INTERACTIVE RESEARCH ON THE DIGITAL DIVIDE AND SOCIAL ALIENATION OF THE ELDERLY IN ZHEJIANG PROVINCE

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Abstract: This study focuses on the digital integration problems of the elderly in Zhejiang Province, aiming to analyze the intrinsic connection between the digital divide and the sense of social alienation, and to explore the effective path to alleviate the sense of social alienation of the elderly. Through a questionnaire survey (270 older adults) and in-depth interviews, we analyzed the digital divide from the dimensions of personal cognition, social support, external environment, and operation and use, and analyzed older adults' difficulties in the use of electronic products, aging needs, and sense of social alienation using principal component analysis and linear regression. The results show that the digital divide is closely related to older people's sense of social alienation, and its influence mainly stems from older people's own factors, technological environment and social support. Accordingly, the study suggests that the keys for older people to cross the digital divide and alleviate their sense of social alienation are technological inclusion, group guidance and active acceptance. This will help older people to better integrate into the digital society and enjoy a happy old age.
Keywords: Digital divide; The elderly in Zhejiang province; Social alienation; Interactive research

1 INTRODUCTION

At present, population ageing in China is accelerating at an unprecedented pace and scale. Zhejiang Province, as a representative region of deep aging, the proportion of elderly people aged 65 and above in the household register continues to rise. At the same time, the rapid development of digital technology, the digital divide problem in the elderly group is more and more prominent: a large number of older people are at a loss for technological leaps, difficult to keep pace with the times, and there is a significant gap between their digital knowledge, access and use and that of young people [1]. This not only hinders the enjoyment of technological convenience by older persons, but also affects their social integration and quality of life, and requires urgent attention and solutions.

To date, there has been some academic research on the digital divide and social alienation in old age:

(1) There are different understandings in the conceptual definition [2,3], such as the digital divide in the elderly refers to the gap between the elderly and young people in the possession and access to information and the use of digital resources [4]. And social alienation refers to the negative emotions such as loneliness and helplessness felt by individuals in the process of integrating into the society due to various reasons, which is outwardly manifested as a change in objective behavior when interacting with the environment [5].

(2) There are also various perspectives on the causes of alienation, for example, empty nesters in cities tend to develop more social alienation [6]; and migrant elders often have difficulty in resolving their negative emotions, so that they are alienated and disconnected from society [7].

(3) Most scholars are positive about the Internet's contribution to positive aging, for example, they believe that older people's connectivity facilitates the maintenance of physical and mental health and promotes positive emotional experiences [8].

In summary, the limitations of existing research include: there is currently an abundance of research on the relationship between negative emotions and the generation of social alienation in the elderly in China, but there is little research on the interaction mechanism between alienation and the digital divide; and there is a lack of specific knowledge among academics about the content and frequency of networking among the elderly in a particular region, which has a greater impact on subsequent research.

Therefore, this paper analyzes the plight of digital access for the elderly in Zhejiang based on a survey on the network participation of the elderly in Zhejiang, and explores the factors influencing the formation and development of the sense of alienation; digs deeper into the mechanism of the digital divide's effect on the sense of alienation of the elderly in Zhejiang, explores the positive and negative relationships, and puts forward countermeasure proposals to promote the network participation of the elderly and alleviate their sense of alienation from the perspective of the micro-geographical region, so as to help build a more inclusive and integrated digital society, to This will help build a more inclusive and integrated digital society and promote the sharing of people's well-being and the common prosperity of spiritual life.

2 STUDY DESIGN

2.1 Main Research Methods

This study mainly adopts the questionnaire survey and in-depth interview method to gain an interpretive understanding of the behavior and meaning construction of the interviewees, and to reduce the self-defense psychology of the interviewees, so as to gain a deeper understanding of the difficulties in the use of electronic products by the elderly and their aging needs, and then put forward countermeasures to reduce the digital divide and alleviate the sense of social alienation.

2.2 Basic Information on the Survey

According to the Statistical Bulletin on the Elderly Population and Aging in Zhejiang Province in 2023 issued by Zhejiang Provincial Office for the Aged, the top 3 cities in the province in terms of the degree of aging are Zhoushan, Shaoxing and Huzhou City, and the city with the lowest degree of aging is Wenzhou City. The questionnaire issued basically covered the above mentioned areas with prominent or lighter aging (city administrative district as the basic unit), including urban and rural zones, and a total of 270 questionnaires were recovered. Interviews were conducted with 30 elderly people, and the interview questions focused on the difficulties in the use of electronic products by the elderly, the scope of application, the needs of aging and the degree of social alienation caused by the digital divide.

The respondents included 131 men (59 to 90 years old) and 139 women (55 to 94 years old). Literacy (highest level of education) was distinguished as follows: 5 illiterates, 91 elementary school students, 47 junior high school students, 40 secondary school students, 28 college students, 22 university students, 3 master's degree holders, and 1 doctoral degree holder.

The textual data from the questionnaire is converted numerically below in Table 1.

Table 1 Variable Definition and Symbol Description

Controls	Nnotation	Clarification
Social alienation of older persons	Isolation	5 = "Much more detached", 4 = "More detached", 3 = "Fairly detached", 2 = "Not too detached", 1 = "Not at all"
distinguishing between the sexes	Gender	1=Male, 0=Female
(a person's) age	Age	\
educational level	Education	1 = illiterate; 2 = elementary school; 3 = middle school; 4 = high school; 5 = vocational high school; 6 = Associate Degree; 7 = Bachelor's Degree; 8 = master's degree; 9 = Doctoral Degree
income level	Income	1=None, 2=less than or equal to 2000, 3=2000-5000, 4=5000-8000, 5=more than 8000

2.3 Description of Research Variables

2.3.1 Explained variable: social alienation of the elderly (Isolation)

Questionnaire item "Do you feel socially disconnected in your life now?" was used to measure the degree of social detachment felt by older people. There are five options, namely, "much more detached", "more detached", "fairly detached", "not too detached", and "not at all". The options were assigned a value of 5 to 1 in that order, with larger values indicating a greater sense of detachment.

2.3.2 Core explanatory variable: digital divide (Divide)

This research explains the variable of digital divide in four dimensions:

(1) Personal cognition dimension: The three data items in the questionnaire, "Do you feel overwhelmed when using digital products," "Do you want to ask for help when you encounter difficulties when using digital products," and "Can you alleviate the difficulty in time if it arises? "The three data items explain the personal perception.

(2) Social support dimension: The two data items in the questionnaire, "availability of digital devices" and "availability of network coverage at the place of residence", explain social support.

(3) External environment dimension: the questionnaire's three data items, "Whether children teach the elderly to use digital tools," "Whether there is relevant digital skills training in the community," and "How to ask for help when encountering difficulties when using digital products," explain the external environment dimension. "The three data items explain the external environment.

(4) Operational Usage Dimension: the questionnaire explains the operational usage of five data items: "one-week social network usage", "one-week video software usage", "one-week electronic payment usage", "one-week online shopping frequency", "one-week online registration and medication frequency", and "one-week online registration and medication frequency". "one week of online shopping frequency" "one week of online registration and medication frequency" in the questionnaire, these five data explain the operation usage.

These 4 dimensions are rationalized below:

The survey data were subjected to principal component analysis dimensionality reduction. Obtaining the following Table 2.

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Table 2 Reasonableness Test of Principal Component Analysis

Reasonableness Test	Value
KMO sampling applicability	0.778
Bartlett spherical test significance	0.000

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As can be seen from Table 2, the applicability of KMO sampling is 0.778, indicating that the data is very suitable for principal component analysis; the significance of Bartlett spherical test is much less than 0.05, indicating that there is correlation between the variables, which makes it suitable for principal component analysis; meanwhile, the principal component analysis shows that it is more appropriate to retain four principal components, which also confirms the previous analysis of the four dimensions of the digital divide.

Subsequently, the four principal components were calculated to obtain the quantitative results of the digital divide. Since the geographical environment and socio-economic characteristics of different regions are very different, and their digitalization levels are very different, the above results were reprocessed to obtain a standardized digital divide index at the individual level, with a larger value indicating a smaller digital divide at the individual level.

2.4 Analysis of survey data

In order to study in detail the mechanism of related indicators on digital divide and social isolation, the linear regression modeling was carried out according to the relationship between digital divide and indicators by adopting the stepwise regression step method, and the results show that with the continuous addition of independent variables, the R2 of the model is increasing, the standard deviation is decreasing, and the model's explanatory ability is increasing. The linear regression model between the digital divide and the indicators was finally obtained as:

$$Divide = \beta_0 + BX + \varepsilon \tag{1}$$

where the constant terms $\beta_0 = -2.287$, ε represents the error and the meaning of X with its coefficients are shown in Table 3:

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Table 3 Independent Variables and Their Coefficients

X	hidden meaning	Unstandardized coefficient B	Standardized coefficient β
x_1	Whether the child would teach the elder to use digital tools	0.407	0.203
x_2	How to get help when you have trouble using digital products	0.485	0.243
x_3	Weekly social network usage	0.183	0.259
x_4	Weekly video software usage rate	0.378	0.189
x_5	Weekly frequency of electronic payments	0.175	0.249
x_6	Weekly frequency of online shopping	0.106	0.140
x_7	Weekly frequency of online medication pickup	0.355	0.175
x_8	Can the bad mood be relieved in time if it arises	0.164	0.132
x_9	Whether you feel overwhelmed when using digital products	0.282	0.141
x_{10}	Whether you want to ask for help when having trouble using digital products	0.229	0.115
x_{11}	Availability of digital equipment	0.066	0.092
x_{12}	Availability of network coverage where you live	0.056	0.085
x_{13}	Availability of relevant digital skills training in your community	0.015	0.008

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In order to study the mechanism and causes of social alienation, we choose five independent variables, including "digital divide", "gender", "age", "education level", "income level", etc. to analyze the mechanism, and use Python to draw Spearman correlation coefficients as shown in Figure 1 below. ", "income level" and other five independent variables to analyze the mechanism, using Python to draw Spearman correlation coefficients, as shown in Figure 1 below:
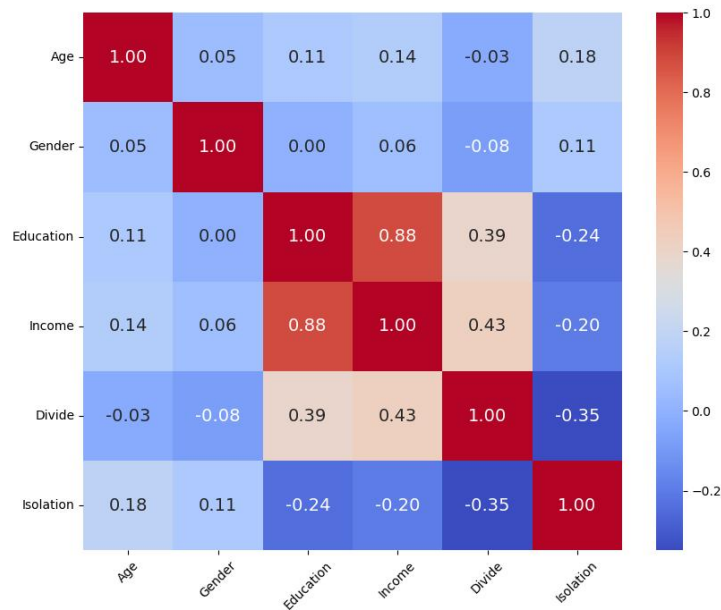
Figure 1 Heat Map of Spearman Correlation Analysis

The above figure illustrates that the negative correlation between the sense of social alienation and the digital divide index is large, while the correlation with other variables is weak. Thus, the least squares method is used to establish a one-way linear regression model between the sense of social alienation and the digital divide:

$$Isolation = \beta_0 + \beta_1 Divide_i + \varepsilon \tag{2}$$

The solution is $\beta_0 = 1.173 \times 10^{-16}$, $\beta_1 = -0.381$, and the goodness of fit of the model $R^2 = 0.449$, indicating that the model is able to explain the variables.

3 DISCUSSION

3.1 Analysis of Factors Contributing to the Sense of Alienation

Combining the data and interview information, the analysis concludes that the problem of the digital divide among the elderly can be divided into: (1) Technology access barriers: many elderly people do not have cell phones or are unable to access the Internet, limiting their digital access. (2) Lack of operating skills: There is a lack of systematic learning and training of digital skills for the elderly, especially in rural areas. (3) Inadequate design of smart devices: many product interfaces give less consideration to the special needs of the elderly, such as declining audiovisual ability, leading to difficulties in their use. (4) Psychological barriers: the unfamiliarity with technology and privacy and security issues have caused fear and rejection among the elderly, resulting in a decrease in their willingness and initiative to learn and accept new technologies, and difficulties in digital access.

The four core factors of the digital divide that influence the formation and development of alienation in older adults include:

(1) Older people's own factors: self-perceived limitations and psychological resistance

The decline of physiological functions of the elderly, such as the weakening of perceptions, the decline of memory and comprehension, and the gradual deterioration of the mental level, leads to the cognitive limitations of digital products, generates the fear and rejection of new technologies, and is prone to self-suspicion when operating, which triggers a sense of social alienation.

(2) External factors of the technological environment: technology adaptation and regional development differences

Inadequate design of age-friendly interfaces, such as small fonts, many advertisements and unclear functions of icons, hinders the use experience and digital literacy of older persons. Differences in regional development have led to uneven digital infrastructure, with developed regions having more digital opportunities for the elderly, while lagging regions face difficulties in accessing the Internet, exacerbating the digital divide and sense of alienation.

(3) Social support system: community care and family support

Community technology hotlines and digital-themed activities are insufficient, and there is a lack of "one-to-one" assistance and "digital buddy" mechanisms; family support mechanisms are immature, and the elderly lack emotional support and need more patient accompaniment from their families in order to help them cross the digital divide and improve their well-being. A sound social support system is the key to promoting digital access for the elderly and reducing the sense of social alienation.

3.2 Recommendations for countermeasures

3.2.1 Technological inclusion: a foundational force in bridging the digital divide

Technological inclusion is the willingness and ability of digitally disadvantaged groups to actively participate in digital application scenarios and achieve better digital inclusion [9].

To this end, software and apps should develop age-friendly interfaces with large fonts, high contrast, simple layouts and clear icons, reduce complex steps and multi-layered menus to simplify the operation process, provide voice interaction functions to reduce the obstacles and discomfort of older persons, and alleviate their sense of alienation in the digital society. Enhance the ease of use of devices, for example, by designing cell phones and computers with larger buttons and better grip.

Network coverage and stability should be strengthened to ensure the smooth use of digital services by older persons. Great importance should be attached to data security, and technical protection should be strengthened to safeguard the personal information and property of older persons when they use digital technology.

3.2.2 Group guidance: effective strategies for crossing the digital divide

Community-led digital learning groups for the elderly are formed to encourage the exchange of experience among the elderly. Invite young volunteers to conduct regular lectures and training on popularization of digital technology, teaching in an easy-to-understand manner. Organize competitions on the application of digital technology for the elderly, setting up simple and interesting tasks such as the production of electronic photo albums and giving them rewards, so as to stimulate the elderly's sense of competition, sense of achievement and participation in the digital society. Online, setting up technical assistance hotlines and specialized digital learning platforms for the elderly, providing a wealth of teaching videos and graphic tutorials. An online question-and-answer area has been set up to help older persons solve technical problems in a timely manner, utilizing remote assistance technology.

Encourage children to patiently teach their elders digital technology at home, and schools have launched the "Little Hands Holding Big Hands" campaign, which allows students to teach their elders about digital knowledge, enhancing intergenerational interaction and emotional exchange. Cases of older persons successfully crossing the digital divide have been publicized through the media to set an example and inspire older persons to learn digital technology.

3.2.3 Active acceptance: a necessary condition for crossing the digital divide

Older persons themselves should enhance their sense of acceptance of fresh technology. They should bravely take the first step to learn new concepts and master new technologies, and overcome their fear and rejection of new technologies. They should actively seek advice from their friends and seniors, and gradually familiarize themselves with the operation procedures of new technologies, so as to reduce the sense of social alienation brought about by unfamiliarity with the technologies.

Only when the elderly proactively embrace new technologies can they truly integrate into this fast-changing era and lead a more colorful, convenient and comfortable life in their twilight years.

4 CONCLUSION

Through questionnaire survey (270 older adults) and in-depth interviews (30 older adults), combined with principal component analysis and linear regression, this study explored the intrinsic links between the digital divide and social alienation among older adults in Zhejiang Province, as well as its influencing factors. The results show that older adults' self-perceived limitations, unfriendly external environment and insufficient social support are the core factors of the digital divide affecting the sense of social alienation.

The main research work includes: 1) conducting questionnaire surveys and in-depth interviews with older adults in different aging areas of Zhejiang Province; 2) analyzing the digital divide in four dimensions, namely, personal cognition, social support, external environment, and operational use; 3) applying statistical methods to reveal the relationship between the digital divide and the sense of social alienation and the mechanism of the digital divide; and 4) proposing targeted countermeasure suggestions, which will provide theoretical and practical guidance for solving the problem of the digital divide in older adults.

The feasibility and application value of the countermeasure suggestions proposed in this study are outstanding, and they are expected to create an age-friendly digital environment, reduce the sense of social alienation, and promote active aging. The threshold of digital access for the elderly is lowered through technological inclusion; the group guidance strategy enhances the motivation and confidence of the elderly to learn with the help of community and family support; and the concept of active acceptance guides the elderly to actively learn new technologies and improve their digital literacy.

Future research can expand the following directions: 1) expand the scope of the study to include older adults from more regions and explore regional and cultural differences; 2) combine the development of emerging technologies (e.g., AI, IoT) and explore their potential application in digital inclusion of older adults; 3) strengthen interdisciplinary research (psychology, sociology, information science, etc.) to analyze the complex interaction mechanism between the digital divide and the sense of social alienation, and to facilitate the construction of a more inclusive digital society.

COMPETING INTERESTS

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