Digital Literacy Development Model for Chinese Primary School Student

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Abstract

This article's objectives were to: (1) analyze the demands of Chinese primary school students in terms of digital literacy development; (2) construct a digital literacy development model for Chinese primary school students; and (3) validate the model. Methods: A comprehensive literature review and expert panel discussions were conducted simultaneously to formulate an initial list of expert analysis competency. A total of twenty one experts were chosen based on their expertise in different disciplines. experts with more than ten years of experience in education and PhD degrees or academic leaders, including seven primary school teachers, seven primary school executives, and seven education researchers. Among the experts, there are five purposive experts with fifteen years of experience and Ph.D. degrees or professors. **Results:** After three Delphi rounds, the final 80 items of the digital literacy analysis competency were created, and it was agreed that the five fundamental components of digital literacy development needs for Chinese primary school students are (a) technical skills ability, information search and evaluation ability, digital creativity ability, digital ethics and social responsibility, and digital security awareness. (b) Trends and possibilities in eight dimensions. (c) The construction of a holistic curriculum is influenced by eight important factors: resource protection, collaborative participation, cultivating thinking, diverse methods, teacher development, cross-disciplinary design, and personalized experience. Optimizing the theoretical curriculum teaching system, creating a varied practical training platform, creating a self-learning stimulation mechanism, refining a multifaceted collaborative support system, and enhancing the training level assessment system are the five development-oriented aspects. **Conclusion:** Five key components necessary for effective digital literacy development: technical skills, information search and evaluation abilities, digital creativity, digital ethics and social responsibility, and digital security awareness. To enhance the digital literacy curriculum, the study recommends optimizing the theoretical teaching system, creating diverse practical training platforms, establishing mechanisms to stimulate self-learning, developing collaborative support structures, and refining assessment systems for development-level training.
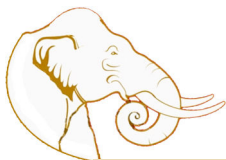
Keywords: Digital Literacy Development Model; Digital Literacy of Primary School
Students; Chinese Primary School Students

Introduction

Digital literacy for Chinese primary school students encompasses technical skills ability, information search and evaluation, digital creativity, digital ethics, social responsibility, and digital security (Yantao & Lina, 2022). Despite achievements in developing digital literacy in China, primary school students' digital literacy levels remain uneven, with regional disparities (Wang et al., 2024a). They lack motivation to discover and use digital resources, and awareness of data security. Computational thinking is not yet efficient, and their ability to use digital tools to improve learning efficiency and growth needs strengthening (Croucher et al., 2023). Continuing education is necessary to instill correct values, ethics, and legal awareness (Wang et al., 2024b).

The need for improving digital literacy among these students has not been fully met, and their digital literacy level needs to be developed.

Research Objectives

1. To analyze the need for the development of digital literacy among Chinese primary school students.
2. To create a digital literacy development model for Chinese primary school students.
3. To validate the created model.

Literature Review

In recent years, the development of digital literacy among Chinese primary school students has attracted significant attention from numerous experts, with related research and exploration continuously advancing. By organizing and analyzing existing research findings from both domestic and international sources, the needs of digital literacy among Chinese elementary school students, trends, and opportunities for the development of digital literacy in primary school students, and key elements influencing the development of digital literacy in primary school students in China can be summarized as follows:

1. Needs of Digital Literacy for Chinese Elementary School Students Five major issues in the digital literacy of Chinese primary school students have been identified. These include deficiencies in technical skills, information search and evaluation abilities, digital creativity, digital ethics, social responsibility, and digital security awareness. Chen, Zhang, and Wu (2013) highlight that many students struggle with basic technical operations, hindering their digital literacy development. Sha et al (2019) note that students often lack effective
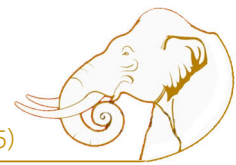
information search and evaluation skills, crucial for discerning credible sources. Fakhrudin (2023) identifies a significant gap in digital creativity, as the lack of focus on problem-solving skills leaves students unprepared for creative thinking in digital contexts. Sulasmi (2022) discusses the insufficient emphasis on digital ethics and social responsibility, leading to students being unprepared for online ethical dilemmas. Additionally, Sulasmi (2022) highlights the lack of digital security awareness among students, stressing the need for educational reforms similar to those in South Korea. Addressing these challenges requires a multifaceted approach that integrates structured frameworks and practical strategies into the education system.

2. Trends and Opportunities for the Development of Digital Literacy in Primary School Students Emphasizing interdisciplinary integration, practical operational skills, and innovative teaching methods are current trends in developing digital literacy among elementary students. Interdisciplinary approaches enhance comprehensive understanding (Hutagalung & Purbani, 2021), while practical skills development equips students to use digital tools effectively (Masyhura, 2022; Fan et al., 2015). Innovative pedagogical strategies further engage students in learning (Korkmaz & Akçay, 2024). Additionally, the focus on data literacy, digital ethics, and safety, and digital safety education is crucial for fostering responsible digital behavior. Personalized learning strategies cater to individual needs, improving outcomes. Lastly, multi-faceted collaboration and partnerships enhance program effectiveness. Together, these trends form a comprehensive approach to advancing digital literacy in elementary education.

The Digital Literacy Development stresses the necessity of early digital literacy. Young learners need digital skills to prosper in a tech-driven world. Digital literacy promotes critical thinking, problem-solving, and responsible digital citizenship as well as academic success. The review also discusses new digital literacy trends, such as incorporating coding and computational thinking into educational programs, using gamified learning platforms, and using artificial intelligence to personalize learning. These changes may help primary school students navigate and contribute to the digital economy by improving their digital abilities. Thus, a comprehensive approach for improving digital literacy in Chinese primary school students must be developed to meet their needs. The current trends and can create a fascinating, inclusive, and future-ready educational framework.

Research Framework

The framework involves identifying the current gaps in digital literacy, understanding the specific challenges faced by students, and assessing the importance of digital skills in their academic and personal growth. Then authors focus on creating a comprehensive digital literacy development model tailored to the needs of students. Create model that incorporate contemporary educational technologies, pedagogical strategies, and curriculum
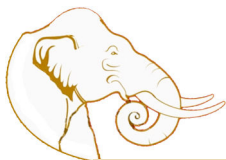
enhancements designed to effectively foster digital competencies. Finally, the research seeks to validate the created model through empirical testing and evaluation.

Research Method

To define the digital literacy analysis competency, this study utilized Delphi technique involving experts in seven primary school teachers, seven educational managers, and seven educational researchers, each with over 10 years of experience. Among these, 9 experts with more than 15 years of experience in teaching management or research**.** To ensure the quality and relevance of this study, we set the following inclusion criteria for the expert panel which is having extensive knowledge and/or experience in a). handling digital lieracy cases in school, b). having direct roles in teaching and/or developing teaching module in their respective professions.

2) Research Tools: An expert survey questionnaire was designed based on a literature review to assess current problems and demands in developing digital literacy among Chinese primary school students. The authors define clear objectives and identify a panel of experts in relevant fields such as education, digital literacy, curriculum design, and child development. A structured questionnaire is then designed for the initial round, incorporating open-ended questions to gather expert opinions on the five fundamental components of digital literacy development, key influencing factors, and recommended strategies. After collecting responses, the data is analyzed to identify common themes and insights. This information is used to create a second-round questionnaire, which presents synthesized findings and asks experts to rate or prioritize specific items based on importance and feasibility. The iterative process continues for three rounds, refining the research tool and responses each time to reach a consensus. Finally, the validated research tool will include well-defined metrics that measure agreement levels, ensuring that the study results contribute meaningfully to the development of a robust digital literacy model tailored for Chinese primary school students..

3) Data collection: Expert investigation. 21 experts were invited to evaluate the questionnaire, 21 questionnaires were distributed and 21 were collected, all of which were valid.

4) Data analysis and application. Analyze feedback data from 21 experts, use qualitative research method to analyze expert feedback on issues with a consent percentage below 75%, modify the questionnaire, and solicit expert opinions again.

5) Presentation of research results: Expert confirmation. Compile the steps, processes, and results of the previous steps into an expert evaluation form, solicit opinions from 9 experts, and confirm the effectiveness of each item.
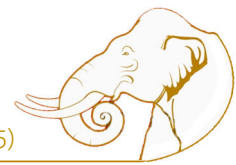
Results

Objective 1: To analyze the demands of Chinese primary school students in terms of digital literacy development.

1. Current digital literacy ability needed for Chinese primary school students show that the survey results of 21 experts, there are 5 aspects commonly agreed upon by experts in the digital literacy area, including technical skills ability, information search and evaluation ability, digital creativity ability, digital ethics and social responsibility, and digital security awareness show in table 1

Table 1 Current digital literacy ability needed for Chinese primary school students.

Questions	Excellent	Good	Medium	Pass	Poor
1. Technical Skills Ability	21(100%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)
2. Information Search and Evaluation Ability	19(90.48%)	1(4.76%)	1(4.76%)	0(0.00%)	0(0.00%)
3. Digital Creativity Ability	18(85.71%)	2(9.52%)	1(4.76%)	0(0.00%)	0(0.00%)
4. Digital Ethics and Social Responsibility	15(72.43%)	5(23.81%)	1(4.76%)	0(0.00%)	0(0.00%)
5. Digital Security Awareness	12(57.14%)	8(38.09%)	1(4.76%)	0(0.00%)	0(0.00%)

Table 1 illustrate the survey results on the current state of digital literacy among Chinese primary school students indicate that 100% of respondents believe technical skills ability positively influence the development of students' quality accomplishments. Additionally, 90.48% consider information search and evaluation ability equally important, 85.71% view digital creativity ability as crucial, and 57.14% believe digital security awareness is significant. Respondents could express their views on five levels: excellent, good, medium, pass, poor.
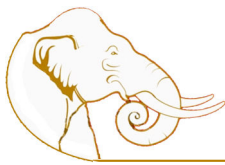
2. Key elements of digital literacy for Chinese primary school students.
21 experts have a very positive attitude towards the key elements affecting digital literacy for Chinese primary school students, with a high degree of consensus. They have given consistency on 8 key elements.

Table 2 Key elements that affect the development of digital literacy of Chinese primaryschool students

Key elements	Md	Mo	IQR	Result
Holistic Curriculum	5.0	5	0.0	Pass
Cross-discipline Design	5.0	5	0.0	Pass
Diverse Methods	5.0	5	0.0	Pass
Teacher Development	4.0	5	2.0	Modify
Cultivate Thinking	4.0	5	2.0	Modify
Personalized Experience	4.0	4	2.0	Modify
Resource Protection	4.0	4	2.0	Modify
Collaborative Participation	3.0	3	2.0	Modify

According to Table 2, three of the eight factors affecting the digital literacy of Chinese primary school students are more consistent with the interquartile range (0.0<IQR<1.0) or median (4.0<Md<5.0), indicating that 60% of the influencing factors are more consistent. Very strongly agree with the following view: 1. Holistic Curriculum (Md=5.0, Mo=5, IQR=0), 2. Cross-disciplinary Design (Md=5.0, Mo=5, IQR=0), 3. Diverse Methods (Md=5.0, Mo=5, IQR=0), 4. Teacher Development (Md=4.0, Mo=5, IQR=2.0) shows that there are significant differences in opinions among the interviewees.

Objective 2: To construct a digital literacy development model for Chinese primary school students. Construct a digital literacy development framework specifically designed for primary school students in China. Using the results and findings from the interviews conducted in this section, a thorough analysis was performed to assess the need for digital literacy development among students in primary schools in China. Using system thinking, construct a digital literacy development model for Chinese primary school students.
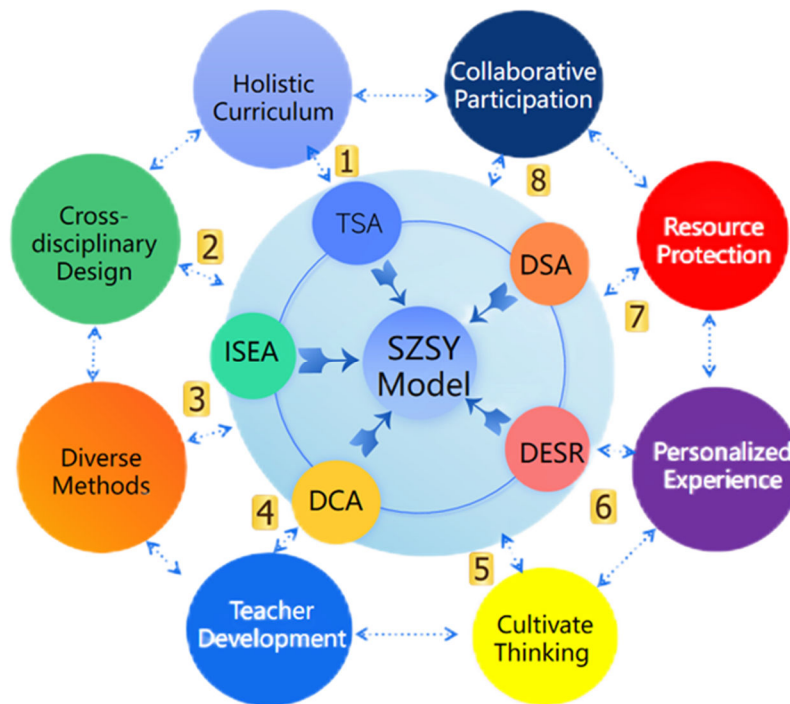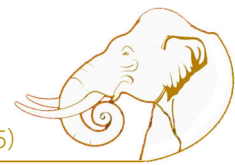
Figure 1 Digital literacy development model for Chinese primary school students

Model Description: Specific meaning of the acronyms in the model as follows:

TSA: Technical Skills Ability

ISEA: Information Search and Evaluation Ability

DCA: Digital Creativity Ability

DESR: Digital Ethics and Social Responsibility

DSA: Digital Security Awareness

The "Digital Literacy Development Model for Chinese Primary School Students" (SZSY Model) is a structured framework designed to enhance students' comprehensive digital competencies. This model is built on five critical variables: TSA (Technical Skills Ability), which equips students with essential technical know-how to operate digital tools effectively; ISEA (Information Search and Evaluation Ability), which promotes the ability to find and critically assess digital information; DCA (Digital Creativity Ability), which fosters innovation and creative expression through digital mediums; DESR (Digital Ethics and Social Responsibility), which instills responsible and ethical behavior online; and DSA (Digital Security Awareness), which ensures students' safety and awareness in navigating digital environments. These components collectively shape the SZSY Model, aiming to create a balanced curriculum that prepares students for proficient, responsible, and secure digital participation.

Objective 3: To validate the model. The validation of the created Digital Literacy Development Model for Chinese Primary School Students yielded promising results. Through a series of implementations in various primary schools, the model was rigorously tested and evaluated. Feedback from educators and students indicated significant improvements in students' digital literacy skills.

1. In this model, all elements interact with each other. Digital literacy among Chinese primary school students is the core element. Technical Skills and Operational Abilities, Information Search and Evaluation Skills, Digital Creativity and Innovation Abilities, Digital Ethics and Social Responsibility, and Digital Security Awareness are the components of the core element and are considered fundamental elements. Holistic Curriculum, Cross-disciplinary Design, Diverse Methods, Personalized Experience, Cultivate Thinking, Resource Protection, Teacher Development, and Collaborative Participation are influencing elements.

2. Developing the fundamental elements helps to develop the core element, and the development of the core element can also promote the development of each fundamental element. The five fundamental elements represent requirements for specific abilities and qualities, and there are interactions among these five elements.

3. The eight influencing elements impact the core element and the five fundamental elements. Research has found that the eight influencing elements have varying degrees of impact on the five fundamental elements, with some having a strong influence and others having a weak influence. The eight influencing elements ultimately achieve an impact on the core element through their influence on the five fundamental elements, affecting the development of digital literacy among Chinese primary school students.

4. There are also interactions among the eight influencing elements. For example, the element of Teacher Development affects Cross-disciplinary Design, and the element of Collaborative Participation affects Teacher Development. The interactions and roles of the eight influencing elements impact the development of digital literacy among Chinese primary school students.

5. This model further clarifies the way the eight influencing factors impact the core element, specifically by acting on the five fundamental elements to ultimately affect the core element.

6. This model further emphasizes the interactions among the eight influencing factors.

7. In the model, "Holistic digital learning environment," which previously influenced the fundamental element of Digital Security Awareness, is replaced by the influencing factor "Create digital environment," emphasizing the influence of Collaborative Participation.

8. Upon organizing and analyzing the expert opinions, it was found that among the eight key factors influencing the digital literacy of Chinese primary school students, Holistic
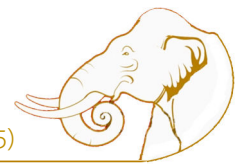
Curriculum is the most important. The importance of the other factors is ranked as follows: Cross-disciplinary Design, Diverse Methods, Teacher Development, Cultivate Thinking, Personalized Experience, Resource Protection, Collaborative Participation.

9. The model uses different symbols to indicate the varying degrees of influence, highlighting their differences and emphasizing the extent of each factor's impact.

Conclusion

Developing primary school students' digital literacy involves government, society, family, and school. It's a complex project with many participants and influencing factors. This study constructs a development model from a social ecosystem perspective, offering significant theoretical and practical value for future research.

Discussion

1. The demands of digital literacy among Chinese primary school students. Through literature analysis and expert consultation, five major issues in the digital literacy of Chinese primary school students have been identified. These include deficiencies in technical skills ability, information search and evaluation ability, digital creativity, digital ethics, and social responsibility, and digital security awareness. Isrokatun et al. (2022) highlight that many students struggle with basic technical operations, hindering their digital literacy development. Jiaxin et al. (2022) note that students often lack effective information search and evaluation skills, crucial for discerning credible sources. Addressing these challenges requires a multifaceted approach that integrates structured frameworks and practical strategies into the education system.

2. Trends and opportunities for the development of digital literacy in primary school students
Current trends emphasize interdisciplinary integration, practical operational skills, and innovative teaching methods. The focus on data literacy, digital ethics, and safety is crucial for fostering responsible digital behavior (Hui & Chang, 2016). Personalized learning strategies cater to individual needs, improving outcomes. Multi-faceted collaboration and partnerships enhance program effectiveness, forming a comprehensive approach to advancing digital literacy in elementary education (Cao et al., 2024).

3. Key elements that affect the development of digital literacy of Chinese primary school students. The development of digital literacy in Chinese primary
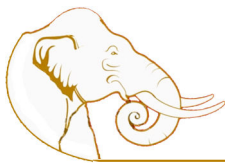
school students is influenced by several key elements. A holistic curriculum integrates digital literacy across subjects. Cross-disciplinary design enhances relevance and applicability (Fan & Cao, 2015). Diverse methods, such as hands-on activities, engage students effectively (Li et al., 2021). Continuous teacher development equips educators with the necessary skills (Gu & Ding, 2022). Cultivating critical thinking fosters responsible technology use. Personalized teaching experiences meet individual needs. Resource protection supports effective tool use, while collaborative participation creates a comprehensive digital literacy ecosystem.

Body of recently acquired knowledge from research

From research, body of knowledge is created as show in figure 2.
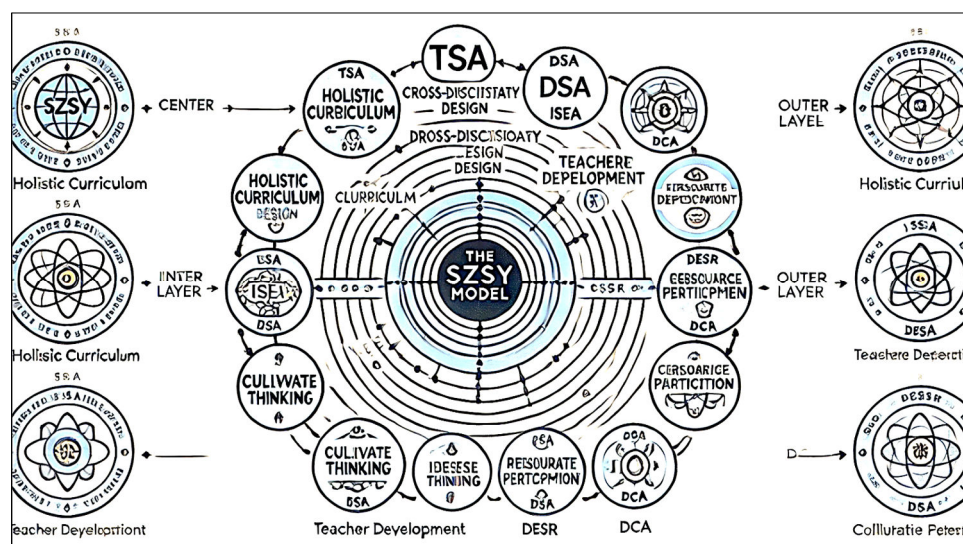

Figure 2 Chinese primary school students using a digital literacy development approach

The SZSY Model, a comprehensive educational framework centered around the SZSY core. The model features two primary layers: the inner circle and the outer circle. The inner circle includes five key components: TSA, DSA, ISEA, DESR, and DCA. These components are pivotal to the model's functioning and serve as the foundational elements. Surrounding the inner circle is the outer circle, which comprises eight educational principles: Holistic Curriculum, Cross-disciplinary Design, Diverse Methods, Teacher Development, Cultivate Thinking, Personalized Experience, Resource Protection, and Collaborative Participation. Each principle is interconnected, illustrating how the SZSY Model integrates various aspects of education to create a holistic and interdisciplinary approach. The model highlights the connections between these components and
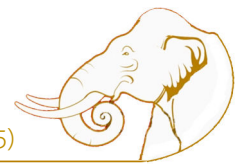
principles, demonstrating a cohesive system designed to foster a comprehensive and dynamic learning environment.

Recommendations

Recommendations for applying research results

1. Meet primary school students' digital literacy needs through empirical research and interdisciplinary collaboration for comprehensive development.

2. Periodically evaluate and adjust China's primary school digital literacy models using comprehensive, data-driven methods and long-term follow-up.

3. Explore and verify the digital literacy needs of Chinese primary school students using systematic, detailed evaluation methods.

4. Compare digital literacy development among Chinese primary school students across regions and grades, addressing key differences.

Recommendations for future research.

Future research should focus on developing:

1. Detailed assessment tools to evaluate each of the five core elements of digital literacy. These tools should be age-appropriate and culturally relevant to accurately measure the specific digital literacy skills of primary school students.

2. Research should explore technology integration in curriculum to check that how different technologies can enhance each of the five core digital literacy elements and identify best practices for their implementation.

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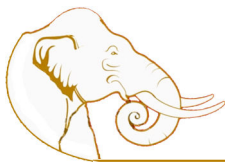
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