Intro

State your RQ: At what age should individuals acquire a smartphone to minimize the negative impact on selected cognitive functioning abilities: at the age of 12 or after the age of 10?

State and operationalize independent and dependent variables (if applicable):

	What	**Operational Definition (How)**
Independent	Age of smartphone acquisition	The age at which an individual gets their own personal smartphone
Dependent	Cognitive functioning	This refers to 3 specific dimensions of cognitive functioning: Attention, Working Memory, Executive functioning

State your null and alternative hypothesis (if applicable):

Null	There is no significant difference in the impact on selected cognitive (Working Memory, Attention and Cognitive failures)functioning abilities between individuals who acquire a smartphone after the age of 10 and those who acquire it after the age of 12.
Alternative	There is a significant difference in the impact on selected cognitive functioning abilities (Working Memory, Attention and Cognitive failures) between individuals who acquire a smartphone after the age of 10 and those who acquire it after the age of 12.

Key points from lit review/background research:
Previous has mostly been focused on excessive use of smartphone and how variables linked to it like screen time can negatively impact facets of coginitive and behavioral development. Most studies involve screen time and how it impacts the aforementioned aspects of development negatively and causes associated pathologies. However, these studies do not consider how acquiring a personal smartphone or ownership of a phone can aggravate or impact these variables. For instance, owning a smartphone of their own increases screen time. The general variables and relations discusses in previous literature include:

1. Impact on Cognitive Functioning
Previous research has explored the impact of excessive smartphone use on cognitive functioning. This includes difficulties in cognitive-emotion regulation, impulsivity, impaired cognitive function, and reduced numerical processing capacity.

2. Emotional and Behavioral Effects:

Excessive smartphone use has been associated with emotional and behavioral effects, such as addiction to social networking, shyness, low self-esteem, conduct problems, hyperactivity, and inattention.

3. Sleep Patterns
Smartphone use, particularly before bedtime, has been found to disrupt sleep patterns. It can suppress the secretion of melatonin, a hormone critical for sleep regulation. This leads to later sleeping times and shorter sleep duration.

4. Brain Structure and Function
Studies have shown associations between smartphone use and brain activity, including the right amygdala's activity in adolescents. Excessive smartphone users may exhibit impairment in cognitive control during emotional processing and social interactions.

5. Attention and Impulsivity
Excessive smartphone use has been linked to impaired attention, increased impulsivity, and reduced inhibitory control. This can affect focus, motivation, and self-control.

6. Screen Time and Brain Development:
Research suggests that screen time, including smartphone use, can impact brain development in children and adolescents. It can lead to changes in brain structure, especially in regions associated with language, literacy skills, and cortical thickness.

7. Parental Influence:
Parental problematic smartphone use has been positively related to children's emotional and behavioral difficulties. Children may imitate their parents' behavior when it comes to screen time.

8. Screen Time Guidelines
Health organizations like the World Health Organization (WHO) recommend limited screen time for young children, with specific age-related guidelines, such as no screen time for children in their first year of life and limited screen time for those aged 2 to 4.

9. Moderating Factors:
Some studies have explored moderating factors, including smartphone dependency, the physical presence of the device, and the device's status (e.g., facing up or down, silent vs. off).

10. Screen Time and Behavioral Problems:
Screen time, including smartphone use, has been linked to both internalizing problems (e.g., depression and anxiety) and externalizing behavioral concerns (e.g., aggression).

11. Sleep and Desynchronizing:
Screen time, especially at night, can disrupt sleep patterns and desynchronize the body's internal clock, leading to hormonal imbalances and brain inflammation.

12. Stress Reactions:
Screen time, particularly excessive use, can induce stress reactions, both acute and chronic. This can result in hormone imbalances and affect mood regulation.

13. Sensory Overload and Attention:
Screen time can overload the sensory system, fracture attention, and deplete mental reserves. It can lead to difficulties in focusing and processing information effectively.

14. Outdoor Exposure
 Screen time can reduce exposure to outdoor environments, including nature. This reduced exposure may impact attention, lower stress levels, and contribute to aggression.

Previous literature has extensively examined the multifaceted impact of smartphone use on cognitive functioning, emotional and behavioral development, sleep patterns, brain structure and function, and various other factors. These studies have considered age, screen time duration, and specific cognitive domains as variables of interest. However, it's important to note that while some studies suggest negative impacts, others have reported mixed or nuanced findings, highlighting the complexity of this topic. The variable for ownership of a phone was not discussed which creates a knowledge gap that our project seeks to explore.

Methodology

State your design type (if applicable): Between group design with Cross sectional Correlational approach
- **Why we're using this**
  Three primary reasons we are choosing this design is because of its
  Efficiency: Cross-sectional studies are more efficient and quicker to conduct/long-term data collection is not possible. This method will help us collect data from two groups of pre-categorized individuals.
  Immediate Data: We are going to collect data from participants at a single point in time and analyze it immediately.
  Applicability: The findings can provide insights into the relationship between smartphone acquisition age and cognitive functioning in young adults.
  We are comparing cognitive functioning between two groups (those who acquired smartphones before 12 and those who acquired smartphones after the age of 12 years.

Outline your procedure:
1. A screening survey will be conducted to collect basic demographics.
2. Following the survey, if the participants meet the criteria, they'll be reached out to set a time for experiments/tests.
3. Digital versions of Digit Span Test and Wisconsin Card Sorting test will be used so that tests can be conducted remotely as well.
4. Once the data is collected, scores will be put together.

5. Scores of each participant will then be analysed to accept or reject the null hypothesis.

Following are the digital tests we plan on conducting:
<u>Attention and Working Memory</u>
To be measured by the following activities:
Digit Span Forward and Backward
   Website: https://tools.timodenk.com/digit-span-test -> consult literature to adjust timing between two numbers; has both forward and backwards

Another Version of the test:
https://www.psytoolkit.org/experiment-library/experiment_digitspan.html

Cognitive Failures Questionnaire (CFQ): Designed to measure subjective cognitive failures or lapses in everyday cognitive functioning
Includes items related to Memory Lapses (Forgetfulness of names, dates, or where objects are placed), Attention Lapses (Difficulty in sustaining attention, becoming easily distracted), Perception Lapses (Errors in visual or auditory perception, such as misjudging distances or mishearing spoken information), Motor Function Lapses (Coordination issues, clumsiness, or problems with fine motor skills), Executive Functioning Lapses (Difficulty in planning, organizing, and executing tasks)

State your sampling method:
   ● **Why you're using this: Stratified Sampling**
   ● **Specific characteristics you are looking for in your sample:**
      Young adults aged 18-25 (We are considering a younger population though)
      Those who acquired their smartphone before 12 and those who acquired (started owning) a smartphone after 12
      Belonging to Middle and Upper middle income families

Outline how you will get this sample:
   ● Divide target population into distinct strata based on these characteristics:
      Stratum 1: Young adults aged 18-25 with smartphone acquisition before 12 from middle and upper-middle-income families.
      Stratum 2: Young adults aged 18-25 with smartphone acquisition after 12 from middle and upper-middle-income families.

   ● Determine Sample Size
      Decide on the desired sample size for each stratum. May want to allocate a proportionate number of participants to each stratum based on the relative size of the subpopulations.

   ● Random Sampling Within Strata

For each stratum, use a random sampling method to select participants.

- Data Collection
  Once we have collected the demographic info via a survey, we will contact the selected participants and conduct the tests to collect cognitive functioning data.

- Analysis
  Lastly, we will analyze the data collected from the selected participants to examine the impact of smartphone acquisition age on cognitive functioning abilities within the specified income brackets.

In this study, we plan to employ a stratified sampling approach to obtain a representative sample of young adults aged 18-25. We are interested in examining the relationship between smartphone acquisition age and cognitive functioning abilities among individuals who belong to middle and upper-middle-income families.

Next, we will determine the sample size for each stratum. Within each stratum, we will use a random sampling method to select participants. This random selection process will be conducted independently for each stratum, ensuring that each eligible individual has an equal chance of being selected.

State and explain your control variables:

Variable	Why	How
Screen Time	Higher screen time was associated with lesser hours of sleep and hence poorer cognitive functioning (i.e. poor memory, deteriorated ability to recall)	One can control for screen time by measuring and accounting for the amount of time participants spend on various screens (smartphones, computers, tablets, etc.) in their analysis.
Content Type	Can be a mediator maybe Content type may mediate the relationship between smartphone usage and cognitive functioning. Certain content may have a different impact on cognitive abilities.	Categorize the content consumed on smartphones into relevant categories (e.g.educational, entertainment, social media) and furthermore analyze how these content types relate to cognitive abilities.
Peer Involvement/influence	Since we're conducting the study with adults, their use of smartphone is impacted by how people found them and their friends are using it.	One can consider including a measure of peer involvement or peer influence in the analysis, such as asking participants about the influence of their friends'

		smartphone use on their own.
socioeconomic status of families	Children of wealthier families may possess a higher chance of opportunities to be given a smartphone. Such as this, families with a lower income may not be able to provide their children with a smartphone against their will.	Collect data on participants' family socioeconomic status and consider this when analyzing the impact of smartphone usage on cognitive functioning.
Use of other devices	Other electronic devices like computers and iPads can expose children to the same type of information.	Include a variable that quantifies the use of other electronic devices and their impact
Parental Involvement in upbringing	Children who spend more time with their parents have less time on their own, and thus less need to. Use smartphones to entertain themselves. Also linked to screen time	Collect data on the level of parental involvement in upbringing and assess how it relates to smartphone usage and cognitive abilities
Current smartphone usage	Because our intended participant population are young adults, their later usage of phones may also impact their cognitive abilities.	Include data on participants' current smartphone usage to control for its influence.
Parental educational level	Based on how the children's parents were raised and educated may reflect back unto how their child is expected to behave. For example, if the parents had grown up learning literature solely through books, their children may be expected to do the same.	Include a variable for parental educational level and assess its potential impact on smartphone use.

Materials needed:
For in-person tests conduction, the researcher will set up the laptop and the internet.
For those participating remotely, they will be required to have a computer and good/stable internet connection.

Analysis

How will you analyze your data: