The Affecting Mechanism of Fun of Learning Environment on Digital Literacy of High School Students Studying Japanese in Shandong Province, China

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[**Abstract**] Digital literacy is the main cause of enhancing students' future academic performance and promoting their growth, and fun learning activities are associated with digital literacy. Therefore, using a sample of 1,036 high school students studying Japanese in 23 schools in Shandong Province, China, the relationship between fun of learning environment and digital literacy, as well as the facilitating role of inner peace state and motivational regulation strategies, were investigated. The results confirm, for the first time, that fun of learning environment was positively related to digital literacy of high school students studying Japanese in Shandong Province, China. That inner peace state and motivational regulation strategies had a facilitating effect. This suggests that high school students studying Japanese need not only fun learning activities but also the connection between experienced peace states of mind and self-motivated control strategies to promote their digital literacy fully in Shandong Province, China.

[**Key words**] high school students studying Japanese; fun of learning environment; digital literacy; inner peace state; motivational regulation strategies

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[**DOI**] https://doi.org/10.62662/kxwxy0112006

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1 Introduction

Ervianti, Sampelolo and Pratama (2023), Gu, Huang and Lee (2023), Riyanti et al. (2023), Wahyuni et al. (2023), Zhang and Hyland (2023), and Zulkarnain et al. (2024) suggested that digital literacy is a core element in modern education that can drive students' professional development in multicultural environments. As stated by Kayaduman, Battal and Polat (2023), Murtadho et al. (2023), and Özeren (2023), digital literacy is an important constituent in advancing modern education. Furthermore, Kholid and Darmawan (2023), Nguyen and Habók (2024), and Utaminingsih et al. (2023) emphasized that although global attention to digital literacy enhancement has come to the forefront, there is a shortage of research in the field and a digital divide due to differentiation, which hampers the enhancement of students' academic performance. Thus, Fadilah, Rusdi and Ristanto (2023), Hadad, Watted and Blau (2023), Istiara and Hastomo (2023), Purwanto, Fahmi and Cahyono (2023), Rudyanto et al. (2023), and Yeşilyurt and Vezne (2023) called for identifying the antecedents and process mechanisms that affect students' digital literacy to become the most critical issue at the moment. Thus, Salganova and Osipova (2023), Nuryadi and Widiatmaka (2023), and Veronika et al. (2023) emphasized that only by identifying the antecedents and facilitating mechanisms of students' digital literacy can we break through the digital divide, promote the balanced development of educational resources, and even help students become future talents.

On the other hand, Riyanti, Sagena and Lestari's (2023) study found that the online learning environment is related to digital literacy. In addition, studies by Hall, Nix and Baker (2023), and Wahyuni et al. (2023) also

found that digital literacy is related to experience and motivation. However, it is not clear how fun of learning environment is related to digital literacy and whether the relationship is affected by inner peace state and motivational regulation strategies.

In addition, Ng, Ng and Chu (2023), Swarastuti, Budiyanto and Purwanto (2024), and Zhang and Hyland (2023) stated that digital literacy has an outstanding effect on students' foreign language learning. As Feng (2024), Rahman, Qasri and Ofara (2023), and Satar, Hauck and Bilki (2023) stated, digital literacy is a determinant of students' learning performance. However, this remains unproven among high school students studying Japanese in Shandong Province, China. On the other hand, Feng (2024), Wang (2023), and Zhang and Hyland (2023) suggested that the current digital literacy of Chinese students is poor and there is an urgent need to identify strategies to improve it. In addition, He et al. (2024), Liu (2023), Yasa et al. (2024), Ye, Wei and Bao (2023), Zhang and Wu (2023), and Zhang et al. (2024) emphasized the current low composite index of digital literacy among students in Shandong Province, China, and the need to find ways to help students improve their digital literacy in order to improve and adequately enhance their digital skills.

Therefore, the purpose of this study is to investigate the relationship between fun of learning environment and digital literacy of high school students studying Japanese in Shandong Province, China, as well as the facilitating effects of inner peace state and motivational regulation strategies, to reveal the primary factors and facilitating mechanisms that influence digital literacy of high school students studying Japanese in Shandong Province, China. This has important implications for identifying the antecedents and pathways that affect digital literacy of high school students studying Japanese in Shandong Province, China, and advancing their future academic performance and long-term development.

2 Literature review and hypothesis development

2.1 Digital literacy

According to Zhou (2023), digital literacy is the skills necessary for individuals in a digital society, including the ability to use digital technologies in work, learning and life. In addition, Martin and Grudziecki (2006) considered it as the ability of an individual to carry out a range of activities with the help of digital devices, tools, and resources in a given context. Similarly, Tao and Tang (2021) defined digital literacy as a complex set of competency traits, i. e. the awareness, ability and responsibility of students to be able to effectively use digital technologies to access, process, use, manage and evaluate digital information and resources, to be able to identify, analyze and solve problems in their learning and working, and to optimize, innovate and change the way they learn, work and live. As can be seen from the above, digital literacy emphasizes the cultivation of an individual's ability to apply digital technologies and professional development ability.

2.2 Fun of learning environment and digital literacy

Hung et al. (2016) defined fun of learning environment as the enjoyment of students' learning environment. In addition, Liu (2019) described digital literacy as the ability of students to use digital technologies confidently and critically in their academic lives. Riyanti et al. (2023) found that an online learning environment is associated with digital literacy. Bukit, Marcela and Ernawati (2023), Mokhtar, Xuan and Lokman (2023), and Rusticus, Pashootan and Mah (2023) argued that this is because fun of learning environment can stimulate students' interest and transform it into learning inputs, which can enhance the development of students' literacy. As Englund et al. (2023), Molinari and Grazia (2023), Rusticus et al. (2023), Sun, Kangas and Ruokamo (2023), Tisza (2023), and Tidy et al. (2024) stated that fun of learning environment facilitates students to reduce learning stress and relatively, enhances attitudes and experiences, it is key to enhancing students' overall academic performance. Hence the hypothesis:

H1: Fun of learning environment positively affects digital literacy of high school students studying Japanese.

2.3 The moderator role played by inner peace state

One possible mechanism that promotes the relationship between fun of learning environment and digital literacy is inner peace state. Wang et al. (2016a) defined inner peace state as a peaceful state of mind or experience. Patel and Ehrenzeller (2023) found that the environment was associated with inner peace state. In addition, Ji, Feng and Zhao's (2023) study also found that well-being had a facilitating effect between teacher support and academic self-concept. Wang et al. (2016b) stated that inner peace state increases students' resilience to life and learning, leading to better growth. Therefore, the interaction of fun of learning environment and inner peace state can stimulate students' interest and motivation and strengthen their resilience, which will ultimately further enhance learners' digital literacy. Hence the hypothesis:

H2: Inner peace state of high school students studying Japanese has a positive moderating effect between fun of learning environment and digital literacy.

2.4 The moderator role played by motivational regulation strategies

One factor that may contribute to digital literacy is motivational regulation strategies, which were defined by Wolters (1998) as the process in which individuals consciously adopt strategies to intervene, manage, and control their motivation to accomplish a particular activity or goal. Sun (2023) found that teacher support was associated with motivational regulation. In addition, Ren's (2023) study found that motivational regulation mediated the relationship between blended learning environments and engagement in learning. As stated by Kryshko et al. (2020), Teng (2024), and Sun (2023), motivational regulation moderates one's motivation according to different scenarios and is beneficial to students' success, as well as facilitating students to put effort and show persistence in their learning. Therefore, the interaction of fun of learning environment and motivational regulation strategies can strengthen students' self-control and enhance their interest, which will ultimately further enhance learners' digital literacy. Hence the hypothesis:

H3: Motivational regulation strategies of high school students studying Japanese have a positive moderating effect between fun of learning environment and digital literacy.

3 Methodology

3.1 Research framework

Construct the framework based on the hypotheses, as shown in Figure 1 below:

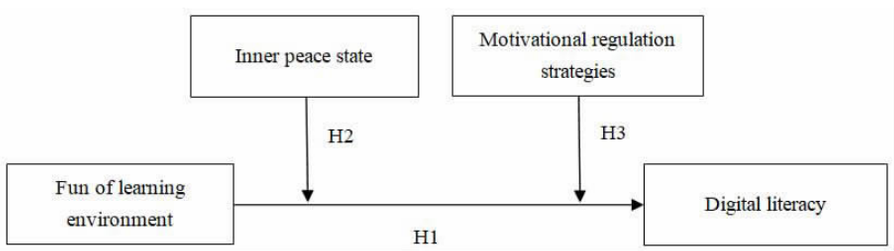

Figure 1. Depiction of the study's framework

3.2 Samples and procedures

The survey was conducted from January to March 2024. High school students studying Japanese from 23 schools in Shandong Province, China, were selected by purposive sampling. Their perceptions of fun of learning environment, digital literacy, inner peace state, and motivational regulation strategies were investigated by electronic questionnaires, with a final valid sample of 1036 (validity rate 79.692%).

3.3 Measures

Fun of learning environment scale: designed by Hung et al. (2016), divided into peer interaction,

environment fun creation, and learning atmosphere, 3 factors with 13 items (α=0.885).

Digital literacy scale: designed by Liu (2019), divided into competence in the information domain, communication and cooperation domain, security and privacy domain, digital content creation domain, and problem-solving domain, 5 factors with 22 items (α=0.832).

Inner peace state scale: adapted from Wang et al.'s (2016a) instrument (α=0.89), 1 factor with 5 items (SRMR=0.05).

Motivational regulation strategies scale: the Chinese version of Wolters and Benzon's (2013) instrument translated by Li et al. (2023), 6 factors with 30 items (α=0.979).

The questionnaire was measured and self-assessed on a 5-point scale, with gender, nature of school, and parents' education as demographic variables.

4 Results

4.1 Distribution of population traits

In the sample (as shown in Table 1), there are more male students (68.340%); more private school students (83.784%); more fathers (48.359%) with junior high school education and below; and more mothers (46.139%) with junior high school education and below.

Table 1. Distribution of population traits

Variables	Category	N	%
Gender	Male	708	68.340
	Female	328	31.660
Nature of school	Public school	168	16.216
	Private school	868	83.784
Father's education	Junior high school education and below	501	48.359
	High school education	153	14.768
	Junior college education	203	19.595
	Undergraduate education	121	11.680
	Master degree	45	4.344
	Doctor degree	13	1.255
Mother's education	Junior high school education and below	478	46.139
	High school education	230	22.201
	Junior college education	206	19.884
	Undergraduate education	98	9.459
	Master degree	22	2.124
	Doctor degree	2	0.193

Note: N=1036.

4.2 Model fit

SRMR=0.03, which is a good match (as shown in Table 2).

Table 2. Root mean square error

	Primary sample	Mean	95%	99%
Saturated model	0.03	0.029	0.031	0.032
Estimated model	0.03	0.029	0.031	0.032

Note: * =p<0.05.

4.3 Correlation analysis

The correlation matrix (as shown in Table 3) shows that fun of learning environment is positively correlated with digital literacy of high school students studying Japanese ($\beta = 0.437$ ***, $p < 0.001$), and H1 is valid.

Table 3. Narrative and correlation coefficient matrix

Variables	M	SD	1	2	3	4
1. Fun of learning environment	3.026	0.756	0.733			
2. Inner peace state	3.446	0.848	0.239 ***	0.729		
3. Motivational regulation strategies	3.287	0.87	0.294 ***	0.277 ***	0.743	
4. Digital literacy	3.232	0.855	0.437 ***	0.349 ***	0.378 ***	0.742
α			0.809	0.889	0.904	0.874
CR			0.877	0.905	0.875	0.890
AVE			0.538	0.532	0.553	0.551

Note: * = $p < 0.05$.

4.4 Moderator analysis

Moderator analysis (as shown in Table 4) shows that the interaction between fun of learning environment and inner peace state of high school students studying Japanese is significant ($\beta = 0.285$ ***, $p < 0.001$), indicating that the inner peace state promotes the relationship between fun of learning environment and digital literacy, and H2 is valid.

In addition, the interaction between fun of learning environment and motivational regulation strategies of high school students studying Japanese is significant ($\beta = 0.147$ ***, $p < 0.001$), indicating that the motivational regulation strategies promote the relationship between fun of learning environment and digital literacy, and H3 is valid.

Table 4. Moderator analysis

	Digital literacy					
	M1	M2	M3	M4	M5	M6
Gender	0.028	0.029	0.013	0.028	0.024	0.025
Nature of school	0.043	0.04	0.028	0.043	0.042	0.043
Father's education	0.169 ***	0.164 ***	0.162 ***	0.169 ***	0.168 ***	0.168 ***
Mother's education	0.137 ***	0.139 ***	0.135 ***	0.137 ***	0.152 ***	0.148 ***
Fun of learning environment	0.538 ***	0.484 ***	0.494 ***	0.538 ***	0.475 ***	0.472 ***
Inner peace state		0.170 ***	0.181 ***			
Fun of learning environment× inner peace state			0.285 ***			
Motivational regulation strategies					0.175 ***	0.178 ***
Fun of learning environment× motivational regulation strategies						0.147 ***
R^2	0.323	0.349	0.427	0.323	0.348	0.349
Adj R^2	0.316	0.341	0.419	0.316	0.340	0.340
F	44.415 ***	42.671 ***	51.892 ***	44.415 ***	42.442 ***	37.365 ***
DW			1.925			2.063

Note: * = $p < 0.05$.

As depicted in Figure 2, inner peace state of high school students studying Japanese reinforces the relationship between fun of learning environment and digital literacy.

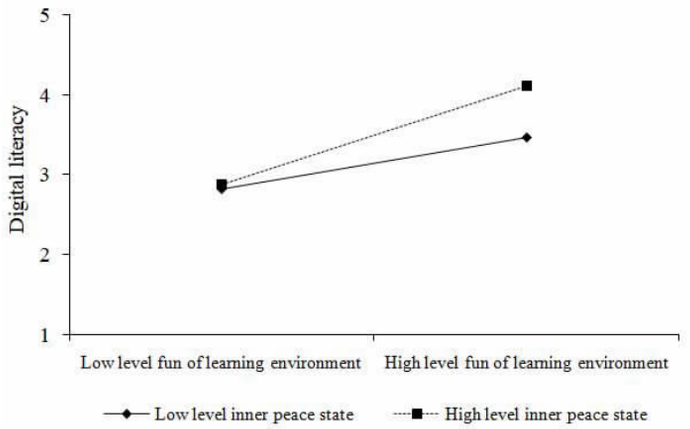

Figure 2. Moderating effect of inner peace state on the relationship between fun of learning environment and digital literacy

As depicted in Figure 3, motivational regulation strategies of high school students studying Japanese reinforces the relationship between fun of learning environment and digital literacy.

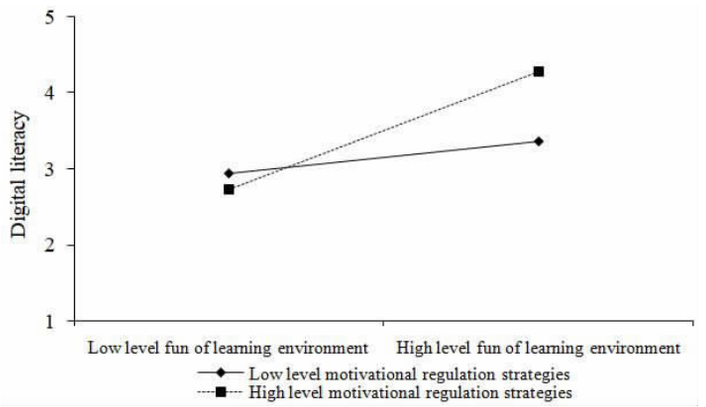

Figure 3. Moderating effect of motivational regulation strategies on the relationship between fun of learning environment and digital literacy

5 Discussion

5.1 Discussion, conclusion and suggestion

The results show for the first time that fun of learning environment is positively correlated with digital literacy of high school students studying Japanese. This is because students' perception of fun of learning environment enhances their interest and self-control, and also reinforces learning outcomes, enabling them to better cope with the stress of learning, which in turn can help them to better master digital skills. As stated by Kolarska (2020), Mundiri and Hamimah (2022), and Hong et al. (2016), learning environments have a long-term impact on students' growth and learning outcomes. Therefore, it is recommended that schools in Shandong Province, China, establish learning activities that are fun and through which students' digital literacy can be adequately enhanced, which can lead to a better mastery of digital technology and thus enhance students' academic performance.

The results show for the first time that there is a facilitating effect between inner peace state and fun of learning environment and digital literacy of high school students studying Japanese. This is because the interaction between fun of learning environment and inner peace state stimulates students' interest and motivation, and strengthens their resilience, which ultimately contributes to their digital literacy. As stated by Barati and Fahami (2024), Liu et al.

(2015), and Wang et al. (2016b), inner peace state increases students' resilience to life and learning and leads to better long-term development. Therefore, it is recommended that schools in Shandong Province, China, incorporate inner peace state into their students' professional development system, and allow students to enhance their inner peace state through long-term training in the development process, which will adequately enhance students' digital skills.

The results show for the first time that motivational regulation strategies of high school students studying Japanese have a facilitating effect between fun of learning environment and digital literacy. This is because the interaction between fun of learning environment and motivational regulation strategies strengthens students' self-control and interest, which ultimately promotes their digital literacy. As stated by Kryshko et al. (2020), Teng (2024), and Sun (2023), motivational regulation can regulate one's motivation according to different scenarios, and enhance students' effort and persistence. Therefore, it is recommended that schools in Shandong Province, China, should incorporate motivational regulation strategies into their students' professional development system so that students can improve their self-motivation control strategies in the process of development through long-term learning, which will maximize their digital skills.

5.2 Research contribution

This study contributes to the field of digital skills. This study highlights the characteristics of digital literacy and identifies the influence of fun of learning environment on it, and also finds the facilitating role of inner peace state with motivational regulation strategies in the above-mentioned relationship.

This advances the understanding of the antecedents of digital literacy and also expands the mechanisms of its promotion, which is important for the future long-term development of high school students studying Japanese in Shandong Province, China.

5.3 Limitations and directions

First, the sample size is less than 2,000, this study is conducted only in Shandong Province, China, and the conclusions may not be widely generalizable. Therefore, it is suggested that future studies could further expand the sample size or select other regions in China for comparative analyses, thus enhancing the adaptability of the study.

Second, this study only chooses fun of learning environment as an antecedent and inner peace state and motivational regulation strategies as facilitating mechanisms, which is not yet able to fully understand the antecedents and facilitators that affect students' digital literacy. Therefore, it is suggested that future research could also explore other antecedents and process mechanisms affecting digital literacy, such as emotional creativity (Stawicki & Krishnakumar, 2023), interactive mindfulness (MacDonald & Neville, 2023), and online learning communities (Fan & Sukpasjaroen, 2024; Meng & Li, 2024; Zhao, McClure & Gather, 2024), to further advance the development of students' digital skills (Li et al. 2024ab; Li et al. 2025ab; Shu & Li, 2024).

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