The Affecting Mechanism of Parental Educational Involvement Synergy on Secondary Nursing Students' AI Literacy in Yunnan Province of China

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［**Abstract**］AI is a necessary tool for students, and parental education is associated with AI literacy. Therefore, this study used purposive sampling with a virtual questionnaire to obtain a sample of 1,085 secondary nursing students from 3 schools in Yunnan Province, China (validity rate 98.636%) to investigate the relationship between parental educational involvement synergy and secondary nursing students' AI literacy, as well as the facilitating effects of virtue cognition and social reward. The results show that parental educational involvement synergy is positively related to AI literacy of secondary nursing students in Yunnan Province, China, and there are facilitating effects of virtue cognition and social reward. This suggests that secondary nursing students need not only parental educational support, but also the connection between higher mental functions and social stimuli to enhance their mastery of intelligent tools adequately in Yunnan Province, China.

［**Key words**］secondary nursing students; parental educational involvement synergy; AI literacy; virtue cognition; social reward

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1　Introduction

In the era of Education 5.0, AI literacy is a must-have skill for students to advance learners' professional development as well as to meet challenges in future jobs (Chiu et al., 2024; Kong, Cheung & Tsang, 2024; Stolpe & Hallström, 2024). As stated by Ng, Su and Chu (2024), only learners proficient in AI can make them competent digital citizens (Bender, 2024; Han et al., 2024; AbdulKareem & Oladimeji, 2024). Therefore, how to effectively develop students' AI literacy has become a global focus (Hong & Kim, 2024; Shen & Cui, 2024; Wang et al., 2024).

In addition, research has shown that home-schooling styles are associated with student literacy (Du & Li, 2022). Additionally, research has found that cognition and interaction are related to AI literacy (Celik, 2023; Seo et al., 2021). However, it is not clear how parental involvement synergy relates to AI literacy and whether there is a facilitating effect of virtue cognition and social reward in this relationship. On the other hand, the digital skills of student nurses are currently at a low to moderate level, which is detrimental to their learning, professional development, and future employability in Yunnan Province, China (Wu & Phognsatha, 2024; Yi et al., 2022; Zhao & Ma, 2024). Therefore, it is valuable to explore the main factors and facilitating mechanisms that influence AI literacy among secondary nursing students in Yunnan Province, China (Abou Hashish & Alnajjar, 2024; Cheng et al., 2024; Hwang, Tang & Tu, 2024).

Therefore, the purpose of this study is to investigate the relationship between parental educational involvement synergy and secondary nursing students' AI literacy in Yunnan Province, China, as well as the facilitating effects of virtue cognition and social reward, to identify the antecedents and facilitating mechanisms that influence the AI literacy of secondary nursing students in Yunnan Province, China, to promote their learning power and professional development. This study can provide experience in promoting AI literacy among local secondary nursing students and also bring some insights into teaching practice.

2　Literature review and hypothesis

2.1 Parental educational involvement synergy

According to Han et al. （2024）, the division of synergistic parenting structure is broadly categorized into two scenarios：one divides the direction or degree of synergy, i. e. , the two opposing dimensions of synergy and conflict；and the other divides it according to the way of synergy, such as dimensions of conceptual congruence, communication, respect, cooperation, and emotional integration （Han et al. , 2024）. Therefore, Han et al. （2024）defined parental involvement synergy as the involvement of parents in their children's education with a high degree of conceptual unity, mutual respect, support, communication, integration of emotions, and the ability to coordinate and cooperate in behavior.

2.2 Parental educational involvement synergy and AI literacy

Parental educational involvement synergy reflects parents' involvement in their children's education with a high degree of conceptual congruence, mutual emotional respect, support, communication, integration of emotions, and the ability to coordinate and collaborate in behavior （Han et al. , 2024）. On the other hand, AI Literacy reflects the ability of AI in terms of technological understanding, critical evaluation, and practical application （Laupichler et al. , 2023）. Research has shown that family parenting styles are positively correlated with students' literacy （Du & Li, 2022）. And the involvement of positive parental co-parenting facilitates the creation of a harmonious parent-child relationship and family atmosphere, which can bring optimistic emotions to children and stimulate their learning power, thus promoting the growth of students' abilities （Chen, 2017；Eden, Chisom & Adeniyi, 2024；Penderi, Karousou & Papanastasatou, 2023；Pu & Xu, 2023；Wang & Cheng, 2021）. Conversely, disagreements in parenting will create a crisis for the family （Fargion, 2023；Schmeer et al. , 2023；Scheibling & Milkie, 2023）. Thus the hypothesis：

H1：Parental educational involvement synergy is positively related to secondary nursing students' AI literacy.

2.3 The moderator role played by virtue cognition

Virtue cognition reflects higher mental functions and is a cognitive pattern unique to Chinese people （Peng & Li, 2024）. Research has shown that cognition is positively correlated with AI literacy （Celik, 2023）. This is because virtue cognition provides students with mental energy, making them more adept at learning and also agile in mastering knowledge （Peng & Li, 2024）. Therefore, the interaction of parental educational involvement synergy with virtue cognition can lead to a more stable home environment, which will further promote the formation of rapport and provide students with positive emotions, which will make them more self-confident, thus promoting the growth of their abilities （Carr, 2024；Martati & Haryanti, 2023；Paul et al. , 2022）. Thus the hypothesis：

H2：There is a positive moderating effect of virtue cognition in the relationship between parental educational involvement synergy and secondary nursing students' AI literacy.

2.4 The moderator role played by social reward

Social reward reflects all the social stimuli that individuals receive for motivational or recreational experiences as they engage in social interactions throughout human society （Foulkes et al. , 2014）. Research has shown that interaction is associated with AI literacy （Seo et al. , 2021）. This is because prosocial reward determine an individual's response strategies to social behaviors and have the function of shaping an individual's social behaviors （Elrayah & Semlali, 2023；Faal, Schmitt & Yu, 2023；Weinstein, 2023）. Conversely, a lack of social reward often leads to various types of mental disorders （Gao et al. , 2023）. Thus, the interaction between parental educational involvement synergy and social reward can enhance family interactions, which favor students' positive responses to social evaluations, and reinforce their motivation, enjoyment, and interest in learning, which ultimately enhances students' competence （Brandt, Gardner & Clark, 2024；Prabowo & Suyitno, 2023；Smith & Nichols, 2023）. Thus the hypothesis：

H3：Social reward has a positive moderating effect on the relationship between parental educational involvement synergy and secondary nursing students' AI literacy.

3　Methodology

3.1 Samples and procedures

The survey was conducted in October 2024 with purposive sampling. A group of secondary school nursing students from 3 schools in Yunnan Province, China, were selected and a virtual questionnaire was used to investigate their perceptions of parental educational involvement synergy, AI literacy, virtue cognition, and social reward, with a final valid sample of 1,085 (validity rate 98.636%).

In the sample, there were more female students, accounting for 97.327%; private schools accounted for the highest percentage of 72.995%; and the region of future employment intention was slightly more urban with the highest percentage of 52.166%.

3.2 Measure

Parental educational involvement synergy scale: designed by Han et al. (2024) with 2 factors and 39 questions ($\alpha = 0.88$). It reflects parents' involvement in their children's education with a high degree of conceptual congruence, mutual emotional respect, support, communication, integration of emotions, and the ability to coordinate and collaborate in behavior (Han et al., 2024).

AI literacy scale: designed by Laupichler et al. (2023) with 3 factors and 31 questions ($\alpha = 0.89$). It reflects AI competence in technical understanding, critical evaluation, and practical application (Laupichler et al., 2023).

Virtue cognition scale: designed according to the theory of Peng and Li (2024), 2 factors with 6 questions. It reflects higher mental functions and is a cognitive model specific to Chinese people (Peng & Li, 2024).

Social reward scale: Gao et al. (2023) adapted Foulkes et al.'s (2014) instrument, 5 factors with 21 questions ($\alpha = 0.83$). It reflects all the social stimuli of motivational or recreational experiences that an individual receives as he or she engages in social interactions throughout human society (Foulkes et al., 2014).

The questionnaire was a 5-point scale with gender, nature of school, and region of future employment intention as demographic variables.

The overall model had an SRMR = 0.06, slightly lacking match (>0.05).

4　Results

According to the correlation analysis, the parental educational involvement synergy is positively correlated with secondary nursing students' AI literacy ($\beta = 0.546 ***$), and H1 is valid.

According to the reconciliation analysis, the interaction between parental educational involvement synergy and virtue cognition is significant ($\beta = 0.137 ***$), indicating that virtue cognition facilitates the relationship between parental educational involvement synergy and secondary nursing students' AI literacy, and H2 is valid. In addition, the interaction between parental educational involvement synergy and social reward is significant ($\beta = 0.149 ***$), indicating that social reward facilitates the relationship between parental educational involvement synergy and secondary nursing students' AI literacy, and H3 is established.

5　Discussion

5.1 Discussion

The results confirm for the first time that parental educational involvement synergy is positively associated with secondary nursing students' AI literacy in Yunnan Province, China. That is, the stronger the parental educational involvement synergy is, the stronger the secondary nursing students' AI literacy will be. In addition, the results also confirm for the first time that virtue cognition and social reward could promote the relationship between parental educational involvement synergy and secondary nursing students' AI literacy. That is, the stronger the virtuous cognition and social reward are, the stronger the effect of parental educational involvement synergy on secondary nursing students' AI literacy will be.

5.2 Contribution

The results of the study contribute to the theory of AI literacy in that it not only clarifies the positive effects of parental educational involvement synergy but also identifies the facilitating effects of virtue cognition and social

reward. However, previous studies have mainly dealt with the influence of school and teacher factors on AI literacy (Chiu et al. , 2024; AbdulKareem & Oladimeji, 2024; Stolpe & Hallström, 2024), while neglecting the influence of the home environment on it, especially in the nurse-student population. The results of the study confirm that secondary nursing students need not only consistent parental educational support but also connections between higher psychological functions and social stimuli to adequately enhance their AI literacy, which effectively expands the development of the theory in Yunnan Province, China.

5. 3 Implications

5. 3. 1 Implications from teachers' development

Enhancing teachers' digital professionalism and skills is a key factor in realizing the goal of employment and parenting, and it is recommended that vocational schools in Yunnan Province, China, deepen their teacher reforms around five aspects: awareness of AI, technological knowledge, application, social responsibility, and professional development. First, at the cognitive level, it is necessary to raise teachers' AI awareness, change from passive acceptance to active learning, and meet new changes and challenges in the market with a more positive and open mind. Teachers gradually cultivate their data awareness and thinking in their teaching practice, and integrate digital education into the teaching classroom and educational philosophy. Second, at the level of knowledge and skills, they continuously strengthen their digital technology knowledge and skills and strive to master advanced teaching methods and AI teaching tools. According to the educators' digital competence development model, design cultivation programs around the different stages of teachers' careers, and build a digital literacy training system for lifelong learning. Third, at the level of AI application, pay timely attention to the impact of cutting-edge AI technology on practical teaching and learning, grasp the relationship between good people and technology, classroom and technology use, and flexibly utilize intelligent technological tools to carry out educational and teaching practices. Fourth, at the level of digital social responsibility, it is necessary to have a sober awareness of technical rationality and sensitivity to perceive risks and to enhance teachers' awareness of digital safety and security and ethical and moral concepts. Teachers' social responsibility should be strengthened through assessment methods, to create an atmosphere and environment of positive development, moderate utilization, and rational creation. Fifth, at the level of professional development, strengthen the digital construction of nursing discipline. Use AI technology in professional practice and fully integrate professional construction with AI, so that the development of the nursing profession will be of higher quality and the training of professionals will be more suitable for the needs of the future job market.

5. 3. 2 Implications from textbook reform

It is recommended that vocational schools in Yunnan Province, China, create high-quality digital resources to enhance students' AI literacy. On the one hand, the content of teaching materials should be enriched to incorporate AI elements. It is recommended to integrate cutting-edge concepts, knowledge, and other resources in the AI era according to the development needs of the medical profession, based on the characteristics of students and changes in the knowledge structure, to lay the foundation for the construction of digital teaching in the discipline. On the other hand, it is necessary to explore the development of digital courses and the construction of digital teaching materials. The weak interaction and low immersion in the paper textbook scenario due to the imbalance of the subject's power has become a shackle in promoting the process of smart education and the innovative development of education and teaching. It is necessary to actively explore the development of AI courses based on the requirements of the era, science, and systematicity, form a forward-looking knowledge system and value concepts that can reflect the context of the times and the development of subject specialties, combine the changes in new teaching models such as online education, course live streaming, and blended teaching, pay attention to the interactive experience with the students, and strengthen the design of e-teaching materials, curriculum-centered fusion teaching materials, and other new forms of teaching materials in the AI era construction to meet the needs of high-quality AI teaching.

5. 3. 3 Implications for pedagogical reform

It is suggested that vocational schools in Yunnan Province, China, explore the new model of digital education

pedagogy as an important method to enhance the digital vocational literacy and skills of secondary students, which should make full use of digital education resources and take the initiative to incorporate AI technology into the teaching design to form a good teaching ecology. With the help of AI tools and technology, scattered knowledge points will be constructed into a systematic knowledge structure, enriching the teaching content and increasing the fun, logic, etc. of teaching. Secondly, it will reverse the current problem of very low AI literacy among nursing students in Yunnan Province, China (Wu & Phognsatha, 2024; Yi et al., 2022; Zhao & Ma, 2024), who have great deficiencies in AI utilization ability, mastery, etc., which is due to the problem of secondary students' attitude towards AI learning. It is suggested to change the learning attitude of secondary students by organizing various AI skill competitions, learning activities, and other means to stimulate their interest and initiative in AI literacy and skills.

With the advent of the Education 5.0 era, students' AI literacy has become an important goal of education (Bender, 2024; Han et al., 2024; AbdulKareem & Oladimeji, 2024). Through strategies such as teacher reform to enhance teachers' digital awareness, technical knowledge and skills, chemical application, social responsibility, and professional development; teaching material reform to enrich the content of teaching materials, incorporate AI elements, and explore the development of digital curriculum and construction of digital teaching materials; and deepening pedagogical reform to actively explore new models of teaching methodology for AI education, we can continuously promote the AI literacy of secondary students and enhance their employment competitiveness and career development potential to meet the needs of industrial development and talent cultivation in the new era (Cheng et al., 2024; Abou Hashish & Alnajjar, 2024).

5.4 Limitations and directions

The sample was collected from secondary nursing students in Yunnan Province, China, and the results may not be able to gain wide applicability. It is recommended that future studies enhance applicability by sampling nursing students at different academic levels as well as other groups. In addition, more antecedents can be explored for AI literacy in the future, such as grit (Li et al., 2022), future self-continuity, regulatory emotional self-efficacy, etc. to better promote AI literacy (Bender, 2024; Abou Hashish & Alnajjar, 2024; AbdulKareem & Oladimeji, 2024). On the other hand, intermediate mechanisms such as resilience and legacy motivation can also be explored to better meet the future needs of society for talents (Abou Hashish & Alnajjar, 2024; Wu & Phognsatha, 2024; AbdulKareem & Oladimeji, 2024; Shu & Li, 2024; Shu et al., 2024; Li et al., 2024ab).

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