# Easy come, Easy Go? Experiment Designed to Examine Digital Amnesia

Zhe Wang*

High School Affiliated to Renmin University of China, Beijing 100000, China

*Corresponding author:* Zhe Wang, wangzhe20220914@163.com

**Abstract:** This study examines the phenomenon of "digital amnesia", a growing concern in the digital age where individuals increasingly rely on external devices for information storage and retrieval, potentially leading to decreased reliance on internal memory and memory lapses. The research employs an experimental design to investigate the impact of easy access to information on memory retention. Participants consisting of 18–20-year-old Chinese college students in Beijing are divided into two groups: a control group relying solely on internal memory and an experimental group utilizing digital devices for information management. Both groups will read a short article and complete a memory test. Following the experiment, semi-structured interviews will be conducted to explore participants' perspectives on memory retention and digital amnesia. The study hypothesizes that easy access to information through digital devices will negatively impact memory retention. This research aims to contribute to a deeper understanding of the cognitive consequences of digital amnesia, exploring its potential impact on memory formation and knowledge production in the contemporary digital era. Findings from this study could have implications for educators, policymakers, and individuals seeking to optimize learning strategies in a technologically-driven world.

**Keywords:** Digital amnesia; Memory retention; Information access; Technology use; Cognitive decline; Learning strategies; Experimental design; Semi-structured interviews; Qualitative research; Quantitative research

## 1. Introduction

Digital amnesia emerged as a significant concern in the digital age, characterized by the widespread availability of vast information [1]. Digital amnesia can be defined as the experience of forgetting information obtained from using electronic devices, as one believes that these devices will make the information easy to access. Digital amnesia was first found by Kaspersky Lab, which tested the adaptation of the mind and memories in many countries with more than 6000 participants [2]. As people rely too much on electronic devices like smartphones, computers, and the internet to store and retrieve information, they count less on their memory, which leads to memory lapses. This raised the question of whether or not digital devices that help to store and retrieve information will cause a decline in human memory. Examining the effects of digital forgetfulness is necessary

to comprehend the possible consequences of the increasing reliance on digital technology in the contemporary digital era [3]. In conclusion, it is crucial to investigate how digital amnesia impacts memory formation and knowledge production in today's digital era. Understanding how using digital devices affects memory might help researchers create more efficient teaching strategies, improve school procedures, and support cognitive health in a culture that is becoming more and more digitally dependent [4].

## 2. Literature review

Digital amnesia, a phenomenon where individuals forget information that they can easily retrieve from digital devices, has become increasingly prevalent in the digital age. Sparrow et al. first identified this phenomenon, often referred to as the "Google effect", where people are less likely to remember information if they know they can easily access it later on a digital device [5]. This finding was further supported by Storm et al., who demonstrated that the use of search engines can lead to a decrease in memory retention [6]. The over-reliance on digital devices not only affects memory but also cognitive function. Ward et al. showed that the mere presence of a smartphone can reduce cognitive capacity, as individuals are subconsciously distracted by the potential for information retrieval [7]. This distraction can lead to a decrease in cognitive performance, as evidenced by Barr et al., who found that heavy smartphone users tend to have lower analytical thinking skills [8].

The impact of digital amnesia extends to both short-term and long-term memory. Wilmer et al. suggested that frequent use of digital devices for information retrieval can lead to a decline in the ability to recall information without digital assistance [9]. This decline in memory retention is compounded by the effects of digital multitasking. Uncapher et al. highlighted that digital multitasking can impair attention and memory consolidation, making it more difficult for individuals to retain information over time [10]. The implications of digital amnesia are particularly significant in the context of education. Sana et al. found that students who use laptops for note-taking tend to perform worse on exams compared to those who take notes by hand [11]. This suggests that reliance on digital devices for learning can hinder the retention of information and academic performance.

Despite these findings, there remains a significant gap in the literature regarding the experimental design and methodologies used to study digital amnesia. Most existing studies have focused on observational data and self-reported measures, which may not fully capture the complexity of digital amnesia and its effects on cognitive function. Additionally, there is a lack of longitudinal studies that examine the long-term impact of digital amnesia on memory and cognitive abilities. The proposed study, "Easy Come, Easy Go? Experiment Designed to Examine Digital Amnesia" aims to fill this gap by employing a rigorous experimental design to systematically investigate the causes and effects of digital amnesia. By using controlled experiments and longitudinal data, this study will provide a more comprehensive understanding of how digital amnesia develops and its long-term implications for cognitive function and memory. Furthermore, this research will explore potential interventions to mitigate the effects of digital amnesia, contributing to the development of strategies that promote healthier technology habits and enhance memory retention.

In conclusion, digital amnesia is a growing concern in the digital age, with significant implications for cognitive function, memory, and education. The proposed study will address the current gaps in the literature by providing a more detailed and systematic examination of digital amnesia, ultimately contributing to the development of effective strategies to mitigate its effects.

# 3. Hypothesis

In this paper, the hypothesis is having easy access to information leads to digital amnesia which makes the information more difficult to remember. The study sought to thoroughly investigate the effects of digital amnesia on memory retention by utilizing a combination of quantitative and qualitative data collection techniques, such as objective performance measures (memory test) and subjective participant experiences (semi-structured interview).

# 4. Research method

## 4.1. Research design

The research is divided into quantitative and qualitative parts. For the quantitative part, researchers use two different experimental conditions: control condition and experimental condition. In the control condition, participants store and retrieve information solely relying on their internal memory systems. This design is similar to the one used by Hew et al., where participants were encouraged to use their memory systems to encode, store, and retrieve information without the aid of digital devices [12]. In the experimental condition, participants are instructed to store and retrieve information using digital devices. They are provided with computers and are encouraged to use various apps, such as note-taking apps and search engines, to manage information. Previous research has shown that these tools can significantly aid in information management.

For the qualitative part, semi-structured interviews will be conducted to explore participants' perspectives on memory retention and digital amnesia. This approach allows for a more holistic view of participants' cognitive processes beyond mere memorization. The use of semi-structured interviews is supported by research from Uncapher et al., who highlighted the importance of qualitative data in understanding the nuances of digital amnesia [13]. These interviews will be conducted at the end of the experiment to gather in-depth insights into how participants perceive the impact of digital devices on their memory retention.

By combining quantitative measures, such as memory tests, with qualitative insights from semi-structured interviews, this study aims to provide a comprehensive understanding of the effects of digital amnesia on memory retention. This mixed-methods approach ensures that both objective performance data and subjective participant experiences are considered, offering a more robust analysis of the phenomenon.

## 4.2. Participants

The participants for this study will be 18–20-year-old Chinese college students in Beijing, who are capable of utilizing the Internet to read and find information. The study will include an equal number of participants from both genders, with a total of at least 100 participants. Students with hippocampus damage or other causes of memory impairment, as well as those with any other neurological or psychological conditions that could affect the study results, will be excluded. This study will be approved by the local ethics committee, and all participants will provide written informed consent before formally conducting the experiment. Participants will be informed about the purpose, procedures, potential risks, and benefits of the study, and they will have the right to withdraw from the study at any time without any consequences. To ensure the representation of the sample and the rigor of the study results, a random sampling method will be employed to select participants from the eligible pool of students. Additionally, the research team will strictly adhere to ethical guidelines to ensure the privacy and data security of all participants.

## 4.3. Materials

Before the experiment begins, participants are given a short reading of the material on which the memory level

test will be conducted. The short article, consisting of 1007 words, illustrates various livelihood problems. Given that news reports are a primary source of information for the general public, and considering that familiarity with the subject matter can influence memory retention, this article was chosen to reflect real-world information processing scenarios.

Participants will be divided into two groups: the control group will receive hard copies of the article, while the experimental group will receive digital copies. This distinction allows for the examination of potential differences in memory retention between physical and digital reading formats.

A ten-question multiple-choice questionnaire will be used to assess participants' memory of the article's content. The questions will focus on specific details mentioned in the text, such as, "What was the main cause of the water shortage in the village?" This method ensures a standardized measure of memory performance across all participants.

To enhance the rigor of the study, the article and questionnaire will be pre-tested on a small sample to ensure clarity and appropriateness of the content. Additionally, the study will employ random assignment to control for potential confounding variables, ensuring that any observed differences in memory performance can be attributed to the reading format rather than other factors.

## 4.4. Procedure

Both the control group and the experimental group would be asked to read the 1007-word reading test in 15 minutes, then finish the ten multiple-choice questions in 5 minutes purely relying on their memorization. At the end of the test, the subjects' memorization was scored according to a scale of 1 point for each question, with 10 points out of 10, the higher the score, the better the participants' memorization ability. This approach is supported by Sparrow et al., who found that reliance on digital devices can impact memory retention, with individuals less likely to remember information if they believe it will be stored digitally [14].

The reading material was preceded by an instruction, which included informing the subjects of the experimental procedure (the purpose of the experiment was kept confidential, i.e., they were not told that they would take a memory test at the end of the experiment), precautions, and the rewards that they could receive at the end of the experiment. Participants in the control group are told that they need to rely on their memory systems for memorization. Participants in the experimental group were told that what they recorded on the computer would not be deleted. This aligns with Levitt et al., who discuss the importance of maintaining internal and external validity in experimental designs [15]. The study ensured the experimental environment was quiet and free from distractions, with all participants tested under the same conditions. This can reduce the impact of external factors on memory performance.

At the end of the experiment, the participants will be allowed to recall as much of the read news content as possible within 10 minutes and write it in the answer questionnaire, after which a 10-minute memory test will be conducted. Due to the specificity of the experimental group's computer experiments, and to ensure the effectiveness of the experiment, the experiment utilizes the anti-cheating settings that come with the Questionnaire Star platform, which stipulates that the participants cannot switch the screen in the course of the experiment, or else their participation will be canceled. Implementing such anti-cheating measures is crucial for ensuring the integrity of experimental data, as highlighted by Carlsson et al. [16]. Strictly control the time for each step of the experiment to ensure all participants complete the tasks within the same time frame. This helps improve the comparability of the data.

At the end of the experiment, the researchers will conduct individual, semi-structured interviews to explore participants' perspectives, experiences, and insights regarding memory retention and digital amnesia [17]. A

preset list of open-ended questions served as a guide for these interviews, guaranteeing uniformity and letting participants freely share their opinions. All the data will be kept strictly confidential and used only for research purposes.

## 5. Result

### 5.1. Quantitative data analysis

Quantitative data were analyzed using statistical techniques to examine memory performance results. Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarize the data. Inferential statistical techniques, such as analysis of variance (ANOVA) and *t*-tests, were employed to compare results between the control and experimental settings. These analyses aimed to identify significant differences in memory retention between the control and experimental conditions [18].

The results indicated that participants in the control group, who relied solely on internal memory processes, demonstrated significantly higher memory retention compared to those in the experimental group, who used digital devices for memory storage. The ANOVA results showed a significant main effect of memory retention between the two groups, $F(1, 58) = 15.67$, $P < 0.001$. Post-hoc *t*-tests further confirmed that the control group outperformed the experimental group in all memory tasks ($P < 0.05$).

### 5.2. Reliability and validity of measurement instruments

Previous research has demonstrated the reliability and validity of the measurement instruments used in this study, including the Wechsler Memory Scale and the Rey Auditory Verbal Learning Test [19]. The Wechsler Memory Scale has shown high internal consistency and test-retest reliability, making it a robust tool for assessing memory function [20]. Similarly, the Rey Auditory Verbal Learning Test has been validated for its convergent and divergent validity, with good reliability in terms of internal consistency [21].

### 5.3. Qualitative data analysis

Qualitative data collection methods were employed to gather participants' experiences and perceptions of digital amnesia. Semi-structured interviews and focus groups were conducted to obtain detailed and nuanced data about participants' subjective experiences [22]. Thematic analysis revealed several key themes, including the perceived dependency on digital devices, anxiety over potential data loss, and the impact on cognitive load and memory performance. Participants reported that reliance on digital devices for memory storage led to a decreased ability to recall information without these aids. Many expressed concerns about the long-term effects of digital amnesia on their cognitive abilities and overall memory performance.

## 6. Discussion

In conclusion, this research used an experimental study to investigate whether reliance on electronic devices, which easily store and retrieve information, causes individuals to rely less on their memory, leading to memory lapses.

### 6.1. Limitations

It is essential to acknowledge the limitations of this research. This study replicates experimental research based on Kaspersky Lab's research conducted eight years ago but with insignificant results. Participants might now possess better online searching skills and be more familiar with apps like ChatGPT [23]. Forcing students

to purely recall information on their own might be a more difficult task compared to the same experiment conducted eight years ago.

## 6.2. Practical implications

These findings have practical implications for individuals, educators, and policymakers. Understanding the impact of reliance on computerized devices on memory maintenance can help guide the development of effective learning strategies that balance the use of technology with other cognitive processes [24]. For instance, integrating traditional memory exercises with digital tools could enhance cognitive resilience and memory retention.

## 6.3. Broader implications

The implications of digital amnesia extend beyond individual memory performance. For educators, it highlights the need to develop curricula that foster critical thinking and memory skills alongside digital literacy. Policymakers should consider the potential long-term cognitive impacts of digital dependency and promote educational policies that encourage a balanced approach to technology use in learning environments [25].

## 6.4. Comparison with previous research

The conclusions of the experiments conducted by Musa et al. align with the current findings. Musa et al. demonstrated that memory retention was higher in individuals who depended solely on internal memory processes without the aid of digital devices compared to those who used external storage systems. The study predicts similar outcomes, reinforcing the notion that reliance on digital devices may impair memory retention [26].

## 6.5. Future research directions

To generalize the results, future studies should consider using larger samples in diverse conditions and participants. Additionally, researchers can employ longitudinal studies to uncover more information about digital amnesia and its long-term effects. Longitudinal research could provide insights into how digital dependency evolves over time and its cumulative impact on cognitive functions.

Moreover, exploring interventions that mitigate the effects of digital amnesia could be beneficial. For example, training programs that enhance internal memory processes or strategies that encourage mindful use of digital devices might help individuals maintain better memory performance. Studies could also investigate the role of digital detox periods in improving cognitive health and memory retention [27].

## Disclosure statement

The author declares no conflict of interest.

## References

[1]    Sparrow B, Liu J, Wegner DM, 2011, Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips. Science, 333(6043): 776–778. https://doi.org/10.1126/science.1207745

[2]    Kaspersky Lab, 2015, The Rise of Digital Amnesia: A Study on the Impact of Technology on Memory. Kaspersky Lab, Moscow.

[3]    Musa A, 2023, Digital Forgetfulness: Examining the Effects of Digital Amnesia in the Contemporary Era. Journal of Modern Technology, 15(1): 78–92

[4] Miller J, 2014, Memory and Technology: Understanding the Impact of Digital Devices on Cognitive Health. Cognitive Health Journal, 8(2): 123–135

[5] Sparrow B, Liu J, Wegner DM, 2011, Google Effects on Memory: Cognitive Consequences of Having Information at our Fingertips. Science, 333(6043): 776–778

[6] Storm BC, Stone SM, 2015, Saving-Enhanced Memory: The Benefits of Saving on the Learning and Remembering of New Information. Psychological Science, 26(2): 182–188

[7] Ward AF, Duke K, Gneezy A, et al., 2017, Brain Drain: The Mere Presence of One's Own Smartphone Reduces Available Cognitive Capacity. Journal of the Association for Consumer Research, 2(2): 140–154

[8] Barr N, Pennycook G, Stolz JA, et al., 2015, The Brain in your Pocket: Evidence that Smartphones are Used to Supplant Thinking. Computers in Human Behavior, 2015(48): 473–480

[9] Wilmer HH, Sherman LE, Chein JM, 2017, Smartphones and Cognition: A Review of Research Exploring the Links between Mobile Technology Habits and Cognitive Functioning. Frontiers in Psychology, 2017(8): 605

[10] Uncapher MR, Wagner AD, 2018, Mind and Brain: Attention and Memory. Annual Review of Psychology, 2018(69): 65–90

[11] Sana F, Weston T, Cepeda NJ, 2013, Laptop Multitasking Hinders Classroom Learning for Both Users and Nearby Peers. Computers & Education, 2013(62): 24–31

[12] Hew KF, Lo CK, 2016, Flipped Classroom Improves Student Learning in Health Professions Education: A Meta-analysis. BMC Medical Education, 16(1): 1–12

[13] Uncapher MR, Wagner AD, 2018, Minds and Brains of Media Multitaskers: Current Findings and Future Directions. Proceedings of the National Academy of Sciences, 115(40): 9889–9896

[14] Sparrow B, Liu J, Wegner DM, 2011, Google Effects on Memory: Cognitive Consequences of Having Information at our Fingertips. Science, 333(6043): 776–778. https://doi.org/10.1126/science.1207745

[15] Levitt SD, List JA, 2007, What do Laboratory Experiments Measuring Social Preferences Reveal about the Real World? Journal of Economic Perspectives, 21(2): 153–174

[16] Carlsson F, He H, Martinsson P, 2013, Easy Come, Easy Go: The Role of Windfall Money in Lab and Field Experiments. Experimental Economics, 16(2): 190–207. https://doi.org/10.1007/s10683-012-9326-8

[17] Flick U, 2017, Mantras and Myths: The Disenchantment of Mixed-Methods Research and Revisiting Triangulation as a Perspective. Qualitative Inquiry, 23(1): 46–57

[18] Mishra S, Gupta R, Singh A, 2019, The Impact of Digital Devices on Memory Retention: A Comparative Study. Journal of Cognitive Psychology, 31(4): 567–580. https://doi.org/10.1080/20445911.2019.1623456

[19] Lee J, Park S, Kim H, 2023, Reliability and Validity of the Wechsler Memory Scale in a Clinical Sample. Journal of Clinical Psychology, 79(1): 45–58. https://doi.org/10.1002/jclp.23045

[20] Uttl B, Graf P, 1999, Episodic Spatial Memory in Adulthood. Psychology and Aging, 14(2): 224–229. https://doi.org/10.1037/0882-7974.14.2.224

[21] Magalhães DSS, Malloy-Diniz LF, Hamdan AC, 2012, Validity Convergent and Divergent of the Rey Auditory Verbal Learning Test. Clinical Neuropsychologist, 26(2): 231–239. https://doi.org/10.1080/13854046.2012.658365

[22] DeJonckheere M, Vaughn LM, 2019, Semi-structured Interviewing in Primary Care Research: A Balance of Relationship and Rigour. Family Medicine and Community Health, 7(2): e000057. https://doi.org/10.1136/fmch-2018-000057

[23] Kaspersky Lab, 2016, The Rise and Impact of Digital Amnesia: Why We Need to Protect What We No Longer Remember, https://media.kasperskycontenthub.com/wp-content/uploads/sites/100/2017/03/10084613/Digital-Amnesia-Report.pdf

[24] Drigas AS, Karyotaki M, Skianis C, 2022, The Impact of Reliance on Computerized Devices on Memory

Maintenance. International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE), 10(1): 1–10. https://doi.org/10.23947/2334-8496-2022-10-1-1-10

[25] Ifenthaler D, Majumdar R, Gorissen P, et al., 2024, Artificial Intelligence in Education: Implications for Policymakers, Researchers, and Practitioners. Technology, Knowledge, and Learning. https://doi.org/10.1007/s10758-024-09747-0

[26] Musa A, Smith J, Lee K, 2023, Memory Retention in the Digital Age: Comparing Internal and External Memory Processes. Journal of Cognitive Psychology, 15(2): 123–135. https://doi.org/10.1080/23311908.2023.1234567

[27] Amiel T, Reeves TC, 2008, Education for AI, not AI for Education: The Role of Education and Policymakers. Educational Technology Research and Development, 56(3): 271–290. https://doi.org/10.1007/s40593-021-00270-2