Investigating Chinese Community Residents' Perceptions of the Effect of Digital Emergency Science Popularization

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Abstract

Objective: To analyze the perceptions of Chinese community residents regarding the effect of digital emergency science popularization and to evaluate their satisfaction. Methods: A systematic sampling method was utilized to collect 316 valid questionnaires from community residents about their perceptions of digital emergency science popularization in terms of dissemination subjects and channels.

Results: Data analysis demonstrated that community residents were generally satisfied with the effect of digital emergency science popularization. Satisfaction was highest for dissemination channels and content, while lowest for audience perception. However, the quality and targeting of digital emergency science content need improvement.

Conclusion: Community residents can perceive the effect of digital emergency science popularization well, but there is a room for improvement in targeting the dissemination audience.

Keywords

Digitalization; Emergency Science Popularization; Satisfaction Evaluation, Perception of Effect

Introduction

In the digital era, innovative science popularization models have become a focus for academics. Generally, digital science popularization can maximize the scope of dissemination and improve audience skills. With the power of digital media, residents in remote areas of China can access accurate emergency science knowledge. Maximizing the use of digital conditions to disseminate emergency knowledge more widely is a critical task in current emergency management. In order to better promote the popularization of digital emergency science, this study collected data through questionnaires and conducted an in-depth analysis of community residents' perceptions and satisfaction with its effect, aiming to provide references for its future development.

Method

This study primarily employs the Fuzzy Comprehensive Evaluation Method, a comprehensive evaluation method based on fuzzy mathematics. It transforms qualitative evaluation into quantitative evaluation via using

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the theory of membership degree in fuzzy mathematics, delivering an overall evaluation of objects or phenomena influenced by multiple factors.

Based on the literature reviews and the research results of Qiao et al. (2023), the factors and their weights affecting community residents' perceptions of digital emergency science popularization were identified, as shown in Table 1.

Table 1 Evaluation Indicators and Weights

Primary indicators	Secondary indicators	weights	Tertiary indicators	weights	The meaning of Tertiary indicators
Community residents' satisfaction evaluation indicators for digital emergency science popularization	Perception of disseminators	0.141	Authority	0.542	The extent to which the disseminators are authoritative and reliable
			Originality	0.458	The extent to which the disseminators' content remains original.
	perception of science popularization content	0.265	Scientificity	0.272	The extent to which the science popularization content is scientific and reliable.
			Consistency	0.131	The extent to which the science popularization content is consistent with the title
			Timeliness	0.101	The extent to which the science popularization content keeps up with societal needs
			Practicality	0.115	The extent to which the science popularization content is interesting and attractive
			Interestingness	0.14	The extent to which the science popularization content is interesting and attractive
			Comprehensibility	0.242	The extent to which the science popularization content is simple and easy to understand.
	perception of dissemination channels	0.145	Interactivity	1	The extent to which the dissemination channels allow for user interaction
	perception of dissemination audience,	0.335	Suitability	1	The extent to which the audience perceives the digital emergency science popularization to be suitable for themselves
	perception of dissemination effectiveness	0.114	Accessibility	0.35	The level of coverage of digital emergency science popularization knowledge dissemination
			Satisfaction	0.62	The extent of residents' satisfaction with the perceived effectiveness of digital emergency science popularization

The evaluation indicators primarily include six aspects of community residents' perceptions of digital emergency science popularization and communication: perception of disseminators, reflected as authority and originality; perception of science popularization content, embodied as scientificity, consistency, timeliness, practicality, interestingness, and comprehensibility; perception of dissemination channels, mainly reflecting interactivity; perception of dissemination audiences, principally manifesting Suitability; perception of dissemination effectiveness, consisting of accessibility and satisfaction.

Evaluation of Digital Emergency Science Popularization Effectiveness

Distribution of Questionnaires

Based on the established evaluation indicators, this study designed corresponding survey questionnaires. The research was conducted by distributing the questionnaires both online and

offline, encompassing aspects such as respondents' basic information and their perception of the effectiveness of digital emergency science popularization. It targeted community residents in China, with a total of 318 questionnaires distributed. After excluding unqualified questionnaire data, 316 valid questionnaires remained. The questionnaire measured satisfaction by using a Likert five-point scale, with 5 points for "very satisfied," 4 points for "satisfied," 3 points for "neutral," 2 points for "dissatisfied," and 1 point for "very dissatisfied."

Statistical Analysis of Sample

For the data obtained from the survey, a two-sample statistical analysis is required to analyse the basic information of the sample subjects to determine if the sample data is representative. Therefore, this study conducted descriptive statistics on the community residents participating in the questionnaire survey. The specific information is shown in Table 2.

Table 2 Sample Information Statistics

Items	Options	Frequency	Percentage
Gender	Male	143	43.25%
	Female	173	54.75%
Age	Under 18	2	0.63%
	18-30	123	38.92%
	30-45	87	27.53%
	45-55	66	20.89%
	Over 55	38	12.03%
Occupation	Students/ Unemployed	33	10.44%
	Public servant	63	19.94%
	Private sector employees	83	26.27%
	State-owned enterprise employees	63	19.94%
	Freelancers/ Self-employed	73	23.10%
Residence	Urban community	170	53.80%
	Rural community	146	46.20%
Education level	Junior High or Below	23	7.28%
	High School or Vocational	71	22.47%
	Associate degree	73	23.10%
	Bachelor degree	189	43.01%
	Master or higher degree	91	13.23%

Data analysis reveals that the gender distribution is relatively balanced. In terms of age distribution, the majority are aged between 18 and 45, accounting for 66.45%. Regarding educational background, nearly 70% of respondents have received higher education, indicating a certain level of attention to knowledge, which helps ensure the quality of the questionnaire. In the aspect of occupational distribution, the survey covers a variety of professions, including those who have public-sector jobs and non-governmental jobs, students, and freelancers, providing a certain level of representativeness. Therefore, the survey data meets the requirements for high quality.

Evaluation Process

Using the fuzzy comprehensive evaluation method, the results of the community residents' perception survey on the effectiveness of digital emergency science popularization were organized. The satisfaction ratings for each item were statistically analyzed to obtain the frequency distribution of each indicator, as shown in Table 3.

Table 3 Summary of Satisfaction Scores

Indicators	Indicators coding	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
Authority	B1C1	29	37	31	136	82
Originality	B1C2	30	32	53	107	94
Scientificity	B2C3	24	38	54	116	83
consistency	B2C4	21	41	42	128	84
timeliness	B2C1	25	30	59	114	88
practicality	B2C2	24	34	51	101	106
interestingness	B2C3	21	31	64	108	92
comprehensibility	B2C4	28	31	55	110	91
Interactivity	B3C1	29	27	49	116	95
Suitability	B4C1	20	48	51	114	83
Accessibility	B5C1	29	26	45	112	103
Satisfaction	B5C2	25	27	53	95	115

According to the Fuzzy Comprehensive Evaluation Method, the frequency distribution results of the questionnaire statistics are preliminarily processed to better conduct the evaluation. The following five dimensions of criteria are obtained:

$$R1 = \begin{Bmatrix} 0.09 & 0.12 & 0.10 & 0.43 & 0.26 \\ 0.09 & 0.10 & 0.17 & 0.34 & 0.30 \end{Bmatrix}$$

$$R2 = \begin{Bmatrix} 0.08 & 0.12 & 0.17 & 0.37 & 0.26 \\ 0.07 & 0.13 & 0.13 & 0.41 & 0.27 \\ 0.08 & 0.09 & 0.19 & 0.36 & 0.28 \\ 0.08 & 0.11 & 0.16 & 0.32 & 0.34 \\ 0.07 & 0.10 & 0.20 & 0.34 & 0.29 \\ 0.09 & 0.10 & 0.17 & 0.35 & 0.29 \end{Bmatrix}$$

$$R3 = \{0.09 \quad 0.09 \quad 0.16 \quad 0.36 \quad 0.26\}$$

$$R4 = \{0.06 \quad 0.15 \quad 0.16 \quad 0.36 \quad 0.26\}$$

$$R5 = \begin{Bmatrix} 0.09 & 0.08 & 0.14 & 0.35 & 0.33 \\ 0.08 & 0.09 & 0.17 & 0.30 & 0.36 \end{Bmatrix}$$

Criterion Layer Fuzzy Judgment Matrix B:

$$B = W \times R$$

Through calculation, the fuzzy evaluation set of each criterion layer is as follows:

$$B1 = \{0.09 \quad 0.11 \quad 0.13 \quad 0.39 \quad 0.28\}$$

$$B2 = \{0.08 \quad 0.11 \quad 0.17 \quad 0.36 \quad 0.28\}$$

$$B3 = \{0.09 \quad 0.09 \quad 0.16 \quad 0.37 \quad 0.30\}$$

$$B4 = \{0.06 \quad 0.15 \quad 0.16 \quad 0.36 \quad 0.26\}$$

$$B5 = \{0.08 \quad 0.08 \quad 0.15 \quad 0.31 \quad 0.34\}$$

Overall, the fuzzy judgment matrix B for the target layer is:

$$B = \{0.08 \quad 0.12 \quad 0.16 \quad 0.36 \quad 0.28\}$$

Scores for each criterion layer are:

$$P1 = 0.09 \times 1 + 0.11 \times 2 + 0.13 \times 3 + 0.39 \times 4 + 0.28 \times 5 = 3.64$$

$$P2 = 0.08 \times 1 + 0.11 \times 2 + 0.17 \times 3 + 0.36 \times 4 + 0.28 \times 5 = 3.66$$

$$P3 = 0.09 \times 1 + 0.09 \times 2 + 0.16 \times 3 + 0.37 \times 4 + 0.30 \times 5 = 3.70$$

$$P4 = 0.06 \times 1 + 0.15 \times 2 + 0.16 \times 3 + 0.36 \times 4 + 0.26 \times 5 = 3.61$$

$$P5 = 0.08 \times 1 + 0.08 \times 2 + 0.15 \times 3 + 0.31 \times 4 + 0.34 \times 5 = 3.65$$

Comprehensive evaluation score E:

$$E = B \times H$$

Here, H is the fuzzy evaluation score, $H = \{1 \quad 2 \quad 3 \quad 4 \quad 5\}$

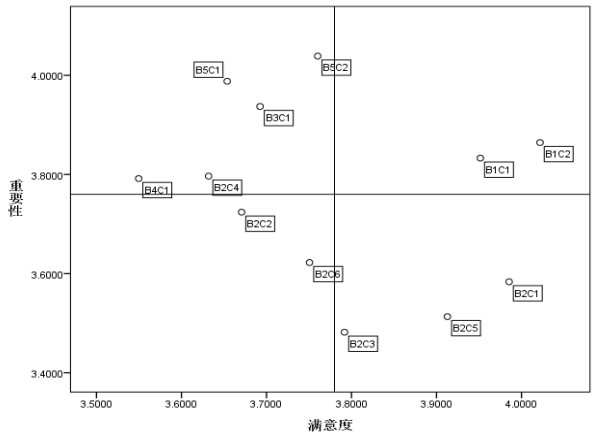
$$E = 3.64$$

Through calculation, the ranking of the criterion layers for the perception of the effectiveness of digital emergency science popularization is as follows: perception of dissemination channels (3.70) > perception of dissemination content (3.66) > perception of dissemination effects (3.65) > perception of disseminators (3.64) > perception of dissemination audiences (3.61). The satisfaction levels and comprehensive scores for each criterion layer are all within the range of (3, 4). Therefore, the satisfaction level of the community residents surveyed in this study for the perception of the effect of digital emergency science popularization is "satisfication".

The IPA Evaluation and Analysis

To acquire a more intuitive understanding of the effectiveness of various evaluation indicators in digital emergency science popularization, we have further analyzed using the IPA method. IPA involves identifying the main indicators, combining their importance with satisfaction to construct a quadrant chart, which visually represents the importance and satisfaction of each indicator. This approach facilitates the development of corresponding improvement strategies. In this study, the perception satisfaction of the general public regarding the effectiveness of digital emergency science popularization is plotted on the horizontal axis, while the importance of each evaluation indicator for the general public is plotted on the vertical axis. The average importance mean and satisfaction mean from questionnaire data are used as the midpoint, dividing the area enclosed by the x-axis and y-axis into four quadrants, thereby analyzing the differences in the importance and satisfaction of the evaluation indicators perceived by the general public.

Figure 1: "Importance and Satisfaction" Quadrant Chart for Community Residents' Perception of the Effect of Digital Emergency Science Popularization



By drawing vertical and horizontal intersecting lines, the entire coordinate axis is divided into four quadrants, forming the importance-satisfaction quadrant chart. Quadrant I is the primary advantage area. Quadrant II represents the secondary advantage area. Quadrant III is the secondary disadvantage area. Quadrant IV represents the primary disadvantage area.

As shown in Figure 1, the indicators of authority and originality fall in Quadrant I, which belongs to the high importance and high satisfaction area. This suggests that community residents are more concerned with the reliability and credibility of the sources of emergency science popularization knowledge, and this should be maintained.

Quadrant II belongs to the high importance-low satisfaction area. This area includes the indicators of practicality, interactivity, suitability, accessibility, and satisfaction. The indicators in this quadrant play a significant role in boosting the perception of satisfaction with the effectiveness of digital emergency science popularization and so should be given special attention.

Indicators falling in Quadrant III-the low importance-low-satisfaction region are consistency and comprehensibility The indicators in this quadrant are less satisfactory overall and need continuous improvement.

Quadrant IV belongs to the low importance-high satisfaction area. The indicators falling in this area are scientificity, timeliness, and comprehensibility. Although the importance of these indicators is not very high, they have achieved higher satisfaction among users. The indicators in this quadrant can either be maintained as they are or be slightly improved further.

Results

(1) Overall Satisfaction with Digital Emergency Science Popularization Among Community Residents

According to the research results, community residents are generally satisfied with the effectiveness of digital emergency science popularization, believing that it can be applied to some extent in practice. Among the numerous aspects, perception of communication channels and communication content scored the highest, while perception of the audience scored the lowest.

(2) Need for Improved Targeting in Digital Emergency Science Popularization

In the IPA analysis chart, feedback from community residents on indicators such as the suitability and practicality of digital emergency science popularization was relatively low. This demonstrates a lack of specificity in digital emergency science popularization and indicates that the depth of emergency science popularization work tailored to the actual needs of community residents' production and life needs to be enhanced.

(3) Content of Digital Emergency Science Popularization Needs Strengthening

Based on satisfaction evaluation and IPA analysis results, it can be seen that there is room for improvement in the consistency and comprehensibility of digital emergency science popularization. Issues include inconsistency between the titles and content of emergency science popularization knowledge, with some

titles being exaggerated to attract public attention, and some emergency science popularization content not being expressed in an easily understandable manner, making it difficult for community residents to comprehend simply.

Discussion

Digital emergency science popularization is used to respond to sudden emergencies, thus it is of great significance in protecting the personal safety of community residents and reducing property losses. Some scholars have proposed the concept of community response grid to enhance the feasibility of using mobile communication technology and network development in disaster response [5]. Investigating and studying the public perception and satisfaction towards the effect of digital emergency science popularization is crucial for improving it. According to this study, community residents perceive digital science popularization as a major means of bridging the knowledge gap between community residents and professional scientific popularization content, thereby facilitating the comprehension of popularized emergency science knowledge [6]. To improve community residents' perception and satisfaction towards the effect of emergency science popularization, efforts can be made in the following three aspects:

Firstly, regarding the issue of insufficient pertinence of digital emergency science popularization, we should focus on improving the improving its alignment with actual production and life, and create targeted emergency science popularization knowledge based on the actual situation of residents.

Secondly, in terms of the quality of digital emergency science popularization content needing improvement, we should play the regulatory role of the communication platform to ensure the consistency between emergency science popularization content and titles to the greatest extent. Meanwhile, the creators of digital emergency science popularization content should strive to popularize emergency knowledge in a more accessible manner.

Thirdly, the content of digital emergency science popularization should focus on the production and living demands of community residents, and actively promote the dissemination of relevant knowledge.

Conflict of Interests: the author has claimed that no conflict of interests exists.

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