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Junior High School Artificial Intelligence Literacy: Connotation, Evaluation and Promotion Strategy

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Abstract

In the junior middle school of compulsory education in China, artificial intelligence courses are being rapidly promoted to help students form artificial intelligence literacy. Then, how to define the connotation of junior high school students' artificial intelligence literacy, build a literacy evaluation framework, and provide decision support for students' information literacy level improvement is an urgent topic to be studied at present. Based on this, this study deeply analyzes the development context and connotation of artificial intelligence literacy and information literacy, and defines the connotation of literacy with emphasis on the uniqueness and independence of artificial intelligence literacy. Based on this, we design the evaluation framework of artificial intelligence literacy in junior high schools, and evaluate the artificial intelligence literacy level of junior high school students in Qingdao Artificial Intelligence Education Experimental Zone, China. The evaluation results show that the overall level of students' artificial intelligence literacy is high, but the development in four dimensions is uneven. There are significant differences in artificial intelligence literacy among junior middle school students with different gender, grade, class frequency, task cooperation frequency, learning value and goal, and self-efficacy. Finally, according to the evaluation results, this study puts forward the corresponding strategies to improve the quality of artificial intelligence.

Keywords

Artificial Intelligence Literacy, Literacy Assessment, Questionnaire Survey, Students' Literacy, Influencing Factor

1. Introduction

Artificial intelligence education is the national intelligence education of mul-

ti-level artificial intelligence education system, which covers the setting of AI related courses in primary and secondary schools. It plays an important role in training young people to have the knowledge, ability, thinking and responsibility of dialogue technology ethics to meet the needs of talents in the intelligent age (He et al., 2022). At present, the artificial intelligence education in junior high schools in China is gradually moving from knowledge education to a new development stage of literacy improvement. It is increasingly urgent to clarify the connotation of the core literacy of the artificial intelligence discipline in junior high schools, formulate a scientific and effective evaluation system and explore targeted cultivation methods. Based on the analysis of the relationship between artificial intelligence literacy and information literacy, the development and derivation of artificial intelligence literacy and the composition of information literacy elements, this study determines the scope and classification of artificial intelligence literacy in junior high schools, and then further determines the literacy connotation and evaluation framework by combining the existing literature on the connotation research and evaluation framework of artificial intelligence literacy and related policy documents, and has carried out practical exploration and improvement in Qingdao. The purpose of this study is to build a comprehensive, scientific and effective evaluation framework for junior high school students' artificial intelligence literacy, so as to accurately, objectively and comprehensively evaluate students' artificial intelligence literacy level and provide decision support for improving students' information literacy level.

2. The Connotation of Junior High School Artificial Intelligence Literacy

1) The development context of the connotation of artificial intelligence literacy

The research on artificial intelligence literacy in China education has a long history. But it was not until 2018 that artificial intelligence literacy began to be widely concerned by people due to the influence of the development trend of artificial intelligence technology itself (Zhang et al., 2022). According to the independence of the connotation of artificial intelligence literacy in junior high school, it can be summarized as the following three stages:

In the first stage, artificial intelligence enters the education field as an important part of the information technology subject in junior middle school, promoting the improvement of students' divergent thinking ability, logical thinking ability and understanding of the frontier of information technology (Zhang, 2003). In the second stage, the proportion of artificial intelligence in junior middle school information technology discipline increases, but it still exists as a chapter or elective part of junior middle school information technology discipline. Programming ability, computational thinking and deep cognition of intelligent society become the new development of artificial intelligence on the connotation of information literacy of students in the new era (Chen et al., 2018). In the third stage, the connotation of artificial intelligence literacy no longer de-

pends on the information technology discipline literacy, but is given the connotation of citizen literacy in the era of artificial intelligence. Previously, many scholars summarized artificial intelligence literacy as intelligence literacy, but failed to have a more consistent view on its connotation. Wang (2018) discusses the connotation of students' intelligence literacy based on the connotation and requirements of core literacy. He believes that intelligence literacy is essentially the enrichment and development of students' core literacy in a new era. Specifically, it is the further clarification of the connotation of "information consciousness" in core literacy in the era of artificial intelligence. However, some scholars believe that the connotation of intelligence literacy is not limited to "information consciousness", but the basic comprehensive literacy in the era of artificial intelligence, including three training stages: cultivating an open and inclusive intelligent attitude, quickly mastering various light intelligent tools and solving practical problems by using artificial intelligence disciplinary thinking (Zhou & Wang, 2019), or summarizing the literacy that intelligent talents cultivated by artificial intelligence education should have as knowledge literacy, ability literacy and digital literacy (Lu et al., 2021).

Generally speaking, the rich development of the connotation of artificial intelligence literacy is constantly developing with the function of artificial intelligence in human society and the change of human society's demand for artificial intelligence. But unfortunately, the existing interpretations of the connotation of artificial intelligence literacy in junior high schools have failed to directly link artificial intelligence literacy with social production, so it is impossible to be truly comprehensive when summarizing, summarizing and dividing artificial intelligence literacy; Secondly, the existing interpretation of junior high school artificial intelligence literacy has not defined the evaluation criteria, so it cannot provide sufficient reference and basis for the formulation of curriculum standards, the compilation of teaching materials and the opening of courses for popularizing artificial intelligence education in junior high school.

2) Definition of the connotation of junior high school artificial intelligence literacy

First of all, based on the combing and analysis of China's domestic and foreign information literacy evaluation frameworks, such as *Computer and Information Literacy Evaluation Framework* and *Beijing University Information Literacy Capability Standard System* (Zeng et al., 2006), combined with the research of Zhu et al. (2020), the categories of information literacy components are summarized: knowledge, consciousness, ability and morality; Secondly, compared with the emphasis of information literacy on knowledge literacy, artificial intelligence literacy pays more attention to the knowledge learning in the whole process of situational problem solving, which runs through the cultivation process of consciousness literacy, ability literacy and moral literacy. Therefore, knowledge class is not suitable to appear as an independent category in the connotation of artificial intelligence literacy. In addition, the teaching of artificial

intelligence pays special attention to the cultivation of students' innovative ability, which requires students to have the ability of innovative scheme design in addition to the awareness, ability and responsibility of using artificial intelligence technology to solve problems. Therefore, combined with the deep understanding of the components or evaluation criteria of artificial intelligence literacy in junior high schools involved in existing research and related policy documents, this study classifies the components of artificial intelligence literacy in junior high schools into: consciousness, ability, innovation and morality; Finally, based on the direct expression of artificial intelligence technology driving the development of social productive forces-artificial intelligence products, as a starting point, the factors needed to research, design and manufacture artificial intelligence products to meet the needs of social development are deduced. The scientific point of this idea lies in determining the quality composition by inferring the demand from the result, which makes its coverage of students' ability requirements more scientific and perfect than the existing quality framework. Inspired by this, the definition of artificial intelligence literacy in junior high school in this study requires students to have engineering thinking and innovative thinking to transform the world, and systematically study the basic knowledge of artificial intelligence and use artificial intelligence technology. In the process, they should constantly think about the relationship between artificial intelligence and human beings and society, and always follow certain ethical norms and assume certain intelligent social responsibilities (Qian et al., 2019).

Based on the above analysis, this study defines AI literacy as the comprehensive expression of the knowledge and skills, processes and methods, emotional attitudes and values gradually formed in the process of students receiving AI education (Jiang., 2013).We can further divide it into four dimensions, namely, artificial intelligence awareness, intelligent technology application, practical innovative thinking and intelligent social responsibility. The requirement levels of the four dimensions are related step by step, as shown in Figure 1. First of all,
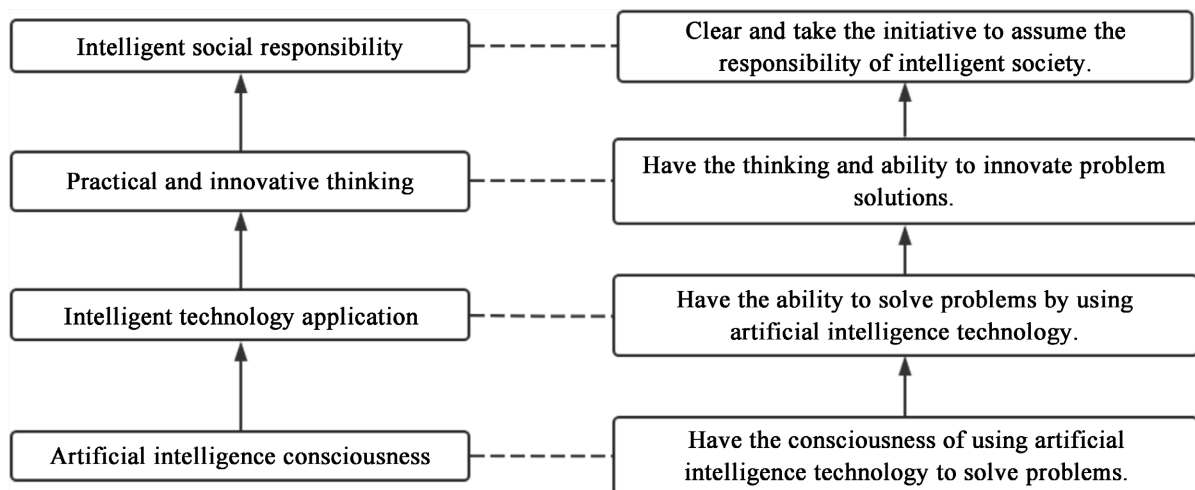

Figure 1. Successive relationship of artificial intelligence literacy levels in junior middle schools.

students should have a certain knowledge and awareness of artificial intelligence, which can accurately identify artificial intelligence technology products and artificial intelligence technology application scenarios in their study and life. On this basis, they should also have the consciousness and psychological tendency to actively use artificial intelligence to solve problems. Secondly, students should be familiar with all kinds of artificial intelligence technology, and can skillfully use and operate artificial intelligence technology products, and can use this technology to solve certain problems. Third, in the process of skillfully using artificial intelligence technology to solve problems, students use their innovative ability to apply artificial intelligence technology innovatively and solve problems innovatively. Finally, intelligent social responsibility puts forward higher requirements for students' moral, emotional and psychological tendencies, and requires students to deepen their understanding in the learning process. The level of students' intelligent social responsibility will always affect the value orientation and development direction of students' learning and application of artificial intelligence technology.

3. Artificial Intelligence Literacy Assessment Tools

In order to clarify the connotation of the core literacy of junior high school artificial intelligence discipline, develop a scientific and effective assessment system and explore targeted cultivation methods, this study first clarified the connotation and dimension of junior high school artificial intelligence literacy by combining with the analysis of existing research and relevant data, and further formed the assessment questionnaire of junior high school artificial intelligence literacy. In order to test the scientificity and practicability of the literacy framework and the evaluation questionnaire, we use the questionnaire to evaluate the artificial intelligence literacy of junior high school students in Qingdao AI pilot area, and put forward the corresponding training suggestions based on the evaluation results.

1) The formation of junior high school artificial intelligence literacy assessment questionnaire

Constructing a scientific, appropriate and effective evaluation framework of artificial intelligence literacy is the key to promote the improvement of artificial intelligence literacy (Qian et al., 2019). By comparing the connotation and evaluation framework of artificial intelligence literacy in domestic and foreign research, and drawing lessons from the evaluation dimension of information literacy, this research team finally formed the evaluation standard framework of artificial intelligence literacy in junior high school after four rounds of expert argumentation. The standard framework includes 4 first-level indicators and 12 second-level indicators, as shown in Table 1.

The final questionnaire consists of three parts. The first part is the basic information of students, including students' gender, grade, class frequency, task cooperation frequency and parents' attitude towards artificial intelligence learning.

Table 1. Evaluation framework of junior middle school students' artificial intelligence literacy in Qingdao.

	Primary index	Secondary index	Specific reference
Artificial intelligence literacy	Artificial intelligence consciousness	Intelligent recognition	Qian et al. (2019), Jiang (2023), Zhang et al. (2022)
		Mental disposition	
		Explicit behavior	
	Intelligent technology application	Functional application	
		Technical operation	
	Practical and innovative thinking	Divergent thinking	
		Scheme innovation	
		Problem solving	
		Application innovation	
	Intelligent social responsibility	Consciousness	
		Attitude	
		Accountability	

The second part is the measurement scale of students' self-efficacy, learning goals and values, and critical thinking; The third part is the evaluation of students' artificial intelligence literacy (Liu et al., 2015).

2) Reliability and validity test of the evaluation questionnaire

The questionnaires designed in this study for the evaluation of artificial intelligence literacy in junior high schools in Qingdao are all closed-ended questions, including multiple-choice questions, multiple-choice questions, scale questions and so on. Cronbach's Alpha value of the questionnaire is 0.897, KMO value is 0.935, and the significance of Bartlett spherical test is 0.000 (less than 0.05), which shows that the questionnaire scale has good reliability and structural validity.

3) Research object

In order to fully reflect the artificial intelligence literacy level of junior high schools in Qingdao, China, this study conducted an assessment in 329 junior high schools offering artificial intelligence courses in 12 districts, counties and cities of Qingdao. After screening the recovered questionnaires, the invalid questionnaires were eliminated, and the remaining valid questionnaires were 39,071, accounting for 73.70%.

4. The Analysis of Artificial Intelligence Literacy Evaluation Results

1) Data analysis

a) The overall level of junior high school students' artificial intelligence literacy

The overall average of junior high school students' artificial intelligence literacy is 77.78 (with a total score of 100 points). The information literacy scores of

junior students are divided into four grades, and the proportion of excellent (more than 85 points), good (75 - 84.99), average (60 - 74.99) and poor (0 - 59.99) in each grade is calculated respectively. The number of people in "excellent" and "good" grades accounted for 43.9% and 22.0% of the total number respectively, while the number of people in "average" and "poor" grades accounted for 20.0% and 14.0% of the total number. Calculate the scoring rate of four first-level indicators of junior high school students' artificial intelligence literacy respectively. It is found that the scoring rates of the four first-level indicators are all above 60%, which indicates that junior high school students have a certain level of artificial intelligence literacy. In addition, as shown in Figure 2, there is uneven development in the four dimensions. Artificial intelligence awareness and intelligent social responsibility perform better, with the scoring rates of 80.32% and 82.15% respectively, followed by practical and innovative thinking, with 79.16%, while the scoring rate of intelligent technology application is the lowest, with 60.74%.

b) Difference test of junior middle school students' artificial intelligence literacy

In order to deeply analyze the current situation of junior high school students' artificial intelligence literacy, independent sample T test and one-way ANOVA are used to test the differences of junior high school students' artificial intelligence literacy with different characteristics. Among them, junior high school students with different gender, grade, parents' attitude, frequency of class and task cooperation, level of self-efficacy, learning value and goal and critical thinking level all have significant differences in artificial intelligence literacy level.

i) There are obvious gender and grade differences in artificial intelligence literacy among junior high school students.
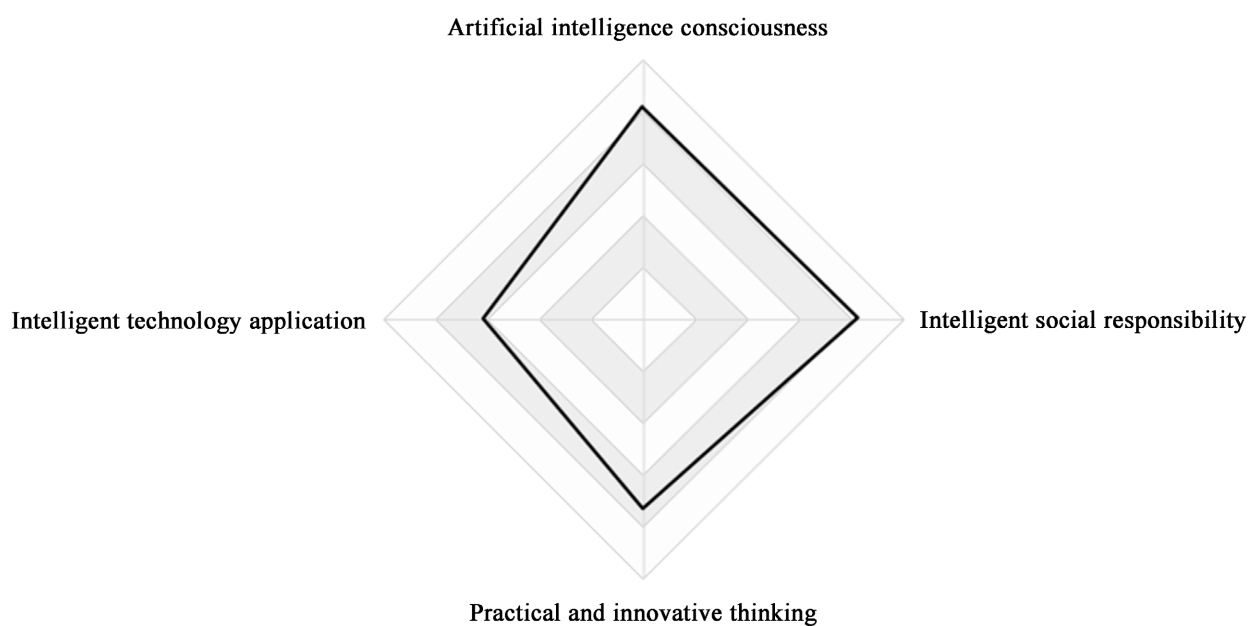

Figure 2. Junior high school students' artificial intelligence literacy level.

There are significant differences in the level and dimensions of junior middle school students' artificial intelligence literacy in gender and grade. In terms of gender differences, girls' overall level of artificial intelligence literacy is significantly higher than boys'. In four first-level dimensions, girls' level of artificial intelligence awareness, application level of intelligent technology and intelligent social responsibility are significantly higher than boys', while boys' level of practical and innovative thinking is higher than girls', but it is not significant. In terms of grade differences, the level of artificial intelligence literacy of junior one students is significantly higher. In four first-level dimensions, the level of artificial intelligence awareness and intelligent social responsibility dimension of junior two students is significantly lower than that of junior one and junior three students, and there is no significant difference between junior one and junior three students. The application level of intelligent technology and the level of practical innovative thinking in grade three are significantly lower than those in grade one and grade two, and there is no significant difference between grade one and grade two. See Table 2 for the group difference analysis of junior middle school students' artificial intelligence literacy.

ii) There are obvious differences in the external learning conditions of AI literacy in junior high school students.

There are significant differences in the level and dimensions of junior middle school students' artificial intelligence literacy in parents' attitude, class frequency and task cooperation frequency. In the aspect of parents' attitude differences, the scores of each dimension decreased significantly with the negative attitude of parents. In terms of the difference of class frequency, the scores of each dimension fluctuate with the increase of class frequency, and the total score of artificial intelligence literacy, artificial intelligence consciousness and intelligent social responsibility are the highest when the class frequency is "one week", and the

Table 2. Analysis results of artificial intelligence literacy differences among junior middle school students.

Background variable		Artificial intelligence literacy	Artificial intelligence consciousness	Intelligent technology application	Practical and innovative thinking	Intelligent social responsibility
gender	man	77.02	26.43	29.86	26.65	20.15
	woman	78.54	27.12	30.89	26.13	20.92
	t	−9.24***	−9.68***	−6.774*	8.336	−13.98***
grade	First grade ①	78.62	27.15	30.80	26.48	20.80
	Second grade ②	77.05	26.32	30.59	26.35	20.24
	Third grade ③	76.68	26.94	26.83	26.03	20.60
	F	49.54***	61.90***	112.79***	7.40***	47.46***
	Post-event comparison	① > ②, ② > ① > ③	① > ②, ③ > ②	① > ③, ② > ③	① > ③, ② > ③	① > ②, ③ > ②

Note: ***P ≤ 0.001.

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scores of intelligent technology application and practical innovative thinking are the highest when the class frequency is "two weeks". In terms of task cooperation frequency, the scores of each dimension fluctuate with the increase of task cooperation frequency, and the total score of artificial intelligence literacy, the application of intelligent technology and practical innovative thinking are the highest when the task cooperation frequency is always, and the scores of artificial intelligence consciousness and intelligent social responsibility are the highest when the task cooperation frequency is often. The difference analysis of external learning conditions of junior middle school students' artificial intelligence literacy is shown in Table 3.

iii) There are significant differences in the personal level of junior high school students' artificial intelligence literacy.

Table 3. Analysis results of external learning conditions of junior middle school students' artificial intelligence literacy.

Background variable		Artificial intelligence literacy	Artificial intelligence consciousness	Intelligent technology application	Practical and innovative thinking	Intelligent social responsibility
Parental attitude	Support ①	80.25	27.65	31.06	27.33	21.18
	Neutral ②	67.44	23.22	27.78	22.08	17.93
	Objection③	51.43	16.59	20.64	19.74	12.87
	F	1319.48***	223.40***	2061.00***	1174.94***	1949.67***
	Post-event comparison	① > ② > ③	① > ② > ③	① > ② > ③	① > ② > ③	① > ② > ③
Class frequency	More than two classes a week ①	64.40	22.19	24.87	21.85	17.06
	One class every two weeks ②	76.94	25.15	32.18	27.31	19.98
	One class a week ③	79.46	27.73	30.53	26.51	21.11
	Two classes a week ④	74.63	25.13	29.85	26.20	19.40
	Three or more classes a week ⑤	74.05	25.35	27.28	27.21	18.87
	F	435.29***	101.94***	277.64***	286.67***	364.75***
	Post-event comparison	③ the highest	③ the highest	② the highest	② the highest	③ the highest
Task cooperation frequency	Never ①	59.90	20.86	24.30	19.66	15.85
	Rarely ②	63.24	21.73	25.99	20.85	16.77
	Sometimes ③	70.59	24.48	28.65	22.80	18.92
	Often ④	80.26	28.07	30.13	26.84	21.40
	Always ⑤	81.19	27.30	32.51	28.65	21.05
	F	1030.22***	620.19***	161.96***	1649.80***	527.26***
	Post-event comparison	⑤ is the highest	④ is the highest	⑤ is the highest	⑤ is the highest	④ is the highest

Note: ***$P \leq 0.001$.

There are significant differences between junior middle school students' artificial intelligence literacy level and each dimension in self-efficacy, critical thinking and learning value and goal level, and the artificial intelligence literacy has improved with the improvement of all aspects. The difference analysis of external learning conditions of junior high school students' artificial intelligence literacy is shown in Table 4.

2) Research results and discussion

a) The overall level of junior high school artificial intelligence literacy is high, but the development of each dimension is uneven.

The research results show that the overall level of junior high school artificial intelligence literacy in Qingdao Artificial Intelligence Education Experimental Zone is at a high level, but there are certain differences in four dimensions, among which the development level of intelligent social responsibility is the highest, followed by artificial intelligence consciousness, practical and innovative thinking is relatively weak, and the application score of intelligent technology is the lowest. As far as the requirements for students are concerned, the consciousness of artificial intelligence, the application of intelligent technology, practical innovative thinking and intelligent social responsibility are successively related and increasing step by step. Simply put, the improvement of literacy in

Table 4. Analysis results of individual level differences of junior middle school students' artificial intelligence literacy.

Background variable		Artificial intelligence literacy	Artificial intelligence consciousness	Intelligent technology application	Practical and innovative thinking	Intelligent social responsibility
Self-efficacy level	Low ①	56.95	17.86	22.67	16.59	14.58
	Middle ②	68.61	21.06	25.67	19.46	16.17
	High ③	81.33	27.60	31.06	27.35	21.13
	F	2643.18***	1649.47***	244.25***	4462.97***	1211.17***
	Post-event comparison	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①
Critical thinking level	Low ①	53.06	17.86	22.67	16.59	14.58
	Middle ②	60.77	21.06	25.67	19.46	16.17
	High ③	80.15	27.60	31.06	27.35	21.13
	F	2736.41***	1645.60***	304.54***	4117.48***	1345.22***
	Post-event comparison	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①
Learning value and goal level	Low ①	52.83	17.77	22.32	16.77	14.44
	Middle ②	62.48	21.06	28.98	20.50	16.14
	High ③	80.97	27.95	30.88	27.62	21.42
	F	3725.75***	2572.94***	175.88***	4843.44***	2148.06***
	Post-event comparison	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①	③ > ② > ①

Note: ***$P \leq 0.001$.

each dimension should be based on the previous dimension. But interestingly, the development level of intelligent social responsibility in this study is the highest, and the development level of practical innovative thinking also exceeds the application of intelligent technology, which should be related to the different requirements for basic knowledge and skills of artificial intelligence in each dimension. Although intelligent social responsibility is a higher level requirement for students' consciousness, attitude and sense of responsibility, it does not need too much knowledge or operational skills as the basis, and will be gradually improved through edification and correct guidance in learning; For the other three dimensions, basic knowledge is the theoretical basis, and operational skills and experience are the practical basis. However, because the evaluation of practical innovative thinking dimension focuses on the investigation of students' innovative thinking level, compared with the application dimension of intelligent technology, the score of innovative practical thinking dimension is less affected by students' knowledge and skill level. Therefore, the uneven development of junior high school students' artificial intelligence literacy actually exposes the lack of basic knowledge, operational skills and experience of junior high school students, which is also confirmed by the research conclusion of Zhang (2020).

b) Different groups have different levels of artificial intelligence literacy.

In terms of gender, the level of artificial intelligence awareness, intelligent technology application and intelligent social responsibility is significantly higher than that of boys, and the level of practical and innovative thinking of boys is higher than that of girls. But on the whole, girls' artificial intelligence literacy is significantly higher than boys', which is consistent with the findings of Yang et al. (2018) and Zhu et al. (2018) about middle school students' information literacy. The difference is that Zhu et al. put innovation and application literacy in the same dimension when they divide the information literacy dimension of junior high school students, and the result is that girls are significantly higher than boys, which should be related to the different emphasis on students' requirements of information literacy and artificial intelligence literacy. Generally speaking, in all kinds of research and evaluation of junior high school students' information literacy or artificial intelligence literacy, girls score higher than boys.

In terms of grade, the artificial intelligence literacy of grade one is significantly higher than that of grade two and grade three, but there is no significant difference between grade two and grade three. This is contrary to most of the research results on junior high school students' information literacy. Generally speaking, with the accumulation of learning, the level of literacy should be improved. After the interview with the teaching and research staff in Qingdao Artificial Intelligence Education Experimental Zone, it is known that the time of carrying out artificial intelligence education in Qingdao Artificial Intelligence Education Experimental Zone is still short, and students of all grades are learning artificial intelligence for the first year, and there is no accumulation of relevant foundations; In addition, the artificial intelligence education in Qingdao is still in its infancy, and the development of artificial intelligence courses in junior high schools is

different. The second and third grades are arranged less in class hours than the first grade students because of the academic level test and further studies.

c) Junior high school artificial intelligence literacy is influenced by parents' attitude, class frequency and task cooperation frequency.

In terms of parents' attitude, the more positive parents' attitude towards learning artificial intelligence, the higher the level of junior high school students' artificial intelligence literacy. Parents' understanding and support for children has a significant positive effect on children's learning input, so it is very important to get parents' understanding and support for students' learning artificial intelligence to improve junior high school students' artificial intelligence literacy (Tian & Yuan, 2019).

In terms of class frequency, this study found that the class frequency of one week is the best for improving the artificial intelligence literacy of junior high school students in Qingdao artificial intelligence experimental area. According to the statistics of the number of students in each grade who choose this class frequency, it is found that the first grade students account for the most, which also proves that the artificial intelligence literacy level of junior high school students is closely related to the class arrangement.

In terms of task cooperation frequency, the research results show that a higher level of task cooperation frequency will significantly promote the improvement of junior high school students' artificial intelligence literacy level. This shows that the task characteristics of artificial intelligence course need students to complete through a certain degree of cooperation. In this process, students are more likely to get good grades, improve their interest in learning and social communication ability, and then promote the improvement of their literacy level (Qin & Zheng, 2022).

d) Junior high school artificial intelligence literacy is influenced by self-efficacy, critical thinking and learning value and goal.

In terms of self-efficacy, this study found that junior high school students' artificial intelligence literacy is positively correlated with their self-efficacy level. San et al. (2018) found that students' sense of self-efficacy can significantly positively predict information literacy when studying the multi-layer influencing factors of middle school students' information literacy. Based on the derived relationship between artificial intelligence literacy and information literacy, it can be concluded that the improvement of artificial intelligence literacy requires students to have confidence in subject learning and a high level of self-efficacy.

In terms of critical thinking, the study found that the level of artificial intelligence literacy of junior high school students was influenced by their own critical thinking level. This should be related to the discipline characteristics of artificial intelligence itself. Specifically, the study of artificial intelligence in junior high school pays attention to problem solving in project situations, and uses critical thinking to scrutinize and select problem-solving solutions. Therefore, the cultivation of critical thinking is an important node in the process of improving junior high school students' artificial intelligence literacy.

In terms of learning value and goal, it is found that the more recognized the value of learning artificial intelligence and the higher the goal, the higher the level of students' artificial intelligence literacy. The clarity of the value and goal of learning artificial intelligence will affect the learning interest and emotion, thus further affecting the level of artificial intelligence literacy (Xin & Jia, 2019), which is similar to the conclusion of Hu & Wang (2022) on the factors affecting the improvement of students' reading literacy.

5. Junior High School Students' Artificial Intelligence Literacy Promotion Strategy

1) Consolidate the foundation of students' artificial intelligence and improve students' problem-solving ability.

a) Attach importance to the subject knowledge base and provide practical training opportunities.

In the investigation, it is found that students' basic knowledge of artificial intelligence is not solid enough and their understanding is not thorough enough, which makes it difficult for them to further study and apply the basic knowledge of artificial intelligence. Basic knowledge is the cornerstone of a subject, but because the subject of artificial intelligence has not been included in the examination subject category, teachers pay insufficient attention to it. In addition, there is another important reason that leads students to use algorithmic thinking to abstract problems, build models and solve problems-lack of understanding depth. The simple word memory will soon disappear, and the rigid understanding of technology application will gradually blur. The application of artificial intelligence technology can be seen everywhere in life. It is the most effective way to explain the definition, set the problem situation and then provide students with practical opportunities to solve life problems (Eguchi et al., 2021), which can not only let students know the application mode of technology as soon as possible, but also pull the distance between artificial intelligence technology and students through examples, which is convenient for students to associate, question and think in their studies.

b) Strengthen the training of teachers, and reasonably arrange the distribution of class hours.

As a new discipline with broad development prospects and vitality, artificial intelligence lacks enough professional teachers to teach artificial intelligence courses and train students to master artificial intelligence technology (Huang, 2021). Excellent teaching staff is a prerequisite for consolidating the foundation of students' artificial intelligence. At present, part-time teachers account for the majority of the artificial intelligence teachers, and because there are few shared resources that can be used for self-study in the current artificial intelligence discipline, it is necessary for schools to organize them in a unified way to improve teachers' teaching and research ability as soon as possible.

On the basis of guaranteed class hours, in order to enhance the continuity of knowledge learning, schools should reasonably arrange the time span of artificial

intelligence courses and combine classroom teaching with community practice activities. Failure to strengthen the knowledge learned for a long time will lead to students taking time to think back in each class, which will cause a certain cognitive burden and reduce students' interest in learning. In addition, one of the functions of the artificial intelligence course is to help students understand the principles of artificial intelligence in the process of experiencing the achievements of artificial intelligence, and then realize the application of artificial intelligence through design (Zhong & Huang, 2022). Therefore, appropriately increasing the number of experimental courses will help to improve students' familiarity with using artificial intelligence technology to solve problems, and then improve their problem-solving ability.

2) Make good use of dynamic grouping strategy to enhance the internal driving force of learning.

According to the analysis of the influence of gender difference and task cooperation frequency difference on junior high school students' artificial intelligence literacy level, it can be seen that boys and girls have different development levels in different dimensions and students are more inclined to complete tasks through cooperation. Therefore, dynamic grouping strategy can be used to dynamically group learners according to the requirements of different tasks for various dimensions of artificial intelligence literacy, and the learners' own self-efficacy, critical thinking level, learning value and goal level, learning motivation and interest, so that they can carry out project-based learning through group cooperation. Dynamic grouping can improve students' cooperative tendency and learning motivation (Zhong & Huang, 2022), and benign cooperation can effectively improve the success rate of tasks, so that students can experience the joy of success, thus improving students' value and goal level and self-efficacy level of artificial intelligence learning, and ultimately promoting the improvement of artificial intelligence literacy.

3) The implementation of home-school joint strategy to build a good learning atmosphere

Whether it is included in the college entrance examination is never the criterion to judge whether a subject or a kind of knowledge is valuable (Wang, 2018). In the learning stage, as an interdisciplinary subject spanning many disciplines, artificial intelligence will appear in various forms in the learning of various disciplines in the blending of disciplines; After entering the society, only by mastering certain knowledge of artificial intelligence can we cooperate with artificial intelligence in work and life and achieve higher work and learning efficiency. Facing the great challenge of the intelligent society, junior high school students must be prepared to adapt to the learning, living and working environment of the intelligent society (Qian et al., 2019). Parents should take a long-term view of the value of artificial intelligence education, actively cooperate with the development of artificial intelligence education in schools, support their children to learn artificial intelligence courses, and pay attention to guiding their children's perception of artificial intelligence in life. From the perspective of social psychol-

ogy, the classroom atmosphere perceived by students during learning activities, the importance attached by teachers and parents to a certain course will have an important impact on the improvement of literacy (Hu & Wang, 2022). Therefore, building a good artificial intelligence learning environment jointly by home and school plays an important role in improving students' artificial intelligence literacy.

Combined with the analysis of the existing research and data, this study clarifies the connotation of junior high school artificial intelligence literacy: the comprehensive performance of students' knowledge, skills, processes, methods, emotional attitudes and values about artificial intelligence gradually formed in the process of receiving artificial intelligence education. Furthermore, the connotation of literacy is divided into four dimensions: awareness of industrial intelligence, application of intelligent technology, practical and innovative thinking and intelligent social responsibility. It can be concluded that the definition and dimension division of junior high school artificial intelligence literacy in this study are relatively scientific, and the junior high school artificial intelligence literacy evaluation questionnaire based on this can also reflect students' artificial intelligence literacy level to some extent. In view of the problems exposed by the evaluation results, we think that we should pay special attention to three aspects in actual teaching: first, attaching importance to the knowledge base of the subject and providing practical training opportunities; Second, making good use of dynamic grouping strategy to enhance the internal driving force of learning; Third, implementing the strategy of combining home and school to build a good learning atmosphere.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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