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Research on Personal Academic Information Management Tools for Researchers: Postprint

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Abstract

[目的/意义]To explore the factors influencing researchers' intention to use personal academic information management tools, construct a relevant theoretical model, and provide theoretical guidance and recommendations for the development and design of effective personal academic information management tools, thereby enhancing information utilization and research productivity.[方法/过程]Employing a grounded theory research approach, theoretical saturation sampling was used to conduct face-to-face semi-structured interviews with open-ended questions among 17 researchers. Through coding analysis, factors influencing researchers' intention to use personal academic information management tools were identified, including perceived usefulness, perceived ease of use, individual factors, and contextual factors, to construct a corresponding theoretical model. Additionally, based on the needs survey and analysis of researchers in this study, eight commonly used academic information management tools were selected for comparative analysis across dimensions such as information classification and acquisition, storage management, organization, and communication and sharing.[结果/结论]The development of personal academic information management tools for researchers should consider user interface design, information organizational structure, compensation for users' cognitive limitations, resolution of information synchronization and sharing issues, assurance of academic information security, alignment with users' usage habits, support for semantic integration and push functionality, and facilitation of team research information sharing.

Full Text

Preamble

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Research on Personal Academic Information Management Tools for Scientific

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Abstract

[**Purpose/Significance**] This study explores the influencing factors of researchers' intention to use personal academic information management tools, constructs a relevant theoretical model, and provides theoretical guidance and recommendations for developing effective personal academic information management tools to improve information utilization and research efficiency. [**Method/Process**] Based on grounded theory methodology, this study employs theoretical saturation sampling to conduct face-to-face semi-structured interviews with open-ended questions among 17 researchers. Through coding analysis, the influencing factors of researchers' intention to use personal academic information management tools are identified, including perceived usefulness, perceived ease of use, individual factors, and contextual factors, and a corresponding theoretical model is constructed. Meanwhile, according to the demand survey and analysis of researchers in this study, eight commonly used academic information management tools are selected for comparative analysis across information classification and acquisition, storage management, organization, and communication sharing. [**Result/Conclusion**] The construction of personal academic information management tools for researchers should consider user interface, information organization structure, compensation for users' cognitive limitations, resolution of information synchronization and sharing, assurance of academic information security, alignment with user habits, support for semantic integration and push, and facilitation of team research information sharing.

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International Data Corporation (IDC) reported in "The Digital Universe of 2020: Big Data, Bigger Digital Shadows, and the Fastest Growth in the Far East" that the size of the digital universe doubles every two years from 2013 to 2020, and the amount of newly created and copied information worldwide will exceed 40ZB in 2020 [1]. In this big data environment, every individual is impacted by this rapid development. The amount of information that individuals create, collect, and store for future use continues to increase daily. Although computer data processing capabilities are also improving, knowledge workers spend one-third of their time searching for information they never find [2]. The competitive advantage of researchers lies not in the quantity of academic information they possess, but in how they effectively manage academic information to achieve knowledge innovation. IDC research reports indicate that 90% of knowledge workers' so-called "innovative work" is repetitive. Therefore, efficient

information management tools are needed to organize personal academic information, promote knowledge exchange and dissemination, and enhance research efficiency. R. Boardman [3] pointed out that personal information management tools should support functions for information acquisition, organization, management, and retrieval mechanisms. In recent years, personal information management (PIM)—how individuals create, collect, organize, and retrieve their electronically stored personal information—has gradually become an important research topic in the information management field. Ideal personal information management enables people to obtain high-quality information in appropriate forms at the right time and place.

With the Web 2.0 era, the continuous increase in personal information, enhanced computer performance, expanding storage capacity, and convenient storage devices, researchers store large amounts of academic research information in their personal information spaces. In the digital academic research era, researchers characterized by high knowledge dependency and high collaborative work need to effectively manage their personal academic information. Research on the design and development of personal information management tools mainly includes: (1) Integrated information management tools, such as Stuff I've Seen (SIS) [4], User-Monitoring Environment for Activities (UMEA) [5], TimeSpace [6], personal project planning software Planz [7], personal scientific document retrieval system LocalContent [8], and mobile personal information management tool PIMA [9]; (2) Semantic information management tools, such as user-end semantic web application platform Haystack [10], semantic browser SEMantics EXplorer (SEMEX) [11], semantic desktop system IRIS (integrate, relate, infer, share) [12], open-source semantic desktop application DeepaMehta [13], and wiki-based task management tool TAPIR (task and personal information rendering) [14]; (3) Visualization information management tools, such as Microsoft Research's MyLifeBits [15], interactive visualization tool VisMe [16], and desktop organization tool BumpTop [17].

Domestic research on personal information management tools is mainly conducted in information management and computer science disciplines. The information management discipline primarily provides review introductions of foreign personal information management tools, systems, or prototypes, while the computer science discipline designs and develops personal information management tools. For example, Gao Xiang [18] designed the Boogu online personal information management tool using Ajax architecture based on the characteristics of personal memory; Deng Changzhi et al. [19] constructed an activity-centered personal information management tool ACPIM (activity-centered personal information management); Chen Mingxuan et al. [20] developed the Ruby mobile device personal information management tool. However, these personal information management tool prototypes have not been widely applied due to inconsistency with user habits, complex operation, inadequate consideration of individual user needs, and lack of evaluation.

Personal academic information management is a research branch of personal

information management and a scientific method for effectively managing personal academic information. This study defines personal academic information management as the process by which individuals manage their controlled and owned digital academic information, including personal academic information preservation, organization and maintenance, and retrieval and utilization. Personal academic information management is based on academic information, aims to achieve knowledge innovation and sharing, and treats academic information as a resource that can be developed and utilized. Through effective and scientific management of personal academic information, researchers can purposefully, timely, and efficiently update their knowledge and skills. The essence of personal academic information management is to help researchers integrate their academic information, enhance information literacy, continuously improve their disciplinary knowledge framework, and thereby enhance work efficiency and personal competitiveness. According to the laws of information technology development—"auxiliary law" and "simulation law"—the design of personal academic information management tools should meet researchers' information needs in the current academic research environment and achieve auxiliary management functions. This study adopts grounded theory methodology to conduct in-depth interviews with researchers about their academic information management processes, analyzes the main factors influencing their intention to use personal academic information management tools, and conducts comparative analysis of commonly used academic information management tools, thereby proposing a concept for a personal academic information management tool that serves the research process and meets researchers' intrinsic needs, which is beneficial for subsequent tool development, design, and promotion.

2. Analysis of Personal Academic Information Management Tool Usage Intention Based on Grounded Theory

2.1 Research Questions, Methods, and Procedures

This study employs qualitative grounded theory methodology to conduct in-depth interviews with researchers and analyze the factors influencing their intention to use personal academic information management tools. Grounded theory is a validated and increasingly used method among behavioral researchers. It is a process of continuous questioning, comparison, classification, relationship building, and theoretical discovery. The core of grounded theory lies in avoiding researchers' subjective, preconceived assumptions, allowing research questions and final conclusions to emerge naturally from social processes and their study; it is a dynamic research process. This study strictly follows N. R. Pandit's five-stage grounded theory procedure (see Figure 1 [Figure 1: see original paper]) [21]. After developing the initial semi-structured interview outline, the author invited two researchers for pilot interviews and collected corresponding revision suggestions for the interview outline. Based on these suggestions, the interview outline was revised and improved to form the final semi-structured interview protocol.

Figure 1. Grounded Theory Research Procedure

The issues addressed in this study mainly include: What tools do researchers use to acquire academic information in the social media environment? What tools are used to preserve and organize different types of academic information? How is information transmission, synchronization, and sharing achieved between different tools and devices? Are tools used to find previously saved academic information?

2.2 Sample Selection

Qualitative research samples are generally small, following the principle of purposive sampling, selecting only those samples that maximize information [22]. According to the research purpose, this study identifies researchers with academic research backgrounds as research subjects. Based on grounded theory methodology, theoretical saturation sampling was used to conduct face-to-face semi-structured interviews with open-ended questions among 17 researchers (with a male-to-female ratio of 6:11). With participants' permission, the entire interview process was recorded and all recordings were converted into text files. After reaching 17 interviewees, theoretical saturation began, with no new concepts or categories emerging. To make the interview sample more representative, the researchers in this survey were selected from diverse disciplines. Specific interviewee details are shown in Table 1 .

Table 1. Basic Information of Interviewees

2.3 Validity Verification

Validity is a judgment criterion in traditional positivist quantitative research, aiming to objectively measure and quantify to infer universal laws. Qualitative research also emphasizes validity testing as an important standard for judging research quality. This study uses the expert survey method to select experts in information management and information behavior to grasp the overall semi-structured interview outline and the final theoretical framework, evaluating from descriptive validity, interpretive validity, and theoretical validity. The author then modifies the framework according to the evaluation results to form the final theoretical model.

2.4 Data Coding Analysis

2.4.1 Open Coding Open coding involves conceptualizing and categorizing interview data based on preliminary analysis. The specific operation process consists of three steps: phenomenon definition and summarization, concept formation (A1…An), and category extraction (B1…Bn), thereby identifying 53 concepts and 15 categories, as shown in Table 2 :

Table 2. Open Coding Categorization

- **B1 Information Spatiotemporal Distribution**: A1 information accumulation, A2 information fragmentation, A3 reduced information storage costs, A4 unlimited digital storage space
- **B2 Personal Memory**: A5 forgetting information names or keywords, A6 forgetting information storage locations, A7 forgetting information modification versions
- **B3 Information Hoarding**: A8 information duplication, A9 information aging, A10 reluctance to delete information, A11 difficulty judging information value
- **B4 Information Loss**: A12 irreversible accidental deletion, A13 information loss due to device damage, A14 information loss due to virus corruption, A15 information loss due to device virus infection
- **B5 Work Efficiency**: A16 clear logical hierarchy, A17 information organization capability, A18 information push, A19 intelligence (e.g., automatic synchronization), A20 information reminders, A21 information retrieval efficiency
- **B6 Personal Habits**: A22 habit of using tools to manage information, A23 habit of information reappearance
- **B7 User Satisfaction**: A24 very satisfied, A25 satisfied, A26 neutral, A27 dissatisfied, A28 very dissatisfied
- **B8 Security**: A29 concern about personal information leakage, A30 user distrust of tools, A31 tool security protection, A32 personal privacy issues
- **B9 Tool Functionality and Operation**: A33 file browsing and searching, A34 system search function, A35 general information management, A36 simple and convenient, A37 open-source nature
- **B10 Tool Interface**: A38 human-computer interaction interface, A39 clear navigation
- **B11 Tool Stability**: A40 tool version, A41 smooth tool system operation, A42 compatibility
- **B12 Social Influence**: A43 usage by people around, A44 friend recommendations, A45 tool self-promotion
- **B13 Academic Information Transmission, Synchronization, and Sharing Problems**: A46 information resource integration, A47 user's information network environment, A48 information synchronization and updating
- **B14 Personal Academic Information Literacy**: A49 multiple backups, A50 privacy protection, A51 information security awareness
- **B15 Self-Efficacy**: A52 personal information processing capability, A53 personal tool operation capability

2.4.2 Axial Coding Through analysis, it was found that the different categories obtained from open coding may have internal associations. This study classifies them according to the intrinsic relationships between categories. The meanings of each main category and their corresponding open coding categories are shown in Table 3 :

Table 3. Example of Open Coding Process for Interview Data

The open coding process identified 15 categories, connecting some categories into a main category to prepare for theoretical construction. According to the relationships between different categories, after clustering and abstracting the 15 categories, this study ultimately formed four main categories, coded as Cn. The meanings of each main category and their corresponding open coding categories are shown in Table 4 :

Table 4. Axial Coding Process

- **C1 Perceived Usefulness**: B5 work efficiency (degree to which researchers' work performance improves after using tools), B7 user satisfaction (researchers' pleasure when information needs are met after using tools), B8 security (researchers' trust in tools and tools' information security safeguards)
- **C2 Perceived Ease of Use**: B9 tool functionality and operation (whether tool operation is simple and practical), B10 tool interface (whether interaction interface is user-friendly), B11 tool stability (whether system is stable during operation)
- **C3 Contextual Factors**: B1 information spatiotemporal distribution (distribution of academic information in time and space), B3 information hoarding (over-storage and difficulty deleting academic information), B4 information loss (information loss due to accidental deletion or viruses), B12 social influence (degree to which important people think researchers should use tools), B13 academic information transmission, synchronization, and sharing problems (how to integrate similar information, network transmission)
- **C4 Individual Factors**: B2 personal memory (researchers' memory of academic information names, keywords, storage locations, and modification versions), B6 personal habits (researchers' habits in managing personal academic information), B14 personal academic information literacy (academic information literacy possessed by researchers, such as information backup and privacy protection), B15 self-efficacy (researchers' control over academic information processing)

2.4.3 Selective Coding Selective coding mainly involves selecting core categories to further explain the relationships between main categories and other categories, as well as supplementing categories that need development in the future [23], thereby providing theoretical explanations for the influencing factors of researchers' intention to use personal academic information management tools. Based on the following relationship structure, this study identifies "influencing factors of personal academic information management tool usage intention" as the core category and proposes a theoretical model of influencing factors for personal academic information management tool usage intention, as shown in Figure 2 [Figure 2: see original paper]. The relationship structure of main categories and representative interview statements in this study are shown in Table

5 .

Figure 2. Theoretical Model of Influencing Factors for Researchers' Intention to Use Personal Academic Information Management Tools

Table 5. Relationship Structure of Main Categories

- **Perceived Usefulness → Personal Academic Information Management Tool Usage Intention**: Researchers' perception of tool usefulness affects their intention to use. Representative statement: "I personally think using tools and software to manage information might be important, but it relates to your workload. I've used EndNote for literature review, and it helped classify literature to some extent and improved my work efficiency, but it's not completely intelligent, and some formats still need further correction later…" (Work efficiency affects intention to use personal academic information management tools)
- **Perceived Ease of Use → Personal Academic Information Management Tool Usage Intention**: Researchers' perception of tool ease of use affects their intention to use. Representative statement: "Some current academic information management tools are not completely intelligent, and version compatibility is problematic after upgrades. I recently found that my E-Study couldn't be used after upgrading, putting me in a passive position. The already established bibliography had to be redone, which really wasted time…" (Tool stability affects intention to use personal academic information management tools)
- **Contextual Factors → Personal Academic Information Management Tool Usage Intention**: Information spatiotemporal distribution, information hoarding, information loss, and problems in academic information transmission are external factors affecting researchers' intention to use. Representative statement: "Hard drive broke, but data had been exported, still lost some. That's why I later used cloud storage, because associated data once lost cannot be recovered…" (Objective external factors like information loss affect intention to use personal academic information management tools)
- **Individual Factors → Personal Academic Information Management Tool Usage Intention**: Personal memory, habits, academic information literacy, and self-efficacy are internal factors affecting researchers' intention to use. Representative statement: "I choose to save information to my computer because I'm worried some information might disappear if not saved, like web links becoming invalid. It's more reliable to save it myself… I'm used to finding saved information by folder themes because I have a lot of information now. Using search would waste time, and sometimes I might not remember the name…" (Internal factors like self-efficacy and personal memory affect intention to use personal academic information management tools)

2.4.4 Theoretical Saturation Test This study uses interview text materials from four researchers (P14-P17) for theoretical saturation testing. Through open coding, axial coding, and selective coding, no new relationship structures were found. The core category remains "influencing factors of personal academic information management tool usage intention," indicating that the category coding and model construction in this study are theoretically saturated. Due to space limitations, only partial interview data is exemplified here.

(1) "No (I don't use tools). References are all manually processed. This makes me more assured because I'm satisfied with the status quo, so I haven't wanted to try using them. If I have too much research information to manage in the future, I might try them. I'm a traditional person and don't trust online things very much. I'm very worried about personal information leakage. I'd rather save it in my mobile hard drive. But software tools are installed on computers, and once connected to the internet, they're not under my control…" (A27 concern about personal information leakage, A28 user distrust of tools → B8 security → C1 perceived usefulness)

(2) "Now I really have more and more information. If I rely entirely on manual management, efficiency would definitely be low. Moreover, some software tools now have relatively complete functions. For example, EndNote and NoteExpress are good at managing reference literature organization. Writing papers involves a large number of literature citations, and using them is very convenient…" (A15 information organization capability → B5 work efficiency → C1 perceived usefulness)

3. Conceptualization of Personal Academic Information Management Tools for Researchers

3.1 Analysis of Current Usage of Personal Academic Information Management Tools

Through grounded theory research on in-depth interview content about researchers' personal academic information management behaviors, this study found that most researchers use tools to manage personal academic information. According to different types of managed information, these tools are divided into literature management tools, academic information preservation tools, and academic information search tools, as shown in Figure 3 [Figure 3: see original paper].

Figure 3. Types of Personal Academic Information Management Tools

(1) **Literature Information Management Tools**: Such as EndNote, NoteExpress, and CNKI E-Study. For researchers, knowledge innovation cannot be separated from reading large amounts of literature. Literature management software can conveniently help them manage literature

information, achieving one-stop literature reading and management, cross-database literature retrieval, and thesis writing format editing and typesetting. However, interviews revealed that although current literature information management tools' functions are gradually improving, respondents' evaluations are mixed. Respondents generally reported functional deficiencies across tools in aspects such as note annotation and retrieval, reference format management, tool system stability, integration of multiple academic information resources (such as web academic information, image academic information, etc.), and tool open-source nature, requiring further improvement in the future.

(2) **Academic Information Preservation Tools**: Academic information storage carriers include computer hard drives, USB flash drives, mobile hard drives, etc. With the development of internet information technology, some free network cloud storage spaces have emerged. This study's investigation found that most researchers recognize the importance of academic information preservation. As information storage costs continue to decline, using mobile hard drives to preserve personal academic information has become more convenient. The widespread application of the internet and the popularization of mobile terminal devices have brought convenience to academic research while also bringing problems of academic information storage, migration, and management. Cloud computing provides new solutions and technical support for this. Personal cloud storage enables users to access and share documents, pictures, and other resources anytime, anywhere through mobile phones, pads, PCs, and other terminal devices, facilitating researchers to achieve synchronization, integration, backup, and sharing of academic information scattered across different devices. Some interviewed researchers expressed that although cloud storage tools offer large free space, they believe their security and stability remain problematic. Due to the lack of moral and legal constraints on software service providers, once academic information is lost or leaked, the consequences would be irreversible. Some respondents indicated that they use mind mapping to construct knowledge trees for preserving related information to facilitate a holistic understanding of professional fields.

(3) **Academic Information Search Tools**: Regarding academic information reappearance, most respondents stated that reappearance results are closely related to the quality of information organization. From respondents' information reappearance results, it is evident that researchers with clear themes and well-established classifications can often quickly locate required information. However, due to limitations in personal memory, researchers also forget academic information storage locations. Most respondents indicated they search for relevant folders through situational recall, while some use desktop search tools like hard drive search. However, because memory of specific information names and keywords is unclear, using tools for information reappearance can be challenging, and search results are not completely intelligent. Excessive search results also create

cognitive screening burdens.

This study selected eight commonly used academic information management tools among researchers at the current stage. Since these tools' basic functions already have detailed user manuals, they are not elaborated here. Only a functional comparison analysis of these eight tools is conducted based on this study's demand survey and analysis of researchers, as shown in Table 6 :

Table 6. Comparative Analysis of Functions of Commonly Used Academic Information Management Tools

Function	NoteExpress	EndNote	Notefirst	E-Study	Youdao Cloud Notes	OneNote	EverNote	Baidu Cloud
Preserve multiple types of information (documents, images, web pages, etc.)	Y	Y	Y	Y	Y	Y	Y	Y
Fragmented information management	Y	N	Y	Y	Y	Y	Y	N
Personalized information push	N	N	N	N	Y	N	Y	N

Function	NoteExpress	EndNote	Notefirst	E-Study	Youdao Cloud Notes	OneNote	EverNote	Baidu Cloud
Multi-terminal synchronization and sharing	Y	Y	Y	Y	Y	Y	Y	Y
Team research collaboration and information sharing	N	N	N	N	Y	Y	Y	Y
Semi-automated/automated information archiving and organization	P	N	P	P	N	N	N	N

Function	NoteExpress	EndNote	Notefirst	E-Study	Youdao Cloud Notes	OneNote	EverNote	Baidu Cloud
Flexible organization methods (folders, tags, etc.)	Y	Y	Y	Y	Y	Y	Y	N
Keyword information query and filtering (supporting full-text content retrieval)	Y	Y	Y	Y	Y	Y	Y	N

Note: “Y” indicates the tool has the corresponding function, “N” indicates it does not, and “P” indicates partial support.

The comparative analysis in Table 6 shows that these tools have their own strengths but also certain defects during usage. How to effectively integrate and consolidate the above functions based on current networked and digital research characteristics while fully considering researchers’ behavioral habits to truly become personalized academic information management assistants for researchers becomes particularly important.

3.2 Design Concepts for Personal Academic Information Management Tools

This study's survey results indicate that most researchers recognize the importance of personal academic information management. According to the theoretical model of influencing factors for researchers' intention to use personal academic information management tools constructed above, perceived usefulness, perceived ease of use, individual factors, and contextual factors are the main reasons affecting whether they use tools to manage personal academic information. To better help researchers use personal academic information management tools to manage and reappear information, the design of such tools needs to further meet researchers' intrinsic needs, which has certain guiding significance for subsequent tool design, development, and promotion.

Based on further analysis of this study's survey results, the following design implications are derived:

(1) **Keep it simple and user-friendly interface (Keep It Simple and Stupid, KISS)**. The KISS principle is the most highly recommended principle in current design and should also be emphasized in personal academic information management tool design. Usability is one of the main needs for academic information management tools expressed by respondents in interviews. J. Nielsen [24] pointed out that usability is a quality attribute for evaluating user interface ease of use, divided into five dimensions: learnability (difficulty for users to complete tasks when first using the design), efficiency (user speed in completing tasks after becoming familiar with the design), memorability (difficulty for users to re-familiarize with the design after not using it for some time), errors (frequency and severity of user errors and ease of recovery), and user satisfaction with the design. He also noted that design practicality—how to cater to user needs—is important. Researchers use tools to manage academic information partly to save time and energy. Tool design should be user-centric, with simple and smooth operation and intuitive interfaces that meet the principle of least effort.

(2) **Support multiple information organization structures**. Researchers preserve academic information to quickly and accurately find relevant content when needed. By classifying and organizing stored academic information, researchers enable the information to truly generate value for personal research innovation and improve overall research efficiency. This study's survey found that current academic information organization mainly follows folder hierarchy structures by information content themes, which conforms to users' long-standing habits. Respondents indicated that the logical relationships between folder levels facilitate accurate information retrieval when needed. However, as researchers' academic information volume continuously increases, folder organization structures gradually reveal drawbacks. Since researchers'

information environments and academic research tasks are constantly changing, this requires more flexible information classification and organization methods. Overly fixed and single folder structures are difficult to meet their needs. Moreover, excessively deep folder hierarchies are not conducive to subsequent retrieval. Individual classification is a complex cognitive activity, and similar folder classification themes caused by individual cognition can lead to substantial information duplication. Therefore, tool design should consider multiple organization structures for academic information, incorporating folder hierarchy structures, tag cloud structures, timeline structures, information semantic network structures, and other organization methods.

(3) **Compensate for limitations in personal memory and cognition**. This study's results show that researchers have limitations in personal memory. They are not good at remembering details of academic information, easily forgetting information names or keywords, storage locations, and modification versions. However, they can retrieve information through associative situational recall. Most respondents indicated they are not accustomed to using tools to find needed information because they cannot recall information details (such as names, keywords) to construct search queries, and tool search results require further screening, creating a certain cognitive burden. In designing personal academic information management tools, consideration should be given to individuals' memory of information characteristics, improving search and query functions, adding contextual information content recall and retrieval functions, and giving users greater space to meet their search needs.

(4) **Resolve academic information dispersion and synchronization/sharing across multi-terminal devices**. With the emergence and popularization of the internet, continuous development of information technology, and richness of mobile terminal devices, how researchers achieve transmission, synchronization, and sharing of academic information scattered across different terminal devices is very important. Researchers' research process is a divergent problem-discovery and problem-solving cycle, requiring 随时随地保存 accumulated and encountered information data during the research process. Dispersed storage of academic information increases management complexity. When information content changes, how to achieve update and merging of information across different terminal devices is also crucial. Therefore, personal academic information management tool design must consider academic information synchronization and sharing issues. The tool's application environment should not be limited to computer platforms but should also exist on mobile devices such as mobile phones, achieving true multi-terminal academic information viewing and sharing through account password login.

(5) **Importance of academic information security**. The era of large-

capacity data storage allows people to view and manage data from any device and location, but privacy protection must be considered when viewing data information. Different types of information have different levels of security needs. This study found that respondents all recognize the importance of academic information security. Academic information security ensures that personal creative achievements (such as academic paper ideas and drafts) will not be damaged or lost due to software, hardware, or personal reasons. Respondents indicated that timely and effective backup management of academic information can well ensure information security. Academic information backup management mainly falls into two types: one is tools saved locally and completely controlled by individuals, such as mobile hard drives; the other is tools saved on network cloud storage. While network-based tools bring convenience to researchers, they also have certain problems. Some respondents expressed distrust of network-based tools, believing that data stability, information security, and privacy issues cannot be ensured after data upload. Therefore, when designing a personal cloud-based academic information management tool, this researcher need should be considered, ensuring that user information data can be exported at any time to avoid user information loss due to software issues.

(6) **Personalized design that aligns with user habits**. Personal academic information management tool design should fully consider researchers' habits of preserving, organizing, sorting, and searching academic information. Tool design should track and preserve researchers' information management habits. Users should be able to choose functions that meet personal needs.

(7) **Information organization consistency**. As researchers' academic information volume continuously increases, academic information needs to be preserved and organized by categories. All respondents in this study indicated that effective and reasonable organization of academic information is important, and the quality of organization affects future academic information retrieval efficiency. Although most respondents recognize this issue, they are not skilled at classifying information and are unwilling to spend substantial time and energy organizing personal academic information. As academic research deepens, their information collections become increasingly large. Inconsistent organization standards also lead to problems like duplicate information preservation, affecting future academic information reappearance efficiency. Therefore, tool design should enable semi-automated and automated archiving and regular organization of academic information, achieving standardization of academic information organization to save management time and energy and further enhance research efficiency.

(8) **Multi-dimensional revelation and representation of academic information**. Digital academic information should be revealed and rep-

resented from multiple perspectives. When designing search functions for personal academic information management tools, in addition to considering keywords, titles, and other factors, information should also be described and revealed from dimensions such as information type and information creation time.

(9) **Semantic integration and push**. The continuous development of the internet has brought problems such as information explosion and information disorientation. Personal academic information management tools should be based on knowledge grids and semantic networks, with knowledge-based and intelligent functions. According to researchers' knowledge behaviors and information search records, the tools should predict researchers' academic information preferences and needs, filter useless and less relevant information, and accurately push academic information to researchers. The tools should also support information reappearance combined with artificial intelligence technology and natural language technology, analyzing users' information query requests from the perspective of semantic understanding.

(10) **Support for team research collaboration**. Researchers are easily influenced by surrounding environments and people when using tools. Personal academic information management tools should not only effectively organize and manage researchers' academic information but also strengthen academic information communication, cooperation, and sharing among research team members, providing resource sharing and collaborative support for team research collaboration.

4. Discussion and Future Directions

This study employs qualitative grounded theory methodology to analyze and code in-depth interview data, summarizing and analyzing the influencing factors of researchers' intention to use personal academic information management tools. Through analysis of the current usage status of personal academic information management tools, it provides guidance and suggestions for developing suitable tools for researchers. However, this study has certain limitations: First, grounded theory requires theoretical construction to be deeply contextualized, and researchers must maintain high objectivity throughout the research process to avoid interference from subjective judgments. However, absolute objectivity may be difficult to guarantee in actual operation, and the author inevitably experiences some influence from subjective experiences, experiences, and existing literature. Second, there are limitations in the research sample. Although theoretical saturation has been achieved, future research should survey multidisciplinary researcher samples. Finally, this study provides a theoretical foundation for constructing personal academic information management tools for researchers through qualitative research. Future work will further implement specific modules and functional designs of the tools.

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Research on Personal Academic Information Management Tools for Scientific Researchers

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Abstract: [Purpose/significance] This article explores the influencing factors of scientific researchers' intention to use personal information management tools, constructs a related conceptual model, and provides theoretical guidance and advice for developing effective personal information management tools and improving information utilization and research work efficiency. [Method/process] Qualitative data is collected from 17 scientific researchers using semi-structured interviews. Four primary factors influencing the intention to use personal academic information management tools are concluded according to coding analysis based on grounded theory, and an influencing factors model is constructed,

including perceived usefulness, perceived ease of use, individual factors, and contextual factors. Meanwhile, according to the investigation and analysis of scientific researchers' demands, eight commonly used academic information management tools are selected for comparative analysis from the aspects of information classification and acquisition, storage management, organization, and communication and sharing. [Result/conclusion] The construction of personal academic information management tools for scientific researchers needs to consider users' interface, information organization structure, users' cognitive limitations, information synchronization sharing, academic information security, users' usage habits, semantic integration and pushing, and team research information sharing.

Note: Figure translations are in progress. See original paper for figures.

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