[:,8:12].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

num_chatgpt_uses	rating_comparison_other	occupation_status
education_level		
-----	-----	-----
21 Times or more Education	4	Working Professional Higher
21 Times or more Degree	5	Student Bachelor's
0 - 5 Times Degree	0	Student Bachelor's
6 - 10 Times Degree	5	Unemployed Bachelor's
21 Times or more Education	3	Working Professional Higher

```
[ ]: # Preview dataset in pre-processed format - Part 4.
#-----
col_w_s = 23
col_w = [col_w_s,col_w_s,col_w_s,col_w_s]
h_fmt = 'keys'
t_fmt = 'simple'
s_index = False

print(tabulate(
    data.iloc[:,12:14].head()
    ,headers = h_fmt
    ,tablefmt = t_fmt
    ,showindex = s_index
    ,maxheadercolwidths = col_w
    ,maxcolwidths = col_w
))
```

```
professional_sector    student_course
-----
utilities
                        philosophy
                        biology teacher teach
                        highscool kids biology
software development
```

Once the pre-processing of data was completed, the next stage was to perform initial descriptive analysis, based on what was set out in the paper:

1. How many participants found ChatGPT enhanced their knowledge? What percentage of the population reported knowledge enhancement, and the percentage where it did not.
2. Among participants who reported knowledge enhancement, how many now use ChatGPT for knowledge acquisition?



## 5 Initial Summary Statistics and Descriptive Analysis

### 5.1 Initial Summary Statistics

```
[ ]: # Number of respondents who participated in survey.
#-----
total_participants = data.shape[0]
print('Number of respondents participated in survey: ',total_participants)

# Number of questions used in survey
#-----
total_questions = data.shape[1] - 1 if 'Timestamp' in data.columns else data.
↳shape[1]
print('Number of questions used in survey: ',total_questions)

# Produce ydata-profiler report with configuration, to show as appendix
#-----
data_profile = ProfileReport\
(
    data
    # Apply correlations potentially useful to explore
    #-----
    ,correlations = {
        "pearson": {"calculate": False}
        , "phi_k": {"calculate": True}
        , "spearman": {"calculate": False}
        , "kendall": {"calculate": False}
        , "cramers": {"calculate": True}
    }
    ,infer_dtypes = True
    ,interactions = None
    ,missing_diagrams = None
    ,title = "ChatGPT: The advancement of knowledge and incorporation for
↳its users"
    ,dataset = {
        "author" : "Louis Othen"
        , "description": "Data of participant responses
↳downloaded from Google Forms survey tool."
    }
    ,dark_mode=True
)
# Update report to include descriptions as to what variables relate to.
#-----
data_profile.config.variables.descriptions = \
{
    "Timestamp": "Date and time of participant survey submission"
```

```

    , "consent_obtained": "Related to question: Based on the above, please
    ↪confirm that you are happy to provide consent and to proceed with this
    ↪survey as a participant?"
    , "rq1_question": "RQ1 - Related to question: Can you confirm if you have
    ↪used ChatGPT previously?"
    , "rq2_question": "RQ2 - Related to question: When you used ChatGPT - based
    ↪on the prompt you entered - did the response help enhance your knowledge in
    ↪that area?"
    , "rating_response": "Related to question: Based on the response you received
    ↪from ChatGPT, how would you rate the response you were provided?"
    , "prompt_entered": "Related to question: Can you describe - in a few words -
    ↪what prompt you provided ChatGPT to answer based on above?"
    , "prompt_obtainable_elsewhere": "Related to question: With the prompt you
    ↪entered, do you believe you could of obtained the information you wanted
    ↪elsewhere?"
    , "rq3_question": "RQ3 - Related to question: If ChatGPT did enhance your
    ↪knowledge, have you used it more into your day-to-day routine since?"
    , "num_chatgpt_uses": "Related to question: How many times approximately,
    ↪have you used ChatGPT since you have been aware of it? "
    , "rating_comparison_other": "Related to question: Based on previous ChatGPT
    ↪use, how would you compare it with platforms such as Google, Youtube, or
    ↪other method in terms of ease for acquiring knowledge on a particular topic?"
    , "occupation_status": "Related to question: Please confirm your occupational
    ↪status"
    , "education_level": "Related to question: Please describe your level of
    ↪education"
    , "professional_sector": "Related to question: In a few words, what industry
    ↪sector closely aligns with the sector you currently work within?"
    , "student_course": "Related to question: In a few words, please describe the
    ↪course you are studying?"
}
# Download copy of report into a HTML file.
#-----
data_profile.to_file('Dissertation EDA - Louis Othen.html')

```

Number of respondents participated in survey: 17

Number of questions used in survey: 13

Summarize dataset: 0%| | 0/5 [00:00<?, ?it/s]

Generate report structure: 0%| | 0/1 [00:00<?, ?it/s]

Render HTML: 0%| | 0/1 [00:00<?, ?it/s]

Export report to file: 0%| | 0/1 [00:00<?, ?it/s]

## 5.2 Descriptive Analysis

This section covers the analysis to answer the research questions raised in this research.

### 5.2.1 RQ1 - How many Participants are using ChatGPT?

```
[ ]: #=====
# RQ1 - How many participants used ChatGPT?
#-----

# Group counts based on either Yes(1) or No(0).
#-----
rq1_counts = data['rq1_question'].value_counts()

# Show percentage proportion of the population each group holds.
#-----
rq1_pcts = (rq1_counts / rq1_counts.sum())

# View proportion of results.
#-----
print(rq1_counts,rq1_pcts * 100)

# Create pie chart to visualise results.
#-----
fig = px.pie\
(
    values = rq1_counts
    #,names = rq1_counts.index
    ,names = ['Yes','No']
    ,labels = rq1_pcts
    ,hole = .5
    ,color_discrete_sequence = px.colors.carto.Prism
    ,width = 600
)

# Update pie chart layout.
#-----
fig.update_layout\
(
    margin=dict(l=20,r=20,t=20,b=20)
    ,font=dict(family = "times New Roman",size = 18,color = '#000000')
)

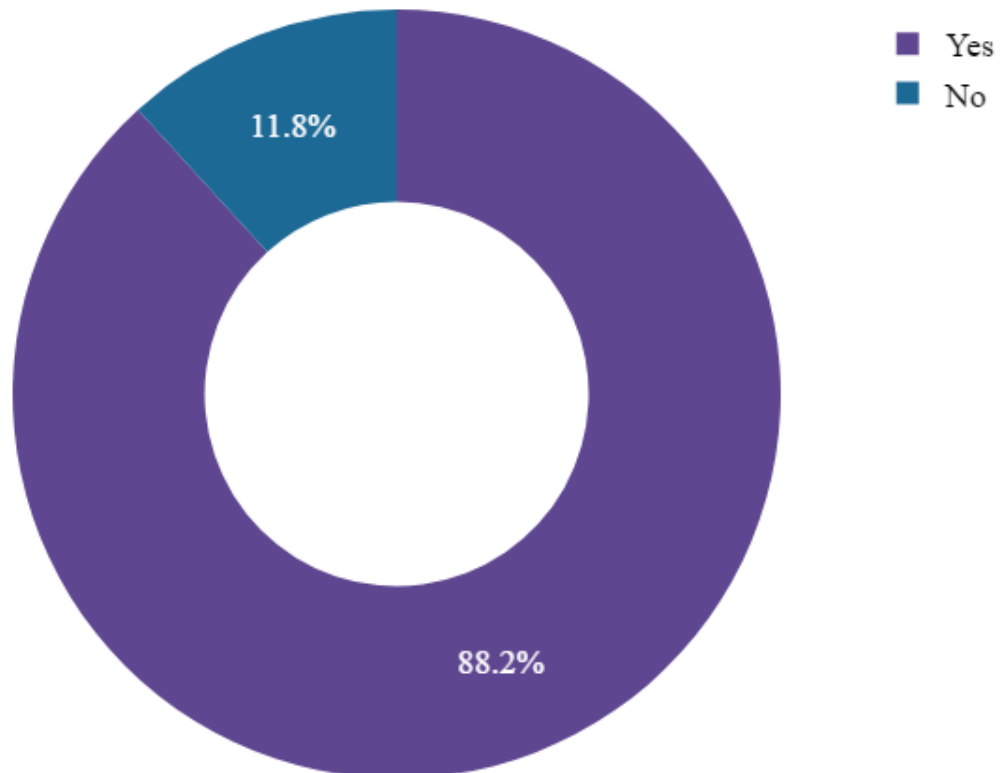
# Used to preview chart and save as image.
#-----
#fig.show()

# Import previously saved chart image to render into pdf format.
```

```
#-----  
Image('Figure 1 - RQ1 - Dissertation - LouisOthen.png')
```

```
rq1_question  
1      15  
0       2  
Name: count, dtype: int64 rq1_question  
1      88.235294  
0      11.764706  
Name: count, dtype: float64
```

```
[ ]:
```



### 5.2.2 RQ2 - If ChatGPT is being used by the participant, did the use of it enhance a user's knowledge?

```
[ ]: #=====
# RQ2 - If ChatGPT is being used by the participant, did the use of it enhance
    ↳ a user's knowledge?
#-----

# Subset data where ChatGPT was used.
#-----
data_used_chatgpt = data.query("rq1_question == 1")

# Group counts based on either Yes(1) or No(0).
#-----
rq2_counts = data_used_chatgpt['rq2_question'].value_counts()

# Show percentage proportion of the population each group holds.
#-----
rq2_pcts = (rq2_counts / rq2_counts.sum())

# View proportion of results.
#-----
print(rq2_counts,rq2_pcts * 100)

# Create pie chart to visualise results.
#-----
fig = px.pie\
(
    values = rq2_counts
    ,names = rq2_counts.index
    ,labels = rq2_pcts
    ,hole = 0
    ,color_discrete_sequence = px.colors.carto.Darkmint_r
)

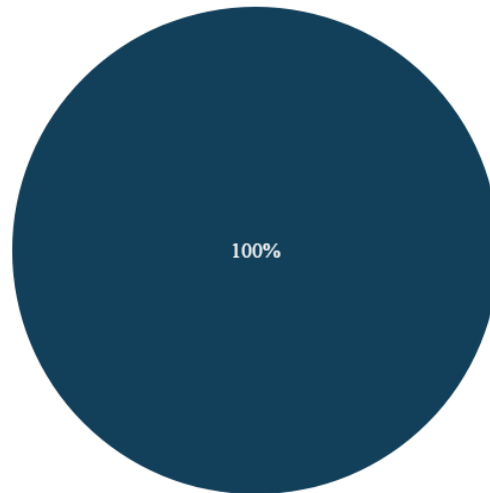
# Update pie chart layout.
#-----
fig.update_layout\
(
    margin=dict(l = 20,r = 20,t = 20,b = 20)
    ,font=dict(family = "times New Roman",size = 18,color = '#000000')
)

# Used to preview chart and save as image.
#-----
fig.show()
```

```
# Import previously saved chart image to render into pdf format.  
#-----  
Image('RQ2 - Dissertation - Louis0then.png')
```

```
rq2_question  
1      15  
Name: count, dtype: int64 rq2_question  
1      100.0  
Name: count, dtype: float64
```

```
[ ]:
```



■ 1

### 5.2.3 RQ3 - If ChatGPT did enhance a user's knowledge, has ChatGPT been adopted by the user for routine knowledge acquisition?

```
[ ]: #=====
# RQ3 - If ChatGPT did enhance a user's knowledge, has ChatGPT been adopted by
↳ the user for routine knowledge acquisition?
#-----

# Subset data where knowledge enhancement was reported.
#-----
data_enhanced_knowledge = data.query("rq2_question == 1")

# Group counts based on either Yes(1) or No(0).

rq3_counts = data_enhanced_knowledge['rq3_question'].value_counts()

# View percentage proportion of the population each group holds.
#-----
rq3_pcts = (rq3_counts / rq3_counts.sum())
print(rq3_counts,rq3_pcts * 100)

# Create pie chart to visualise results.
#-----
fig = px.pie\
(
    values = rq3_counts
    ,names = ['Yes','No']
    ,labels = rq3_pcts
    ,hole = 0.5
    ,color_discrete_sequence = px.colors.cmocean.delta
    ,width = 600
)

# Update pie chart layout.
#-----
fig.update_layout\
(
    margin=dict(l = 20,r = 20,t = 20,b = 20)
    ,font=dict(family = "times New Roman",size = 18,color = '#000000')
)

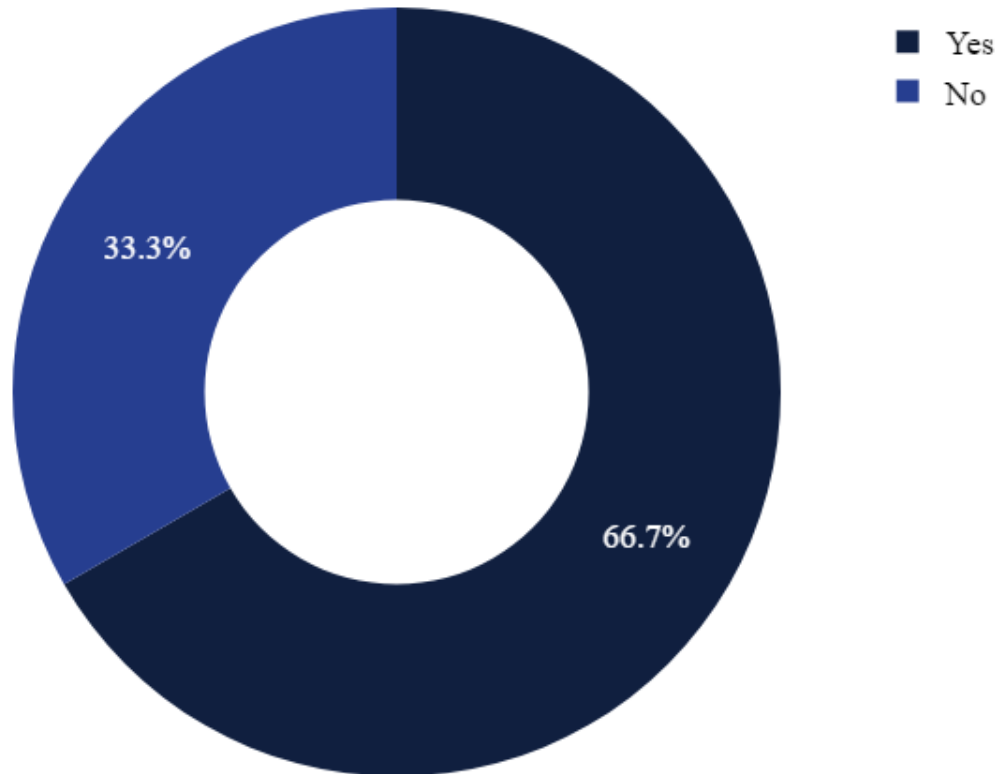
# Used to preview chart and save as image.
#-----
#fig.show()

# Import previously saved chart image to render into pdf format.
#-----
```

```
Image('Figure 2 - RQ3 - Dissertation - Louis0then.png')
```

```
rq3_question
1      10
0       5
Name: count, dtype: int64 rq3_question
1      66.666667
0      33.333333
Name: count, dtype: float64
```

```
[ ]:
```



Now the descriptive analysis is applied against the research questions, the next section looks to answer the research hypotheses proposed.



## 6 Hypothesis Testing and Pearson's Correlation Coefficient

### 6.1 Binomial Test - RH1 - The utilisation of ChatGPT increases the likelihood of enhancing a user's knowledge on a specific topic.

```
[ ]: # Bring in responses where they have used ChatGPT before.
#-----
rh1_data = data.query("rq1_question == 1")

# Use series of responses on knowledge enhancement for a user.
#-----
rh1_data = rh1_data['rq2_question']

# Show output from rh1 series.
#-----
#print(rh1_data, '\n')

# Store number of successes from rh1_data.
#-----
rh1_successes = sum(rh1_data)

# Store total number of trials from rh1_data.
#-----
rh1_trials = len(rh1_data)

# Assumption of null hypothesis, only 50% or less of participants reported
↳ knowledge enhancement from ChatGPT.
#-----
rh1_probability = 0.5

# Perform Binomial Test and record p-value.
#-----
rh1_p_value = binom_test(
    x = rh1_successes
    ,n = rh1_trials
    ,p = rh1_probability
    ,alternative='greater'
)

print('Number of successes: ', rh1_successes)

print('Number of trials: ',rh1_trials,'\n')

print(
    'p-value from binomial hypothesis test:'
    ,np.format_float_positional(rh1_p_value,trim = '-')
)
```

```
# Confirm if Null hypothesis rejected.
#-----
if rh1_p_value < 0.05:
    print('Therefore, hypothesis RH1 is accepted and the null hypothesis is_
    ↪rejected.')
elif rh1_p_value >= 0.05:
    print('Therefore, hypothesis RH1 is rejected and failed to reject the null_
    ↪hypothesis.')
```

Number of successes: 15

Number of trials: 15

p-value from binomial hypothesis test: 0.000030517578125

Therefore, hypothesis RH1 is accepted and the null hypothesis is rejected.

## 6.2 Binomial Test - RH2 - Users who perceive ChatGPT as enhancing their knowledge are more likely to incorporate ChatGPT into their routine for knowledge acquisition compared to those who do not perceive ChatGPT as enhancing their knowledge.

```
[ ]: # Bring in responses where knowledge enhancement was found.
#-----
rh2_data = data.query("rq2_question == 1")

# Use series of responses on knowledge enhancement for a user.
#-----
rh2_data = rh2_data['rq3_question']

# Show output from rh1 series.
#-----
#print(rh2_data)

# Store number of successes from rh1_data.
#-----
rh2_successes = sum(rh2_data)

# Store total number of trials from rh1_data.
#-----
rh2_trials = len(rh2_data)

# Assumption of null hypothesis, only 50% or less of participants reported
↳ incorporation of ChatGPT.
#-----
rh2_probability = 0.5

# Perform Binomial Test and record p-value.
#-----
rh2_p_value = binom_test(
    x = rh2_successes
    ,n = rh2_trials
    ,p = rh2_probability
    ,alternative= 'greater'
)

print('Number of successes: ',rh2_successes)

print('Number of trials: ',rh2_trials)

print(
    'p-value from binomial hypothesis test:'
    ,np.format_float_positional(rh2_p_value,trim = '-')
)
```

```
# Confirm if Null hypothesis rejected.
#-----
if rh2_p_value < 0.05:
    print('Therefore, hypothesis RH2 is accepted and the null hypothesis is_
    ↪rejected.')
elif rh2_p_value >= 0.05:
    print('Therefore, hypothesis RH2 is rejected and failed to reject the null_
    ↪hypothesis.')
```

Number of successes: 10

Number of trials: 15

p-value from binomial hypothesis test: 0.15087890624999997

Therefore, hypothesis RH2 is rejected and failed to reject the null hypothesis.

### 6.3 RH2 - Pearsons Correlation Coefficient

```

[ ]: # Bring results of RQ2 and RQ3 questions in data.
#-----
data_for_corr = data[['rq2_question','rq3_question']]

# Show results of pandas.DataFrame.corr.
#-----
print(data_for_corr.corr(method = 'pearson'))

# Compute pearsonr function from the scipy.stats package.
#-----
pearson_results = pearsonr(data['rq2_question'],data['rq3_question'])

# Create correlation matrix to visualise results.
#-----
fig = px.imshow(
    data_for_corr.corr(method='pearson')
    ,text_auto = True
    ,title = f"p-value: {pearson_results.pvalue}"
    ,width = 600
)

# Update chart layout.
#-----
fig.update_layout(
    margin=dict(l=25, r=25, t=25, b=25)
    ,title=dict(
        font=dict(
            family = "Times New Roman",
            size = 18,
            color = '#000000'
        )
    )
    ,font=dict(
        family = "times New Roman"
        ,size = 18
        ,color = '#000000'
    )
)

# Used to preview chart and save as image.
#-----
#fig.show()

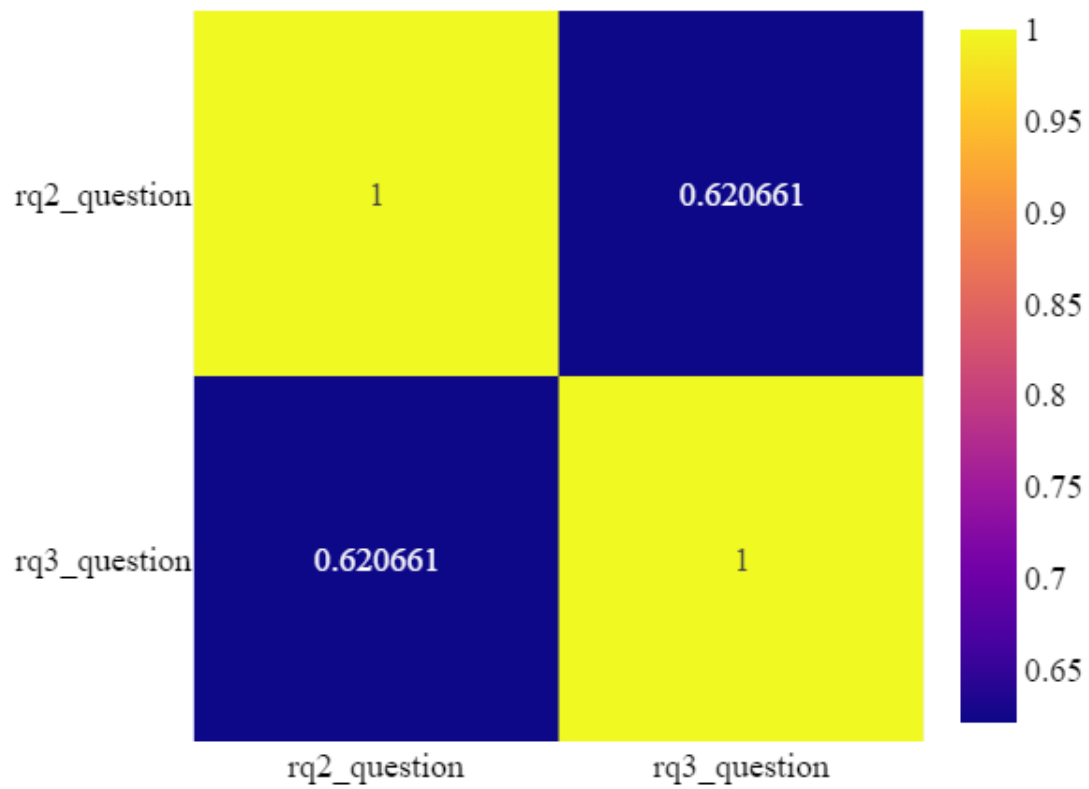
# Import previously saved chart image to render into pdf format.
#-----
Image('Figure 3 - RH2 - Dissertation - LouisOthen.png')

```

rq2\_question rq3\_question

```
rq2_question    1.000000    0.620661
rq3_question    0.620661    1.000000
```

[ ]: p-value: 0.00784681907214592



## 7 Output Processed Dataset

```
[ ]: data.to_csv(folderPath + 'DissertationOutput.csv')
```

## 8 Additional Insights

### 8.1 Rating ChatGPT Response

```
[ ]: # Create histogram, showing how ChatGPT responses were rated.
#-----
fig = px.histogram(
    data_frame = data['rating_response']
    , text_auto = True
    ,nbins = 6
    ,width = 600
    ,color_discrete_sequence = ['purple']
)

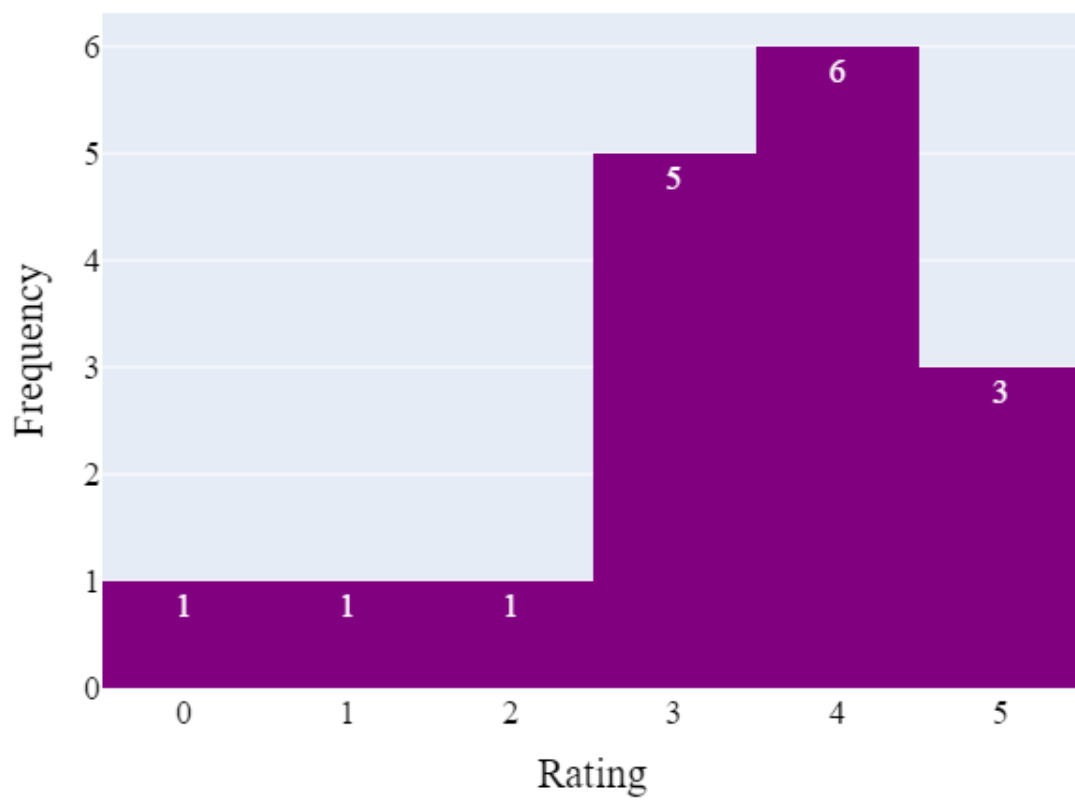
# Update chart layout.
#-----
fig.update_xaxes(title_text = 'Rating')
fig.update_yaxes(title_text = 'Frequency')
fig.update_traces(showlegend = False)
fig.update_layout(
    margin = dict(l = 25,r = 25,t = 25,b = 25)
    ,font = dict(family = "times New Roman",size = 18,color_
↵='#000000')
)

# Used to preview chart and save as image.
#-----
#fig.show()

# Import previously saved chart image to render into pdf format.
#-----
Image('Figure 4 - Rating ChatGPT Response - Louis0then.png')
```

```
[ ]:
```





## 8.2 Comparing ChatGPT to other tools

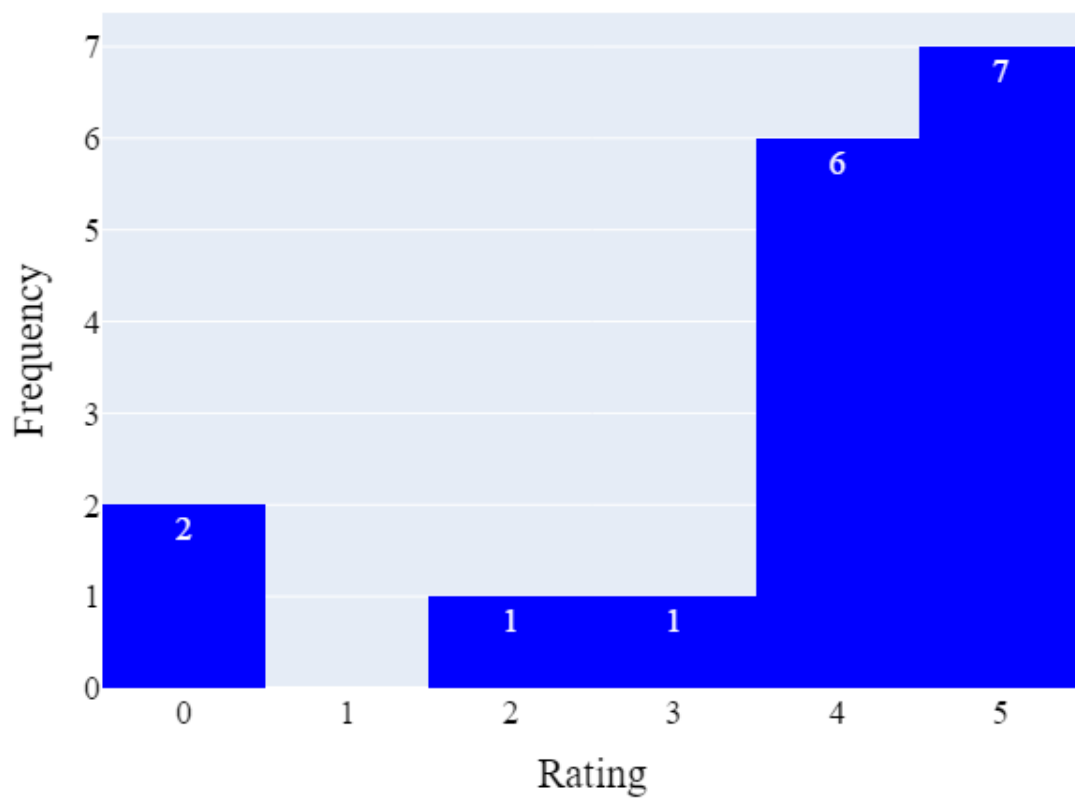
```
[ ]: # Create histogram, showing rating of comparison of ChatGPT to other tools.
#-----
fig = px.histogram(
    data_frame = data['rating_comparison_other']
    ,text_auto = True
    ,nbins = 6
    ,width = 600
    ,color_discrete_sequence = ['blue']
)

# Update chart layout.
#-----
fig.update_xaxes(title_text = 'Rating')
fig.update_yaxes(title_text = 'Frequency')
fig.update_traces(showlegend = False)
fig.update_layout(
    margin=dict(l=25, r=25, t=25, b=25)
    ,font=dict(family = "times New Roman",size = 18,color_
↵='000000')
)

# Used to preview chart and save as image.
#-----
#fig.show()

# Import previously saved chart image to render into pdf format.
#-----
Image('Figure 5 - Comparing ChatGPT to other tools - LouisOthen.png')
```

[ ]:



# Overview



Overview

Dataset

Variables

Alerts17

Reproduction

Dataset statistics

Number of variables

14

Number of observations

17

Missing cells

0

Missing cells (%)

0.0%

Duplicate rows

0

Duplicate rows (%)

0.0%

Total size in memory

2.1 KiB

Average record size in memory

127.4 B

Variable types

DateTime

1

Categorical

10

Numeric

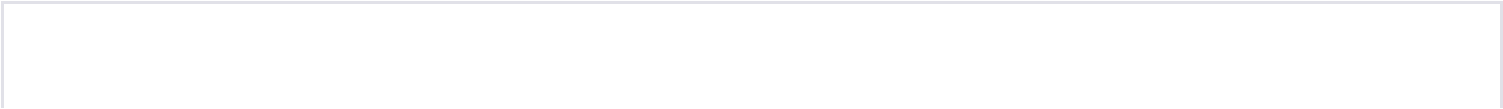
1

Text

2

Please click box on top right for an interactive version. Viewable only through PDF software.

# Variables



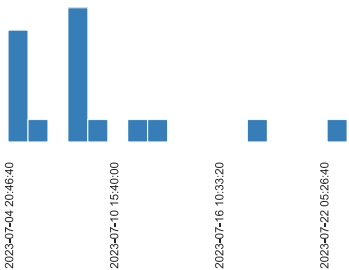
Timestamp

Date

HIGH CORRELATIONUNIQUE

Date and time of participant survey submission

Distinct	17	Minimum	2023-07-04 16:59:44
Distinct (%)	100.0%	Maximum	2023-07-23 09:05:33
Missing	0		
Missing (%)	0.0%		
Memory size	268.0 B		



More details

consent\_obtained

Categorical

CONSTANT

Related to question: Based on the above, please confirm that you are happy to provide consent and to proceed with this survey as a participant?

Distinct	1	Yes	17
Distinct (%)	5.9%		
Missing	0		
Missing (%)	0.0%		

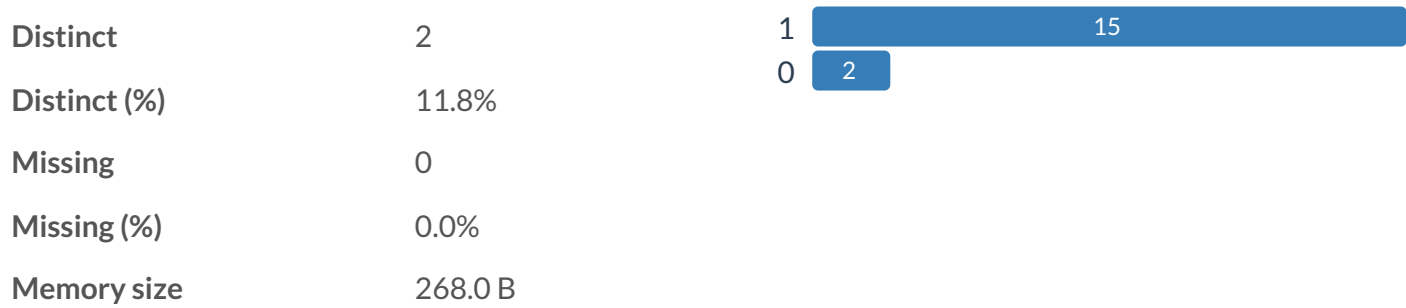
More details

rq1\_question

Categorical

HIGH CORRELATION

RQ1 - Related to question: Can you confirm if you have used ChatGPT previously?



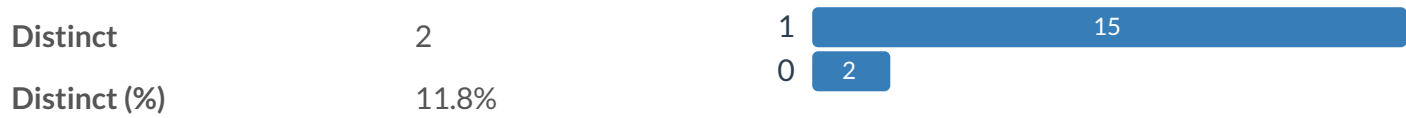
More details

rq2\_question

Categorical

HIGH CORRELATION

RQ2 - Related to question: When you used ChatGPT - based on the prompt you entered - did the response help enhance your knowledge in that area?



Memory size 268.0 B

More details

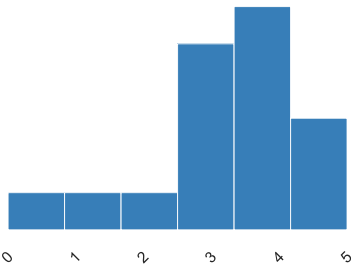
rating\_response

Real number ( $\mathbb{R}$ )

HIGH CORRELATION ZEROS

Related to question: Based on the response you received from ChatGPT, how would you rate the response you were provided?

Distinct	6	Minimum	0
Distinct (%)	35.3%	Maximum	5
Missing	0	Zeros	1
Missing (%)	0.0%	Zeros (%)	5.9%
Infinite	0	Negative	0
Infinite (%)	0.0%	Negative (%)	0.0%
Mean	3.3529412	Memory size	268.0 B



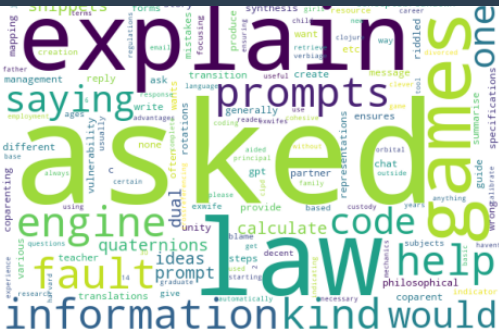
More details

prompt\_entered

Text

HIGH CORRELATION UNIQUE

Distinct (%)	100.0%
Missing	0
Missing (%)	0.0%
Memory size	268.0 B



More details

prompt\_obtainable\_elsewhere

Categorical

HIGH CORRELATION

Related to question: With the prompt you entered, do you believe you could of obtained the information you wanted elsewhere?

Distinct	3
Distinct (%)	17.6%
Missing	0
Missing (%)	0.0%
Memory size	281.0 B

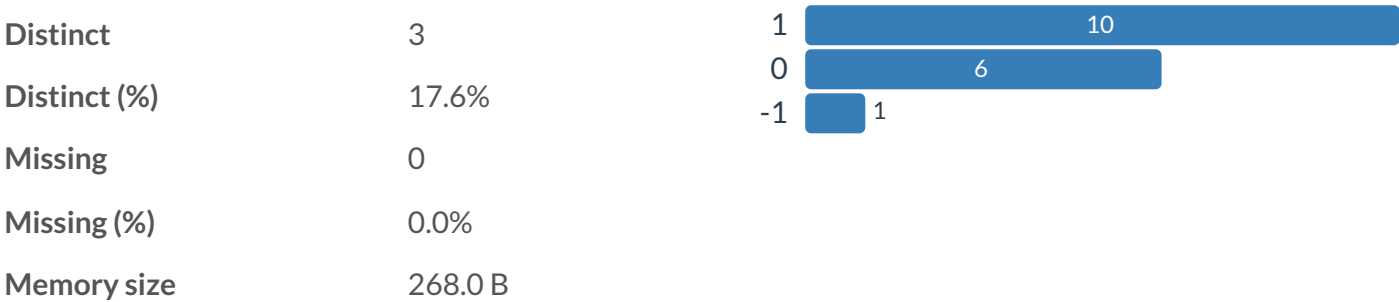


More details



HIGH CORRELATION

RQ3 - Related to question: If ChatGPT did enhance your knowledge, have you used it more into your day-to-day routine since?



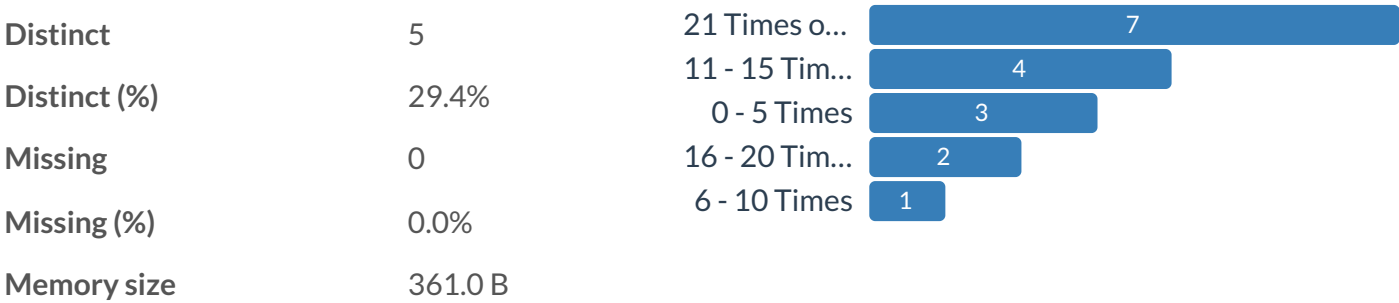
More details

num\_chatgpt\_uses

Categorical

HIGH CORRELATION

Related to question: How many times approximately, have you used ChatGPT since you have been aware of it?

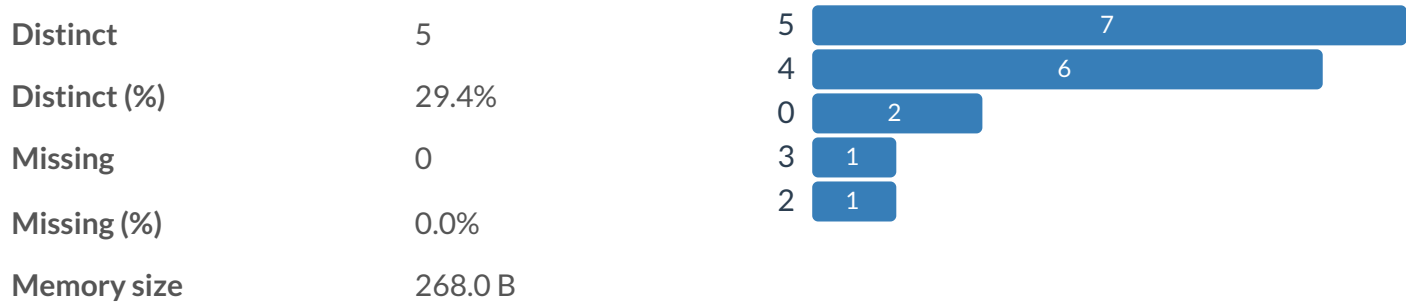


More details

Categorical

HIGH CORRELATION

Related to question: Based on previous ChatGPT use, how would you compare it with platforms such as Google, Youtube, or other method in terms of ease for acquiring knowledge on a particular topic?



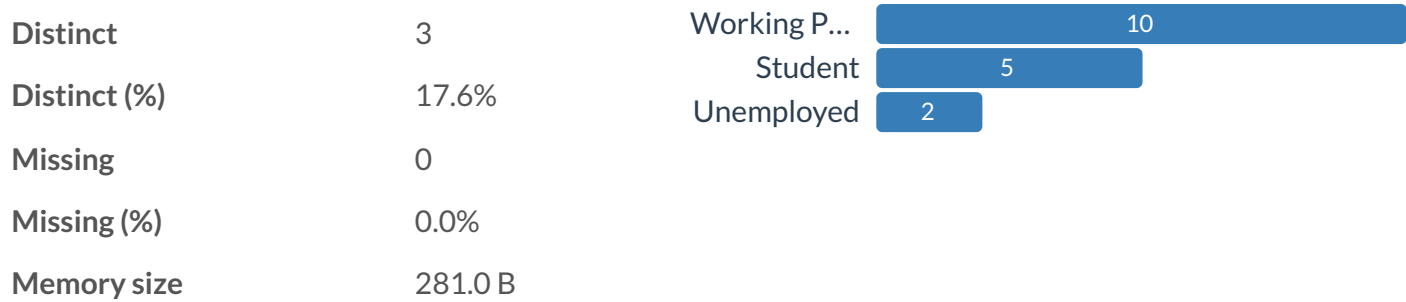
More details

occupation\_status

Categorical

HIGH CORRELATION

Related to question: Please confirm your occupational status



education\_level

Categorical

HIGH CORRELATION

Related to question: Please describe your level of education

Distinct	3	Bachelor's ...	9
Distinct (%)	17.6%	Higher Edu...	6
Missing	0	Master's D...	2
Missing (%)	0.0%		
Memory size	281.0 B		

More details

professional\_sector

Text

HIGH CORRELATION

Related to question: In a few words, what industry sector closely aligns with the sector you currently work within?

Distinct	11
Distinct (%)	64.7%
Missing	0
Missing (%)	0.0%
Memory size	268.0 B



More details

student\_course

Categorical

HIGH CORRELATION

Related to question: In a few words, please describe the course you are studying?

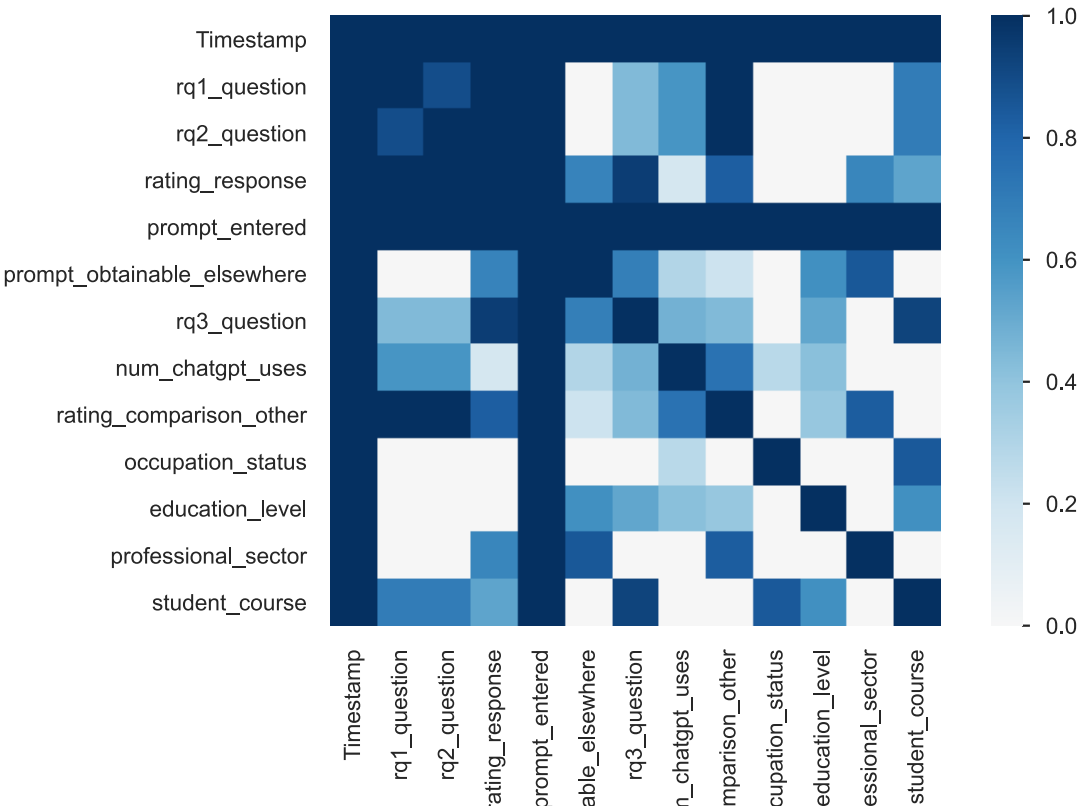
Distinct	6		12
Distinct (%)	35.3%	philosophy	1
Missing	0	biology tea...	1
Missing (%)	0.0%	msc compu...	1
Memory size	268.0 B	msc compu...	1

More details

Correlations

Heatmap

Table



Sample

	Timestamp	consent_obtained	rq1_question	rq2_question	rating_response	
0	2023-07-04 16:59:44	Yes	1	1	4	
1	2023-07-04 18:29:44	Yes	1	1	4	
2	2023-07-04 18:37:15	Yes	0	0	1	
3	2023-07-05 02:26:17	Yes	1	1	4	
4	2023-07-05 10:48:04	Yes	1	1	2	
5	2023-07-05 22:25:05	Yes	1	1	5	
6	2023-07-08 00:49:44	Yes	1	1	3	
7	2023-07-08 10:50:39	Yes	1	1	5	
8	2023-07-08 11:59:59	Yes	1	1	3	
9	2023-07-08 13:54:40	Yes	1	1	3	

This document is also available in Welsh

## Ethical approval of research projects in online programmes

There are 3 routes for review and approval:

1. RESC (Research Ethics Sub-Committee) - for staff and postgraduate research student proposals involving human subjects; all research involving animals, and all research requiring formal external approval [use the full RESC application form]
2. Staff and postgraduate research students Low Risk research [i.e. not covered by 1. above – use a Checklist and Cover Sheet form]
3. **Research done by undergraduate and online Masters students [use a Checklist and Cover Sheet form]**

**All proposals through all routes involve completing the relevant sections of the Checklist, to highlight any potential ethical risk factors.**

Programme	MSc Computer Science with Big Data Analytics (ONLCDA - MSc Computer Science with Big Data Analytics)		
Module	CONL718		
Student Name	Louis Othen	Student ID	S21002027
Research Project Title	ChatGPT: The advancement of knowledge and incorporation for its users.		

I give approval for this research project to proceed, on the grounds that:

- it is consistent with the programme specification
- a suitable and sufficient risk assessment has been carried out
- the checklist has been fully completed
- it does not contain any ethical risk factors which may cause harm of any kind to research subjects, the researcher, the University or any other person or organisation

**AND/OR**

any risk factors have been clearly identified and appropriate measures put in place for their management and mitigation

- where relevant, appropriate and robust plans have been made to gain informed consent from prospective research subjects
- it is not required to be submitted for approval to the Research Ethics Sub-Committee

Project Tutor Name	Subrahmaniam Krishnan-Harihara		
Signature	<i>Subrahmaniam Krishnan-Harihara</i>	Date	04/07/2023

**Significant changes**

I approve the changes proposed by the student, on the grounds specified above.

Project Tutor Name			
Signature		Date	

**Notes:**

1. This form must be completed before primary data collection / experimental work begins.
2. The Checklist which follows must be fully completed.
3. The person approving the research must be satisfied that any ethical risk factors have been clearly identified and appropriate measures put in place for their management and mitigation.
4. This signed form should be filed with the student's project proposal.

5. The University's Code of Practice on Ethical Standards for Research is available at:  
<https://moodle.glyndwr.ac.uk/course/view.php?id=26703>



## Glyndŵr University - Checklist for ethical approval of a research project

### Checklist 1 – to be completed for ALL proposals [answer ALL questions]

	Yes	No
1. Does the research comply with the University's Code of Practice on Ethical Standards for Research? [ <a href="https://moodle.glyndwr.ac.uk/course/view.php?id=26703">https://moodle.glyndwr.ac.uk/course/view.php?id=26703</a> ]	X	
2. Does this research comply with the requirements of any relevant professional body's code of conduct? [If Not Applicable, mark 'Yes']	X	
3. Has a suitable and sufficient risk assessment been carried out (including potential harm to the researcher)?	X	
4. Will the study require the co-operation of a 'gatekeeper' for initial permission / access to the people, animals, places, data, or other resources required for the research?		X
5. Does this research require the formal approval of an external body <sup>1</sup> ?		X
6. Could the research have an impact on people living or working in the immediate locality?		X
7. Will anyone other than the researcher (the applicant) and the research supervisor (if relevant) have access to the raw data produced by the research?		X
8. Is there a sponsor?		X
9. Is there a collaborating organisation?		X
10. Will any research be undertaken outside UK legal jurisdiction?		X
11. Will your research involve investigation of or engagement with terrorist or violent extremist groups?		X
12. Will your research and its findings have any potential in relation to furthering extremist ideology or causes and/or will any process or artefact produced have potential to be used to further extremist ends?		X

### Does the proposed research:-

	Yes	No
Directly involve people? (go to Checklist 2)	X	
Directly involve animals or animal by-products? (go to Checklist 3)		X
Have a potential impact on the environment? (go to Checklist 4)		X

Checklist 2 Research directly involving people [answer ALL questions]	Yes	No
13. Will you use Social Media to interact with participants?	X	
14. Does the study involve NHS patients, staff or premises? <sup>1</sup>		X
15. Does the study involve participants who are particularly vulnerable (e.g. children, victims of crime, homeless, mental illness etc.)? Please read carefully the Code of Practice.		X
16. Does the study involve participants who would find it difficult to give informed consent (e.g. children, people with learning difficulties)? Please read carefully the Code of Practice.		X
17. Is a Disclosure and Barring Service (DBS) check required?		X
18. Will it be necessary for participants to take part in the study without their knowledge or consent at the time? (e.g. covert observation of people in non-public places)		X
19. Will the study require any deception of participants?		X

<sup>1</sup> If so, the proposal must have full RESC approval before the applicant applies to the external body. 'NHS patients' means people invited to take part in the research because of that status (now or previously).

<b>Checklist 2 Research directly involving people [answer ALL questions]</b>	<b>Yes</b>	<b>No</b>
20. Will the study involve discussion of topics which the participants may find sensitive? (e.g. sexual activity, personal drug use, income etc.)		X
21. Are there cultural or religious issues associated with the research?		X
22. Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		X
23. Are drugs, placebos or other substances (e.g. food substances, vitamins, Chinese medicine) to be administered to the study participants? <sup>2</sup>		X
24. Will the study involve invasive, intrusive or potentially harmful procedures of any kind? (e.g. Acupuncture, fitness testing)		X
25. Will blood or tissue samples be obtained from participants?		X
26. Does the proposed research involve human tissue or human embryos?		X
27. Is pain or more than mild discomfort to participants likely to result from the study?		X
28. Could the study induce psychological distress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?		X
29. Will the study involve prolonged or repetitive testing?		X

<b>Checklist 3: Research directly involving animals [answer ALL questions]</b>	<b>Yes</b>	<b>No</b>
30. Does the research involve any procedure that may have the potential effect of causing the animal(s) pain, suffering, distress or lasting harm? (regulated procedures under the terms of the Animals (Scientific Procedures) Act)		
31. Does the research involve a series of otherwise non-regulated procedures that together or cumulatively may cause that animal pain, suffering, distress or lasting harm?		
32. Does the research involve vertebrate animals or "Octopus Vulgaris" (protected animals under the terms of the Animals (Scientific Procedures) Act) <sup>3</sup>		
33. Does the research involve using any animal by-products or tissue?		
34. Does the research involve any procedure or intervention on the animal(s) that is not part of its/their normal management practice?		
35. Does the research involve movement of animals from one place to another?		
36. Does the research involve animals in the wild?		

<b>Checklist 4: Research having a potential impact on the environment [answer ALL questions]</b>	<b>Yes</b>	<b>No</b>
37. Do you have legal access / permission to work on the proposed site?		
38. Does the site have any legal designation (e.g. SSSI)?		
39. Could the research have an impact on the environment? (e.g. air / land / water contamination, damage to animal habitats)?		
40. Does the research involve working with any Genetically Modified Organisms? (e.g. GMOs in animal feeds)?		
41. Will you be importing plants, plant material, pests, soil or growing medium into the UK?		

<sup>2</sup> Clinical Trials are not covered by Glyndŵr University insurance and such studies will also need MHRA registration and to conform with EU Clinical Trials Directive (2001)

<sup>3</sup> The Animals (Scientific Procedures) Act 1986 is available at <https://moodle.glyndwr.ac.uk/course/view.php?id=26703>