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Article

The Current Situation and Influential Factors of Bottom-Up Technology Transmission in Chinese Rural Families

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Abstract: With the rapid development of science and technology and the drastic changes of society, the digital generation gap has a negative impact on intergenerational relationships. To help the older generation integrate into the digital world and narrow the digital generation gap within families, this study investigated the current situation of three-generation bottom-up technology transmission in Chinese rural families and explored the factors related to this process. Using the questionnaire survey, we surveyed 436 samples of 79 families in China, including 197 grandparents, 122 parents and 117 children. The results show that most of the older generation learn to use WeChat from the younger generation. Although the grandparents' adoption and use of digital media are significantly lower than those of the parents, they are significantly more receptive to bottom-up technology transmission than the parents. Furthermore, bottom-up technology transmission is mainly related to the demographic characteristics, subjective feelings, psychological expectations, degree of interaction and intimacy of family members. The more vulnerable individuals (older, less educated, female, less self-efficacy and more psychological disorders), the more likely they are to receive bottom-up technology transmission. The findings emphasized the important influence of mediated communication and intimacy in bottom-up technology transmission in Chinese rural families.

Keywords: digital media, bottom-up technology transmission, WeChat, rural families, three generations

Introduction

In the information age, with the rapid development of the Internet, new media technology has penetrated and embedded in various fields of people's lives. Nowadays, social networking has become quotidian, with the number of users increasing from year to year (Khairulnissa et al., 2021). The "digital generation gap" has been repeatedly proved by the follow-up surveys of the Chinese government and the industry (Tencent, 2018; CNNIC, 2022). The digital generation gap has caused frictions and contradictions between family generations and affected the construction of harmonious family relationships. How to narrow the digital generation gap has become the focus of Chinese society. Bottom-up technology transmission has become the core path of the solution, and the family has become the main place where bottom-up technology transmission occurs.

Recent literature proposes that children can socialize their parents into changing the parents' sport fandom in a process researchers refer to as reverse socialization (Hyatt et al., 2018). Researchers define it as the process in which children influence and alter their parents' attitudes and behaviours (Jiao & Wei, 2020). Some consumer researchers have noted the reverse socialization process, whereby children convinced their parents to try new foods and restaurants, buy and wear more trendy clothes, and buy and consume in environmentally friendly ways (Ekström, 2007), or taught their parents to use new technology (Shim, Serido, & Barber, 2011; Watne, Lobo & Brennan, 2011). Reverse socialization exerts a positive influence on brand attitude and facilitates parents' adoption of the socialized brand (Jiao & Wei, 2020). When children acquire

advanced technology, skills, knowledge, or experiences that parents do not possess, their parents become willing to learn from their children (Bertol et al., 2017; Kerrane et al., 2012). Today, in the prefigurative society of the digital revolution and internet, reverse socialization may occur because children have more expertise than parents about innovations (Ekström, 2007; Plowman et al., 2008, 2010). For young people who are regarded as "digital natives," the integration of the Internet into their daily life is common practice(Hussain & Ismail, 2021). We can expect that the traditional top-down socialization pattern can be reversed with the adoption of new technologies.

Unlike the Western family structure, which centres on two generations of parents and children, the Chinese family structure still emphasizes "Three generations under one roof". According to CNNIC's survey data, by December 2021, the number of Internet users aged 60 and over in China has reached 119 million. Therefore, the study of bottom-up technology transmission cannot ignore the grandparents in the family. In addition, previous studies on bottom-up technology transmission have paid little attention to bottom-up technology transmission of Chinese rural families (Hong & Li, 2019), but by December 2021, the number of Internet users in rural China has reached 284 million, so the communication academic community cannot ignore Chinese rural Internet users. Thus, this study will investigate the current situation of three-generation bottom-up technology transmission in rural families in China and explore the factors that intervene in bottom-up transmission.

Literature Review

1. Bottom-up Technology Transmission within Families

Bottom-up technology transmission is defined as youths' perceived influence on their parents' digital media adoption (i.e., the parents' buying of new technology or the youths' convincing their parents to purchase the new technology) and learning process (i.e., the extent to which children have taught their parents how to use ICTs). Many scholars have paid attention to the phenomenon of the younger generation teaching the older generation technology and affirmed the important role of the younger generation in the process of the older generation accessing and using the Internet. Studies have investigated the impact of children on their parents using and learning digital media, focusing on how children teach their parents to use digital media, such as computers, mobile phones and the Internet (Ito, 2009; Correa, 2014). A survey of 187 parent-child pairs in Flanders found that children instructed their parents on how to use digital media, especially new media such as smartphones, tablets and apps (Sara, 2018).

The research on bottom-up technology transmission often focuses on the young generation (Zhou & Ding, 2020). Only a few studies have examined the performance of both parents and children (Li, 2017; Hong & Li, 2019), and very few studies have regarded the ancestors as the research object (Zhou & Ding, 2020). In the process of family digitization, children are "young experts" (Livingstone, 2009), "enthusiastic experts" (Bakardjieva, 2005; Fernández-Ardèvol, 2014), the "link" between parents and computer professionals (Kiesler, Zdaniuk, Lundmark & Kraut, 2000), and media brokers of the family (Katz, 2010). They promote home digitization in many ways: providing a reason for acquiring home Internet access, increasing elders' interest in using the Internet, and improving elders' online skills (Crocco, Cramer, & Meier, 2008).

Bottom-up technology transmission research was introduced into China in the 1980s by a Chinese scholar, Zhou Xiaohong. He conducted two stages of large-scale interviews, which demonstrated that the phenomenon of bottom-up technology transmission widely appeared in Chinese families and pointed out the main reasons why offspring were able to conduct bottom-up technology transmission to their parental generation (Zhou, 2000; Zhou, 2008). Since the introduction of bottom-up technology transmission research in China, Chinese scholars have made in-depth explorations of the formation, performance, nature and social function of bottom-up technology transmission and studied the phenomenon of bottom-up technology transmission from different perspectives. Zhou Yuqiong found that the deeper the degree of bottom-up technology transmission was, the more harmonious the parent-child relationship was, and the more parents were able to respect their children (Zhou, 2014); Zhu Xiuling's research found that bottom-up technology transmission triggered a shift in family power relations from one-way authority to two-way authority (Zhu, 2015; Zhu, 2018). Scholars carry out investigations and research in China's urban areas but do not carry out

investigations and research on bottom-up technology transmission in rural areas. With this in mind, we ask the following:

RQ1: What is the current situation of three-generation bottom-up technology transmission (i.e., digital media adoption and learning process) in Chinese rural families?

2. Factors Related to Bottom-Up Technology Transmission

Research by Korupp and Szydik (2005), Nelissen and Van den Bulck (2018), Lüders and Brandtzæg (2017), and Cáceres and Chaparro (2017) demonstrated that bottom-up technology transmission in various media forms (internet, smartphones, tablets, SNS, etc.) was widespread across countries. Some studies believed that the influencing factors of bottom-up technology transmission were mainly related to individual demographic characteristics such as gender (Lu, Bao, & Lin, 2012), age, education level, income (Zhou, 2014), and occupation (Zhu, 2018). For instance, Lu et al. (2012) found that the higher the parents' education level, the deeper the impact of bottom-up technology transmission. Zhu and He (2002) thought that subjective perceptions including perceptions of new media features, popularity, and demand could affect the adoption and use of new media by the parent.

Some researchers emphasized the influence of living distance (Huang, Li, & Pan, 2016), family communication patterns (Jiang & Luo, 2009), family communication levels (Lu, Bao, & Lin, 2012), parenting styles (Zhu, 2018), parent-child relationships (Huang, Li, & Pan, 2016) on bottom-up technology transmission. For example, Jiang (2008) said that the more equal the parent-child relationships, the more likely it was that bottom-up technology transmission would occur.

The bottom-up influence process is more (or less) likely to occur depending on the context, such as structural factors and family culture (Correa et al., 2013). It is relevant to account for structural factors, including the household class position, gender roles, and the ages of family members. It is also pertinent to consider the family culture, namely, the politics of the home and the interactions among household members (Haddon, 2006).

As most of bottom-up technology transmission studies explored factors in a fragmented manner, we synthesized the perspectives of Chinese and Western scholars and put forward the localization factors that influenced bottom-up technology transmission: demographic characteristics, subjective feelings, psychological expectations, degree of interaction, degree of intimacy and intergenerational support (see Figure 1).

Subjective feelings

Individuals' perceptions of the characteristics, popularity and needs of new media can significantly influence their adoption and use of new media (Zhu & He, 2002). Theoretically, these subjective feelings will also influence the willingness of the older generation to accept bottom-up technology transmission, because the main purpose of bottom-up technology transmission is to assist them in adopting and using new media.

Psychological expectations

Some people said that the psychological expectations of parents and children influenced the bottom-up technology transmission process. For example, Jiang (2008) showed that the willingness of children to transmit the technology and the willingness of parents to accept were the influencing factors, and Zhu (2018) found that the parents' performance expectations, effort expectations and innovative spirit were the influencing factors. Ding (2019) believed that the older generation's psychological expectations of bottom-up technology transmission included the older generation's self-efficacy in the process of bottom-up technology transmission and subjective psychological obstacles to the process of the younger generation teaching themselves.

Degree of interaction
The degree of interaction refers to the way and frequency of communication with family members. It was measured from the distance of family members, interaction patterns, the frequency of interaction, the duration of interaction, and the frequency of joint activities (Ding, 2019).

Degree of intimacy
Intergenerational intimacy refers to a kind of intergenerational mutual cognition, understanding and emotional sharing reflected in deep communication, oral expression and physical expression in emotional dependence (Yan & Yang, 2017).

Intergenerational support
Intergenerational support refers to the informal support provided by different generations of family members, including economic support and instrumental support (Lin, 2014).

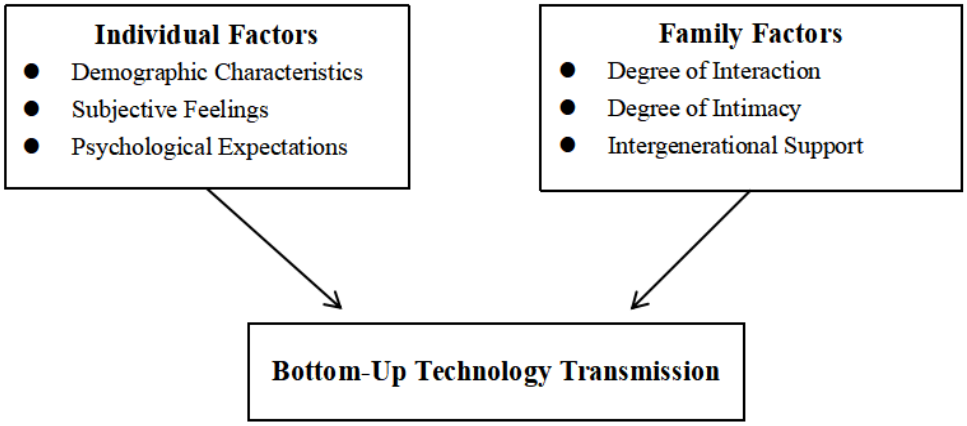

Figure 1. Factors that intervene in bottom-up technology transmission

This theoretical framework not only integrates the existing literature but also introduces two new research perspectives. Firstly, most of the past studies observed bottom-up technology transmission from the perspective of the younger generation, which essentially reflected the "transmission given" (that is, the transmission that the younger generation claims to carry out to the older generation). This theoretical framework focuses on both the younger and older generations and examines "transmission received" (that is, the transmission that the older generation receives from the younger generation). Secondly, most studies are limited to the two generations of parents and children, leaving out the elderly who need the technology transmission most. It is also inconsistent with the common three-generation structure of Chinese families. We divided the participants into grandparents and parents and investigated and compared the grandparent's receipt of the younger generation's technology transmission and the parent's receipt of their children's technology transmission. As such, we ask the following:

RQ2： Do demographic characteristics, subjective feelings, psychological expectations, degree of interaction, degree of intimacy and intergenerational support influence bottom-up technology transmission in rural Chinese families?

Methodology

1. Sampling and Procedure
According to the convenience of the investigation, this study selected the villages under the jurisdiction of the investigator's hometown: Liuqiao Town, Huaibei City, Anhui Province. Liuqiao Town is a nationally civilized town, with 17 villages under its jurisdiction, including Penglou, Chenji and Dinglou. By the end of 2020, Liuqiao Town had a total registered residence population of 61,409. 13,585 people (22.1%) were under the

age of 18; 15,826 people (25.8%) were aged 18-34; 22,296 people (36.3%) were aged 35-59; and 9,702 people (15.8%) were aged 60 or above, so the age distribution of the population can meet the needs of this study. At the same time, the fibre optic network has covered Liuqiao Town, which can meet the demand for high-speed internet access of users (The Official Website of the People's Government of Suixi County, 2022). After a period of preliminary investigation, it was found that the large-scale proliferation of WeChat in this area is underway. So, this area has investigability.

Based on pilot study, the value of Cronbach's α and KMO coefficient are higher than 0.7 for all variables (see Table 1). If Cronbach's α is more than 0.7, the scale is considered reliable (Boubker, Naoui, Ouajdouni, & Arroud, 2022). The validity of the scales was tested by KMO and Bartlett's test of sphericity. If the KMO coefficient is more than 0.6 and the significance score of Bartlett's test of sphericity is less than 0.05, the scale is considered valid (Boubker et al., 2022). Hence, this study is valid and reliable.

Table 1. Reliability and validity of the scales

Scales	**Cronbach's α**	**KMO coefficient**	**Significance score**
The perception of WeChat characteristics scale	.984	.787	.000
The perception of WeChat popularity scale	.969	.833	.000
The perception of WeChat needs scale	.982	.791	.000
The self-efficacy scale	.920	.815	.000
The psychological disorder scale	.809	.742	.000
The attitude scale	.731	.822	.000

Considering the weak enthusiasm of parents and grandparents to fill in the online questionnaire, and ensuring that participants can carefully fill in the questionnaire, a face-to-face convenience sampling survey was conducted from April 16 to May 14, 2022. Investigator took the rural elderly in Liuqiao Town as the source of samples. Investigator entered villages to look for people aged 60 and above, entered their homes with their consent, and interviewed their children and grandchildren as much as possible. Three generations completed different versions of the questionnaire (some questions were expressed differently depending on family roles). Finally, the questionnaires were collected from 436 participants, including 197 grandparents, 122 parents and 117 children. The data were analyzed by percentages and regression analysis using SPSS Statistics 23.

2. Measures

Subjective feelings

Taking WeChat as an example, we used the existing scale (Zhou, 2018) to measure the three dimensions of subjective feelings--the perception of WeChat characteristics, the perception of WeChat popularity, and the perception of WeChat needs. The scale consisted of 22 items assessed with a five-point Likert scale. Sample items include "I think WeChat is very functional", "It's not safe to pay by WeChat" and "I think WeChat is difficult to learn and use".

Psychological expectations

Ding (2019) designed the self-efficacy scale and the psychological disorder scale. The self-efficacy scale consisted of 7 items assessed with a five-point Likert scale. Sample items include "I can't learn these new things even if I want to" and "It's useless for me to learn these new things". The psychological disorder scale consisted of 5 items assessed with a five-point Likert scale. Sample items include "I'm worried that they don't respect me enough" and "I'm worried that they are too busy to teach me".

Degree of interaction

The distance of family members includes "living together", "the same district/county", "the same city", "the same province", "other provinces" and "abroad". The interaction patterns include "face-to-face", "phone call", "text message", "WeChat message" and "video call", and the last four are averaged together as "mediated communication". The frequency of interaction ranges from almost none to almost daily on five scales. The duration of interaction is a five-level variable with equal intervals of 30 minutes. The frequency of joint activities includes eating together, watching television, walking for exercise and going out shopping.

Degree of intimacy

In this study, the attitude scale designed by Ding Haiqiong (2019) was used to measure the three generations' perception of family intimacy. The scale consisted of 5 items assessed with a five-point Likert scale. Sample items include "I feel relieved to let my children do things" and "I have a close relationship with my children".

Intergenerational support

We used the intergenerational support scale (Lin, 2014) to test how three generations assessed their support for their parents or children. There is one question that "In the past 12 months, have you given the younger/older generation any money or gifts, and helped the younger/older generation do housework or babysit". The four options are "I have given them some money or gifts and helped them do housework or babysit", "I have given them some money or gifts but not helped them do housework or babysit", "I have helped them do housework or babysit but not given them some money or gifts", and "I have not given them some money or gifts and not helped them do housework or babysit".

The Findings

1. Profile of Demography

Table 2. Demographic characteristics of 79 families

	Grandparents	**Parents**	**Children**
Gender			
Male	46.7%	43.4%	47.9%
Female	53.3%	56.6%	52.1%
Age			
0-10 years old			17.1%
11-20 years old			29.9%
21-30 years old		11.5%	50.4%
31-40 years old		28.7%	2.6%
41-50 years old		46.7%	
51-60 years old		13.1%	
61-70 years old	44.2%		
71-80 years old	46.7%		
Over 80 years old	9.1%		
Education level			
Primary school and below	72.1%	11.5%	20.5%
Junior high school	20.8%	36.1%	22.2%
High school	7.1%	46.7%	33.3%
Undergraduate	0%	5.7%	21.4%
Postgraduate and above	0%	0%	2.6%
N	197	122	117

Table 3. Descriptive statistics of four factors of 79 families

	Grandparents		**Parents**		**Children**	
	Mean	SD	Mean	SD	Mean	SD
Subjective feelings about WeChat						
Perception of WeChat characteristics	3.41	0.64	3.45	0.58	3.85	0.51
Perception of WeChat popularity	3.56	0.78	3.64	0.77	3.91	0.86
Perception of WeChat needs	3.09	0.79	3.38	0.69	3.74	0.61
Psychological expectations						
Self-efficacy	2.74	0.93	3.55	0.91		
Psychological disorder	2.48	0.95	2.36	0.90		
Degree of interaction						
Distance of family members	2.11	1.17	2.46	1.67	2.39	1.61
Frequency of interaction	2.82	0.84	3.22	0.83	3.24	0.93
-Face-to-face	4.11	1.07	3.76	1.42	3.72	1.31
-Mediated communication	2.53	0.89	3.21	0.98	2.44	0.94
Duration of interaction	1.62	0.97	1.97	1.08	1.79	1.35
Frequency of joint activities	8.32	8.71	13.31	21.69	8.94	11.51
Degree of intimacy	4.11	0.53	3.93	0.55	3.88	0.58

Table 4. Intergenerational support of 79 families

	Grandparents	**Parents**	**Children**
Economic and instrumental support	32.0%	68.4%	52.7%
Only economic support	5.3%	24.1%	17.2%
Only instrumental support	37.2%	5.6%	27.2%
No support	25.5%	1.9%	2.9%

A total of 436 valid questionnaires were collected from 79 families, including 197 from grandparents, 122 from parents and 117 from children. Table 2 summarizes the distribution of key demographic variables for the three-generation samples of 79 families. Of the total sample, 53.3% of grandparents were female, 56.6% of parents were female and 52.1% of children were female. Most grandparents were 71-80 years old (46.7%), and the education level of grandparents was mainly primary school and below (72.1%). Most parents were 41-50 years old (46.7%), and the education level of parents was mainly high school (46.7%). Most children were 21-30 years old (50.4%), and the education level of children was mainly high school (33.3%). Table 3 shows the mean and standard deviation of participants' subjective feelings about WeChat, psychological expectations, degree of interaction and degree of intimacy. Table 4 shows the rate of intergenerational support. The intergenerational support of grandparents was mainly only instrumental support (37.2%). The intergenerational support of parents was mainly economic and instrumental support (68.4%). The intergenerational support of children was mainly economic and instrumental support (52.7%).

2. Current Situation of Bottom-Up Technology Transmission in Chinese Rural Families

The digital media adoption was measured by investigating whether the respondents use WeChat. The overall WeChat adoption rate of the older generation was 60.8%, of which 89 grandparents used WeChat (45.2%) and 105 parents used WeChat (97.5%). The difference between the two was highly significant ($p < .001$). To measure the digital media learning process, the respondents were asked who taught them to use WeChat. When asked "who first taught you to use WeChat" (i.e., WeChat learning process), 59.8% of the older generation received WeChat learning process from the younger generation, with 70.8% of grandparents and 50.5% of parents receiving WeChat learning process from the younger generation. The difference between the two was highly significant ($X^2=94.38$, $df=1$, $p < .001$). Then the study investigated whether the respondents had mastered 18 functions of WeChat, including accepting friend invitations, adding friends, voice and video chat and other functions. If the respondents had mastered one function, they would get 1 point. If they had not, they would get 0 point. Then the respondents were asked that who taught them to use each function. As a result, the number of the digital media learning process was counted.

Among 194 older generation who used WeChat, they had mastered an average of 9.80 WeChat functions, and the number of WeChat functions taught by the younger generation was 5.55. Grandparents had mastered an average of 7.64 WeChat functions, and the number of WeChat functions taught by the younger generation was 5.22. Parents had mastered an average of 12.21 WeChat functions, and the number of WeChat functions taught by the younger generation was 5.82. As shown in Table 5, parents' mastery of digital skills was higher than that of grandparents. Among grandparents, more than 80% mastered the functions of voice chat and voice live chat; while among parents, more than 80% mastered the functions of accepting friend invitations, voice chats, adding friends, voice live chat, subscribing to the official account, giving likes and comments on Moments, video live chat, posting something on Moments. Except for the skill of creating the official accounts, the proportion of grandparents learning digital skills from the younger generation was higher than that of parents.

Table 5. Older generation's learning and mastery of WeChat functions of 79 families

	Grandparents		**Parents**	
	Mastery rate	Rate of learning from the younger generation	Mastery rate	Rate of learning from the younger generation
Accepting friend invitations	57.3%	76.5%	93.3%	58.2%
Adding friends	55.1%	73.5%	85.7%	41.1%
Text chat	24.7%	68.2%	78.1%	67.1%
Voice chat	91.0%	72.8%	94.3%	64.6%
Voice live chat	80.9%	76.4%	84.8%	69.7%
Video live chat	77.5%	89.9%	81.9%	80.2%
Creating the official accounts	0.0%	0.0%	4.8%	20.0%
Red packet	61.8%	61.8%	64.8%	35.3%
Transfer	49.4%	63.6%	59.0%	41.9%
Pay	19.1%	64.7%	48.6%	37.3%
Posting something on Moments	50.6%	77.8%	80.0%	36.9%
Mini program	12.4%	45.5%	60.0%	41.3%
Subscribing to the official account	39.3%	40.0%	84.8%	37.1%
Sharing the official account article	49.4%	54.5%	72.4%	36.8%
Giving likes and comments on Moments	64.0%	57.9%	84.8%	46.1%
Set up a group	10.1%	66.7%	31.4%	54.5%
Search information	5.6%	40.0%	30.5%	28.1%
Search chat history	15.7%	50.0%	23.8%	44.0%

3. Factors Related to Bottom-Up Technology Transmission in Chinese Rural Families

The study took demographic characteristics, subjective feelings, psychological expectations, degree of interaction, degree of intimacy, and intergenerational support as independent variables. To examine the influencing factors of digital media adoption, the study took WeChat digital media adoption as the dependent variable for binary logistic regression. To examine the influencing factors of the digital media learning process, the study took WeChat function mastery as the dependent variable for general linear regression. The results are shown in Table 6. Overall, individual factors and family factors had strong explanatory power for bottom-up technology transmission (R^2 is between .152-- .261). Digital media adoption was mainly related to demographic characteristics, subjective feelings, degree of interaction and degree of intimacy, and the determinants of digital media adoption of grandparents and parents were roughly the same. Specifically, whether they were grandparents or parents, women who were older, less educated, had a more negative perception of WeChat characteristics, had more frequent mediated communication with their families, and had higher degree of intimacy with their families were more likely to buy digital media. In addition, grandparents who had more joint activities with their families were more likely to buy digital media. The determinants of the digital media learning process were roughly the same as digital media adoption, while the determinants of grandparents and parents were slightly different. Specifically, whether they were grandparents or parents, women who had a more negative perception of WeChat characteristics, had more frequent mediated

communication with their families, and had higher degree of intimacy with their families were more likely to learn how to use digital media from the younger generation. Grandparents who had a more negative perception of WeChat popularity had a stronger perception of WeChat needs, spent more time communicating with family members and were more likely to learn how to use digital media from the younger generation. Parents who were older, were less educated and had less self-efficacy were more likely to learn how to use digital media from the younger generation.

According to the findings, we could draw a typical portrait of the recipients of bottom-up technology transmission. At the individual level, they were vulnerable (older, less educated, female, less self-efficacy, and more psychological disorders). They had contradictory views on new media. Although they thought that new media was not good, they still had strong needs for it. They interacted with their families frequently, deeply and closely, and they were at the core of the family structure. They were most likely mothers and grandmothers who were "out of date" in digitalization in Chinese families. In order to keep up with the pace of family digital integration without remained marginalized, they were trying to receive more bottom-up technology transmission through close interaction with their families. According to the comprehensive comparison of the influencing factors of bottom-up technology transmission between grandparents and parents, family factors had a greater impact on grandparents than parents, while individual factors had a greater impact on parents than grandparents.

Table 6. Factors related to bottom-up technology transmission.

		Digital media adoption Beta		**Digital media learning Beta**	
		Grandparents	Parents	Grandparents	Parents
Individual Factors	**Demographic characteristics**				
	Gender(Female=0)	−.751***	−.451*	−.132***	−.103**
	Age	.415***	.562**	.011	.153***
	Education level	−.239**	−.611***	−.071	−.253***
	Subjective feelings of WeChat				
	Perception of WeChat characteristics	−.912***	−.714***	−.085*	−.152***
	Perception of WeChat popularity	.078	.119	−.067*	−.012
	Perception of WeChat needs	.046	−.182	.126**	.062
	Psychological expectations				
	Self-efficacy	−.005	−.264	.010	−.114*
	Psychological disorder	−.087	.082	−.021	.025
Family Factors	**Degree of interaction**				
	Distance of family members	.146	−.153	−.077	−.061
	Frequency of face-to-face communication	−.004	−.058	.008	−.067
	Frequency of mediated communication	.265*	.315**	.189***	.092*
	Duration of interaction	.228	.084	.124***	.129**
	Frequency of joint activities	.051**	.003	.056	.083
	Degree of intimacy	.365**	.726***	.099**	.093*
	Intergenerational support (No support=0)				
	Economic and instrumental support	.148	−.149	.037	.055
	Only economic support	.136	−.026	.061	.084
	Only instrumental support	.388	−.361	.064	.036
	R^2	.152	.261	.159	.195
	N	89	105	89	105

*p<.05 、 **p<.01 、 ***p<.001

Discussion

On WeChat adoption, the adoption rate of grandparents was 45.2%, and that of parents was 97.5%. 59.8% of the older generation were taught to use WeChat by their younger generation. WeChat skills such as voice chat, accepting friend invitations and adding friends were the skills most mastered by the older generation. Among the 18 WeChat functions, grandparents learned most of the functions from the younger generation, while the self-learning rate of parents was much higher than that of grandparents.

In terms of demographic characteristics, the female older generation accepted more bottom-up technology transmission than the male older generation. The older and less educated the older generation were, the more bottom-up technology transmission they accepted. In terms of subjective feelings about WeChat, the more negative perception of WeChat characteristics, the more bottom-up technology transmission the older generation accepted. The more negative perception of WeChat popularity, the stronger perception of WeChat needs, the more likely grandparents were to learn how to use digital media from the younger generation. There was no correlation between these two points and the bottom-up technology acceptance by the parental generation. In terms of psychological expectations, the lower the self-efficacy, the more likely parents were to learn how to use digital media from the younger generation. In terms of the degree of interaction, the more frequent mediated communication with their families, the more bottom-up technology transmission the older generation accepted. The longer the interaction time, the more likely the older generation were to learn how to use digital media from the younger generation. The more frequent joint activities, the more likely grandparents were to buy digital media. Distance of family members and frequency of face-to-face communication had no correlation with the bottom-up technology transmission. Family members need to communicate through mobile phones and other tools instead of meeting each other, which means that there are few opportunities to meet each other, and there is a situation of living in different places, so remote contact is more necessary. In this way, the digital media adoption between generations is even more stimulated. In terms of the degree of intimacy, the older generation who had higher degree of intimacy with their families were more likely to accept bottom-up technology transmission. Intergenerational support had no correlation with bottom-up technology transmission.

Interestingly, most Chinese think that co-living space is a necessary factor for the formation of "family". However, this study found that the two variables, the distance of family members and face-to-face interaction frequency were not significant in all regression, but the mediated communication frequency was significant in all regression. This comparison illustrated the redefinition of time, space and family communication patterns because of the media. With the development of digital media, people use WeChat to transform words, gestures, pictures, etc. into symbols and send them to each other. Family members living in different places use WeChat as a vehicle for online interaction so as to build a virtual space that can simulate the feeling of living together (Wu, & Long, 2016). In this private space isolated from the social public space, family members can communicate online twenty-four seven.

In addition, the intergenerational support was not significant in all regressions, while intimacy was significant in all regressions. The two variables were designed to measure family intergenerational relationships. The former focused on the economic and labour contributions to the family, while the latter focused on the emotional intimacy between family members. This was consistent with the traditional Chinese concept of family. With the gradual evolution of Chinese family from economic function to emotional function (Yan, 2018), the Chinese believe that the family should be a place of warmth, comfort and affection, and it's for emotional sustenance (Ding, & Guan, 2017; Wang, Du, & Wang, 2021). Therefore, the influence of intimacy on bottom-up technology transmission was much higher than that of intergenerational support.

To sum up, our findings highlight the important influence of mediated communication and intimacy in bottom-up technology transmission in Chinese rural families. It can be seen that the interaction across time and space with the help of digital media has enabled the younger generation to gain certain authority in Chinese rural families. It is fostering a new type of family intimacy and gradually replacing the traditional Chinese family power structure (Wu, & Long, 2016).

Admittedly, there are still some shortcomings in this study. Only families in five villages in Anhui Province were selected for the survey. In the future, we should visit and study more Chinese rural families

when available. And the data need to be compared between urban and rural families in order to draw deeper conclusions.

Conclusion

This paper examined the current situation and influencing factors of bottom-up technology transmission in Chinese rural families based on questionnaire data from a sample of 79 rural families in Anhui Province. This study found that although the grandparents' adoption and use of digital media were significantly lower than those of the parents, they were significantly more receptive to bottom-up technology transmission than the parents. The more vulnerable individuals (older, less educated, female, less self-efficacy, and more psychological disorders), the more likely they were to receive bottom-up technology transmission. The compensatory function of family factors for the digitally vulnerable groups had been further confirmed by comparing the influencing factors of bottom-up technology transmission between grandparents and parents. The digital vulnerable groups were able to draw strength from family communication and became the main beneficiaries of bottom-up technology transmission.

The contribution of this paper is mainly reflected in two points. Firstly, we proposed that bottom-up technology transmission should be investigated in the context of family communication. While most existing studies have discussed the influencing factors of bottom-up technology transmission at the individual level, we integrated family factors and proposed a theoretical framework that was more in line with the Chinese context. Secondly, a comparative perspective ran throughout our study. Bottom-up technology transmission is intergenerational interaction between the older and younger generations, but most of the existing research has ignored the older generation. This study distinguished the grandparents and parents among the older generation, and compared the extent to which they were influenced by the younger generation and the factors that influenced them.

Bottom-up technology transmission within families has bridged the digital generation gap to some extent. In terms of the findings, we suggest that the younger generation lead the older generation into the world of the Internet by influencing the older generation, including convincing their parents to purchase smartphones, teaching them to surf the Internet, helping them apply for WeChat and teaching them to use it, etc. This is conducive to promoting the contraction of intergenerational communication in Chinese rural families and strengthening the mutual integration and understanding between generations. This has significant practical significance to the current Chinese society, and at the same time reflects the humanistic care that communication studies should have as a social discipline.

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