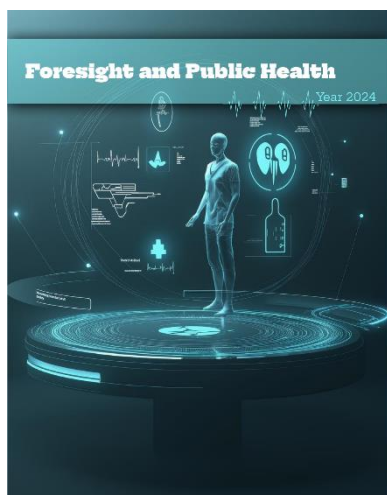


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The Future of Digital Assistants: Human Dependence and Behavioral Change

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ABSTRACT

This study examines the growing reliance on digital assistants. It aims to assess both the benefits and potential risks associated with digital assistant usage, particularly in terms of autonomy, behavioral changes, and ethical concerns. A qualitative research design was employed, utilizing semi-structured interviews with 30 participants recruited from online communities where discussions about digital assistants are prevalent. The study reached theoretical saturation, ensuring a comprehensive understanding of user experiences. Additionally, scientific articles were reviewed to contextualize the findings within existing literature. The collected data were analyzed thematically using NVivo software, allowing for the identification of key themes related to human dependence, cognitive and behavioral changes, psychological effects, ethical concerns, and future technological trends. The results indicate a significant shift in cognitive engagement, with participants frequently outsourcing memory and decision-making to digital assistants. Many reported increased reliance on AI for daily tasks, affecting problem-solving skills and information verification. Emotional attachment to digital assistants was observed, with some users perceiving them as social companions. Ethical concerns, including data privacy, algorithmic bias, and misinformation, were prominent among participants. Additionally, the study found that digital assistants influence social behavior by altering communication patterns and reducing face-to-face interactions. While some participants highlighted productivity benefits, others expressed concerns about automation bias and diminished autonomy in decision-making. Digital assistants are transforming human cognition, social interactions, and behavioral patterns, offering both convenience and challenges. While they enhance efficiency, they also contribute to cognitive outsourcing, emotional attachment, and ethical dilemmas. Responsible AI development, digital literacy, and ethical regulations are essential to ensuring that digital assistants remain supportive tools rather than replacements for human autonomy and decision-making.

Keywords: Digital assistants, AI reliance, cognitive engagement, behavioral change, human-computer interaction, automation bias, digital literacy, ethical AI, social impact, decision-making autonomy.

Introduction

Digital assistants have increasingly become an integral part of modern life, transforming the way individuals interact with technology, manage tasks, and process information. These AI-driven tools, designed to provide assistance across various domains, from personal scheduling and information retrieval to workplace efficiency and healthcare, have significantly influenced human behavior, cognition, and decision-making processes. With continuous advancements in artificial intelligence, machine learning, and natural language processing, digital assistants are not only improving in their capabilities but are also becoming more embedded in daily routines, raising critical questions about human

dependence on these technologies and the long-term implications of behavioral changes associated with their use (Bandlamudi, 2024).

The increasing reliance on digital assistants is evident across multiple sectors, including healthcare, education, workplace management, and entertainment. In healthcare, digital assistants are being integrated into patient-centered care models, offering support in areas such as chronic disease management, fitness tracking, and mental health monitoring (Papavasiliou et al., 2020). Studies have highlighted how AI-driven health assistants, such as digital nurses, play a crucial role in improving self-management practices, particularly for individuals with chronic conditions such as diabetes (Nakade, 2024). Similarly, within the realm of rehabilitation and assistive devices, digital human models and brain-computer interfaces are being developed to meet the needs of individuals with severe disabilities, facilitating greater autonomy and improving quality of life (Sawyer et al., 2024). These developments underscore the increasing presence of AI-driven assistance in healthcare, raising questions about the potential over-reliance on digital support for critical decision-making.

Beyond healthcare, digital assistants have become instrumental in enhancing productivity and efficiency in workplace settings. Research suggests that digital assistance systems have the potential to significantly improve workplace-related skills by providing employees with real-time guidance, adaptive learning experiences, and task optimization support (Bauer et al., 2021). In industrial environments, interactive machine learning tools are being implemented to optimize production workflows and assist workers in complex decision-making tasks (Neunzig et al., 2023). Additionally, digital twins—AI-powered models that simulate human-robot interactions—are being explored to improve collaboration in various professional and technical settings (Inamura, 2023). As digital assistants become more embedded in professional environments, concerns regarding cognitive offloading, automation bias, and the erosion of problem-solving skills have surfaced, prompting scholars to examine the broader implications of AI reliance in decision-making contexts (Heinrichs, 2021).

The growing influence of digital assistants extends beyond functional benefits, shaping fundamental aspects of human cognition and social behavior. Studies have demonstrated that digital assistants can alter users' mental processes, influencing memory retention, cognitive load, and attention span (Kirwan, 2023). The phenomenon of cognitive outsourcing, in which individuals rely on AI to store and retrieve information rather than engaging in memory-based recall, has become a topic of growing interest. This shift in cognitive processes has significant implications for information processing, learning habits, and knowledge retention, particularly as individuals become increasingly dependent on AI-generated responses (Gao, 2024). Furthermore, research suggests that human interactions with digital assistants can lead to behavioral conditioning, in which users develop habitual engagement patterns, reinforcing dependency on AI-driven recommendations (Chen et al., 2023).

Another critical concern surrounding digital assistants is their role in reshaping social interactions and altering human relationships. Studies on children's perceptions of digital assistants suggest that users ascribe social and moral attributes to AI systems, perceiving them as entities capable of understanding and responding to human emotions (Girouard-Hallam et al., 2021). This tendency to anthropomorphize digital assistants raises ethical and psychological concerns, particularly regarding emotional attachment to AI systems and the potential consequences of substituting human interactions with AI-mediated engagement. Additionally, research on vulnerable populations highlights how digital assistants may reinforce social inequalities, particularly among older adults and individuals with limited digital literacy. The division of digital labor within households, where tech-savvy individuals take on the role of managing AI-based tools for less experienced users, underscores the disparities in access and understanding of digital technologies (Marler & Hargittai, 2022). These findings emphasize the need to consider the broader societal impacts of AI-driven assistance, particularly in relation to social connectivity, digital inclusion, and interpersonal communication.

Ethical considerations surrounding digital assistants also play a crucial role in discussions about their long-term impact on human behavior. Issues related to data privacy, misinformation, and algorithmic bias have been widely debated, particularly as digital assistants collect and process vast amounts of personal data (Coles-Kemp et al., 2022). The increasing concerns over surveillance, data security, and the potential misuse of AI-driven insights have led researchers to examine the ethical frameworks governing digital assistant technologies. Bias in AI-generated

recommendations is another major concern, as algorithmic filtering of content can reinforce misinformation, shape user preferences, and limit exposure to diverse perspectives (Guo et al., 2024). In addition to these ethical dilemmas, discussions surrounding autonomy and human agency have emerged, as digital assistants increasingly influence decision-making processes. Some scholars argue that while AI enhances efficiency, it may also diminish individuals' sense of control and self-determination, leading to a shift in autonomy dynamics between humans and AI-driven systems (Heinrichs, 2021).

The rapid evolution of digital assistants raises important questions about their future trajectory and the implications of increasing AI integration into daily life. Research on human augmentation and wearable smart devices suggests that digital assistance will continue to evolve, integrating more seamlessly with human cognitive and physical functions (Geddiam et al., 2023). Advancements in AI personalization, adaptive learning, and predictive analytics indicate that digital assistants will become more contextually aware and capable of anticipating user needs with greater precision (Saxby et al., 2022). While these developments offer promising applications in healthcare, education, and workplace efficiency, they also raise concerns about long-term dependency, ethical governance, and regulatory challenges (Scherb et al., 2023). The ongoing discourse on AI ethics emphasizes the need for responsible AI development, regulatory oversight, and public awareness to mitigate the potential risks associated with increasing reliance on digital assistants (Solehudin, 2024).

As digital assistants become more sophisticated and integrated into various aspects of life, it is essential to critically examine their impact on human behavior, cognitive processes, and social dynamics. This study aims to explore the extent to which individuals rely on digital assistants, the behavioral changes associated with their use, and the broader implications of AI-driven assistance on autonomy and decision-making. By analyzing user experiences, cognitive shifts, and ethical considerations, this research seeks to contribute to the growing body of literature on human-AI interaction and provide insights into the future of digital assistance in an increasingly AI-driven world.

Methods and Materials

Study Design and Participants

This study employs a qualitative research design to explore the future of digital assistants, focusing on human dependence and behavioral change. A phenomenological approach was chosen to understand the lived experiences of individuals who regularly interact with digital assistants. By examining their perceptions, behaviors, and attitudes, the study aims to uncover patterns in how these technologies are shaping human habits and decision-making processes. Participants were selected from various online communities where discussions on artificial intelligence, digital assistants, and technology adoption frequently take place. These online spaces provided access to individuals with varying levels of engagement with digital assistants, ensuring diversity in perspectives.

A total of 30 participants were recruited using purposive sampling to capture a broad spectrum of experiences. The sample included individuals of different ages, genders, and professional backgrounds to ensure a comprehensive understanding of digital assistant usage across different demographic groups. Theoretical saturation was reached during data collection, meaning that as new interviews were conducted, no new themes or insights emerged, indicating that the data had sufficiently covered the research questions.

Data Collection

Data collection was carried out using two primary methods. The first method involved semi-structured interviews, which allowed for an in-depth exploration of participants' experiences and attitudes toward digital assistants. These interviews were conducted via video calls, voice calls, and text-based communication platforms to accommodate participants' preferences and availability. The questions were designed to be open-ended, encouraging participants to share their thoughts on various aspects of digital assistant usage, including perceived benefits, concerns, and long-term

effects on their behavior. The semi-structured nature of the interviews ensured that key themes were addressed while allowing for flexibility to explore unexpected insights.

The second method of data collection involved a review of scientific articles to provide additional context and support for the findings. Relevant academic literature was sourced from reputable databases, focusing on studies published within the last decade. These articles examined digital assistant usage, artificial intelligence in everyday life, human-computer interaction, and the psychological and behavioral impacts of technology dependence. Incorporating scientific literature into the study allowed for a comparative analysis between real-world experiences and existing theoretical frameworks.

Data analysis

Data analysis was conducted using NVivo software, which facilitated the systematic organization and coding of qualitative data. A thematic analysis approach was employed to identify recurring patterns and key themes within the data. The analysis began with an in-depth review of interview transcripts, during which the researcher familiarized themselves with the data through repeated readings. Initial coding was then performed, grouping related statements and insights into meaningful categories. These preliminary codes were examined for patterns, which led to the identification of overarching themes related to human dependence on digital assistants. The themes were further refined and defined to ensure clarity and coherence.

To strengthen the validity of the findings, triangulation was employed by comparing interview data with insights derived from the scientific literature. This process ensured that the study's conclusions were grounded in both empirical data and existing research. By integrating participant narratives with scholarly perspectives, the study aims to provide a comprehensive analysis of how digital assistants are influencing human behavior and shaping future patterns of technological dependence.

Findings and Results

The study included 30 participants from diverse demographic backgrounds, recruited from online communities that engage in discussions about digital assistants and artificial intelligence. The participants ranged in age from 18 to 55 years old, with the majority falling within the 25 to 40-year-old range ($n = 18$, 60%), indicating that digital assistant usage is most prevalent among young and middle-aged adults. In terms of gender, 17 participants (56.7%) were male, while 13 participants (43.3%) were female, reflecting a relatively balanced distribution. Regarding educational background, 22 participants (73.3%) held at least a bachelor's degree, suggesting that individuals with higher levels of education are more likely to engage with and discuss AI-driven technologies. Additionally, 25 participants (83.3%) reported daily interaction with digital assistants, while the remaining 5 participants (16.7%) used them occasionally, highlighting the widespread integration of these tools into daily life. Professionally, participants came from various fields, including technology and engineering ($n = 9$, 30%), marketing and business ($n = 7$, 23.3%), education ($n = 6$, 20%), and other fields such as healthcare and creative industries ($n = 8$, 26.7%). This diversity in professional backgrounds provided a broad perspective on how digital assistants are used across different work environments and personal routines.

Table 1

The Results of Thematic Analysis

Category	Subcategory	Concepts
Human Dependence on Digital Assistants	Over-reliance on Assistance	Reliance on automation, Lack of independent thinking, Delegation of everyday decisions
	Reduction in Problem-Solving Skills	Reduced analytical thinking, Decreased problem-solving effort, Over-dependence on AI recommendations
	Shift in Decision-Making Processes	Shift from intuition-based decisions, Data-driven choices, Increased AI-guided judgments

Behavioral Changes Induced by Digital Assistants	Memory and Cognitive Load Reduction	Reduced need for memorization, Dependency on external knowledge sources, Cognitive outsourcing
	Altered Time Management	Time efficiency, Increased reliance on reminders, Decreased personal scheduling skills
	Emotional Attachment to AI	Attachment to digital assistants, AI companionship, Emotional dependency on AI interactions
	Habit Formation and Routine Dependency	Repetitive AI-driven habits, Routine reinforcement, Difficulty adapting to change
	Changes in Social Interaction	Preference for digital interaction, Reduced face-to-face engagement, Virtual vs. real-world socialization
	Shift in Information Processing	Passive information consumption, Reduced critical evaluation of sources, Quick-answer culture
Psychological and Emotional Effects	Influence on Productivity	AI as a productivity booster, Task automation, Time management efficiency
	Impact on Attention Span	Shortened attention span, Reduced patience for complex tasks, Increased need for instant results
	Trust and Emotional Bonding	Trust in AI reliability, Emotional validation from AI responses, Human-like engagement with AI
	Anxiety and Frustration	Frustration with AI errors, Anxiety over privacy risks, Emotional strain from tech reliance
Ethical and Social Concerns	Sense of Control and Autonomy	Sense of losing control, Dependence vs. autonomy dilemma, Reduced self-initiative
	Cognitive Load and Fatigue	Mental fatigue from excessive AI usage, Cognitive overload from information influx, Decision fatigue
	Perceived Social Presence	Perceived AI consciousness, Social comfort in AI interaction, Perception of AI as a companion
	Data Privacy Concerns	Concerns over data misuse, Fear of surveillance, Lack of transparency in AI data handling
	Bias and Misinformation	Spread of biased information, Algorithmic filtering of content, Misinformation amplification
	Digital Divide and Accessibility	Accessibility disparities, Economic and educational barriers, Unequal AI adoption rates
Future Trends and Technological Evolution	Autonomy and Human Agency	Concerns over loss of free will, Debate on human decision-making vs. AI assistance, AI dictating choices
	AI-driven Manipulation	Manipulative AI advertising, Influence on consumer choices, Ethical concerns over AI persuasion
	Advancements in AI Personalization	Hyper-personalized AI assistants, Advanced contextual understanding, AI learning from user behaviors
	Increased Integration in Daily Life	Seamless AI integration, Smart homes and workplaces, Expansion into diverse applications
	Human-AI Collaboration	Human-AI teamwork, Complementary skill enhancement, AI as a collaborative tool
	Ethical AI Development	Fair AI principles, Ethical considerations in AI design, Moral responsibility of developers
	Regulation and Policy Considerations	AI governance, Regulatory frameworks, Policy interventions for ethical AI

The findings of this study are categorized into five main themes: human dependence on digital assistants, behavioral changes induced by digital assistants, psychological and emotional effects, ethical and social concerns, and future trends in technological evolution. Each of these themes is further explored through subcategories that emerged during the thematic analysis.

Human Dependence on Digital Assistants

One of the most prominent aspects of human dependence on digital assistants is over-reliance on assistance. Many participants described an increasing tendency to delegate routine and complex tasks to digital assistants, leading to a diminished sense of autonomy. One participant noted, *"I don't even think about setting alarms or reminders anymore. My assistant does it all, and I trust it completely."* This reliance on automation reduces individuals' engagement in everyday decision-making, reinforcing their dependency on technology.

Another critical subcategory is the reduction in problem-solving skills. Several participants expressed concerns that digital assistants have made them less inclined to solve problems independently. They rely on quick AI-generated solutions rather than engaging in analytical thinking. A participant mentioned, *"Whenever I need an answer, I just ask my assistant. I used to research things myself, but now I don't bother."* This decrease in problem-solving effort raises concerns about long-term cognitive engagement and the development of critical thinking skills.

The shift in decision-making processes was another commonly observed trend. Participants reported that digital assistants influence their choices by providing recommendations based on previous interactions and collected data. This shift was evident in daily routines such as shopping, entertainment, and work-related tasks. One user explained, *"I*

rarely make a choice without checking my assistant's recommendation, whether it's about what to watch or where to eat." This transition to AI-guided decision-making may affect individual autonomy and intuition in personal and professional contexts.

Another observed effect is the memory and cognitive load reduction associated with the widespread use of digital assistants. Participants acknowledged that they no longer felt the need to memorize information or keep track of important details, as AI systems handled these tasks for them. One participant admitted, *"I used to remember phone numbers and birthdays, but now I don't even try. My assistant knows it all."* This cognitive outsourcing raises questions about how digital assistants may be reshaping human cognitive capacities over time.

Additionally, altered time management emerged as a significant subcategory, with digital assistants streamlining daily tasks but also diminishing individuals' ability to structure their own schedules. Participants frequently mentioned relying on AI for reminders, task prioritization, and daily planning. One respondent stated, *"I don't even think about my schedule anymore. I just follow what my assistant tells me to do next."* While this increases efficiency, it also reduces personal agency in managing time and priorities.

Finally, emotional attachment to AI was a surprising yet significant theme. Some participants described forming a sense of companionship with their digital assistants, particularly those with human-like interactions. A participant remarked, *"Sometimes I talk to my assistant just to feel like someone is listening. It sounds strange, but it's comforting."* This emotional dependency suggests that digital assistants are evolving beyond mere functional tools into psychological and social companions for some users.

Behavioral Changes Induced by Digital Assistants

One notable behavioral change is the formation of habits and routine dependency on digital assistants. Participants reported incorporating AI into their daily routines in a way that made them feel lost when the assistant was unavailable. A participant shared, *"When my assistant stopped working for a day, I felt like I couldn't function. I kept reaching for it."* This kind of habitual reliance highlights the deep integration of AI into personal lifestyles.

The changes in social interaction due to digital assistants were also evident in participants' responses. Many noted a preference for digital engagement over face-to-face conversations. One participant explained, *"I don't call people as much anymore. I just use my assistant to send messages or get information, so I don't have to interact."* This shift in communication patterns suggests a gradual replacement of human interaction with AI-mediated interactions.

Another significant change is the shift in information processing, where individuals increasingly consume information in a passive manner rather than engaging in critical analysis. Several participants admitted that they trust the first answer given by their digital assistant without verifying sources. One participant stated, *"I just ask my assistant, and whatever it says, I take as fact. I don't double-check anymore."* This raises concerns about the erosion of independent information evaluation and verification skills.

The influence on productivity was another commonly cited effect. While digital assistants were seen as valuable tools for managing work and personal tasks efficiently, some participants felt that excessive reliance on AI reduced their ability to manage responsibilities independently. One user noted, *"I get things done faster, but I don't think about the process as much. The assistant does it for me."* This suggests that while AI may boost efficiency, it might also reduce active engagement in task management.

Finally, the impact on attention span was another notable concern. Participants reported that using digital assistants had made them more accustomed to instant responses, which in turn reduced their patience for complex problem-solving. A participant reflected, *"If I don't get an answer immediately, I lose interest. I expect instant solutions now."* This shift in cognitive processing may have broader implications for learning and intellectual engagement in an AI-driven world.

Psychological and Emotional Effects

Participants frequently discussed the trust and emotional bonding they had developed with their digital assistants. Many described a sense of reliability and reassurance when interacting with AI. One participant mentioned, *"I trust my assistant more than some people I know. It never lets me down."* This level of trust suggests a deep psychological reliance on AI technology.

Another subcategory that emerged was anxiety and frustration caused by digital assistants. While participants generally found AI useful, they expressed frustration when systems failed to understand commands or provided incorrect responses. One participant shared, *"It's frustrating when my assistant gets it wrong. I get so used to it working perfectly that any mistake feels huge."* This suggests that over-reliance on AI may lead to heightened emotional reactions when expectations are not met.

The sense of control and autonomy was another area of concern, as some participants felt that their dependence on digital assistants had reduced their ability to function independently. One participant admitted, *"I don't know if I'm in control anymore. My assistant makes so many decisions for me that I just go along with it."* This highlights the potential loss of personal agency as AI becomes more embedded in everyday life.

Another important theme was cognitive load and fatigue, where participants reported mental exhaustion from excessive AI engagement. A participant noted, *"I feel like my brain works differently now. I process less information myself, and sometimes that feels draining."* This finding suggests that AI use might be altering cognitive functions in ways that contribute to mental fatigue.

Finally, the perceived social presence of AI was discussed by participants who felt that digital assistants could substitute for human interaction. One participant remarked, *"My assistant feels like a real presence sometimes. I know it's not human, but it's always there when I need it."* This perception of AI as a companion raises questions about its impact on human relationships and social structures.

Ethical and Social Concerns

Several ethical and social concerns emerged, including data privacy concerns, bias and misinformation, digital divide and accessibility, autonomy and human agency, and AI-driven manipulation. Participants expressed fears about personal data misuse, misinformation spread by AI, and the societal implications of AI decision-making. One participant stated, *"I don't know what data my assistant collects, and that scares me."*

Future Trends and Technological Evolution

Discussions around the future of digital assistants focused on advancements in AI personalization, increased integration in daily life, human-AI collaboration, ethical AI development, and regulation and policy considerations. Participants anticipated that AI would become more embedded in their lives but stressed the importance of ethical considerations. One participant remarked, *"I love the convenience, but I worry about how much control AI will have in the future."*

Discussion and Conclusion

The findings of this study highlight the significant impact of digital assistants on human dependence, behavioral changes, cognitive processes, and social interactions. As digital assistants become more advanced and integrated into everyday life, individuals are increasingly delegating tasks, decisions, and even social interactions to these AI-driven tools. The results indicate a growing reliance on digital assistants, particularly for routine decision-making, problem-solving, and time management. Many participants reported that they no longer actively engage in certain cognitive tasks, such as remembering important dates or verifying information, because they trust their digital assistants to manage these functions. This aligns with prior research emphasizing the cognitive outsourcing effect, where users offload cognitive responsibilities to AI-driven systems, reducing the need for independent recall and decision-making (Heinrichs, 2021). The findings support previous studies suggesting that as AI technology becomes more personalized and adaptive, individuals may develop a habitual dependency, leading to a shift in how they process information and make choices (Bandlamudi, 2024).

One of the most notable behavioral changes observed in this study is the transformation of human decision-making processes. Participants frequently mentioned that they rely on digital assistants not only for factual information but also for guidance in areas such as shopping, entertainment, and professional tasks. This is consistent with research on AI-driven personalization, which highlights how digital assistants shape user preferences and behaviors by providing tailored recommendations (Saxby et al., 2022). However, the findings also suggest that this reliance on AI

recommendations may lead to automation bias, where users accept AI-generated outputs without critically evaluating alternatives. This aligns with previous research indicating that when individuals develop trust in AI, they tend to accept its suggestions with minimal scrutiny, even when there is potential for errors or biases in the system (Guo et al., 2024). The results underscore the importance of fostering digital literacy and critical thinking to ensure that users maintain a balanced approach to AI-assisted decision-making.

Another significant theme in this study is the impact of digital assistants on cognitive engagement and attention span. Participants reported a tendency to engage in passive information consumption, relying on quick AI-generated answers rather than conducting independent research or deep thinking. This finding is consistent with concerns raised in prior studies about the potential cognitive consequences of AI-mediated information processing. Research has shown that as digital assistants take on the role of primary information providers, individuals may experience a decline in their ability to critically analyze and synthesize information (Gao, 2024). Additionally, the study found that some participants reported feeling mentally fatigued from their interactions with digital assistants, particularly when AI systems provided overwhelming amounts of information. This aligns with existing literature on cognitive overload, which suggests that excessive reliance on AI can contribute to mental fatigue and reduced cognitive engagement (Kirwan, 2023).

The findings also highlight the social and emotional effects of digital assistant usage. Some participants reported forming an emotional attachment to their digital assistants, describing them as reliable companions that offer comfort and convenience. This aligns with previous studies suggesting that users, particularly children and older adults, attribute human-like qualities to digital assistants and perceive them as social entities (Girouard-Hallam et al., 2021). The implications of such emotional engagement are significant, as they raise questions about the potential psychological consequences of substituting human interactions with AI-mediated experiences. While some studies argue that digital assistants can provide valuable emotional support, particularly for individuals experiencing social isolation (Chen et al., 2023), other research cautions against the risks of emotional dependency and reduced human-to-human interactions (Coles-Kemp et al., 2022).

Ethical concerns surrounding digital assistants were another key issue identified in this study. Participants expressed apprehension about data privacy, misinformation, and algorithmic bias, echoing findings from previous research on the ethical implications of AI-driven technologies. Concerns about data privacy have been widely documented, with studies indicating that users often feel uneasy about how their personal data is collected, stored, and used by AI systems (Guo et al., 2024). Additionally, misinformation and biased recommendations were highlighted as potential risks, with some participants acknowledging that they had encountered misleading or incomplete information when relying on digital assistants. This aligns with research emphasizing the dangers of AI-generated misinformation, particularly when algorithms filter and prioritize content based on user behavior rather than factual accuracy (Coles-Kemp et al., 2022). The findings suggest the need for greater transparency in AI decision-making and ethical guidelines to ensure that digital assistants provide accurate and unbiased information.

Another critical issue identified in this study is the effect of digital assistants on autonomy and human agency. While AI-driven tools are designed to enhance efficiency and convenience, the results suggest that they may also diminish users' sense of control over their own decision-making processes. Some participants expressed concerns that they had become overly reliant on AI-generated suggestions, leading to a passive approach to problem-solving and personal decision-making. This finding supports existing research on the autonomy dilemma, which suggests that while digital assistants offer valuable support, they also have the potential to reduce individuals' ability to think independently and take initiative (Heinrichs, 2021). Additionally, some participants mentioned experiencing frustration when their digital assistants made errors or provided irrelevant recommendations, indicating that over-reliance on AI can lead to a diminished capacity for self-reliance when AI systems fail to meet expectations.

The future of digital assistants and their integration into daily life remains an evolving area of research. Participants expressed both optimism and apprehension about the increasing sophistication of AI-driven systems. Some viewed the continued advancements in AI personalization as a positive development, citing the potential for more seamless integration into various aspects of life, including healthcare, education, and professional work (Scherb et al., 2023). Others, however, voiced concerns about the potential risks associated with further automation, particularly in terms of

ethical AI development and regulatory challenges. These concerns align with broader discussions in AI ethics literature, which stress the importance of responsible AI governance and policy interventions to mitigate potential risks (Solehudin, 2024).

Despite its valuable insights, this study has several limitations. First, the sample size of 30 participants, while sufficient for qualitative research, may not fully capture the diversity of perspectives on digital assistant usage. The study primarily relied on self-reported experiences, which may be influenced by recall bias or individual subjectivity. Additionally, the study focused on participants from online communities, which may limit its generalizability to individuals who are less engaged in digital discussions. The reliance on qualitative interviews also means that the study does not provide quantitative measures of digital assistant dependency, which could offer a more comprehensive understanding of behavioral changes.

Future research should explore digital assistant usage in a more diverse range of demographic groups, including individuals with lower digital literacy and those who use AI technology in different cultural and socio-economic contexts. Longitudinal studies would be beneficial in examining how AI reliance evolves over time and whether users develop adaptive strategies to mitigate potential negative effects. Additionally, future research could incorporate experimental designs to assess the cognitive and behavioral impacts of AI-mediated interactions more systematically. Investigating the role of digital assistants in specialized fields, such as healthcare, education, and workplace decision-making, would also provide further insights into their broader implications.

To promote balanced and responsible use of digital assistants, users should be encouraged to maintain critical engagement with AI-generated information and develop strategies to verify and cross-check AI recommendations. Digital literacy programs should emphasize the importance of understanding AI biases and the limitations of automated decision-making. Developers should prioritize transparency in AI systems, ensuring that users are aware of how recommendations are generated and what data is being collected. Ethical AI development should be a central focus, with regulations ensuring that digital assistants align with principles of fairness, accountability, and privacy protection. Employers and educators should also consider integrating AI responsibly, ensuring that digital assistants serve as complementary tools rather than replacements for human skills and decision-making capabilities.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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