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COMMENTARY

A Landmark in China's Basic Education Curriculum Reform

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"Education is what remains after one has forgotten what one has learned in school."

—Albert Einstein

CURRICULUM reforms in basic education have been an essential component of educational reform, playing a crucial role in promoting student holistic development. To secure their national competitiveness, developed countries have made persevering efforts to improve their basic education. In the early 1990s, the United States started to implement the reform in curriculum standards as a major strategy to address those long-standing issues in basic education such as low academic levels of students and inequality in education, which could be impediments to the achievement of the nation's political, economic, and social development goals. The revised curriculum standards strived to eliminate the prevalent acceptance of "mediocrity" in the education system. Student learning was transformed into a succession of interrelated activities centered on core objectives and students were encouraged to construct new knowledge based on prior experience. As a result, the previous curriculum system that was loaded with repetitive and superficial exercises was abandoned (Chen, 2004). Realizing that the curriculum reform was key to educational advancement, the United Kingdom promulgated the Education Reform Act 1988, which was modified in 1995 in areas like curriculum objectives, content, structure, evaluation, and management. The Act aimed to promote the common development of students and at the

same time allow schools the autonomy to develop curricula with their unique characteristics according to their specific circumstances (Zhang, 2014). Evidence from pioneering countries' curriculum reforms indicates that the primary function of education in the new era is to boost students' comprehensive competencies and prepare them for the challenges in their future life rather than simply transmit established knowledge to students.

Since its reform and opening up, China has undertaken several curriculum reforms based on the global experience and the nation's special circumstances. In the last two decades, the change in basic education curricula has been accelerated. What has been emphasized in these reforms was that basic education in China is aimed at developing fundamental skills, qualities, and values of students to lay the foundation for their lifelong growth and meet the needs of social development. The cultivation of students' key competencies was established as the main training objective of curricula. The General Framework for the Development of Key Competencies of Chinese Students was formulated in 2016. In terms of curriculum structure, integration of courses has been emphasized and transdisciplinary instruction and practical activities have been advocated to foster students' ability to cope with complicated, real-world issues. In curriculum administration, a three-level curriculum management model has been established, which offer ample autonomy to local educational authorities and schools at all levels. Regarding curriculum experiment, China has been cautious in implementing new curriculum programs. They must be experimented as pilot projects first before being universalized. Additionally, the nation has placed premiums on the deployment of information and internet technologies in basic education. Incorporation of IT-related content into curricula and educational technology-supported teaching methods have been encouraged (Meng, 2019). Overall, curriculum reforms point to the holistic development of students, prompting a transition from focus on knowledge delivery to emphasis on competence development. The notion that education should be student-centered is now well accepted. The "self-regulation + cooperation + inquiry" learning modality, which is meant to cultivate students' innovative and problem-solving capabilities, has become increasingly popular.

In the intense atmosphere of educational transformation, the newly released *Compulsory Education Curriculum Program and Standards 2022 (including the Compulsory Education Curriculum Program and the Compulsory Education Course Standards)* has aroused extensive debate in educational community. The Compulsory Education Curriculum Program 2022 has optimized the goal of compulsory education, improved the plan of courses, and established detailed requirements for curricular implementation. The Compulsory Education Course standards 2022 has upgraded the organization and structure of the 16 courses taught at the compulsory education level (covering primary and junior secondary schooling in China), set academic quality standards, and strengthened the connections between different learning phases (Yu, 2022).

An Interpretation of the Revised Compulsory Education Curriculum Program and Standards: A Revolution in China's Compulsory Education in this issue focuses its discussion on the training objectives of the new curriculum program, intensified reforms it brings to curriculum design and instruction, and strategies for its successful implementation (Wei, 2022). In addition, "major concepts" and "learning task clusters" underpinning holistic module learning are also highlighted in the revised curriculum program and course standards. *A Case Study of 271 Education Group's Learning Protocols: Reconstruction of Course Contents Based on Holistic Module Learning* illustrates how 271 Education Group use their innovative teaching paradigm, holistic module learning protocols, to execute the new curriculum program. It is hoped that the two articles will ignite more debate on curriculum reform (Liu, 2022).

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ORIGINAL ARTICLE

Investigation of 7th and 8th Grade Middle School Students' Environmental Ethics Attitude Levels in Relation to Different Variables

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***Abstract**: One way to increase people's positive behaviors toward nature is to ensure that students gain environmental ethics attitude concerning environmental issues. In this regard, the current study investigates the 7th and 8th-grade students' environmental ethics attitude levels in relation to some variables (grade level, gender, school type). The study employed the survey model, one of the quantitative methods. The current research's sampling was selected using the stratified sampling method. A total of 723 students (349 seventh graders and 374 eighth graders) attending middle school participated in the current study. The "Environmental Ethics Attitude Scale" was used as a data collection tool in this research. The findings of the current study have revealed that the 7th and 8th-grade students' environmental ethics attitude levels vary significantly depending on gender in favor of the female students ($U_{(142857)} = 560.34$; $p < 0.001$). Moreover, no statistically significant difference was found between the environmental ethics attitude levels of the 7th graders and 8th graders ($U_{(124827)} = 63752.00$; $p > 0.05$). In addition, no statistically significant difference was found between the environmental ethics attitude level of the students attending schools located in peripheral districts of the city and that of the students attending schools located in the central districts of the city ($U_{(191838)}) = 48993$; $p > 0.05$). The seventh-grade and eighth-grade students' eccentric environmental ethics attitude mean score and anthropocentric environmental ethics attitude mean score were very close to each other. This shows that the students have environmental ethics attitude yet cannot give up anthropocentric behaviors. Similar studies can be conducted with students from different grade levels.*

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***Keywords**: Environmental Ethics, Attitude, Gender, Grade Level, Middle School, Type of School*

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Introduction

PEOPLE have been living in close interaction with nature since ancient times. However, with the development of technology and industry, people have started to exploit nature more and have nearly gone to war with it. They have started to destroy nature and think they have more right to live than other living creatures. As a result, deterioration in the natural balance started. With the advent of the idea that through the acquisition of ethical behaviors towards nature, this deterioration can be hindered, leading to the emergence of environmental ethics approaches. Environmental ethics is a branch of ethics that questions the relationship between humans and their natural environment and tries to determine the correct behaviors towards the environment environmental ethics is one of the prominent ways of seeking answers to environmental problems. Therefore, from early ages onward, environmental ethics attitude should be inculcated in individuals; thus, a society responsive to nature can be generated.

In recent years, acid rain, destruction of forests, nuclear waste, extinction of species, and global warming problems have shown that people have started interacting with the environment on a global scale. The impact of these actions is not only for today; it can last for hundreds of years or millennia. Therefore, questions about how we should behave towards the environment are increasingly becoming important (Fredericks, 2008). Due to the problems such as climate change, rapid consumption of fossil fuels, and non-renewable resources and distancing of life from being sustainable, a new education is needed to equip active and participating individuals with the necessary knowledge and experience to take part in the creation of a new system (Keleş, 2007). The environmental challenge facing our communities, nation, and planet is increasing daily to deal with this challenge, ethical sensibilities and relationships need to be developed and implemented (Martin & Beatley, 1993). Like environmental pollution, environmental conversion involves a multi-faceted process. Just as there are many ways of polluting the environment, there are different ways of protecting it. One of them is displaying ethical behaviors towards nature (Kayaer, 2013).

Ethics is a practical framework for finding solutions to environmental problems and making suggestions to protect them. Therefore, ethics is an essential concept for solving environmental problems (Des Jardins, 2006). Ethics also determines how people should live. Ethics also explains why entities around us are essential for us (Nelson, 2002). Ethics and environmental research are two complementary disciplines positioned to find answers to questions about how people should behave towards the environment (Fredericks, 2008). Ethics is one of the fundamental values that educators should aim to promote (Schlottmann, 2009). While ethical behavior inspires new and unusual ideas that can unexpectedly lead to change, it also suggests alternative and better tools to address the environmental issues (Nalukenge, 2009).

In the 1960s, a vital link was established between education, environmental management, and international development efforts. In 1968, for the first time, a declaration on environmental ethics was issued at the UNESCO Paris Biosphere Conference (Kopnina, 2012). Environmental ethics emerged as a discipline to explore and express appropriate relationships with the natural world in the 1970s and is continuing to evolve (Goralnik, 2011). Environmental ethics has been developed in response to unique problems caused by loss of biodiversity, pollution, and other environmental problems (Nelson, 2002). Environmental ethics is a new sub-disciplinary philosophy interested in the field of ethics about environmental protection problems. It aims to provide global envi-

ronmental protection with ethical management and motivation (Yang, 2016). Besides, it is an interdisciplinary area that aims to explain appropriate human / nature relations (Goralnik, 2011). Environmental ethics is one of the new sub-disciplines of the philosophy surrounding environmental issues with ethical problems. It aims to provide ethical justification and moral motivation for global environmental protection (Keleş & Özer, 2016).

Environmental ethics has brought a new dimension to conserving natural resources, one of humanity's most significant concerns. This discipline also examines the value and moral status of the environment and non-human beings. In addition, this discipline examines and discusses people's environmental obligations (Mathivanan & Pazhanivelu, 2013). Since environmental ethics examines the relationships between human and ecological environments, it advises asking what is good and bad in human behaviors towards the living and non-living environment and to do what is good and avoid what is wrong.

Environmental ethics does not seek solutions to environmental problems by forcing people; instead explains to people what they should do by imposing some restrictions on them. If people do what is required by environmental ethics, they become happy; otherwise, they will face difficult situations in the future (Özer, 2015). Man is a part of nature. If nature is maltreated, it maltreats people; if nature is treated well, nature will also treat people well. Environmental ethics is not only about people but also other living things or the environment. Environmental ethics is a sustainable concept covering the future environment. The central tenet of environmental ethics is to support sustainable life now and in the future (Mantatov & Mantatova, 2015). Environmental ethics has developed many approaches. These approaches are subsumed under three main headings that are anthropocentric, biocentric, and ecocentric. In addition, there are many other approaches such as ecofeminism, deep ecology, earth ethics, spiritual mystic ecology, social ecology, and futuristic approach. The common goal of all these approaches is to protect the environment. However, they differ in the path followed to achieve this goal.

Significance of the Research

Complex environmental issues will be a significant concern for the next generation that will live with the consequences of past and present actions. Education can play an essential role in this regard. Environmental education can influence the choices students make as a part of the community by encouraging them to connect with and recognize their environment (Dobrinski, 2008). Because environmental cognitive awareness starts to develop at the ages of 9-10 and children can evaluate people-nature interaction in this period, the importance of the quality of the environmental education given in elementary education can be better understood. Environmental education based on ethical and aesthetic values can be an excellent opportunity to educate individuals at peace with nature from these ages when children's values and belief systems begin to take shape (Şimşek, 2011). The primary purpose of environmental ethics education is to develop the skills of students to make ethical, correct decisions, take action and conduct analyses about nature and non-human lifestyles (UNESCO, 2009). A good environmental education can be provided by conscious teachers who have adopted environmental ethics and have high environmental sensitivity and awareness (UNESCO-UNEP, 1990). Environmental ethics must be known and applied to teach students environmental education. Therefore, environmental ethics should be applied in daily life and related to

classes. Environmental ethics responds to environmental problems. Through the environmental ethics attitude to be imparted to students, students are believed to find solutions to environmental problems from an early age. In this way, they will find solutions to global environmental problems in the future, and they will grow as conscious individuals.

A great deal of research has been carried out in the field of environmental ethics. In the related literature, studies focus on the comparison of the undergraduate students' environment and environmental ethics knowledge (Wongchantra et al., 2008), on the attitudes of the last-year students towards environmental ethics (Saka, Sürmeli & Öztuna (2009), on environmental ethics approaches adopted by high school students (Turan, 2009); on the determination of how green university students are based on their ethical attitudes (Özdemir, 2012); on the explanation of the role of the critical thinking on the development of ethical attitudes (Quin, 2012); on the pre-service science teachers' environmental ethics perceptions (Bülbül, 2013); on the elicitation of what environmental ethics means and the need for environmental ethics education (Taneja & Gupta, 2015), the pre-service science teachers' environmental ethics awareness levels (Özer, 2015) and on the undergraduate students' ethical attitudes towards the environment (Sungur, 2017).

Existing research shows a limited number of studies conducted with young children on environmental ethics, especially in the field of education (middle-primary school level). Therefore, environmental should be instilled at young ages for next generation to have a conscious attitude towards the environment.

Learning environmental ethics raises awareness of the issues of environmental ethics in students; motivates them to make ethical decisions towards nature and to act in line with their ethical decisions (World Commission on the Ethics of Scientific Knowledge and Technology, 2009). When the science curriculum was examined, it was found that there are objectives about environmental ethics in the seventh and eighth grades; thus, these grades were included in the current study (MoNE, 2018). In addition, due to the rural and urban environment where schools are located, schools are named peripheral and central. Moreover, the current study attempted to determine whether the environmental ethics attitude scores vary significantly by gender. Based on the idea that if environmental ethics education makes young children recognize the attitude, a promising future and an environment where the natural balance is protected will emerge, the current study will determine the seventh and eighth graders' environmental ethics attitude levels. Students having an environmental ethics attitude mean future generations have environmental consciousness. Therefore, the current study seeks to answer the question "What is the environmental ethics attitude of the seventh and eighth graders?'' Do the seventh and eighth-grade students' environmental ethics attitudes mean scores vary significantly depending on;

- Gender?
- Grade level?
- Type of the school attended?

Method

In the current study, the relational survey technique, one of the descriptive survey models, was used to investigate the middle school seventh and eighth-grade students' environmental ethics attitude levels in relation to different variables.

Participants

The current research sampling comprises 723 students (374 seventh graders and 374 eighth graders) attending schools located in the İslahiye province of the city of Gaziantep in Turkey. The participating students were selected using the stratified sampling method, one of the quantitative sampling methods. As it was thought that it would be difficult to reach all the middle schools in the İslahiye province of the city of Gaziantep, peripheral and central schools were selected proportional to their population ratios and included in the study. Due to the global Covid-19 pandemic, the data was delivered to the students electronically via google forms with the contributions of teachers in different schools. Therefore, the number of participants in this study is limited to the sample of the study. The current study included seventh and eighth-grade students attending two central and three peripheral middle schools. Demographic features of the participating students are given in **Table 1**.

Data Collection Tool

In the current study, as the data collection tool, the "Environmental Ethics Attitude Scale" developed by Gürbüzoğlu Yalmancı (2015) was used. The Environmental Ethics Attitude Scale is a five-point Likert scale aiming to determine students' environmental ethics attitudes. The scale used in the current study consists of a total of 21 items collected under the sub-dimensions of anthropocentric ethics and ecocentric ethics. The Cronbach Alpha coefficient of this scale developed by Gürbüzoğlu Yalmancı (2015) was found to be .87. In the current study, the Cronbach Alpha reliability coefficient was calculated to be .73. In order to determine the construct validity of the scale, factor analysis was conducted, and the Varimax rotation method was used. Any factor with an eigenvalue higher than 1.00 was taken into the scale. Confirmatory factor analysis was conducted to test the hypothesis constructed over the factor analysis; thus, the construct validity was established. From the scale developed by Gürbüzoğlu Yalmancı (2015), two factors, one of which is the anthropocentric approach including four items and the other one is the ecocentric approach including seventeen items, were selected and administered to the students.

Data Analysis

In data analysis, descriptive statistics (percentages, frequencies, arithmetic means, and standard deviations) and to determine whether the distribution is normal or not, Kolmogorov-Smirnov Test was used in the SPSS 17 program package.

As seen in **Table 2**, the total score obtained from the Kolmogorov-Smirnov test shows that the data do not show a normal distribution. Therefore, non-parametric tests were used in the current study.

Results

The current study's first sub-problem aims to answer the question, "Do the seventh and eighth-grade students' environmental ethics attitudes mean scores vary significantly depending on gender?"

Table 1. Demographic Features of the Participating Students.

Variable		N	%
Gender	Female	369	51,0
	Male	354	49,0
School	Central School	534	73,9
	Peripheral School	189	26,1
Grade	7th grade	349	48,3
	8th grade	374	51,7
Total		723	100

Table 2. Kolmogorov-Smirnov(a) Test Related to Normal Distribution.

Kolmogorov-Smirnov (a)			
	F	df	P
Total Score	0.081	723	0.000

Table 3. Mann Whitney U Test Results Related to students' Environmental Ethics Attitude Scores in Relation to Gender.

Group	N	Mean Rank	Rank Sum	U	p
Female	369	387.15	142,857.00	560,34	0.001
Male	354	335.79	118,869.00		

Table 4. Mann Whitney U Test Results Related to Students' Environmental Ethics Attitude Scores in Relation to Grade Level.

Group	N	Mean Rank	Rank Sum	U	p
7th Grade	349	357.67	124,827.00	63,752.00	0.590
8th Grade	374	366.04	136,899.00		

Table 5. Mann Whitney U Test Results to Students' Environmental Ethics Attitude Scores in Relation Type of the School Attended.

Group	N	Mean Rank	Rank Sum	U	p
Central School	534	359.25	191,838.50	48,993.500	0.551
Peripheral School	189	369.78	69,887.50		

As seen in **Table 3**, the environmental ethics attitude means scores vary significantly depending on gender in favor of the female students. The participating female students' environmental ethics attitude mean score is significantly higher than that of the male students.

The second sub-problem of the current study aims to find an answer to the question, "Do the seventh and eighth-grade students' environmental ethics attitude mean scores vary significantly depending on grade level?"

As seen in **Table 4**, the seventh and eighth-grade students' environmental ethics attitude mean scores do not vary significantly depending on grade level. The eighth-grade students' environmental ethics attitude level was not found to be significantly higher than that of the seventh-grade students.

The current study's third sub-problem aims to answer the question, "Do the seventh and eighth-grade students' environmental ethics attitude mean scores vary significantly depending on the type of the school they attended?"

As seen in **Table 5**, the seventh and eighth-grade students' environmental ethics attitude mean scores do not vary significantly depending on the type of they school attended. The environmental ethics attitude mean score of students attending central schools was not significantly higher than that of those attending peripheral schools.

Findings and Interpretations Related to the Responses Given to the Scale Items

The participating students' responses to each item on the scale were analyzed. Frequencies and percentages of their responses to the items are given in **Table 6**.

While the first four factors belong to the anthropocentric ethics approach, the other items belong to the eccentric approach factor. As can be seen in Table 6, the scale item having the highest mean in the anthropocentric ethics approach factor is "Living things useful for human beings should be protected" with 4.70 and 6 (0.8%) of the students stating that they strongly disagree with this statement, 20 (2.8%) stated that they disagree, 11 (1.5%) stated that they are undecided, 105 (14.5%) stated that they agree and 581 (80.4%) stated that they strongly agree.

The scale item having the lowest mean in the anthropocentric ethics approach factor is "Nature exists for human beings" with 3.70 and 83 (11.5%) of the students stating that they strongly disagree with this statement, 95 (13.1%) stated that they disagree, 86 (11.9%) stated that they are undecided, 149 (20.6%) stated that they agree and 310 (42.9%) stated that they strongly agree.

The scale item having the highest mean in the ecocentric ethics approach factor is "Laws laid down for the order of environment should be abided by" with 4.64 and 10 (1.4%) of the students stating that they strongly disagree, 9 (1.2%) stated that they disagree, 34 (4.7%) stated that they are undecided, 124 (17.2%) stated that they agree and 546 (75.5%) stated that they strongly agree.

The scale item having the lowest mean in the ecocentric ethics approach factor is "Increasing human population poses a threat to the protection of nature" with 3.37 and 98 (13.6) of the students stating that they strongly disagree with this statement, 86 (11.9%) stated that they disagree, 178 (24.6%) stated that they are undecided, 166 (23.0%) stated that they agree and 195 (27.0%) stated that they strongly agree.

Table 6. Frequencies and Percentages of the Responses Given by the Students to the Scale Items.

Item No.	Strongly Agree		Agree		Undecided		Disagree		Strongly Disagree		Mean
	N	%	N	%	N	%	N	%	N	%	
Q1	581	80.4	105	14.5	11	1.50	20	2.8	6	0.8	4.70
Q2	271	37.5	146	20.2	195	27.0	68	9.4	43	5.9	3.73
Q3	310	42.9	149	20.6	86	11.9	95	13.1	83	11.5	3.70
Q4	459	63.5	150	20.7	56	7.70	29	4.0	29	4.0	4.35
Q5	320	44.3	226	31.3	124	17.2	31	4.3	22	3.0	4.09
Q6	382	52.8	150	20.7	138	19.1	31	4.3	22	3.0	4.16
Q7	512	70.8	130	18.0	44	6.10	16	2.2	21	2.9	4.51
Q8	421	58.2	146	20.2	66	9.10	52	7.2	38	5.3	4.18
Q9	306	42.3	209	28.9	169	23.4	25	3.5	14	1.9	4.06
Q10	195	27.0	166	23.0	178	24.6	86	11.9	98	13.6	3.37
Q11	234	32.4	182	25.2	215	29.7	53	7.3	39	5.4	3.71
Q12	341	47.2	164	22.7	98	13.6	72	10.0	48	6.6	3.93
Q13	493	68.2	137	18.9	42	5.80	20	2.8	31	4.3	4.44
Q14	483	66.8	138	19.1	48	6.60	26	3.6	28	3.9	4.41
Q15	272	37.6	131	18.1	127	17.6	77	10.7	116	16.0	3.51
Q16	404	55.9	175	24.2	94	13.0	24	3.3	26	3.6	4.25
Q17	345	47.7	156	21.6	132	18.3	37	5.1	53	7.3	3.97
Q18	441	61.0	181	25.0	62	8.60	23	3.2	16	2.2	4.39
Q19	546	75.5	124	17.2	34	4.70	9	1.2	10	1.4	4.64
Q20	389	53.8	150	20.7	126	17.4	30	4.1	28	3.9	4.16
Q21	451	62.4	147	20.3	71	9.80	29	4.0	25	3.5	4.34

Discussion and Conclusion

The current study aims to determine the levels of the seventh and eighth-grade students' environmental ethics attitudes. The results of the study are given below. When the seventh and eighth-grade students' environmental ethics attitude levels were analyzed depending on the gender variable, it was found that the female students' environmental ethics attitude mean score was significantly higher than that of the male students.

Wongchantra et al. (2008) assigned the undergraduate students to the experimental and control groups and gave them environmental issues ethics training. They also found a significant difference in favor of the female students. The findings of Wongchantra et al. (2008) also support the current study's findings. Similarly, Keleş and Özer (2016) also found a significant difference in favor of the female participants in their study focusing on environmental awareness levels. In addition, Alpak Tunç (2016) found a significant difference between the ecocentric attitudes of female and male students in their study on science teachers. In the study of Wongchantra and Nuangchalerm (2011) on environmental ethics with undergraduate students, the female students were significantly improved compared to the male students. These findings reported in the literature support the findings of the current study. Furthermore, as girls

are more sensitive and emotional than boys, it is thought that their environmental ethics attitude was found to be higher than that of the boys in the current study.

The current study found no statistically significant difference between the seventh and eighth-grade students. Saka, Sürmeli and Öztuna (2009) conducted a study and found no difference between the pre-service teachers from different departments regarding their ecological approaches to environmental ethics. Alpak Tunç (2016) did not find a significant difference between the ecocentric attitudes of pre-service science teachers from every grade level. In addition, it was also found that senior students had higher anthropocentric attitudes. In addition, in the study conducted by Bülbül (2013), it was found that the environmental science course did not make any difference in perceptions of environmental ethics. These findings reported in the literature support the findings of the current study. According to these results, students' environmental ethics attitudes are not only affected by the course at school. In addition, family, place of residence, and many other factors affect their attitudes towards the environment. In addition, environmental ethics is a theoretically difficult course and it is thought that students have problems understanding it. Martin and Beatley (1993) stated that the environmental ethics course is a theoretical course, and students have difficulty in it as they can acquire few special skills.

No statistically significant difference was found between the students attending peripheral and central schools. Therefore, there is no study on young children's environmental ethics. However, in one of the many studies conducted on university students, Özer (2015) found no statistically significant difference in the environmental awareness levels of the university students from universities located in 12 different regions in Turkey. In addition, Mathivanan and Pazhanivelu (2013) found no significant difference between the environmental ethics mean scores of the high school students living in urban areas and those living in rural areas. Thus, it seems that the school attended does not significantly influence students' environmental ethics attitudes. In light of these findings, it is thought that more than in schools where students are educated, their social environments, family environment, and out-of-school environments affect their environmental ethics attitudes.

In the current study, the mean score for the items in the anthropocentric dimension was found to be 4.12, while that of the items in the ecocentric dimension was found to be 4.13. These values show that while the students have the ecocentric environmental ethics attitude, they do not give up the anthropocentric environmental ethics attitude. Özdemir (2012) administered the Environmental Ethics Scale to the pre-service teachers from different departments in his study. The majority of the participants were found to be caring about other creatures and believed that they should be protected. Moreover, it was concluded that the participants adopted a strong environmentalist movement. Özdemir's (2012) study supports the current study's findings. Alagoz and Akman (2016) found that gender does not affect teacher candidates' anthropocentric or ecocentric approaches regarding environmental problems. In addition, it was revealed that the averages of students in questions measuring the ecocentric approach within the New Environmental Paradigm Scale are higher. The highness of average can be assessed as there is a change towards ecocentric approach from anthropocentric approach depending on the increase in students' environmental awareness. According to this study, it can be said that the interest and protective style of the family has positive results on the teacher candidates in respect of the anthropocentric approach, but that it has no effect when the ecocentric approach is in the subject. These results show that; in the time period in which we live, as people act with the idea of being the ruler of nature by

displaying human-centered behaviors in general, the participants of the current study may have been influenced by the people around, their families. Thus, they may think the ecocentric approach is the best yet cannot give up anthropocentric behaviors.

If a serious step is not taken to find a solution to the preference for the anthropocentric behaviors, the environment on the verge of collapse will lead us to an irreversible path and a future impossible to live in. This terrible situation is not an outcome of a person or a group's actions but the collective actions of humanity (Taneja & Gupta, 2015). Environmental ethics, especially with environmental laws, makes possible accurate, fair, functional, and careful thinking. When environmental problems are treated with these approaches, students will see what effect ethics creates (McGowa & Buttrick, 2017). According to the results found in this study, only the education given to young students is not enough. It is thought that this education should be effective in families and applied to daily life. In light of the result of this study, it is suggested that similar studies should be conducted in different provinces and classes and that families should be involved in such studies.

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ORIGINAL ARTICLE

A Case Study of the Use of Sandplay Therapy to Help Kids Feel Better about Starting Kindergarten

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***Abstract**: The purpose of this article is to investigate the efficacy of Sandplay Therapy (SPT) in reducing children's kindergarten entrance anxiety in an effort to provide front-line preschool teachers with insights and strategies for addressing the emotional distress of children in their first days of nursery school. As a case study, the application of SPT to a 3-year-old boy who struggled with his transition into kindergarten was cited. The differences in his emotions and behaviors before and after six sessions of SPT were evaluated, revealing that the intervention through SPT significantly decreased his anxiety level while increasing his willingness to attend nursery school and that he finally developed a sound adaptation to the school, according to the comments of the observers. Findings showed that SPT could help kids feel less nervous about starting kindergarten and adjust better to new situations.*

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PRESCHOOLERS commonly suffer from kindergarten entry anxiety, also known as separation anxiety. It refers to emotional reactions such as tension, unease, and sadness generated by the effect of alien environments when children are admitted to kindergarten for the first time and removed from individuals with whom they have formed bonds (mainly their family members). This fear may result in behaviors such as sobbing, difficulty eating, difficulty sleeping, repetition of the same topics, attachment to instructors, unwillingness or refusal to attend kindergarten, etc. (Li, 2020). Prior studies indicated that, without appropriate intervention and therapy, kindergarten entrance anxiety could persist throughout adolescence or even adulthood and be a risk factor for adult anxiety disorders (Pini et al., 2012). Common ways to help kids who are worried about starting kindergarten are to make and read picture books, play graffiti games, and do other kinds of play.

Sandplay Therapy (SPT), also known as sand tray play, is a method of psychotherapy in which the client uses a tray of sand and a variety of toys to build a representation of his or her inner world in the presence of the therapist (Zhang, 2006). Different sorts of mental illnesses and disorders respond differently to SPT, and in some respects, it is preferable to conventional psychotherapy (Roester, 2019). It can successfully identify problems in the unconscious of individuals, thereby enhancing their mental and personality development (Ji, Kang, & Du, 2020). The effectiveness of SPT in correcting psychological and behavioral abnormalities in children has been well acknowledged. In the current study, SPT was used as a way to help kids who were nervous about starting kindergarten. Its healing processes and effects were carefully recorded to provide proof and experience that kindergarteners' anxiety can be helped.

Background Information on the Subject

Demographic Characteristics

Li was a three-year and eight-month-old boy of Zhuang nationality with normal weight and height who was born with an easy delivery.

Family Background

Since they were little children, Li and his younger sister had shared a home with their parents. Li's mother was a college professor, but his father worked in an ordinary office. Even though everyone is busy at work, family members get along well because of the way they raise their children.

Main Problems

Li started going to nursery school when he was three years and eight months old, but during the first few days of kindergarten, he put up a lot of resistance. On the first day of school, he was able to walk to the kindergarten with the help of his grandmother because he was curious about the new environment of school. However, when they arrived at the school gate and he realized that they would have to part ways, he balked at entering and had to be carried in by teachers while sobbing. The cry subsided after five minutes, but when he later witnessed other children crying, it started up again. Basically, he could follow directions from teachers but had trouble dozing off around lunchtime.

Li made it plain that he didn't want to attend nursery school in the morning from days two through five. He purposely dallied on the way to kindergarten, and then he stopped going anywhere. Grandma had to carry him on her back to the school, where she handed him off to the teacher at the gate as he sobbed. He stayed linked to the teacher who was in charge of the kids' day-to-day care all day after finding her to be friendly. On day six of the second week, Li resisted leaving right away and pretended to have a stomach ailment as an excuse. Li's mother took him there to go sliding after the kindergarten's afternoon dismissal in an effort to persuade him that the nursery school was a fun place to be. Li was unhappily carried on Grandma's back to school on the seventh day. On the eighth day, Grandma and Li came to an understanding that she would only carry him a portion of the way from his house to school, and that each day the distance he would travel on her back would be cut in half. Starting on the seventeenth day, Li was able to walk to school in the company of an adult family member, and he did so joyfully.

The Intervention Protocol

Therapy Time

Based on Li's emotions and behaviors, the protocol scheduled him for six sessions of therapy (two per week, over the course of sixteen days) on the following days: Saturday in the first week, Tuesday and Saturday in the second week, Monday and Saturday in the third week, and Monday in the fourth week.

Therapy Venue

Li was enrolled at the kindergarten, Tongxin Garden.

Therapy Tools

A wooden sand tray (57 × 72 × 7 cm), a wooden sand tray table, three wooden display shelves (120 × 120 × 30 cm), 10 kg of natural sea sand, 1,250 toys, and a cell phone with a 64-megapixel high-definition camera.

Therapy Procedure

- *Determining Therapeutic Objectives* (jointly by the therapist, Li, and Li's father)
- The immediate goal was to reduce Li's anxiety about starting kindergarten to the point where he would be willing to walk to school with a family member.
- The main goals were to improve Li's ability to communicate and adapt, as well as his ability to deal with anxiety.
- *Setting the Therapeutic Plan*

It was a therapist-led, one-on-one SPT procedure with no other people around. The steps were as follows: learning about SPT, playing with sand, creating sand tray models, reflecting on and changing the works, talking and communicating, photographing the works, and disassembling the models.

The Intervention Process

During the SPT time, Li continued to attend nursery school but did not get any other therapy.

The first Sand Tray Model (on Saturday in the first Week)

The SPT Process

When the therapist was giving the SPT orientation, Li could not wait to get to the shelves and begin arranging his favorite toys.

He began by placing two cops at the lower edge of the left corner of the sand tray, followed by a police car and a dinosaur at the feet of the two lying policemen. There was an empty falling-over glass, three sharks, an SUV, a pair of scissors, and a basketball stand to the right of the police officer. Between the SUV and the lower edge of the room were a piano and a vanity. On the roof of the SUV were an apple, a watermelon, and a green and yellow snake. In the middle portion of the sand tray, from right to left, were a building, a bus with a crab next to it, a larger yellow snake, and a ship with a man in red clothing lying next to it. In the center of the sand tray was a dark green stone with a blonde doll, black and blue stones, a yellow rhinoceros, a lying-flat police officer, and a dinosaur (who was biting the rhinoceros), an orange man lying flat, and a pink car to its left. From left to right, there are four armed soldiers, a tyrannosaurus, a yellow airplane, a truck, and two cacti in the upper portion of the tray.

Conversation and Communication

> *The therapist tried to make conversation with Li; "Could you say a few words about your work? What is there in it?"*
> *Li replied excitedly, "There are cops, snakes, and soldiers! The soldiers are fighting. There are birds, sharks, rhinoceros, dinosaurs, and even tyrannosaurs. Wow! And cars."*
> *The therapist said, "What a rich work! Could you name it?"*
> *Li thought for a moment: "A fight between the police and dinosaurs."*
> *The therapist asked, "Which toys do you think are the most important?"*
> *Li responded quickly, "The police, dinosaurs, and tyrannosaurs."*
> *The therapist asked, "Which part of the work are you most satisfied with? Why?"*
> *Li answered, "The policemen, the police car, and the dinosaur" (the lower left corner). He did not realize that he had missed the other question.*
> *The therapist asked again, "Why this part?"*
> *Li replied, "Because policemen and dinosaurs are my favorites!"*

The Therapist's Comments

The first sand tray model created by Li was essential to his therapy since it accurately reflected his mental state and inner turmoil. First, the entire model was cohesive and not

severely fragmented. Second, the image of the sand tray depicted an abundance of 43 toys. However, the disorganized arrangement of the toys reflected his lack of inner stability and order and his inability to exert control over his life. He could only take the new world passively and react with some trepidation. Third, the sand tray labor was lively, but the energy flows were disordered and marked by conflicts. The three snakes, massive and violent fighting dinosaurs, and armed soldiers in the model represented his inner confusion and desire to attack and grow stronger; all of the figures lying on the sand could represent people Li did not want to confront or those he valued. The cacti with thorns indicated that Li may have been injured by recent experiences and prompted self-protection awareness. From the miniature work as well as his emotions and behaviors in the nursery school, it could be inferred that his kindergarten attendance had disrupted his original life order and deprived him of some of his preferences and hobbies, which were not being properly addressed at this time, and that professional guidance and self-discovery were required to reorganize his confused psyche in order to assist him in navigating this transitional phase of his life.

Displays of Consciousness (Tuesday and Saturday in the second Week)

The SPT Process

Li happily embraced the therapy sessions as his interest in sandplay grew. During therapy, Li was completely enthralled by the toys on the shelves and enthusiastically arranged them in the sand tray until it was full. Constant verbal and visual contact with the therapist was also maintained. When Li couldn't reach the toys at the top of the shelf, he would seek assistance from the therapist. He would smile and share his favorite toys with the therapist whenever he saw them. At the end of the second session, he would have photos shot of him in exuberant poses with his favorite toys (tanks and dinosaurs), expressing his unwillingness to go and his desire to play for longer. In the third session, Li was able to decide on which toys to include in his sand tray picture, as opposed to the first two sessions, when he simply took whatever toys were within his grasp.

Analysis and Interpretation

- *The Selection of Toys*

In the second session of SPT, Li eliminated the everyday utensils, snakes, policemen, and cacti from his sand tray display, but included two tanks, a Spiderman, Minions, and three automobiles. The overall arrangement of the toys (38 in all) remained sloppy but no longer congested. In the third session, the tray had a wider assortment of toys, including structures, daily utensils, and food. Only two dinosaurs and one tank remained, bringing the total number of people to nine. Scenes of police officers and females lying in the sand and troops half buried occurred. There were a total of 46 toys used.

- *The Sand Tray Model*

Li's second task demonstrated less inner conflict when compared to the model from the previous session. Despite this, a portion of the battles remained, as depicted by the two tanks, five dinosaurs, and five armed soldiers. The second image was more powerful

since it included three automobiles, two tanks, and four warplanes. Li's secret wish for superhuman strength and emotional support was shown by the fact that Spiderman and the Minions existed. These characters represented supernatural powers and unknown forces.

In contrast to the second model, the third model exhibited a greater focus on daily life, indicating that Li's attention had shifted from inner difficulties to daily living. Aircraft, motorcycles, electric bicycles, and bicycles added to the model's dynamism, enhancing the image's depiction of pleasant and harmonious landscapes. The arrival of three pink houses (castles) and food showed that Li was getting more mental energy and feeling more comfortable and stable.

The Healing Stage (Monday and Saturday in the third Week)

The SPT Process

Li got extremely concentrated on the large variety of automobiles of all types, colors, and styles during the fourth session. He liked them all and tried to pick his favorites to put in the sand tray. However, there are too many of them for the tray's limited area. The cars chosen in the previous session were his favorites in the fifth session, although he was dissatisfied with the sand tray's limited area. When he discovered some more interesting train lines, he began to play on the floor because the sand tray was too small for them.

Analysis and Interpretation

- *The Selection of Toys*

During the fourth session, a total of 28 vehicles filled the sand tray, including tanks, aircraft (civil airplanes, helicopters, and military aircraft), mud tankers, excavators, cranes, fire trucks, trucks, garbage trucks, and cars. In between the cars were four armed troops, some buns in a bamboo steamer, a pair of art scissors, and a box of paint. A dining table, stools, food, two enormous gas stoves, and two pots were located from the middle left to the top. For the first time, an Ultraman emerged from the center of the tray, carrying a large pot of prepared food and other food beside him. Four lying-flat dinosaurs rose over the Ultraman.

Li filled the entire sand tray with vehicles and added additional items in the sixth session. The dinosaurs were reduced to three, with one under the gas stove and one under the airplane. The dinosaurs did not stay together as they had before, but instead stood in different places on the tray. The model now includes some furniture and tools, as well as some bright crystals.

- *The Sand Tray Model*

Fifty-six toys were utilized in the fourth model. The fact that the whole sand tray was full of different kinds of cars, animals, food, and household items showed that L was strong and active. Some parts of the kindergarten were also in the model, like the Arabic numbers 1, 2, 3, 4, 5, and 6, paints, and art scissors. This showed that Li was getting

used to the kindergarten environment more and more. Ultraman stood for the supernatural power and emotional support that L has always wanted.

The number of toys in the fifth model grew to 78. Every square inch of the sand tray was occupied by various types of vehicles. The additional bed was located in the lower right corner, reflecting Li's exhaustion. After an investigation, it was discovered that Li was an early riser who could not fall asleep at lunchtime unless accompanied by the assistant instructor. Colorful crystals represented beauty, brilliance, and hope. If there are train tracks, it could mean that Li has found a way to deal with his bad feelings.

The Conclusion of SPT (Monday in the fourth Week)

The SPT Process

Li was very excited about the sixth session. Before the play, L and his therapist had a short conversation about what had been going on in his life at the nursery school. This time, L treated his model like he was making a piece of art. First, he looked carefully at all the toys on the shelves and seemed to have a clear picture of the whole situation in his mind. Soon, a big tree was chosen to go in the lower left corner of the tray. It was followed by a row of trees that included a coconut tree, a tree with a small flower, a smaller tree, and a big willow at the top. A plane was hiding behind a small tree. There was also a row of plants on the far right side of the tray. There were two coconut trees, a pine tree, two trees without leaves, a cactus, and a young tree. A tank with its barrel pointed up stood at the top of the line. At the end of this line of plants, there was an orderly line of dinosaurs, with a lion and tiger at each end and a pine tree next to the tiger. To the left of the animals is another row of green plants: seven trees, four bigger trees, and two coconut trees. In the middle of the tray was a big green lawn with three soldiers, a coconut tree, a plane, two white trees, and a pine tree. On the left side of the lawn, from the bottom edge to the top edge of the tray, there were two vertically stacked engineering vehicles, a red excavator, a skateboard with a soldier on it, four soldiers with a vertically stacked vehicle behind them, a big shell, and two big trees at the top.

Conversation and communication

The therapist said, "Say something about your picture, please."
Li pointed to the soldiers on the left side of the tray excitedly, "They are Chinese soldiers, brave and resilient. The dinosaur wanted to defeat them and eat the grass."
Li then fell into silence, and the therapist gave him a push, "What's next, please?"
Li thought for a moment, "The dinosaur assumed that the grass was delicious and took a bite but found it not so tasty. He just spat it out."
The therapist said, "What a wonderful world you have created! Can you name it?"
After a little bit of reflection, Li said, "Let's call it Forests: Dinosaurs' Home."
The therapist asked, "Which part of the work do you like best? And why?"
"Here are the soldiers and trees (to the left of the lawn). They are so vigilant."

The therapist asked again, "Then which part of the work do you like least? And why?"
"The leafless trees," Li responded without any hesitation. "They look like monsters."
The therapist nodded in agreement, "I see. How do you like this model in comparison with the prior ones?"
Li said loudly, "This one is the best! Beautiful!"
The therapist agreed, "Yes, beautiful, indeed!"
Li reiterated, "It is the most beautiful!"
The therapist: "Please grade it. How would you score it if the perfect score is 100 points?"
Li answered confidently, "Then I will give it a score of 1000 points!"

The Therapist's Comment

First of all, in the last model, the layout of the toys has become more organized and even beautiful in some ways. This shows that Li's internal order has been established, which is a sign of his psychological healing up. Second, for the first time, strong trees showed up on the tray. People usually think of big, tall trees as the "axis of the world" and as signs of life. They also think that the forest has some mysterious power to change. The green spots on the plants in the picture showed how Li's strength and mental energy had come back. Third, the toys worked well together. Their directions matched, they were spaced out evenly, and there was a good amount of space in each area. The whole piece has a lot of harmony and elegance, which shows that Li's mental energy has been rekindled and given a good outlet.

The Efficacy of Intervention

Li's Self-Reported Evaluation

Sand is fun to play with. There are numerous toys. I enjoy dinosaurs, trucks, tanks, policemen... I would like to spend more time with them. Kindergarten is a great deal of fun. You can glide, build using bricks, and doodle... I am fond of both Teacher Tan and H. I no longer wish to cry in kindergarten.

The Therapist's Evaluation

With the progression of therapy, the client's transformation and development have become evident. According to feedback from follow-up appointments, the therapy has largely achieved its intended objectives. The client's concern over entering kindergarten has been alleviated and eliminated. He is now in good mental and physical health, and his intelligence, emotions, psychology, and practice have all developed in tandem. Because of this, he can well follow teachers' instructions and enjoy all of kindergarten's activities.

Others' Evaluation

Box 1

Before Intervention (the first few days)
Anxious
Nervous
Uneasy
Distressful
Lots of cry
Unwilling to enter the kindergarten
Deliberate dawdling on the way to school
Being carried to school by the adult
Attaching to the child-care teacher
After Intervention (the fourth week)
Enjoying the stay at the kindergarten
Looking forward to attending the kindergarten
Interested in kindergarten life
Willing to share his joy
No more crying
Willing to attend the kindergarten
Going to school on foot
Fond of Teacher Tan (assistant class teacher)
Sociable among classmates (making friends with two of them)
Ready to help teachers with class affairs

Li's parents said that he didn't want to go to nursery school for the first two weeks, but things got better after that. Now that he had said goodbye to his family member at the gate, he could walk into school with a smile on his face. Every day, he had a lot to tell his parents about kindergarten, like the nice songs and games he learned, the things Miss Tan did, the compliments his classmates got, the new friends he made, etc. Now that he liked his teachers, classmates, and some of the toys at kindergarten, going there was something he looked forward to.

Li's teachers said that he still cried at the school gate in the second week, but that after ten minutes of comforting from a teacher, he forgot about his sadness and went on to play in kindergarten. From the third week on, he stopped crying, and each week after that, he got better and better. The teacher once wrote in the Home-School Communication Manual, where the child's performance at kindergarten is recorded every week, which Li was always willing to help the class and teachers and always did his best.

Compared to Li's pre-therapy and post-therapy actions and mental states, SPT in a free, safe, and protected setting considerably reduced his kindergarten entrance anxiety and enhanced his adaptability (*Box 1*).

Discussion

SPT can effectively alleviate kindergarten anxiety in children, but it requires multiple therapy sessions. It should be noted that family-related factors, such as maternal emo-

tional characteristics (Xiao, 2021), parental state-trait anxiety (Lyu, 2021), and parent-child interaction (Ma, 2017), as well as kindergarten-related factors, such as teachers' coping responses (Li, 2020), can influence the efficacy of SPT even when no other therapy is administered concurrently. To control the effects of family and kindergarten-related factors on SPT, a more rigorous research design is required. On the other hand, it's also worth looking into whether or not a mix of SPT, family, and kindergarten factors can help kids get used to nursery school more quickly and easily.

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ORIGINAL ARTICLE

Metacognitive Activities Performed by Pre-Service Science Teachers in Scientific Reasoning Skills Teaching with the POE Technique

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***Abstract**: The aim of this study was to investigate the pre-service teachers' metacognitive activities occurring in the teaching scientific reasoning skills with the POE technique. The participants of the research included six pre-service science teachers who were seniors in the science education department of at a university in the west of Turkey. The holistic single-case design was used as the research method in this study. The POE Activity Report, an Activity Journal and a Semi-structured Metacognition Observation Form were used to examine the participants' metacognitive activities. Inductive and comparative analysis was used to. It was found that (i) the pre-service teachers performed various monitoring activities (f = 13) and evaluating activities (f = 4) in the teaching of six different scientific reasoning skills (control of variables, proportional reasoning, correlation reasoning, probability reasoning, combinational reasoning, hypothetical-deductive reasoning) with the POE technique; (ii) there was more variety in metacognitive activities performed by pre-service teachers in teaching of control of variables (f = 15), there was least diversity in the teaching of hypothetical-deductive reasoning skill (f = 10). The results were discussed in line with the related literature, and suggestions were presented regarding the teaching of scientific reasoning skills.*

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Introduction

ONE of the main goals of science education is to develop students' scientific reasoning skills (SRS) (Glaze, 2018). Individuals need to be aware of and have control over their thinking processes in order to understand the SRS they use and to develop these skills through their activities. This requires the use of metacognitive skills (Ersözlü & Çoban, 2012). The importance of metacognition, which is one of most important skills needed in the 21st century for individuals (Sulaiman et al., 2021), in the teaching and learning process has become increasingly clear in recent years (Antonietti et al., 2015; Schraw et al., 2006). In addition, metacognition is one of the knowledge dimensions in Bloom's Taxonomy (Mahajan & Sarjit Singh, 2017), which is based on higher-order thinking skills (HOTS) (Garcia, 2015): these have recently been a focus of science education (Anderson & Krathwohl, 2001). The metacognition dimension defines the student's ability to connect various concepts, interpret, solve problems, explore, reason, and make decisions (Supeno et al., 2019). Metacognitive knowledge and metacognitive processes significantly affect students' performance in scientific reasoning and their subsequent learning achievements (Gillies et al., 2011; Mevarech & Fridkin, 2006; Mevarech & Kramarski, 2003; Zohar & David, 2008).

The SRS and metacognition are among the crucial competencies that pre-service science teachers should have in order to meet the requirements of a dynamically changing world. It is thus necessary to concentrate on these research areas (Chytrý et al., 2018). The importance of metacognition for scientific reasoning (SR) has been emphasized by various studies (Amsel et al., 2008; Andersen & Garcia-Mila, 2017; Magno, 2011; Pedaste et al., 2012). This study focuses on the metacognitive activities of pre-service teachers when they are teaching SRS, which is one of the principal purposes of science education. There are various classifications of the components of metacognition in the literature. This study focused on the regulation of cognition component in the classification of Schraw and Moshman (1995).

Conceptualizations of Scientific Reasoning (SR)

The SR, which include a range of cognitive and metacognitive skills, are considered to function through a cumulative and cyclical process that requires the coordination of theory and evidence (Kuhn, 2011; White et al., 2009). The purpose of this cyclical process is to obtain information or make changes to the existing knowledge (Kuhn, 2011). According to another view, "scientific reasoning involves skills related to inquiry, experimentation, evidence evaluation, and inference made to achieve conceptual change or scientific understanding" (Zimmerman, 2007, p. 172). Here, SR consists of the

interplay of the nonlinear processes involved in formulating hypotheses, designing experiments to test hypotheses, and evaluating them (Dunbar & Klahr, 1989). Given these definitions of SR, control of variables, proportional reasoning, correlational reasoning and probability reasoning, combinational reasoning, and hypothetical-deductive reasoning skills emerge as the logical and mathematical skills that help the development of SRS (Lawson, 2004; Zimmerman, 2000). These skills are also considered necessary for scientific research (Braaten & Windschitl, 2011; Lawson, 2004).

Recent trends in SR research include investigating (i) descriptive, methodological, and conceptual issues of what is normative and authentic in the context of the science laboratory and science classroom; (ii) metacognitive and meta-strategic skills; and (iii) the different types of teaching and practice opportunities necessary to develop, reinforce, and transfer such skills (Zimmerman, 2005). Recent conceptual and empirical studies have indicated that successful SR should include metacognitive and meta-strategic knowledge (Kuhn, 2011). As a matter of fact, meta-analyses of this field have concluded that studies focusing on metacognitive strategies and other strategies that are thought to be important in SR have a substantial effect on the development of SRS (Engelmann et al., 2016).

The POE Technique

One of the instructional activities in which SRS can be developed is the Predict-Observe-Explain (POE) technique (Chang et al., 2013). This technique is a metacognitive teaching tool that improves students' conceptual understanding and problem-solving skills in science lessons (Rickey & Stacey, 2000). POE, developed by White and Gunstone, assumes that successful cognition will be properly structured through the activities of predicting, observing and explaining the results of observation, and it is therefore defined as a learning technique based on the constructivist learning theory (Kearney et al., 2001). This technique requires individuals to predict the outcome of an event, and the reasons for this outcome, without performing any activity, to then observe the event, and finally explain how and why their predictions were or were not consistent with the observations. In other words, this technique is based on the classical research model, in which a hypothesis is defined, relevant data are collected, and the results are discussed (White & Gunstone, 1992).

There is a limited number of studies in the literature on teaching SRS with the POE technique (Choowong & Worapun, 2021; Marušić –Sliško, 2012; Yüksel & Ateş, 2017). However, considering the operational definition and theoretical background of SRS, the POE technique is one of the predominant methods used in teaching these skills. In this study, the POE technique was used to improve the SRS of pre-service teachers.

Metacognition and Metacognitive Activities

The importance of metacognition and cognitive self-regulation for successful SR has been emphasized for many years (Schunk & Zimmerman, 1998; White & Frederiksen, 1998). Metacognition is the individual's ability to think about their own cognitive processes (Flavell, 1979). Although there is no single definition of metacognition, there are various classifications in the literature regarding the components of metacognition. For instance, Schraw (1998) presents a model in which metacognition includes two main components: "knowledge of cognition" and "regulation of cognition". Knowledge of cognition is what individuals know about their own cognition or cognition in general; regulation of cognition relates to a set of activities that help students control their learning. This study focused on the regulation of the cognition component. Various researchers have identified specific dimensions related to the regulation of cognition component: the orientation, planning, monitoring, regulating, controlling, evaluating, and debugging dimensions (e.g., Efklides, 2006; Meijer et al., 2006; Schraw & Moshman, 1995; Veenman, 2011). There are also three basic skills common to regulation of cognition: planning, which involves choosing appropriate strategies and allocating resources that affect performance; monitoring, which refers to one's awareness of one's own understanding and performance of the task; evaluating, which refers to assessing the results and effectiveness of one's learning (Hofstein et al., 2019).

Metacognition can help students look for the best way to develop and practice the knowledge they have learned so that they are able to both diagnose and solve problems (Chatzipanteli et al., 2013; Mevarech & Fan, 2018). Teachers thus need to be able to decide on the strategies that will enable students to use their metacognitive skills (Sulaiman et al., 2021). For this, it is first necessary to determine what metacognitive activities are performed by the students. Metacognitive activities are mental processes such as the individual's awareness, monitoring, and evaluating of their own mental activities while performing a task (Hennessey, 1999). They thus provide regulation and control of cognitive processes and are crucial in the strategic implementation of metacognitive knowledge to achieve cognitive goals (Alexander et al., 1995). In addition, metacognitive activities are guided by metacognitive strategies (Peña-Ayala & Cárdenas, 2015). Factors affecting metacognition include individual differences (personal characteristics such as an individual's prior knowledge, gender, age, cognitive style, and motivation level) (Efklides & Misailidi, 2010), the bond between family and learner (Kleitman & Moscrop, 2010), the teacher's strategic metacognitive knowledge about teaching techniques (Hartman, 2001), and the difficulty and context of the task (Bjorklund, 1990). Furthermore, according to a theory of settings developed by Garner (1990), contextual factors affect the use of metacognitive

strategies. These factors include the application of strategies resulting from the learner's knowledge base, and the appropriateness of those strategies to the relevant domain; specific situations that enable learners to engage in cognitive monitoring; knowledge of the relationship between the use of strategy and the demands of the task; the existence of goals to support the use of strategies; learners' beliefs about the importance of strategies; and the applicability of these strategies to new and related situations. In addition, a number of mechanisms (i.e. cognitive, associative, emotional, psychological and sociological mechanisms) also affect the use of metacognitive strategies and thus metacognitive activities. These cognitive mechanisms include emphasizing, identifying, and regulating the importance of an individuals' use of strategy, and they are closely related to the concept of strategic competence (Phakiti, 2008). Associative mechanisms are defined on the assumption that the choice of strategy is determined by a set of learned correlations between tasks, actions, and outcomes (Crowley et al., 1997). The emotional mechanism explains how attention and processing capacity is diverted from a learning or performance goal to a goal that has already taken precedence in the individual's goal structure. For example, when students are faced with negative emotions, they motivate themselves by combining the available coping resources to overcome this situation (Boekaerts, 1995). The psychological mechanism is related to metacognitive knowledge (Richter & Schmid, 2010). In addition, metacognition also serves as a psychological mechanism that bridges the gap between prejudices embedded in individuals' cognitive mechanisms and the state of cognitive adjustment that facilitates functioning in a dynamic environment (Haynie et al., 2010). Sociological mechanisms also often encourage cooperation (Simpson & Willer, 2015).

SRS and Metacognitive Activities

In this study, we focused on the metacognitive activities performed by preservice teachers in the teaching of SRS. Metacognition and SR often play an important role in the holistic development of students (Limueco & Prudente, 2018). Applying abductive, retrodictive, deductive, and inductive inferences cycles in scientific research consciously requires researchers to be more aware of their reasoning (Lawson, 2010). The concepts of consciousness and awareness evoke the concept of "metacognition" introduced by Flavell (1979). We can say that metacognition enables learners to take control of their learning, think reflectively, understand their tasks, and know what strategies are needed to complete their tasks successfully. Thus, learners can monitor, control and regulate their cognition and learning (Pintrich, 2002).

Sophisticated reasoning includes the use of various strategies for hypothesis-testing, induction, inference, and evaluation of evidence and a metalevel awareness of when, how, and why one should engage in these strate-

gies (Morris et al., 2012). Metacognitive processes include the extent to which individuals monitor their own reasoning process, strive to maintain consistent reasoning, reflect on the progress of their reasoning and monitor the reasoning for inconsistencies (Klaczynski & Narasimham, 1998). Therefore, it can be said that we can engage in metacognitive activities while making scientific reasoning.

The Present Study

There has recently been increasing interest in the metacognitive processes accompanying SR (Ha et al., 2021). Some researchers have even emphasized the importance of metacognition for SR (Amsel et al., 2008; Andersen & Garcia-Mila, 2017; Magno, 2011; Pedaste et al., 2012). There is, though, only a limited number of studies in the literature investigating the relationship between SRS and metacognitive awareness (e.g., Haryani et al., 2018; Limueco & Prudente, 2018). Most of the current research in this domain examines cognitive processes related to learning, remembering, and understanding; less is known about metacognitive processes in complex procedures such as reasoning and problem-solving. However, recently there has been an increase in research in these domains (Ackerman & Thompson, 2017). Metacognition is significant in terms of choosing which SR strategies to use and when to apply them (Omarchevska et al., 2022a). Previous research has emphasized the importance of self-regulation during complex problem-solving activities (e.g., Azevedo et al., 2010; Bannert et al., 2015; Omarchevska et al., 2022b) such as SR (e.g., Manlove et al., 2009; Omarchevska et al., 2022a; Omarchevska et al., 2022b; White et al., 2009). However, a detailed analysis of the interaction between metacognitive skilss to self-regulate individuals' learning during inquiry and activities using SRS is still lacking (Omarchevska et al., 2022a). In addition, no studies have been found that examine the metacognitive activities occurring in the minds of individuals teaching SRS. In this study, we present a detailed analysis of pre-service teachers' metacognitive processes during the teaching of SRS with the POE technique.

It is expected that the findings in this study will contribute to (a) creating an analysing basis for the development of taxonomy of metacognitive activities that take place in the teaching of SRS and (b) give an idea about the possible strategies that can be used to develop these processes and how they can be included in the teaching.

Methodology

The holistic single-case design was used to examine the metacognitive activities of pre-service teacher while teaching the SRS with the POE technique. In this design, a single case is investigated in depth and from a holistic

Table 1. Participant Profile.

Participant codes	Gender	Age	GPA
PST1	Female	21	2.80
PST 2	Female	22	2.80
PST 3	Female	21	3.37
PST 4	Male	20	2.96
PST 5	Male	21	2.46
PST 6	Male	21	2.86

and real-world perspective (Yin, 2018). A seven-week implementation process was carried out in this study. Metacognitive activities occur during the teaching of the control of variables, proportional reasoning, correlation reasoning, probability reasoning, combinational reasoning, and hypothetical-deductive reasoning skills were examined holistically. A typical situation was thus focused on and this situation was examined holistically.

Participants

The study was carried out with six third-grade pre-service science teachers who were enrolled in the SRS course, which is a compulsory course, in the Faculty of Education of a university in the west of Türkiye. The convenient sampling method was used to choose the participants in the study, and six pre-service teachers enrolled in the course also participated in the study. Before the instruction, all the pre-service science teachers were informed about the purpose and the process of research, and their consent was obtained. Three of the participants were male and three were female. Information about the gender, age and grade points average (GPA) of the participants is given in **Table 1**. Participants were coded from PST1 to PST6 to represent each participant.

Data Collection Tools

The POE Activity Report, an Activity Journal, and a Semi-structured Metacognition Observation Form were used in this study. In developing these forms, the literature about metacognition was utilized (e.g., Chen, 2013; Flavell, 1979; Gunstone & Mitchell, 1998; O'Malley ve Chamot, 1990; Ozturk, 2017; Pearson & Cervetti, 2017; Schraw & Dennison, 1994; Vandergrift, 1997) and the forms were created to include metacognitive activities. The data collection tools were evaluated by an expert on metacognition in science education and the final version was created. The POE activity report consisted of three parts and a sample is included in Supplementary Material

1. In this form, a daily life scenario related to the scientific reasoning skill is presented to the students, and predictions about the problem given in the scenario are requested. In the observation phase a closed-ended experiment or an activity is carried out. In the explanation phase, questions about the similarities and differences between the predictions before the activity and the findings after the observation, the reasons for these findings, and the possible relations between the results and daily life are discussed.

The Activity Journal consisted of two parts and seven items including metacognitive activities. In the first part, there were two main questions and sub-questions about the theoretical information of the relevant skill. These questions were as below,

1 *Which scientific reasoning skill was taught in the lesson?*
- *What did you think when you first heard about the scientific reasoning skill, what came to mind, what words evoked in your mind? Why? Can you explain?*

2 *What did you learn theoretically about the relevant scientific reasoning skill? Can you express what you have learned using one of the concept teaching tools (V diagram, concept map, etc.)?*
- *Have you ever experienced a situation in which you did not understand or had difficulty in teaching this skill? Why? What did you do to overcome this problem? Why?*
- *The first part of the journal was completed by the pre-service science teachers after the theoretical information about each relevant scientific reasoning skill had been taught. The second part of the activity journal was about the teaching process for the related skill using the POE technique and consisted of five main questions and sub-questions. The questions were*

3 *We conducted a practice in the teaching of this skill. First, you were given a problem and asked to make predictions. In the second stage, you engaged in an activity to solve the problem. In the third stage, you made a statement about the solution of the problem. In this context,*
- *What did you do? What did you observe?*
- *Did you have any difficulties while performing the practice? Which part did you have difficulties with? Why?*
- *What did you do to overcome this challenge? Why?*
- *Have you always done this, or did you do this for the first time? Why?*

4 *What did you become aware of after teaching the relevant SR skill? Why?*

5 *Did your ideas about this skill change after teaching the relevant SR skill? Why and how?*

6 *How can you associate the relevant scientific reasoning skill to daily life? Why?*

7 *Have you ever had a situation where you said "I wish I had done that" in the teaching of the relevant SR skill? Why and how?*

The second part of the journal was completed by the pre-service teachers after they had practiced teaching each skill with the POE technique. The Metacognition Observation Form consisted of 18 items about metacognitive activities. These items were, "Monitoring whether you understand the theoretical information in the course", "Monitoring the consistency of the theoretical information with your prior knowledge", "Monitoring the change in your ideas about theoretical knowledge", "Drawing attention to unfamiliar concepts/information", "Choosing key points and supporting details", "Monitoring when your prior knowledge is wrong", "Evaluating the accuracy of your prior knowledge", "Monitoring what you know and don't know", "Comparing the consistency of your own predictions with those of your friends' predictions using the POE technique", "Evaluating the reasons your friend's predictions when they are different from your own when using the POE technique", "Evaluating the elements your friends used to decide on their prediction", "Monitoring whether they can explain their observations correctly", "Comparing your observations with your experiences", "Evaluating the consistency of your predictions and observations", "Deciding which of your predictions and your observations are correct", "Becoming aware that you have difficulties while doing the activities and then changing the strategies you use", "Comparing the consistency of the activity with the theoretical knowledge of the relevant skill" and "Evaluating the strategies used for the lesson". In addition, when one of the researchers encountered statements that were not included in the Metacognition Observation Form during teaching but that showed that pre-service teachers were engaging in metacognitive activities, she noted down these statements while she was observing them. As an example, the item "Being aware of what you know and what you do not know" was added in the teaching of the proportional reasoning skill, and the item "Being aware of encountering new situations" was added in the teaching of the combinational reasoning skill.

In order to ensure the content validity of the data collection tools, all the items in the data collection tools were created in order identify metacognitive activities. In addition, there were similar items in the Activity Journal, the Observation Form, and the POE Activity Report. Moreover, two experts were consulted to check the clarity and comprehensibility of the data collection tools. One of the experts specialized in metacognition in science education and the other was a linguist. After taking into account the experts' views, the final version of the data collection tools was created with minor revisions.

Teaching Process

Hypothetical-deductive reasoning, control of variables, proportional reasoning, correlation reasoning, combinational reasoning and probability reasoning are important sub-skills for scientific reasoning (Lawson, 2004). In this

study, these six skills were taught using the POE technique. The SRS teaching process in the study is shown in **Figure 1**.

As seen in **Figure 1**, the teaching of each skill lasted two weeks. In the first week, theoretical information about the scientific reasoning skill was given, and then a discussion was initiated about the problem scenario, prepared by the researchers, that required the use of this skill. Finally, students were asked their predictions about the problem (the "prediction" step of the POE technique). The following week, experiments or activities related to these predictions were performed, actual results were recorded (the "observation" step of the POE technique), and the teaching of the relevant skill was completed by explaining the differences between the predictions and the actual results (the "explanation" step of the POE). An example of the activity for the teaching of hypothetical-deductive reasoning skill is given in ***Appendix 1***.

Data Analysis

Inductive and comparative analysis was used to investigate in detail the participants' metacognitive activities occurring in the teaching of SRS with the POE technique. Since metacognitive activities occurring in the teaching process were being examined, the data collection tools focused on the monitoring and evaluating components of the regulation of cognition. First, the data were analysed back and forth in order to find statements by the participants that exemplified the metacognitive monitoring and metacognitive evaluating categories of the Activity Journal, the Metacognition Observation Form, and the POE Activity Report. The data were coded by considering the definitions of monitoring and evaluating activities in the literature. Thirteen activities for monitoring and four activities for evaluating were coded. After the coding, the operational definitions of the pre-service teacher's metacognitive activities that occurred in the SRS teaching were made: (a) Monitoring activity included being aware of what one knows and does not know, being aware of the challenge faced, being aware of encountering new situations, choosing key points and supporting details, drawing attention to unfamiliar concepts/information, monitoring the consistency of one's prior experiences with new information, monitoring the consistency of one's prior knowledge with information provided by different sources, monitoring the accuracy of the information provided by different sources, monitoring what one knows and does not know, monitoring the consistency of one's predictions with the observations, monitoring when one understands and does not understand an idea encountered, overcoming difficulties and monitoring the change in one's ideas; (b) Evaluating activity included evaluating one's learning, evaluating the accuracy of one's observations, evaluating the efficiency of practices and evaluating the efficacy of the strategies used. In making these

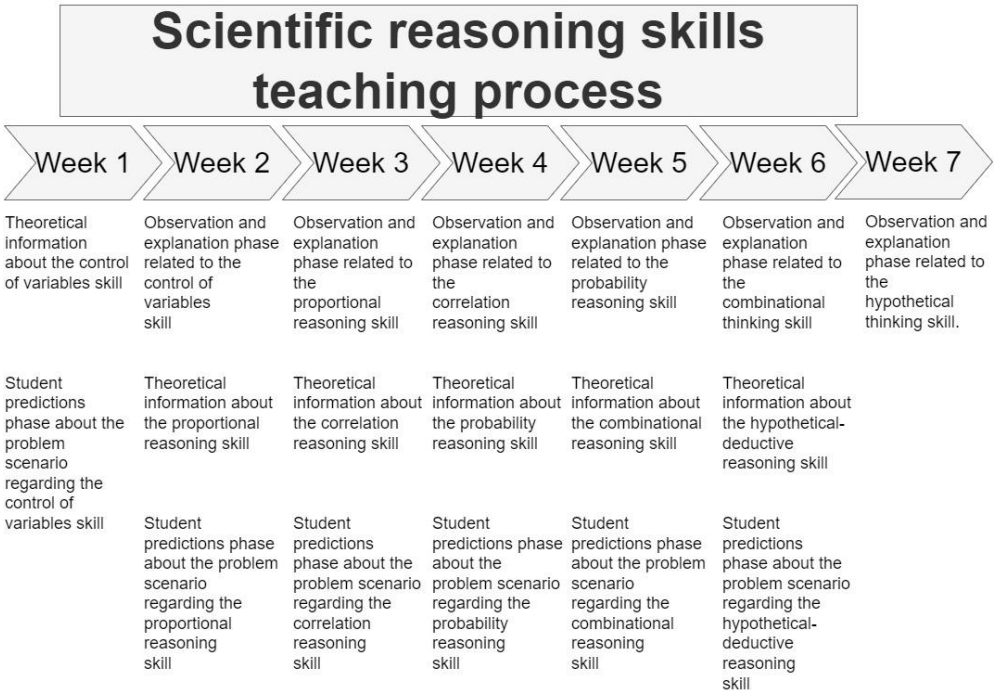

Figure 1. The SRS Teaching Process.

definitions, the studies by Berger and Karabenick (2016), Meijer et al. (2006), Meijer et al. (2012), Shraw & Dennison (1994), Schraw ve Moshman (1995), Veenman (2011) and Yürük (2005) were used.

Second, the subtypes of the metacognitive activities identified were defined according to the operational definitions of the pre-service teacher's metacognitive activities. For example, the monitoring activity was defined as the following sub-activity types: "Being aware of what one knows and does not know", "Drawing attention to unfamiliar concepts/information", "Choosing key points and supporting details", "Monitoring the consistency of one's predictions with the observations" and "Overcoming difficulties". The evaluating activity was defined with the following sub-activities: "Evaluating one's learning", "Evaluating the accuracy of one's observations", "Evaluating the efficiency of the practice", and "Evaluating the efficacy of the strategies used". Some of the sub-monitoring and sub-evaluation activities were compatible with the items in the Metacognition Observation Form (metacognitive observation items were included in the data collection tools section), and some of them were obtained as a result of coding the statements of the participants in the Activity Journal. For example, the sub-monitoring activities such as "Being aware of the challenge faced", "Being aware of encountering new situations", and "Overcoming difficulties" were categories

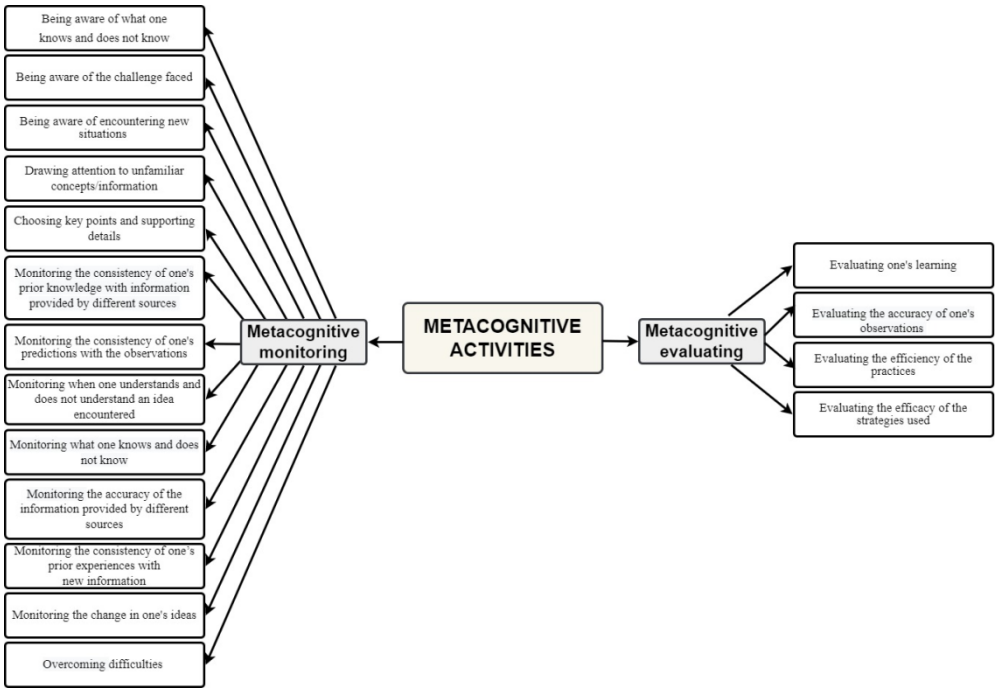

Figure 2. Categories and Sub-Categories Related to Metacognitive Activities.

derived from the Activity Journals. In addition, some items in the Metacognition Observation Form were revised and coded as categories to include both in the Activity Journal and the statements in the Activity Report. For example, the item "Comparing the consistency of your own predictions with those of your friends' predictions using the POE technique" in the Metacognition Observation Form was revised to "Monitoring the accuracy of the information provided by different sources" sub-monitoring activity. The item "Monitoring whether they can explain their observations correctly" was revised to "Evaluating the accuracy of one's observation" sub-evaluating activity. The subtypes of metacognitive activities are coded as sub-categories related to metacognitive activities. The categories and sub-categories obtained by examining the statements of the participants from the Metacognition Observation Form, the Activity Journal and the Activity Report, which are also related to metacognitive activities, are given in **Figure 2**.

While labelling the identified metacognitive activities and their types, one of the researchers considered the literature on metacognition and determined possible names for them. The labelling two researchers then discussed it together and decided on the final naming.

Some direct quotes from the Metacognition Observation Form and the POE Activity Report of PST3, one of the pre-service teachers and exam-

ples of how these were coded in terms of metacognitive activities are given below:

> PST3: *My observations are consistent with my predictions. I set up my first experimental setup, and then I established my second experimental setup. I concluded, "As the number of reels increases, the gain in force increases." The length of the first rope is 70 cm. In the second experimental setup it is 120 cm. In the second system, I should have pulled 140cm. I pulled 120cm, and my prediction was not exactly consistent with my observation. It may have been due to the weight of the reel. Also, I may not have measured correctly while pulling the rope.* (From the Metacognition Observation Form [Monitoring: Monitoring the consistency of one's predictions with the observations.])

> *PST3: There is inconsistency between my predictions and my observations. My predictions and my observations were almost the same. I predicted that there would be a gain in force when I added a movable pulley to the system. I also predicted that the length of the rope would be longer, and I observed better when I experimented. Since I wrote the data in the table wrong at first, my predictions and my observations were inconsistent. I have to correct my data. Also, if the weight of the moving pulley and friction force in the system are neglected, my result would be correct."* (From the POE Activity report [Monitoring: Monitoring the consistency of one's predictions with the observations.])

Tables are included in the Findings section to show which metacognitive activities occurred in the teaching of which scientific reasoning skill.

Validity and Reliability of the Study and Ethics

The study's validity and reliability were ensured through data triangulation, the researcher's position, appropriate and adequate engagement in data collection processes, an audit trail and the rich and dense descriptions technique (Merriam & Tisdell, 2016).

In data triangulation, data obtained from the Activity Journal, the Metacognition Observation Form, and the POE Activity Report related to teaching each scientific reasoning skill were examined. The consistency of the data coded from different data sources was compared, and similar categories emerged. Thus, reliable and common evidence was obtained. The coding set consisting of sample data sections for the categories created for each type of the metacognitive activities was coded by one of the researchers and an expert on metacognition in science education. Inconsistencies detected in the coding were discussed until a satisfactory agreement was reached. By reviewing the literature, the attempt was made to form taxonomy of the metacognitive activities performed by pre-service teachers in teaching SRS with POE.

The investigator's position or reflexivity, strategy was used in this study. One of the researchers is experienced in conducting qualitative studies

and metacognition, and the other is experienced in SRS. In addition, they did not make any personal interventions that would affect the research process positively or negatively, and they did not make any prejudgements about the study results.

The adequate engagement in data collection strategy for data collection took the form of data collection over a specific period (seven weeks). Detailed information about the audit trail is included in the Data Collection Tools, Teaching Process, and Data Analysis sections. In addition, the data for the Activity Journal amounted to a 124-page document, while the data for the Metacognition Observation Form and the POE Activity Report resulted in documents that were 33 and 133 pages long respectively.

Regarding ethics, the necessary permissions were obtained from the Human Research Ethics Committee (letter dated 24.02.2021, numbered E-57452775-900-9101 and decision number 2021/39). In addition, the real names of the participants were kept confidential during the coding and reporting of the qualitative data to ensure their privacy. The participants were coded from PST1 to PST6 to represent each participant.

Results

Various metacognitive activities regarding monitoring and evaluating were found to have occurred in the pre-service teachers during the teaching of six different SRS with the POE technique. Information on the monitoring activities that occurred in each SRS teaching is given in **Table 2**.

When **Table 2** is examined, it is seen that there were 13 different monitoring activities performed by the pre-service teachers in the teaching of six different SRS. There was more variety in the monitoring activities of the pre-service teachers in teaching the control of variables and probability reasoning skills compared to the other skills. There was least diversity in teaching hypothetical-deductive reasoning skills. In addition, in **Table 2**, it is seen that the activities of being aware of what one knows and does not know, being aware of encountering new situations, monitoring the consistency of one's predictions with the observations, monitoring when one understands and does not understand an idea encountered, and overcoming difficulties occurred during the teaching of each scientific reasoning skill. The activities of pre-service teachers to monitor the accuracy of the information provided by different sources and to monitor the consistency of one's prior experiences with new information were found to be active only in teaching the correlational reasoning skill. Sample quotations regarding various monitoring activities performed by the pre-service science teachers in the teaching of SRS are given in **Table 3**.

Table 2. Monitoring Activities in the Teaching of Each Scientific Reasoning Skill.

Type of Monitoring Activities	Control of Variables	Proportional Reasoning	Correlation Reasoning	Probability Reasoning	Combinational Reasoning	Hypothetical-Deductive Reasoning
Being aware of what one knows and does not know	✓	✓	✓	✓	✓	✓
Being aware of the challenge faced	✓	✓	-	✓	-	-
Being aware of encountering new situations	✓	✓	✓	✓	✓	✓
Drawing attention to unfamiliar concepts/information	✓	✓	✓	✓	✓	-
Choosing key points and supporting details	✓	✓	-	✓	✓	✓
Monitoring the consistency of one's prior knowledge with information provided by different sources	✓	-	-	✓	✓	✓
Monitoring the consistency of one's predictions with the observations	✓	✓	✓	✓	✓	✓
Monitoring when one understands and does not understand an idea encountered	✓	✓	✓	✓	✓	✓
Monitoring what one knows and does not know	✓	-	✓	✓	✓	-
Monitoring the accuracy of the information provided by different sources	-	-	✓	-	-	-
Monitoring the consistency of one's prior experiences with new information	-	-	✓	-	-	-
Monitoring the change in one's ideas	✓	-	✓	✓	-	-
Overcoming difficulties	✓	✓	✓	✓	✓	✓

Information on evaluating the metacognitive activities of the pre-service science teachers that occur in the teaching of each SRS is given in **Table 4**.

When **Table 4** is examined, it is seen that four different evaluating activities occurred in the pre-service science teachers during the teaching of six different SRS. There was more variety in the evaluating activities in the teaching of the control of variables and proportional reasoning skills compared to the other skills. In addition, in **Table 4**, it is seen that evaluating

Table 3. Sample Quotes regarding the Kind of Monitoring Activities Performed by the Pre-Service Teachers in SRS Teaching.

Type of Monitoring Activities	SRS Teaching	Sample Quotes
Being aware of encountering new situations	Hypothetical-Deductive reasoning	PST4: *When I added pineapple to the milk, I noticed that there was some agglomeration. I did not expect that I would make such an observation*. (From the Observation Form.) PST4: *I knew that when lemon was added to milk, the milk would curdle, but I was not so sure that I would get that result for pineapple juice, and when I saw that the milk had curdled, I was very surprised.* (From the Activity Journal.)
Choosing key points and supporting details	Combinational reasoning	PST2: *By learning this skill, I realized the importance of systematically thinking about all the possibilities that could affect an event.* (From the Observation Form.)
Monitoring the consistency of one's prior knowledge with information provided by different sources	Control of variables	PST4: *PST3 gives a different explanation about the experimental data, did you notice, sir?* Researcher: *Yes.* PST4: *PST3 looked at the reaction time. So, he reached a different conclusion. I am looking at the end time of the reactions in different test tubes.* (From the Observation Form.)
Monitoring when one understands and does not understand an idea encountered	Probability reasoning	PST1: *I thought the probability thinking skill was hard. Because probability was a difficult subject for me. But when I listened to this lesson, I realized that it was not difficult at all. While listening to the lecture, I realized that I had difficulty because I did not like the subject. This time I listened to the lecture without any prejudices. For this reason, I realized that the subject is not difficult. Maybe I could have listened without prejudice because she was the lecturer of this course. I just realized that I need to be careful.* (From the Activity Journal)
Monitoring the change in one's ideas	Control of variables	PST2: *I'm confusing dependent and independent variables. I think theoretically at first and then I associate them with lots of examples.* (From the Observation Form.) PST2: *As someone who constantly confuses dependent and independent variables, I was happy to practice this reasoning skill in class. It helped me eliminate my misconception. The reason for my misconception is that I thought that the independent variable was a constant variable that is not affected by any situation and does not depend on any situation. The situation I had difficulty with was that I had the thought that I could not interfere with the independent variable, regardless of everything. But in the lesson, I understood that the dependent variable changes depending on the independent variable. In my mind, I replaced the wrong idea with the right idea. In this way, I overcame my problem by adopting the idea that the dependent variable changes depending on the independent.* (From the Activity Journal.)

one's learning, evaluating the efficiency of the practices, and evaluating the efficacy of the strategies used become active in the teaching of each scientific reasoning skill. The process of evaluating the accuracy of one's observations was found to be active only in the teaching of the control of variables and proportional reasoning skills. Sample quotes regarding the various evaluating activities performed by the pre-service teachers in the teaching of these skills are given in **Table 5**.

Table 4. Evaluating Activities in the Teaching of Each Scientific Reasoning Skill.

Type Of Metacognitive Evaluating Activities	Control of Variables	Proportional Reasoning	Correlation Reasoning	Probability Reasoning	Combinational Reasoning	Hypothetical-Deductive Reasoning
Evaluating one's learning	✓	✓	✓	✓	✓	✓
Evaluating the accuracy of one's observations	✓	✓	-	-	-	-
Evaluating the efficiency of the practices	✓	✓	✓	✓	✓	✓
Evaluating the strategies used	✓	✓	✓	✓	✓	✓

Table 5. Sample Quotes regarding the Types of Evaluating Activities Performed by the Pre-Service Teachers in Scientific Reasoning Skill Teaching.

Type of Evaluating Activities	SRS Teaching	Sample Quotes
Evaluating one's learning	Hypothetical-deductive reasoning	PST4: *I was aware that this skill actually includes most skills because we identify the variables, then we think about all the events. Actually, we need to think combinationally in part. I learned how to do this.* (From the Activity Journal.)
Evaluating the accuracy of one's observations	Proportional reasoning	*PST6: I set the angle as sin 90° and in this situation, I pulled the rope 12 cm. Then, when I widened the angle, I had to pull the rope 21 cm. As the angle widened, there was a gain in force and a loss in distance. However, I may have made a mistake in measuring the angle. The fact that I neglected the weights of reels may have caused the experimental error.* (From the Observation Form.)
Evaluating the efficiency of the practices	Combinational reasoning	PST6: *The practice we did was good in terms of explaining combinational thinking because it was an experiment that showed what kind of results could be obtained by setting different combinations.* (From the Activity Journal.)
Evaluating the efficacy of the strategies used	Probability reasoning	PST4: *If we take samples from certain parts of the whole field, then average these samples and interpret them as a whole, as I did in my own experiment, we will get a more accurate result*. (From the POE Activity Report)

General information on the frequency of the pre-service teachers' metacognitive activities occurring during teaching Scientific Reasoning Skill is given in **Figure 3**.

When **Figure 3** is examined, it can be seen that some metacognitive activities – being aware of what one knows and does not know, being aware of encountering new situations, monitoring the consistency of one's predict-

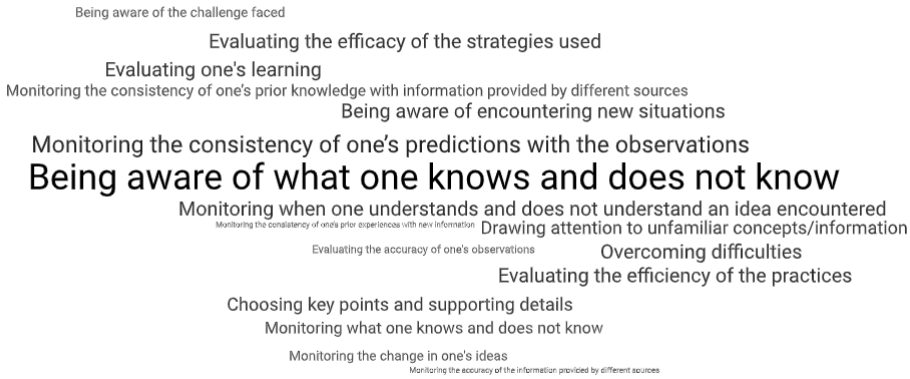

Figure 3. The Frequency of the Pre-Service Teachers' Metacognitive Activities Occurring during Teaching SRS.

tions with the observations, monitoring when one understands and does not understand an idea encountered, overcoming difficulties, evaluating one's learning, evaluating the efficiency of the practices and strategies used – occurred more frequently than others in teaching SRS with the POE technique. Activities to monitor the accuracy of the information provided by different sources, to monitor the consistency of one's prior experiences with new information, and to evaluate the accuracy of one's observations were among the least performed activities.

Discussion and Conclusion

This study determined the metacognitive activities occurring in pre-service science teachers in teaching various reasoning skills with the POE technique. Three conclusions were reached. The first result was that the types of metacognitive activity performed by pre-service teachers (e.g., being aware of what one knows and does not know, being aware of encountering new situations, monitoring the consistency of one's predictions with the observations, monitoring when one understands and does not understand an idea encountered, overcoming difficulties, evaluating one's learning, etc.) reflect the activities occurring in the steps of the POE technique. This can be explained by the fact that POE activities prompt students to make predictions and revise these predictions to monitor their learning (James et al., 2022). In addition, it is emphasized in the literature that this technique is a metacognitive teaching tool that improves students' conceptual understanding and problem-solving

abilities (e.g., Bajar-Sales et al., 2015; Karadeniz et al., 2020; Rickey & Stacey, 2000; Thomas, 2015).

The second result was that there was more variety in the monitoring activities than in the evaluating activities. This can be explained by the fact that the POE technique used in teaching provides the opportunity to question students' prior knowledge and to play an active role in the learning process for each student (Acar-Şeşen & Mutlu, 2016). Thus, the learners have greater conscious awareness during teaching. In addition, it should not be forgotten that the use of monitoring and regulating skills is important for effective instruction during the interactive stage (Artzt & Armour-Thomas, 1998). In general, learners have difficulties monitoring their own cognitions. However, specific situations can be created in the learning environment in order to overcome these difficulties and promote the use of cognitive monitoring strategies (Garner, 1990). In this study, the learner's active monitoring skills were more diverse. This result shows the significance of including metacognition in teaching practices. In particular, students with weak metacognitive skills experienced difficulties in monitoring their learning. Thus, these students need well-designed teaching activities so that they can monitor their learning (Berardi-Coletta et al., 1995). We can achieve this by adding instructional supports (i.e., directives, prompting, and modelling) (Pieger & Bannert, 2018) when designing learning environments. Here, the teacher's knowledge of strategies that can be used to activate the metacognitive skills of the students, and the ability to use this knowledge in the learning environment, in other words, their strategic metacognitive knowledge about teaching techniques (Hartman, 2001), will also play a critical role.

We expect the POE technique to give rise not only to monitoring activities but also to evaluating activities, and that there would be a large variety of evaluating activities during teaching. However, in this study, there was less diversity in the evaluating activities than in the monitoring activities. In the literature on determining metacognitive awareness, there are also quantitative studies showing that teachers'/pre-service teachers' evaluation skills were at a low level (e.g., Fauzi & Sa'diyah, 2019). When learners do not fully understand how to evaluate their learning, they may not realize that they have failed (Garner, 1990). Thus, evaluation activities are very important. These activities also require the use of a variety of specific strategies. We can thus conclude that the participants in this study had limited knowledge about the strategy to use to perform evaluation activities (Zohar, 2012). This can be explained by personal characteristics such as the level of prior knowledge of strategy regarding this activity, their cognitive styles and their motivation levels (Efklides & Misailidi, 2010). In addition, during this process, the lecturer may not have been able to spare enough time to activate the evaluation activities.

Metacognitive strategies can be used to activate metacognitive activities in various teaching practices. For example, self-questioning is a common metacognitive monitoring strategy (Livingston, 2003) and can often be used in teaching practices. Incorporating various strategies into the content of the teaching is one of the ways to develop metacognitive skills (Veenman et al., 2006). To achieve this, instructional supports such as directives, prompting, and modelling can be used (Zepeda et al., 2019).

Being aware of when, how and which strategy to use in different contexts is crucial in performing metacognitive activities (Ku & Ho, 2010). The third result was that the variety and number of metacognitive activities performed by pre-service teachers in the teaching of SRS differ. For example, while there was large diversity in the metacognitive activities performed by pre-service teachers is high in teaching of control of variables skill; there was little diversity in the teaching of hypothetical-deductive reasoning skills. Another example is the finding that the activity of evaluating the accuracy of one's observations became active only in the teaching of control of variables and proportional reasoning skills. The reason for this is that the diversity of metacognitive activities varies depending on the nature of the task (Duncan & McKeachie, 2005) and the needs of the participants in completing the task (Alavi & Kaivanpanah, 2006), and the knowledge of strategy that learners need to fulfil the demands of the task (Garner, 1990). When a task is difficult, this provokes metacognitive activity (Meijer et al., 2006). We can associate to this with the Theory of Constructive Operators. According to this theory, "mental demand", which refers to the minimum number of schemas that must be used to solve a problem, is a measure of the complexity of the problem (Pascual-Leone, 1970), and a person cannot solve a problem whose mental demand is above the person's mental capacity (Pascual-Leone & Johnson, 2005). This is one of the main sources of cognitive load (Van Merrienboer & Sweller, 2005). When we consider the hypothetical-deductive reasoning skill, it is a difficult task that includes the skill of controlling variables and requires various cognitive processes, and the mental demand of the activities used in teaching this skill is higher than other activities. Studies on cognitive load showed that the strategies that need to be used in solving problems facilitate the solution of problems with high mental demands (e.g., Boujaoude et al., 2004; Tsaparlis & Angelopoulos, 2000). If students have a wide range of strategies, they can respond with greater variety and frequency to difficult tasks (Ikeda & Takeuchi, 2000). The hypothetical-deductive reasoning skill also requires the use of some experimental strategies in the process of control of variables (Tschirgi, 1980), and the use of monitoring strategies is crucial in this process (Taub et al., 2018). However, in this study, it was concluded that there was less variety and frequency in their metacognitive activities performed by pre-service teachers in the teaching of hypothetical-deductive reasoning skill than in the teaching of other SRS. This situa-

tion can be explained as arising from the lack of knowledge of pre-service teachers on the use of strategies to perform metacognitive activities. In the literature, there are studies showing that university students are deficient in the use of metacognitive strategies in their learning (e.g., Anthonysamy et al., 2020; Hashemyolia et al., 2015) and that they are not sufficiently interested in metacognition (Boser, 2018).

Limitations and Recommendations for Future Research

This study was limited to pre-service science teachers, teaching six SRS with the POE technique, the regulation of cognition component of metacognition, and qualitative research. Future studies can be conducted to determine the metacognitive activities performed by the learners in the teaching of SRS by using other techniques (argumentation, scientific inquiry, etc.), and to compare the metacognitive activities performed in the teaching of SRS by different techniques. In addition, the metacognitive knowledge and metacognitive experience components of metacognition can also be examined.

The study found that pre-service teachers engaged in fewer metacognitive activities in the teaching of the hypothetical-deductive reasoning less than in teaching other skills. Given that scientific reasoning can be supported by teachers through practices including prompts, scaffolds, didactic interventions, or metastrategic understanding (Kuhn & Dean, 2004), practices that can activate learners' metacognitive activities can be implemented in the teaching of hypothetical-deductive reasoning skill. The cognitive and metacognitive strategies used in teaching SRS can be taught.

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Appendix I

Scenario

Fatma reached this information while she was researching the structure of milk: “The reason why milk appears white is because of the casein micelles suspended in the milk. Casein is the most important protein component in milk. Casein proteins are hydrophobic, in other words they are insoluble in water. For this reason, the casein molecules are associated together in water and form small micelles. Since these micelles are very small, they are suspended in the milk. There are two factors that prevent the casein proteins from forming large micelles in the milk. First, the proteins on the surface of the casein micelles make it difficult for the different micelles to associate together. Second, while the pH of milk is between 6.7-6.9, the casein micelles are negatively charged. Therefore, there are electrical repulsive forces between the micelles.

Based on this information, Fatma wants to investigate the reasons for cessation of milk. What are your hypotheses about the cessation of milk? What would be the deductive reasoning cycle you would use when testing these hypotheses? Please explain.

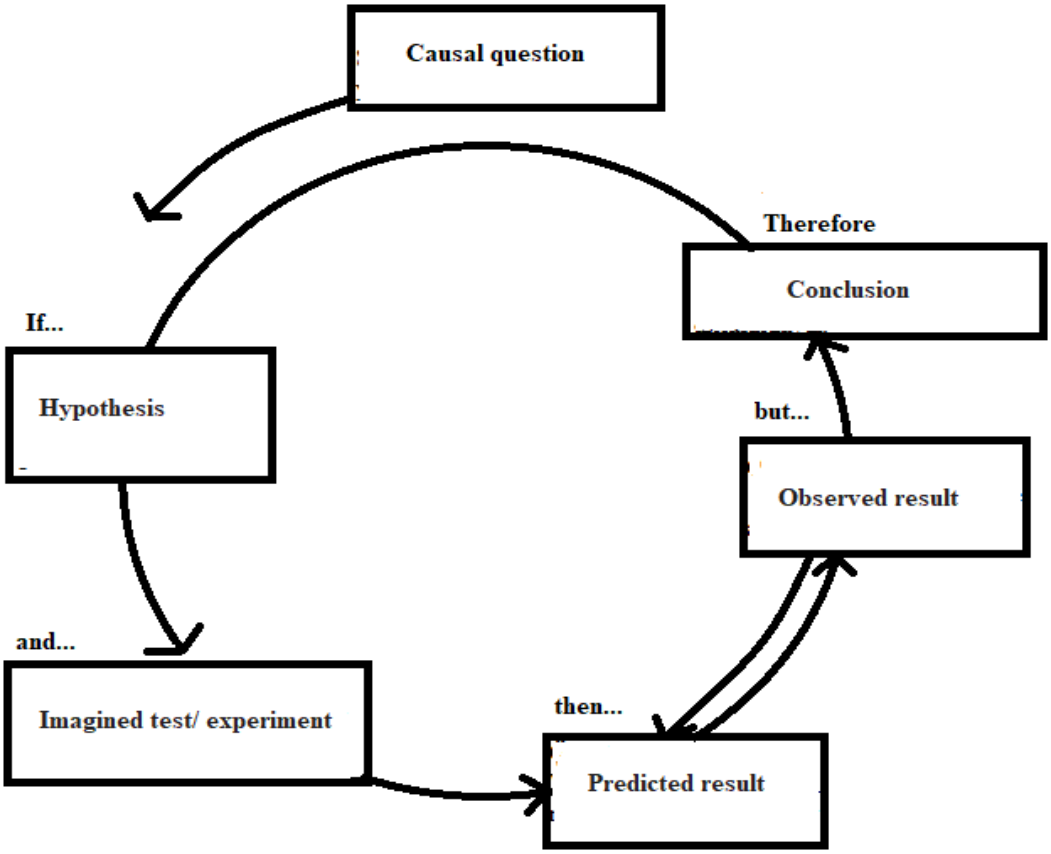
1-Prediction

Hypothesis 1...

Hypothesis 2...

Hypothesis 3...

Hypothetico-deductive reasoning cycle



2- Observation

Materials

• Milk
• Heater
• Heat-resistant container
• Adhesive
• Heat-resistant container
•Adhesive
• Teaspoon
• Paper
• Tablespoon
• Pen
• 6 cups
• Knife
• Lemon
• Plate
• Pineapple
• Strainer

Experimental Procedure

- Let's cut a peeled pineapple in half and cut one piece of into small cubes.
- Let's press the small cubes we cut with our hands or with a mortar until you get juice from pineapple.
- Let's drain the juice of the pineapple pieces with a strainer.
- Let's pour half of the pineapple juice into a cup. Let's heat the remaining half until the bubbles form.
- Let's pour the heated pineapple juice into a cup, and stick a label on it so that it does not confuse this cup with another cup.
- Let's label the first cup as "milk", the second cup as "milk and heated pineapple", the third cup as "milk and pineapple" and the fourth cup as "milk and lemon". Let's add 1 tablespoon of milk to each cup.
- Add a teaspoon of heated pineapple juice to the cup labeled milk and heated pineapple and mix.
- Add a teaspoon of fresh pineapple juice to the cup labeled milk and pineapple and mix.
- Add a teaspoon of lemon juice to the cup labeled milk and lemon and mix.

- Let's wait about 5 minutes. Let's observe the changes and the time of the changes in the mixtures and take note.

I. Experimental set up (Milk) ...

II. Experimental set up (Milk and heated pineapple) ...

III. Experimental set up (Milk and pineapple) ...

IV. Experimental set up (Milk and lemon) ...

3- Explanation Phase

- What conclusion did you reach as a result of your experiment? Did you reject your hypothesis? Did you accept? Why?
- What did you observe when we added lemon juice to milk? How did the change occur? What is the reason for this change?
- What did you observe when we added fresh pineapple juice to the milk? How did the change occur? What is the reason for this change?
- Comparing the mixture of lemon juice and milk and the mixture of fresh pineapple juice and milk, what did you observe? Does the change occur immediately or after a while?
- Pineapple juice (pH between 2.5-3.5) is not as acidic as lemon juice. However, when we add pineapple juice to the milk, micelles still form. Why?
- What did you observe when we added heated pineapple juice to the milk? Why?

ORIGINAL ARTICLE

Exploring Employment Intentions of College Students in Small and Medium-sized Cities against the Backdrop of High-Quality Economic Development: Taking Huai'an City as an Example

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Abstract*: Against the backdrop of high-quality development of the national economy, the development of each city is also facing transformation and upgrading. Cities need high-quality development, and high-quality talents are the key. The problem of attracting high-quality talents in domestic small and medium-sized cities in high-quality development needs to be solved urgently. This paper takes Huai'an, a third-tier city in China, as an example, to understand the intentions and confusions of college students when they seek employment. The qualitative approach of semi-structured interviews is employed. The study finds that in small and medium-sized cities, factors hindering college students from staying in local cities for employment include that the intensity of the government in publicizing high-quality development has not reached to most college students, the guide courses in colleges and universities meet difficulties in the process of delivery, and college students' own career planning are not guided well. In response to the above problems, this paper puts forward suggestions such as strengthening the positive interaction between schools and college students, enhancing the publicity of high-quality urban development among college students, and closely integrating college students' career guidance courses with local development. Quality development attracts more high-quality talents.*

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Introduction

THE Fifth Plenary Session of the 19th Central Committee of the Communist Party of China clearly identified "high-quality development" as one of the important guiding ideologies for economic and social development during China's "14th Five-Year Plan" period (Li et al., 2019). High-quality development is a brand-new development concept, which means innovation in growth patterns. At present, China's cities have entered a stage of high-quality development. The traditional urban development model with land and capital as the core variables is changing, and the traditional way of agglomeration of elements driven by resources and investment is breaking through mechanism re-building, new goal setting, and new route choices (Cheng & Masser, 2003). The high-quality development of cities means that a large number of high-quality talents are needed. Among all, fresh college graduates are undoubtedly an important part. They are not only large in number, but also constitute the main body for high-quality development (Chen, 2013).

At present, the research on high-quality urban development and talent flow at home and abroad mainly focuses on the macro level (Banister & Lichfield, 2003; Downs, 2010; Hopkins, 2001). Some scholars expounded the connotation of high-quality urban development from the aspects of the transformation of development endowments, the theoretical mechanism and goal setting of high-quality urban development, etc (Easterly & Levine, 2003; Engerman & Sokoloff, 2002). Among them, technological innovation, industrial upgrading, fairness and efficiency, and urban security are the key elements of high-quality urban development. In terms of the realization path, it can be regarded as the main realization path from the aspects of urban industry and employment, regional integration and urban-rural integration, and the governance of quality of life.

Secondly, in the research on urban talent flow, some scholars believe that it points out the new characteristics of the current talent flow. The mobility of young talents is greater and faster (Smith, 2014); high-tech industries attract more talents (Abramo et al., 2011); key cities and urban agglomerations are still the first choice for employment (Awumbila, 2017). At present, the problem of urban talent flow is mainly manifested in the obvious downward trend of population, and the urban population is facing two levels. Scholars believe that promoting the integration of regional talents, empowering enterprises, and improving the suitability of urban life can solve the problems faced by the high-quality development of Chinese cities.

The above-mentioned research on the high-quality development of cities and the flow of urban talents is to propose macro solutions from the national level or the regional level such as the Yangtze River Delta and the Pearl River Delta. It is also a strong guiding role for Beijing, Shanghai, Guangzhou and Shenzhen or other first-tier cities such as Hangzhou, Chengdu, and Nanjing. However, for most other third- and fourth-tier cities in China, the above research recommendations are difficult to implement, and they cannot provide specific solutions and solutions. This paper, taking Huai'an City, Jiangsu Province as an example, attempts to solve the dilemma of attracting and retaining talents faced by third-tier cities under the background of high-quality development. Starting from the employment intention of college students in this city, this paper explores what motivates university students to stay or leave a city when seeking employment and provides implications.

Theoretical Framework

Since the last century, the push-pull theory has become a mature theoretical paradigm to study issues such as population mobility, migration, and brain drain (Zhou, 2006). The basic framework of this theory was first proposed by the British economist and sociologist E. G. Ravenstein in 1885. The famous seven laws of population migration are derived from his book The Laws of Population Migration. Later, R. Herbele formally proposed in 1938 that population mobility was caused by a series of forces, including the "push" of the outflow place and the "pull" of the inflow place. When people's needs were not met in their original place of residence, they might plan to move to another place; In addition, even if he is satisfied with his current situation, there may be greater opportunities in other places to promote his mobility. In the 1960s, the British scholar Everett Lee put forward the systematic transfer theory, which is known as "push-pull theory". This theory believes that under the circumstances of market economy and free flow of population, people move and flow because they can improve their living conditions through mobile employment. As a result, the factors that improve the living conditions of immigrants in the inflow area become a pull, while the unfavorable social and economic conditions in the outflow area become a push. Push-pull theory is an important theoretical basis in the study of regional choice of college students' employment. There are four basic theoretical issues in the push-pull theory proposed by Everett Lee: factors affecting migration, migration amount, migration direction and migration characteristics. This paper focuses on the first factor, the factors that affect migration, that is, the factors that local college students stay or leave. Everett Lee subdivided the factors of the migration process into four aspects: factors related to the place of emigration, factors related to the place of emigration, intermediary barriers and personal factors.

Zhong & Liu (2019) identify that among the factors for college students to choose rural employment, their own advantages and disadvantages, cultural differences between urban and rural areas, employment policies, wages and other factors will become the driving force for college students to stay in rural employment, emphasizing that the country should strengthen the guidance and publicity of college students' rural employment policies. Local governments should combine the rural revitalization strategy; adjust measures to local conditions, and increase measures and efforts to attract college students to rural employment. Zhang & Liu (2012), combined with the analysis of the push and pull theory, pointed out that college students' choice of the location for employment development is the result of rational analysis, and it is the decision made by college students after weighing the pull of the inflow place and the push of the outflow place. Among them, the factors conducive to improving living conditions are pulling forces, while the unfavorable living conditions are pushing forces.

When studying the intention of college students to stay in Huai'an City, this paper also focuses on the above aspects for interview and research. In third-tier cities, there are often two weaknesses in college students' employment choice: first, there is a lack of development opportunities and salary treatment in a big city; the second is the lack of sense of belonging and identity of hometown. These two weaknesses are the main impetus for college students to move out, and it is difficult to make a breakthrough in the short term. However, these two aspects must be improved if we want to retain more local college students. Local governments and colleges and universities can take advantage of dislocation to play a good role in employment and emotion, and fully highlight that the salary of Huai'an City is more competitive than that of its hometown (except the first tier big cities). It is more livable and has a sense of belonging than the

first-tier big cities (except hometown). Only in this way can we achieve objective results in the talent competition.

Push-pull theory is an important theoretical basis in the study of regional choice of college students' employment. There are four basic theoretical issues in the push-pull theory proposed by Everett Lee: factors affecting migration, migration amount, migration direction and migration characteristics. This paper focuses on the first factor, the factors that affect migration, that is, the factors that local college students stay or leave. Everett Lee subdivided the factors of the migration process into four aspects: factors related to the place of emigration, factors related to the place of emigration, intermediary barriers and personal factors.

Methodology

This paper uses semi-structured interviews (Seidman, 2006), a qualitative research approach, to investigate university students who are about to graduate, focusing on their subjective feelings, career planning and study plans in the city of Huai'an. Most of the students interviewed were senior students. Because of the employment needs faced by senior students, they have already thought deeply about the development of studying in Huaihe River. Moreover, because the 2022 cohort of graduates were not affected by the COVID-19 during their freshman year and the last semester of their sophomore year, they could freely enter and leave the campus.

In terms of interviewees, this paper conducted in-depth interviews with 22 such students. Audio recordings were made upon the consent of all the interviewees. We compared, analyzed and summarized the data regarding interviewees' understanding of Huai'an City's high-quality development, their own career planning, their intention to stay in Huai'an, and their expectations for the development of college students in Huai'an.

First, the first three interview questions are the interviewers' comprehensive understanding of Huai'an city. As the first condition for moving in and out, it is about the understanding of a particular place. Therefore, the first part of the interview should be clear about the respondents' understanding of City Huai'an. The second part of the interview is about personal factors, including their own capabilities, positioning, career planning, etc. Only when one understands his own abilities and needs can he make reasonable choices in employment. Personal factors are completely subjective and not necessarily accurate, so there will be a gap between ideal and reality. Only by clarifying the personal factors of the interviewees can we find out the main reasons for college students to stay and leave. The third part of the interview is about the reasons for college students to stay and leave. There are many variables of immigration and emigration in the push-pull theory. As mentioned above, it is impossible to quantify all variables objectively and accurately. There are several important factors that really affect the immigration or emigration of individuals. The focus of this study is to directly understand the main reasons for respondents to move in or out through interviews. The fourth part is suggestions. From the perspective of college students, we should know what improvements H City needs to make in attracting talents.

Among the 22 interviewees, 15 were graduates, 5 were non-graduates, and 2 were teachers. The majors covered 6 majors, including science, engineering, humanities and social sciences. There were 5 students from this city and 17 from other cities (including 5 from other provinces). When interviewing students, we should take gender, major, region, grade, occupation and other factors into consideration as much as possi-

ble, and randomly select students and teachers from eligible groups as interviewees, which can reflect the objectivity of the interview content more widely and truly.

Findings

Impression of High-Quality Urban Development: Personal Experience is the Key

Whether one decides to work and live in a city depends on their impressions of the city. City impression refers to an individual's comprehensive emotion towards a city. The impression of a city comes from many factors. For college students who have lived in a city for four years, personal experience is undoubtedly the most intuitive impression of a city. From the results of the questionnaire survey and interview, the 18th grade students generally have a better impression of Huai'an than other grades. The reason is that the 18th grade students have more opportunities to go out, and their favorability to Huai'an has also been greatly improved after personal experience. However, due to the epidemic, students of other grades were often managed in a closed manner during school and could not experience the customs and customs of Huai'an in person. Their impression of Huai'an was not much different from that before they came to Huai'an. In the interview, cultural tourism, convenient transportation, and simple and friendly folk customs are the three high-frequency keywords that appeared in the interview.

> *In terms of culture, Zhou Enlai's influence is relatively large. Compared with his hometown of Nantong, Huai'an has more tourist attractions. (Interviewee 2)*
>
> *Huai'an is not as backward in economy as imagined. It feels that the economy is okay, and tourism is still very good. It is like Zhou Enlai Memorial Hall, Zhou Enlai's Childhood Reading Center, and Wu Chengen's Former Residence. (Interviewee 3)*
>
> *Huai'an culture is still strong, Zhou Enlai, Wu Chengen and so on. When I first came, there was no high-speed rail, West Amusement Park, and now Fangte Park is still under construction. There have been great changes in the past four years. (Interviewee 4)*
>
> *I knew it was Zhou Enlai's hometown before, and I felt that the scenery, humanities and culture here are very good. I feel that there are more tourist attractions, such as Bochi Mountain and Taohua Island. (Interviewee 5)*
>
> *Huai'an's life is relatively harmonious. Culturally, there are Han Xin and Zhou Enlai. (Interviewee 9)*
>
> *Culture last week, Enlai and Hanxin, are located on the north-south dividing line, and high-speed rail has also been built in recent years. (Interviewee 13)*

Basically, they are all in school, they go out less and know less. (Interviewee 16)

Often closed management, little chance to go out to learn about Huai'an, and no impression of Huai'an. (Interviewee 17)

For the impression of a city, personal experience is undoubtedly the best choice. Freshmen who have just arrived in an unfamiliar city, their freshness and curiosity about the city will drive them to go out and explore the city often. During their freshman year, the 18th grade students were not affected by the epidemic and could freely enter and leave the campus, which greatly satisfied their exploration of the city. The students in grades 19, 20, and 21 were in closed management most of the time during school, and they had no chance to go out and learn about the city. In the four years from 2018 to 2022, Huai'an has developed greatly, especially in terms of transportation. In the past four years, Huai'an has opened a high-speed railway and built an elevated road. For everyone living in Huai'an, the travel experience diametrically reflects quality improvement.

"Before there was no high-speed rail, it took me four hours to get home. Now, with high-speed rail, I can go back in less than two hours sometimes on weekends, and the elevated direct access to the high-speed rail station is very convenient" (Interviewee 14)

In addition to the experience of the city, the experience of the school is also an important factor in the emotion of a city. Some students seldom go out because they are relatively housebound. Apart from the well-known tourist attractions, what they know most about Huai'an City is school life.

Huai'an people are more enthusiastic and simpler, especially the school dormitory, canteen aunts, and teachers are very good. The head teacher is very responsible for our class, supervises the study, leads us to do topics and projects, let us formulate postgraduate entrance examination plans, and also help us contact tutor. (Interviewee 7)

I have a good impression of Huai'an. The school's teachers, canteen aunts, and dormitory aunts are very friendly, and students get along well with each other. (Interviewee 9)

I have deep feelings for the school and the college. The library, laboratory, and postgraduate entrance examination classroom are all very good, especially for teachers and classmates. (Interviewee 11)

It can be seen that the teachers of the school, the auntie dormitory, the people that ordinary students often come into contact with, or the places where students often go to the library, sports field, laboratory, and postgraduate entrance examination classroom, constitute the main cognition of students' understanding of the school. If the city of the university is the second home, then the university is the second home. Four years of study and hands-on experience in life form a strong emotional expression. For students who are more housebound, the school experience is greater than the city experi-

ence, and the emotion for the school is greater than the emotion for the city. In other words, in the hearts of these students, the emotion for the school is the emotion for the city, and the high-quality development of the school represents the high-quality development of the city. All the people and things that students can meet in school constitute the basis for their emotions towards the school and also determine their impression of the city.

The impression of a city plays an important role in the factors of individual migration in or out. A good impression will increase the probability of moving in, while a bad impression will increase the possibility of moving out. There are many aspects to the impression of the city, of which the sense of personal experience is undoubtedly the most direct and real way. College students have lived in a city for three or four years at least, and for six or seven years at most. They have personally experienced the campus and the city. This kind of feeling is not formed in a moment or in a single event, but a comprehensive emotional cognition formed by little accumulation in years of school life. Once formed, it is difficult to change. Therefore, from the perspective of immigration factors or emigration factors, the impression of the city is very important, which requires the efforts of the local government and universities to constantly work on a good impression from the first day of college students.

Lack of Publicity in Urban Development: University Students Generally do not Understand the Status Quo and Planning of High-Quality Cities

The development of the city includes not only major livelihood projects such as the construction of high-speed railways, viaducts or large commercial centers, parks, and amusement parks to improve the quality of life of local people; Upgrade, transform. Compared with the former, which everyone can experience personally, the development of the latter is much more low-key, and very few people know it. The latter is the key to truly attracting and retaining talents. Observing the scale and intensity of investment promotion in Huai'an in the past five years, it has indeed brought leap-forward development to the city, and major projects have been launched one after another. But for college students in Huai'an, all this is unfamiliar.

> *I don't know about related companies, but I never thought about developing in Huai'an. (Interviewee 16)*

> *I don't know much about the related companies in Huai'an. It seems that there is Foxconn. The companies in Huai'an seem to be quite ordinary, and there are not many famous companies. (Interviewee 20)*

This is a problem that needs to be solved urgently in the development of small and medium-sized cities like Huai'an. The government spends a lot of manpower and material resources to attract investment, but as a college student in this city, when they are about to graduate, they know nothing about it, let alone these companies seek job development. In the interviews, it was found that many college students have basically had a general job-seeking intention before graduation. Unless they have a particularly ideal and satisfactory job, they generally look for a job according to their original intention.

> *In the second semester of my sophomore year, I have the idea of looking for a job. Since I have studied this major, although I am not too interested, but I have studied it, I will still engage in this industry, otherwise my previous studies will be in vain. (Interviewee 17)*

> *After the freshman year, I felt that I was not interested in this major, nor did I understand it, so I thought about changing careers and doing animation design. (Interviewee 19)*

Among these job-seeking students, preconceived job-seeking intentions are usually formed in their junior year or even earlier. The lack of urban development publicity will inevitably lead to the low development intention of the city's college students to stay in Huai'an.

Secondly, the development of each city usually has a plan for the next 5-10 years, which will focus on the development trend of the city's future development, key industries, and residents' living standards. Taking Huai'an's "14th Five-Year Plan" as an example, the Plan clearly points out that the development orientation of Huai'an during the "14th Five-Year Plan" period is "green highland, hub new city", and at the same time accelerates the promotion of "innovative Huai'an, open Huai'an, beautiful Huai'an, happy Huai'an". "Construction, the specific indicators are not listed one by one. But for ordinary college students, these plans are very unfamiliar and distant. First, ordinary college students hardly pay attention to the future long-term development plan of the city where the university is located, and no one will give them policy presentations and interpretations; second, the development plan takes a long time and has great uncertainty, and most college students Pay more attention to the current reality.

> *The high-quality development of Huai'an requires the introduction of advanced enterprises and the retention of talents. A good company should have good treatment and working environment. The monthly salary of 7,000 CNY in Huai'an is relatively good. The working environment should look relatively clean and not cause too much harm to the body. (Interviewee 2)*

> *The high-quality development of Huai'an is first of all for enterprises to retain talents, especially young people with a high degree of education. Introduce some famous and good companies. (Interviewee 3)*

> *High-speed rail, West Amusement Park, and small trains (city light rail) are all high-quality developments. (Interviewee 4)*

> *The level of higher education in Huai'an must be continuously improved in order to promote high-quality development. (Interviewee 5)*

> *Huai'an promotes culture better, like the spirit of Zhou Enlai. Higher education has yet to be improved. (Interviewee 6)*

Through interviews with two teachers, we can see that they are conservative about college students' understanding of the city's high-quality development.

This problem may be difficult for students. High quality development should be an economic term. They may not know what high quality development is.

College students should not understand the high-quality development of the city, which has nothing to do with them.

From the above interviews, it can be seen that the understanding of ordinary college students on the high-quality development of their cities mainly focuses on the following aspects: attracting more high-quality talents, the development level of local higher education, and the characteristic landscape of the city. These understandings are relatively one-sided, and it is difficult to clearly see the development status and development potential of a city. Contradicting the actual situation, on the one hand, the local government has increased its investment promotion efforts to attract some large-scale high-quality enterprises; the problem is the lack of publicity about the current situation of urban development and long-term planning. Local college students can neither see the existing urban development nor understand the future urban development, resulting in the low development intention of staying in Huai'an.

The Ambiguity of College Students' Self-Positioning: The Uncertainty of City, Job and Career Planning

When talking about future career plans, among the students interviewed, only 4 students clearly expressed their future career plans, and the other 16 students also talked about the industries and career development they want to work in in the future, but all It means that there are many uncertainties in the future, the plan cannot keep up with the changes, and it is necessary to take a step by step. It can be seen from this situation that college students generally lack accurate self-positioning and career planning.

> *Ability is not particularly prominent, general. I hope to have a stable job like a teacher and do not want challenging work. (Interviewee 3)*
>
> *In the future, you may go to the grid, take the selection, or read the blog. I prefer to do the atmosphere of scientific research. (Interviewee 4)*
>
> *The ability needs to be improved, and step by step after work. (Interviewee 5)*
>
> *Looking at the decision in the future, there are many uncertain factors. (Interviewee 7)*
>
> *Do a stable and ordinary work, and there is a certain amount of monthly salary. (Interviewee 13)*
>
> *I don't know this industry, I just find a job related to my professionalism and learn while doing. (Interviewee 16)*

I think it is very difficult for me to know, position and plan my career. It is difficult for me to have an accurate understanding and position of myself, which is always changing. It is even more difficult for college students. There are many possibilities for

their future development. It is uncertain where they will develop, what industry they will be in, and what organization they will be in. (Interviewee teacher 1)

Some students have very clear career plans. Most of our college students are preparing for the postgraduate entrance examination, which is the guidance of the college. But they are not sure what to do after they are admitted to the postgraduate entrance examination, and they do not have to do scientific research. For others, they should take the examination or look for jobs, and take each step to see. (Interviewee teacher 2)

It can be seen from the responses of the teachers interviewed that the uncertainty of college students' self-awareness, positioning and career planning is a common phenomenon.

College graduates have not really experienced the society, and lack intuitive feelings about their own abilities, interests, and social work requirements. There is a big difference between ideals and reality. In the early stage of graduation, it is usually difficult for college graduates to have a very clear and accurate understanding of the self-positioning and career planning. As a result, they often have career plans that do not match their abilities when looking for jobs. During the interviews, it was found that only a small part of the students had a rational and pragmatic attitude towards work, and most of the other students were blind in their job search. The first is to have a low profile, hoping to do a high-paying, decent job. Such students often choose large cities or economically developed first-tier cities, and feel that it is difficult for small and medium-sized cities such as Huai'an to find 'suitable' jobs. The second is to underestimate oneself, feel that he has no ability, and he does not understand professional knowledge, so he can find an administrative clerical position casually, and he can support himself. Such students are more likely to go home for development. The reason is that they are close to home and can take care of each other with their parents. They do not expect work to be successful, but only want to live a comfortable and comfortable life. The third is due to the severe employment situation in the society; choose to join the team of postgraduate entrance examination, public examination and examination. Under the influence of the epidemic in the past two years, many companies have laid off employees, cut wages or even closed down. This dilemma has become a choice that college students have to face when looking for a job. Therefore, a stable job has become the first choice for many college students to find a job. The purpose of the postgraduate entrance examination is also to increase the bargaining chip for finding a stable job.

Whether it is an inaccurate career orientation or a desire to work within the system in pursuit of stability, this general trend is not conducive to the development of talents in small and medium-sized cities like Huai'an, and it becomes more difficult for local companies to recruit suitable talents.

Ideal Work and Less Stress in Life are the Keys to Staying in Huai'an

When talking about staying in Huai'an to work in Huai'an, except for a few classmates, they clearly want to go home for development because of family reasons. Most of the other students have feelings for the city of Huai'an and their alma mater, and have the intention to stay in Huai'an for development. But the premise of staying in the city is to have an ideal job.

I have considered working in Huai'an. After graduation, I may go back to Huai'an to be a teacher in a university or have such an Internet company in Huai'an. I am also willing to stay in Huai'an. (Interviewee 1)

I have also invested in companies in Huai'an before, with a monthly salary of more than 7,000 RMB and a lot of overtime. But there is no upside in 3 years. I felt unacceptable, and finally chose a family that has 4 salary adjustments a year. (Interviewee 2)

I have a stable job and I hope I can take care of my parents. If Huai'an can satisfy such a living state, he will also consider staying in Huai'an. (Interviewee 3)

Have a job that you accept, and have your own relatively independent space. If all are satisfied, we will also consider coming to Huai'an for development. (Interviewee 6)

As long as there is a satisfactory job, most students will definitely choose to stay in Huai'an. Of course, it is not only Huai'an, but the location is not so important to have a satisfactory job now. Unless there are remote areas like Xinjiang and Tibet. (Interviewee teacher 1)

In Huai'an, those who want to be admitted to the civil service or the establishment, or who are paid more than 100000 CNY a year by enterprises, should stay. Now students are very realistic, and they will also compare jobs. As long as their families are not too bad, they would rather wait for the job exam than do jobs with low wages. (Interviewee teacher 2)

From the perspective of teachers, ideal work is the key to the development of college students.

Most of the ideal jobs expected by the interviews are in the system or expect Huai'an to have well -known enterprises to provide superior treatment. Although emotionally speaking, most of the students in the interview have the intention of leaving Huai'an, but from the reality, the possibility of truly staying in Huai'an is very small. Because the work they expect is too ideal, reality is difficult to satisfy their expectations. First, the job in any urban system is 'Xiangyu', with fewer posts, many job seekers, and fierce competition; second, the posts of Huai'an city enterprises meet their expectations of work, and the conditions they need are what they do not have.

The emergence of the above problems is precisely caused by the lack of urban development and propaganda and the inaccurate career planning. First of all, Huai'an has high -quality enterprises, and college students in Huai'an City also have a great opportunity to enter the enterprise. However, Huai'an's high -quality enterprises are compared to other general companies in Huai'an. Its work treatment, development prospects and stability are advantageous, but it cannot compare it with high -quality companies in large cities, even the Fortune 500 companies. Secondly, although the work in the system is stable and the social reputation is good, it is also difficult to improve, strong sense of rules, repeated work content, and young people with innovative ideas may not be suitable for young people.

Soft Power Matters

Combined with the intention of staying in Huai'an for development and the suggestions for Huai'an to attract more college students to Huai'an for development, finding an ideal job is undoubtedly the most critical factor for development in a certain place.

> *Huai'an has more professional counterparts and diversified jobs, so that more college students will stay. (Interviewee 3)*
>
> *Wages and housing are the top priorities. (Interviewee 7)*
>
> *More job opportunities, higher salaries, and more preferential policies for students studying in Huaihe University. (Interviewee 8)*
>
> *Huai'an can improve salaries and increase the benefits for the introduction of high-quality talents. (Interviewee 9)*
>
> *The housing subsidy for college students after working, the company's treatment is good, and there are two days off. (Interviewee 13)*

Only with a material foundation can there be a superstructure. Work and life are undoubtedly the most important concerns of all the interviewed students. The interviewed students expressed their hope that Huai'an can introduce some large and well-known enterprises and increase the preferential policies for students who stay in Huai'an. Huai'an has also introduced a number of large enterprises in recent years, and has also improved the preferential policies for students studying in Huai'an. Taking undergraduates as an example, they can enjoy a housing subsidy of 50,000 CNY when buying a house in Huai'an, and a monthly living allowance of 1,000 CNY. Subsidy is for 3 years. Non-Huai'an graduates can enjoy an annual travel subsidy of 2,000 CNY to visit relatives, continuous subsidy for 3 years, etc. These preferential policies are not too strong, but in the interview, none of the interviewees knew about these preferential policies.

Secondly, the interviewed students also said that Huai'an has advantages in history and culture, and there are many tourist attractions. We can increase publicity efforts to let more people know about Huai'an.

From the official propaganda point of view, Huai'an is the world's food capital and an important central city in northern Jiangsu. In history, there are celebrities such as Zhou Enlai, Han Xin, and Wu Chengen, and it has rich tourism resources and red culture. Moreover, it can be seen from the interviewed students that Huai'an has a long history, rich cultural heritage and rich tourism resources. However, it is such a resource-rich city that is 'low-key' and unknown. In addition, it is located in northern Jiangsu. It is easy for people who don't understand it to have a misunderstanding of a small town in northern Jiangsu that is 'economically backward and weak in development'. In recent years, the Huai'an government has vigorously attracted investment and carried out positive publicity, such as hosting the 2020 CCTV Mid-Autumn Festival Gala and the 2021 China International Marathon, etc., Huai'an's popularity is gradually increasing.

Discussion

Improving the Positive Interaction between Colleges and Students

The alma mater has an irreplaceable position in the psychology of college students; it is the home of college students in a foreign country (Brunello & Cappellari, 2008). The teaching methods of instructors, the educational management attitude of administrators, and the learning and living experience brought to students by various space areas such as school classrooms and dormitories are the direct source of students' feelings for their alma mater (Justice et al., 2007). The service management of the school, and the various space areas of the school should be more student-oriented and better serve the students, thereby generating a positive interaction between the school and the students.

For university students, the first is the teaching of teachers, which should not only have a high theoretical level, but also have a benign interaction inside and outside the classroom. Instructors should not change classroom teaching into reading PPT, or turn a blind eye to students' questions after class. Teachers should make complex and boring theoretical lessons lively and interesting, adopt inspiring teaching, and be able to respond positively to students' questions. Secondly, administrative teachers should be student-centered when managing and serving students. Whether it is various lectures, reports or student activities, it should be for the growth and development of students, reducing or even avoiding formalism, bureaucracy and other styles that hurt students' emotions. Third, create a good campus space area. In addition to the more humanized learning and living areas like libraries, canteens, and dormitories, schools can also make a difference in the creation of landscapes. Many colleges and universities have mountains, rivers, bridges, forests, squares, etc., which can constitute the memory of college students' alma mater. These space areas will be made into places with individuality, meaning and symbolism, which will become the school's Internet celebrity check-in place, and make campus life colorful. When students mention the city, they think of their alma mater, and there are many fond memories of their alma mater.

Strengthening the City's Positive Publicity to College Students

From the interview results, most college students lack a clear understanding of the development of the city where their alma mater is located. Coupled with the epidemic that started in 2020, the school has been closed and managed frequently, and students cannot go out to experience all aspects of the city. It can be seen from the online remarks made by students. This will undoubtedly become more difficult for second- and third-tier cities that want to retain more college students in the city. The only way to change this predicament is to increase the positive publicity of the city among the student groups at the official level of the government and schools.

Promotion can be divided into online and offline. First of all, online publicity is to fully occupy the online media that college students often browse, such as Douyin, Station B, Weibo, etc., and publish a large number of videos, pictures, and topics of Huai'an's high-quality development, involving all aspects of life, tourism, and history, food, leisure, economic development, transportation construction, etc. Let college students often see all kinds of positive publicity reports in Huai'an, so as to increase their favorability to the city. The second is offline promotion. After the epidemic is effective-

ly controlled, local governments and schools can join forces to organize regular on-the-spot visits, such as economic development, corporate visits, cultural experiences, and tourism. Some students can be randomly selected or arranged to focus on the economic development and customs of Huai'an. Students take a one-day or half-day short-distance visit or tour in Huai'an for free or at half their own expense. After the end, let the students write their experiences and feelings and post them on Weibo Chaohua, Douyin, and QQ space to increase the positive publicity of Huai'an.

College Students' Career Planning Courses should be Closely Integrated with Local Development, and should be Carefully Implemented

The career planning course should be a compulsory course for every college student first and foremost. Due to the strong subjectivity of the course, schools and teachers have great autonomy to decide how to explain this course. Universities and local governments can take advantage of this opportunity to closely combine career planning courses with local development, develop textbook compilation and teaching content, and guide students to stay in the city.

The first thing to do is to make a career plan for college students. As mentioned in the previous article, many college students have inaccurate self-positioning, resulting in too high or too low career planning. Schools should make full use of the career guidance courses and make career plans detailed and practical, especially to solve the many puzzled problems of college students, such as what can be done in the future, what is suitable for them, the development prospects of a certain industry or occupation, and how can they be able to do it in the future? What level of development has been achieved? These problems are not theoretical problems, but practical problems, which must be discussed and explained in a classified and detailed manner in combination with the specific actual situation. Let the vast majority of college students have a more reasonable and pragmatic career plan when they graduate.

Secondly, it is necessary to deeply integrate the development trend of the city with the career planning of college students. This requires teachers to combine personal career planning with the development of Huai'an in a targeted manner when explaining career planning. The real case is the best. Through the explanation of real cases, students will subconsciously combine their personal career planning with Huai'an, which can at least improve their intention to stay in Huai'an. Teachers should also combine the current situation of Huai'an's development with the future prospects, that is, they should not only see real benefits for students studying in Huai'an, but also give them confidence and expectations to stay in Huai'an, so that they feel that Huai'an is worth staying for a long time.

The career planning of many college students stems from preconceived notions, such as the more developed the city, the greater their own development; if they do not learn their major well, they think their ability is not good; These viewpoints are all heard. After listening to a lot, a concept is formed. If you want to change this mindset, you must continue to guide with correct career planning explanations. Colleges and universities can carry out career planning courses in the second year of college, and use the time of sophomore and junior year to guide the concept, and it will produce corresponding results in the senior year.

The Government should Intensify Efforts to Introduce Well-Known Enterprises and Publicize the Preferential Policies for College Students to Study in the City

The ideal work and life are undoubtedly the core factor for college students to stay in Huai. However, the number of work and high-quality state-owned enterprises in the system cannot meet the needs of the majority of college students in Huai'an's universities. This requires the government departments to introduce some high -quality large -scale enterprises, which can provide more positions to attract more college students to develop Huai'an. The government should focus on more college students in the city and attract more foreign college students. College students in the city have the advantages of emotion and distance. Under the same conditions, the probability of leaving Huai'an is greater. In terms of the popularity and influence of Huai'an City, there is no obvious advantage in attracting non -Huai'an college students in the city. According to this trend, when the Huai'an government is attracting investment, it should consider the professional settings and job needs of universities in the city. Huai'an enterprises must provide corresponding jobs and competitive salary for college students in Huai'an. In this way, we can stay in more students in Huai.

Secondly, the government must vigorously promote the preferential policies of college students to come to Huai'an. During the interview, it was found that most of the interviews did not know the preferential policies to come to Huai'an. According to relevant documents released in 2022, undergraduate students will have higher subsidies when they purchase houses, rent houses, and visit relatives. And these policies are released in multiple official media, but most college students do not know or even know it. Improving college students' awareness of the subsidy policy of staying at the city can start from the following three aspects.

The first is to increase the entertainment of promotional channels. Generally, this information is published on the official media, but few college students will take the initiative to pay attention to local official media. In today's short-video era, people usually obtain information in entertainment methods such as short videos, so the information of various preferential policies for students in Huai'an college students should also appear in the field of college students in the form of short videos.

Secondly, it is necessary to improve the popularity of publicity methods. Short videos will increase the probability of young college students to see information, but whether it can attract college students to read and remember the information, it is necessary to see if this short video can attract his attention. The duration of the short video is generally in one minute or even ten seconds. The preferential policies of leaving Huai'an should be presented in the most attractive way of young people. If you have to see the video, you can basically understand the core content of the policy. Only by achieving such a publicity effect, the government's preferential policy of staying in Huai'an has achieved the expected purpose, and more college students can stay in Huai'an to develop.

The third is to increase the practical value of publicity content. Judging from the interview results, most of the short videos of Huai'an introduced urban development and tourism landscapes, and rarely involved talents, especially enterprises recruiting talents. When the fresh graduates of Huai'an City University brushed short videos, they brushed a company to recruit their professional positions. The salary and benefits were

very competitive, and they also met the recruitment conditions of the company. It is possible to keep Huai development. The way and form is the carrier that attracts the attention of college students, and the content is the key. These contents must clearly show the advantages of the development of Huai'an, such as 'good corporate treatment, high quality of life, various subsidies, and development potential.' The government should make full use of new media such as short videos and Weibo, so that the college student group can see the useful information of 'unexpected' during entertainment. The content of this information is to directly respond to the job search issues that college students are urgently paid. This problem is continuously presenting these problems in front of college students in a short video, allowing them to understand the high -quality development of Huai'an, the ideal work of Huai'an, and the city's comparative advantages.

Large cities such as Beijing, Guangzhou and Shenzhen have congenital advantages in attracting fresh university graduates. These cities have developed economy, have many opportunities for employment, and have a wide range of development prospects, enhanced space to improve their citizens' livelihood. Each year they attract many fresh college graduates 'North Drifting' and 'Southern'. However, with the transformation of China's economic development, from the rapid growth of the past to high -quality growth, the development of many second- and third -tier cities in China has also caught up. It has greatly improved in employment opportunities, wages, and living facilities. In addition, second -tier and third -tier cities have less competitive pressure, slow life rhythm and cheap house prices. Cities have various subsidy policies for graduates of the city. Balance of life.

Under the trend of a new round of talent competition (Michaels et al., 2001), small and medium-sized cities need to take advantage of the local regional advantages. Young college students are paying attention to new media platforms, focusing on promoting local special resources, livable conditions, and various preferential policies for Huai'an. Universities should do a good job of professional planning of college students and organically integrate personal career planning with local development. Universities should also create a good interaction between schools and students. In terms of teaching, management, and regional space, students -oriented, mostly for students, and make their alma mater a youthful memory of students. With the joint efforts of the government and universities, retaining and attracting more college students is the key to promoting local high-quality development.

One limitation of the study lies in the relatively small sample of the participants from only one city in generalizing the results regarding students' employment intention in third-tier cities. Future results will employ more sampling participants from more cities to explore the topic researched.

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ORIGINAL ARTICLE

A Case Study of 271 Education Group's Learning Protocols: Reconstruction of Course Contents Based on Holistic Module Learning

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***Abstract**: The holistic module learning and protocol-guided learning concepts underpin 271 Education Group's learning protocols. This article discussed the history of learning protocol development and its significance. Using the experience of 271 Education Group as an example, we attempted to illustrate the fundamental structure of learning protocols. It is hoped that this study will have an effect on how the new national curriculum program and course standards are put into place.*

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Introduction

HOLISTIC module learning is a student-centered education methodology that aims to organize classroom instruction around "major concepts" in modules while also re-integrating learning materials and activities into a holistic process (Sun, 2022). Teachers and students must build a systematic and holistic view of knowledge for all topics. "Major concepts" refer to the underlying core ideas, principles, and theories of each discipline, which teachers use to combine disparate knowledge, skills, and methodologies in order for students to have a comprehensive and transferable understanding of knowledge, whereas a "module" is a set of interconnected parts organized around a major concept. Module learning is a teaching approach in which learning materials are divided into broad modules rather than isolated and fragmented classes. A holistic module learning method starts with figuring out what the major concept is. Then, basic questions are made around it to get students to ask questions on their own, and finally, learning is done through task-driven methods.

Protocol-guided learning is a way of teaching in which teachers plan learning protocols for their students ahead of time. These protocols include learning goals, materials, methods, and procedures, and they help students learn more on their own (Wang, 2022). It is also a student-centered teaching model that focuses on developing students' academic skills and fostering their overall growth (Gao, 2006). Well-designed learning protocols are a key part of high-efficiency and high-quality classroom instruction, and they also help make sure that holistic module learning works well.

Based on holistic module learning and protocol-guided learning, 271 Education Group reorganizes course content by making holistic module learning protocols, which are also called 271 learning protocols. Holistic module learning protocols are smart, well-organized plans for learning that help students study on their own. They include learning materials for students, learning dynamics of students, and visual feedback to students.

The Background of the Learning Protocol Construction

Requirements of the New Era for Better Course Planning

Students are exposed to continuously emerging new knowledge due to the rapid development of science and technology and the widespread use of the internet. Comparatively, the contents of textbooks are less current and restricted in scope. Students may lose interest in classroom learning if instruction is limited to predetermined course topics without any supplementary information. In this case, learning protocols can serve as the optimal alternative to textbooks. Students can be better prepared for class and get interested in learning if they are given extra information and a thorough learning plan before the session.

Calls for Curriculum Reform

Educating students to be autonomous learners, critical thinkers, and socially responsible citizens is the primary purpose of education and the most important responsibility of instructors. In a traditional classroom dominated by the teacher, students are passive recipients of static information and have few opportunities to develop their creativity. Nonetheless, creative-thinking-focused learning procedures can drive students to seek out alternative learning strategies. For instance, a holistic module learning protocol might design a module's learning process by integrating objectives, scenarios, tasks, and evaluation, indicating the development of students' higher-order thinking skills. This helps students learn how to learn on their own for the rest of their lives and meets the need for skilled workers in the knowledge economy.

The Need to Improve Student Physical and Mental Development

In China's examination-focused education, kids have been overburdened with repetitive exercises and fixated on test scores, both of which are extremely detrimental to their physical and mental health. The younger generation of today has a strong aversion to mechanical indoctrination and is more interested in proactive and participatory communication and connection. Even if they are based on textbooks, well-designed learning protocols usually go beyond them to satisfy students' urge for exploration. Teachers can use learning protocols to help students take initiative and get involved, as well as to help them learn better.

The Significance of Learning Protocol Construction

Providing Background Information to Facilitate Students' Deep Learning

Students' profound learning encompasses the history of relevant knowledge and their unique life experiences. It necessitates that students comprehend the historical, cultural, and literary contexts of a certain body of information in order to see the ideological and cultural evolution behind it and enrich their own viewpoints and experiences. Moreover, when such background material is interwoven with students' real circumstances, they are more likely to gain subject-matter insights and learn the personalized meaning of knowledge (Jiao, 2019). As a great teaching aid, learning protocols can supply students with vast amounts of background knowledge necessary to their in-depth understanding that is absent in textbooks. It encourages students to comprehend knowledge in historical and cultural settings; to experience multiple modes of thought based on the growth of knowledge; and to absorb knowledge by incorporating it into their own life situations.

Offering Logical Support for Students' Knowledge Structure

Logic is crucial for the creation of a knowledge system. Bruner asserts that knowledge is constantly structured. The best curriculum program for a school should be built on the fundamental structures of subjects. Curriculum change tends to enable students to mas-

ter the fundamental structure of subjects (Li, 2007). Knowledge structure is important not just for understanding the logical linkages underpinning a discipline but also for developing students' ability to transfer transdisciplinary knowledge and solve problems. According to structuralist perspectives on education, the primary goal of learning is to engage students in the process of establishing the knowledge structure of the subject, which requires teachers to guide students in forming a holistic picture of the disciplinary structure rather than merely requiring them to memorize the fragmented contents presented in textbooks. Before they can learn the basic ideas and steps of a discipline, students need to understand how information is put together.

In building learning programs, protocol-guided learning views knowledge as a holistic entity. Based on constructivist principles, it employs complex, relational, and holistic thought to generate structured learning protocols. A structured learning protocol enables students to study knowledge throughout the entire network; comprehend the correlation between knowledge points; comprehend the rationale behind the evolution of disciplines; and construct their own knowledge structure inside and between disciplines. Structured protocols can also, to a certain extent, cause cognitive conflicts in students, get them to think about the structure of their knowledge when faced with new situations and problems, help them improve their knowledge structures as they change and rebuild them, and use their knowledge to solve new problems effectively (Wang, 2014).

Assisting in Generating Students' Sense of Meaning in Learning

Education has been impacted for a very long time by the concept of modern scientism. Educators have often adopted a worldview dominated by scientific and technological rationalism, while the pursuit of life's purpose and spiritual significance has been disregarded (Sun, 1998). Individuals are motivated to widen and intensify their investigation into the kingdom of knowledge by their perception of learning's significance. The process by which public information is converted into individualized knowledge and external objective knowledge is absorbed into the interior spiritual world generates a sense of significance in learning (Rong & Wu, 2016). It is futile to merely transmit knowledge. Li (2015) says that students can only learn in a meaningful way and develop a sense of purpose and competence when they understand the link between what they know and what they are worth.

Learning protocols can act as a link between students' own direct experience and the knowledge found in textbooks, which is an indirect experience. Protocol-guided learning emphasizes the importance of learners' engagement as well as their personal experiences, practices, and events. Through learning protocols, students are aided in developing their own perspective of knowledge and life as they learn by being taught to grasp knowledge in the context of their own personal experiences and life situations. In the meantime, learning protocols create a link between students' knowledge and their inner selves. When students reflect on the link between themselves and their knowledge, they find the hidden value of knowledge, which gives learning a sense of purpose (Zhang, 2015).

The Construction of Learning Protocols by 271 Education Group

The main parts of the strong structure of learning protocols that 271 Education Group made based on the ideas of holistic module learning are learning goals, tasks, scenarios, and evaluation.

Establishing Learning Objectives

The state's Ministry of Education's course standards and the specific learning circumstances of the students determine how learning objectives are created. Students' learning and teachers' instruction might have the same goals with well-defined objectives. Learning goals should help students reach their full potential in terms of "knowledge and skills," "process and method," and "emotional attitude and values" (Li, 2014).

Teachers with the 271 Education Group choose the learning protocol's objectives for each individual module in accordance with the demands of the syllabus and the academic standing of the students. Students are well informed about the goals they will achieve through pre-class learning activities created by the protocol, making them more proactive and engaged in class learning. Learning goals might be intellectual (knowledge and skills) or non-intellectual (emotional and psychological). The learning protocols should clearly state the intellectual objectives, which should be achieved by students using all available means. Teachers may not write down the implicit learning goals, but they will work them into lessons in a flexible way. These goals are not intellectual in nature.

Simultaneously, the language used to express learning objectives should be as specific and accessible as feasible. Avoid using broad terms such as "knowing about," "understanding," "mastering," etc. The objectives indicated in the learning protocol are not merely a reiteration of those in the textbook; rather, they are goals that combine the actual situations of the students in the class with guidance, motivation, and adjustment functions. The prerequisites for establishing learning objectives are listed below.

- Each session must have no more than three or four learning objectives.
- Goals can be broken down into three parts: "knowledge and skills," "process and method," and "emotional attitude and values."
- As part of setting goals, the learning protocol highlights the important and difficult parts of self-directed study that students need to pay attention to.
- Learning objectives must be practical and attainable.

Designing Learning Tasks

The four distinctive characteristics of holistic module learning are task-driven learning, situational experience, autonomous inquiry, and promoting transfer. The schools of the 271 Education Group lay a special emphasis on task design in learning protocols in order to execute this teaching paradigm. The following guidelines should inform the design of the task:

Boosting Students' Self-Motivation to Study

Self-motivation to learn, as opposed to being forced to study, is the most important aspect of task design. Students' interest in learning can be sparked by an ideal learning activity that transforms dull, unfamiliar information into engaging, difficult activities. As students complete assignments, their requests for additional information and abilities grow.

Pointing to the Cultivation of Student Key Competencies

A well-designed exercise can help students develop their fundamental abilities and key characteristics. Students spontaneously design their own knowledge structures while completing learning tasks, improving learning methods and skills, and developing key competencies as a result.

Developing Higher-Order Thinking Skills in Students

Higher-order thinking refers to cognitive abilities based on a higher level of processing. Synthesizing, reasoning, comprehending, application, and evaluation are examples of higher-order thinking skills (HOTS). The tasks in 271 learning protocols are hard enough to require a lot of thought and careful execution in order to help students develop higher-order thinking.

Posing Open Questions

Open questions are those that cannot be answered with "yes" or "no" answers or ready-made textbook solutions. Open, heuristic questions in tasks can pique students' interests in learning, prompt deeper thought of existing knowledge, and spark their curiosity about new areas to be studied.

Constructing Learning Scenarios

Situational learning is a teaching strategy critical to holistic module learning that creates instructional settings based on real-world conditions. Contextualizing learning promotes student initiative and participation in the classroom. Dewey (2005) classified teaching into three categories: Level one addressed each class as a separate unit; level two acknowledged the relationships between knowledge points; and level three, the most effective teaching technique, concentrated on the connections between school education and real-world experiences. These connections can be made through learning scenarios. Based on a certain theme, all kinds of communication, such as texts, charts, and data, can be used to build learning environments that increase students' overall ability to deal with complex tasks in a variety of contexts. Throughout the whole learning process, there are subject-related contexts. This creates an environment and atmosphere that is good for learning, stimulates the natural desire to learn, and lets students get real experience.

It is critical in 271 learning protocols to incorporate real-world challenges into learning activities. Teachers include science and technology, social hot topics, issues about making a living, and other real-world topics in their lessons, taking into account the students' life experiences and academic levels. This way, students can use what they learn to solve practical problems that matter to them, improve their ability to find, analyze, and solve problems, and achieve flexible knowledge transfer and use.

In the learning protocol, authenticity is the most important requirement for situation construction. Students can experience the creation and development of knowledge through an authentic setting, which also helps them internalize that knowledge. Additionally, complicated and contentious real-world problems can stimulate students' in-depth thinking. Students aren't forced to give definitive answers, but those with an open mind are better able to develop their critical and divergent thinking.

Establishing Evaluation Standards

Formative and summative assessments are used in conjunction to evaluate learning in comprehensive modules. Formative assessment includes quizzes and rating scales that are integrated into learning activities. As a summative assessment, there is an exam that corresponds to each module to gauge the academic development of the students. Based on the results of the two types of evaluation, teachers figure out how well their students are getting on with lessons and change their lesson plans as needed.

Test question design in the learning protocol should meet the following requirements.

- Relevance to core knowledge of each course
- Reasonable levels of difficulty, suitable for average students. There are optional questions set for high-achieving students, which are not compulsory.
- There is a completion deadline.
- Timely feedback and correction

Summary

Many Chinese schools have adopted the protocol-guided learning model of instruction in response to curricular reform. Learning protocols enable student-centered and instructor-led instruction, which prevents teacher control in the classroom (common in traditional teaching modalities) and laissez-faire, unstructured classroom management. Instead of immediately imparting knowledge to students, teachers in this teaching paradigm provide them with instructions to independently research and practice. Students that follow the routine are well-prepared for the lesson in advance and identify questions to be brought up in class for discussion, which helps to focus and maximize learning in the classroom. Well-defined classroom activities in the protocol give students an ordered process and increase their participation in class. Additionally, in protocol-guided learning, creative after-class activities take the place of repetitive exercises. This considerably lessens the academic load on students and produces effective after-class extensions.

Holistic module learning, which emphasizes the value of individualized protocols, is more advanced than protocol-guided learning, which is characterized by "learning before teaching." The 271 Education Group's holistic module learning protocols are not only designed with students in mind but are also adaptable to each person's cognitive capacity, academic standing, and learning progress. Additionally, 271BAY educational technology makes it possible to include enormous volumes of learning content and apply learning protocols digitally. Students can select the resources they require, use the learning strategies that work best for them, and share and show their learning outcomes online, adding democratic components to their education that may help them develop more independently.

It is crucial to acknowledge the 271 learning protocols' shortcomings, including the lack of a thorough evaluation framework for students' essential skills and the narrow range of available learning activities and scenarios. The 271 protocols' current iteration is by no means complete. In order to give students the best ways to improve how well they learn and to make sure that the new curriculum reform goes smoothly and works well, we hope that this article will serve as a springboard for more in-depth research and more practice with building learning protocols.

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REVIEW

An Interpretation of the *Revised Compulsory Education Curriculum Program and Standards*: A Revolution in China's Compulsory Education

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***Abstract**: The Compulsory Education Curriculum Program and the Compulsory Education Course Standards make up the Compulsory Education Curriculum Program and Standards 2022, which was released by the Chinese Ministry of Education. The statement emphasizes the development of students' key competencies while optimizing the objectives for compulsory education and outlining new demands for a more intense reform of the educational system in order to fulfill the needs of the current era. In order to better support student autonomous learning and overall development, it is imperative to raise reform awareness among the educational community, enhance teachers' professionalism and instructional skills, and create student-centered learning environments before implementing the revised curriculum program and course standards. In order to add new perspectives to the literature on the new curriculum program and standards and provide implications for teachers and administrators in educational reform, we have focused our interpretation of the document on three dimensions: training objectives, student key competencies, and curriculum and teaching reform. We have also offered some recommendations for its successful implementation.*

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THE *Experimental Plan for Compulsory Education Curriculum Setting 2001 and the Compulsory Education Course Standards 2011* represented cutting-edge educational ideas of the era, were crucial in directing and promoting the reform of education and teaching, and, as a result, significantly increased the standard of basic education. However, their implementation during the previous 20 years has exposed their fundamental flaws, including a lack of precise course descriptions and requirements and systematic connections between various learning phases (the curriculum program divides compulsory education into 4 phases). Since all children are now required to go to school, the demand for education has changed from "going to school" to "getting a good education." This means that the curriculum needs to be changed more deeply and the curriculum for compulsory education needs to be improved.

In addition, as a result of the constant development of science and technology and the rapid spread of mobile media, people's learning and working methods, as well as their lifestyles have been radically transformed; the growth environment of children has undergone profound changes; and basic education and training face new challenges. The curriculum for compulsory education needs to change along with the times and get better as a result.

In this scenario, the *Compulsory Education Curriculum Program and Standards 2022 (which include the Compulsory Education Curriculum Program and the Compulsory Education Course Standards)* is a sign of the times. With the *Compulsory Education Curriculum Program 2022*, the goal of compulsory education has been made clearer, the course plan has been improved, and there are clear rules for how the curriculum should be used. The *Compulsory Education Course Standards 2022* have improved the organization and structure of the 16 courses taught in China's primary and junior secondary schools as part of compulsory education, which has also set academic quality standards and made it easier for students to move from one learning phase to the next (Ministry of Education, 2022).

A Revised Goal for Compulsory Education

The *Compulsory Education Curriculum Program 2022* underlines that the overarching objective of the nation's compulsory education is to educate adolescents with "aspiration," "competence," and "commitment." In this text, "aspirations" refers to the key principles to be instilled in students, who are supposed to align their own goals with the nation's interests and prosperity. "Competence" refers to all abilities and skills essential to a student's holistic development, such as the ability to learn, explore, communicate, engage in physical activity, engage in aesthetic pursuits, and execute manual labor. "Commitment" refers to the positive character traits of students, notably their desire to accept challenges, participate in life and studies, protect the ecological environment, uphold national dignity in cultural exchanges, etc.

Most crucially, the redesigned curriculum program establishes the development of students' key competencies as the primary training goal. Following the publication of the framework for the definition and selection of key competencies by the Organization for Economic Co-operation and Development (OECD) in 2003 (Rychen & Salganik, 2003), numerous nations and academic institutions conducted research on the subject and developed their own frameworks based on their unique circumstances and educational objectives. In a similar way, China did a number of studies, such as fundamental theoretical research, international comparative research, research on education policies, analyses of traditional cultures, empirical studies, and interviews with academics and

experts, and then made the General Framework for the Development of Key Competencies of Chinese Students in 2016 (Lin, 2016).

As defined in the statement, the key competences of Chinese students consist of vital talents and attributes that students should cultivate via education in order to create the groundwork for their lifelong development and meet the demands of societal development. They are divided into six categories: humanistic literacy; scientific spirit; learning ability; awareness of healthy living; sense of responsibility; and creativity and innovation, which include more specific characteristics such as humanistic feelings; aesthetic ability; rational thinking; critical thinking; autonomous inquiry; and interest in learning; self-examination; use of information; respect for life; sound character; self-regulation; social responsibility; and national identity. A competence-oriented education, which is what the revised curriculum program is all about, is more than just learning facts and skills. It is also about helping students develop their core competence, essential character traits, and values, which will help them be successful in the future and help society as a whole.

The Knowledge Foundation for Key Competencies

The primary principle adhered to by the compulsory education curriculum is the cultivation of key competencies and the all-around development of students (Ministry of Education, 2022). The acquisition of essential competencies is inseparable from a solid knowledge base. Rather, it calls for more complex learning processes and paradigms (Yu & Wang, 2017).

The Internalization of Knowledge

In this debate, competence refers to a person's problem-solving abilities in complex situations, which is a synthesis of information, skills, emotions, attitudes, and values, etc. Key abilities cannot be produced with fragmented or inapplicable knowledge; rather, they are founded on potent and transferable knowledge. To get this kind of knowledge, students must internalize what they have learned. To do this, they must first understand and organize the new information, then combine it with what they already know, and finally come up with their own ideas about what it all means.

The traditional view of knowledge, on the other hand, views knowledge as a ready-made, totally objective existence that can be transmitted to students in discrete chunks. Under this philosophy, curriculum specialists classify the most important knowledge into subjects and present it to teachers and students in the form of textbooks; the goal of classroom instruction is to ensure that students acquire reliable and determined knowledge; and the teacher-student relationship becomes one of knowledge transmitter and receiver. The teaching process consists primarily of lecturing, listening, memory, and assessment. The static and fractured knowledge acquired through this mode of education is only applicable during examinations, when students rely on memory and elementary logical thinking to reconstruct the established content. In this instance, knowledge has not been absorbed to bear personal significance; therefore, it is useless for problem-solving in difficult situations and has no positive impact on the development of students' key competencies.

The cultivation of competence necessitates dynamic, transferable knowledge that not only comprises objective components but also, after being digested and restructured by individuals, is awarded with subjective elements and so has individual signifi-

cance (Zhong, 2005). In other words, both objectivity and subjectivity are vital to knowledge; it can only become a powerful, living agent when combined with human experiences, values, and beliefs. So, it doesn't matter how much information a person knows as long as they don't internalize it. Without internalization, their knowledge is useless and can't be used to solve real problems.

The Contextuality and Practicality of Knowledge

Knowledge's application and contextuality are crucial to its internalization, which is important for the growth of key competencies. The Compulsory Education Curriculum Program 2022 emphasizes the value of developing students' proficiency in using knowledge to recognize and resolve issues in situational contexts (Ministry of Education, 2022). Students cannot develop links between their experience and the outside world and produce the personal meaning of knowledge on their own; only through learning in specific contexts and through interaction with situations can they do this. The integration of knowledge mastery, application, and transfer is highlighted by the practicality of knowledge. Knowledge is produced by practice, and practice in turn aids in problem solving.

According to Dewey (2005), every typical experience is the consequence of the interaction of external and internal factors. What we refer to as a context is created by the interaction of these two factors. Learning in the context entails gaining information through engagement, which enables students to incorporate their own experiences into the production of knowledge and assimilate what they have learned. In this case, "context" means anything that relates to what you know and helps you understand it. This is more than just historical or geographical context.

According to the conventional view, knowledge is preexisting and does not involve any student construction. Competence-oriented learning, on the other hand, actively involves students in interacting with circumstances through practice; students actively participate with their minds, behaviors, emotions, and attitudes throughout this process. In order to emphasize the usefulness of knowledge, it should not be presented to students as static, unchanging symbols but rather as a tool for problem-solving, a channel for interpersonal interaction and teamwork, and a source of meaning creation with additional value (Zhang, 2019). Students are given the chance to take in what they have learned and make the change from knowledge to knowing.

Learning through Practice

The updated course standards give a lot of weight to practical instruction across the board. According to the Compulsory Education Course Standards for 2022, teachers should encourage students to take part in exploration activities so that they can learn the basics and methods of each subject by experiencing the problem-finding, problem-solving, knowledge-gathering, and knowledge-applying processes for themselves (Ministry of Education, 2022).

Students are given the tools and processes necessary to develop core competences based on discipline knowledge through practical instruction. According to Dewey (2001), education should aim to improve students' learning through varied and focused practical exercises. Two points need further consideration in this discussion: (i) Is there any definition of "various and specific practical activities"? (ii) What does "improving individuals' learning experiences" mean? Other research contains the answers

to the first query. Bruner (1960), a proponent of the disciplinary structure movement, argued that students should learn as scientists do scientific inquiry; Schwab (2013) recognized practical education as a language for the curriculum to address the problem of incoherence; and Cui et al. (2021) claimed that subject-based practice enables students to use disciplinary knowledge and methodology to solve pertinent problems in each discipline, which goes beyond superficial inquiry Regarding the second query, the acquisition of individual learning experiences indicates that the learner has created a personal understanding of the knowledge. The knowledge is then internalized and given a personal meaning. It can then be used to solve hard problems in the real world and help develop key competencies.

Intensified Reforms in Curriculum Design and Instruction

Optimizing the Curriculum Structure

The Compulsory Education Curriculum Program 2022 introduced significant revisions to the organization of the curriculum. All moral education-related first-through-ninth-grade courses are combined into a single subject titled "Ethics and the Rule of Law." Art classes are reorganized, with those for grades 1 through 7 emphasizing music and drawing, complemented with dance, theater, film appreciation, etc., and those for grades 8 and 9 emphasizing a variety of arts lessons. Science and comprehensive practice must be taught as early as the first grade. Labor and computer technology are removed from comprehensive practice to become stand-alone courses, and so they occupy increasingly prominent roles in the overall curriculum structure (Zhu, 2022).

Additionally, the course design has been modified in a number of ways: selecting major concepts, themes, basic knowledge, and skills for each course and improving its organization in accordance with the strategy for developing students' key competencies; planning theme-based interdisciplinary activities to establish strong connections between different subjects; and making overall coordination to ensure that each subject serves its unique function when a particular content or topic involves syllabi that cross subject boundaries.

Establishing Academic Quality Requirements for Each Subject

The incorporation of comprehensive academic criteria is a prominent component of the new course standards. The *Compulsory Education Course Standards 2022* introduced quality requirements for student academic results in each subject at different learning phases and defined the depth and breadth of all subject knowledge, as well as guidelines for textbook compilation, classroom instruction, testing and evaluation, and so on. Teachers must have a strong understanding of the academic quality requirements and use them as references in lesson preparation, teaching organization, and learning assessment in order to successfully execute the new course standards. It is important to note that the academic quality requirements are more than just knowledge-or intellectual education-based standards; they are presented as a holistic framework of requirements for knowledge achievement, character development, and key competency devel-

opment. Furthermore, determining academic quality requirements involves a shift in emphasis from lecture-centered to learning-centered training. Teachers should not only help students comprehend the quality criteria for their academic performance, but they should also foster self-directed learning, autonomous inquiry, and self-regulated progress. Furthermore, the revised course standards provided detailed instructions pertinent to course contents and academic quality requirements, as well as concrete suggestions for learning assessment and test question design, to ensure consistency of teaching, learning, and testing and to provide exemplary teaching and evaluation cases.

Highlighting Balanced and Holistic Development of Students

The *Compulsory Education Curriculum Program and Standards 2022* underline that the ultimate goal of compulsory education is student overall development. It establishes the necessity of the "five educations" (moral, intellectual, physical, aesthetic, and labor education). Teachers in present education tend to place an undue emphasis on intellectual education while ignoring the other "four educations," because students' future educational chances are mostly determined by the senior secondary school entrance examination and the college entrance examination (Yu, 2022). It is now well acknowledged that an overemphasis on intellectual education is harmful to children's entire development. Labor education, which was previously absent from school education, is now established as an integral part of the curriculum and a long-term course over the entire nine-year compulsory education process in the updated curriculum program. Simultaneously, more emphasis must be placed on the link between theoretical learning and students' life experiences and social practice, as well as the development of more scenarios for classroom teaching in order to improve students' ability to apply knowledge to solve practical problems. Non-cognitive skills such as teamwork, collaboration, communication, adaptation, and self-efficacy are required to solve practical problems, as are cognitive talents such as analysis, deduction, induction, and judgement. Students get many skills in addition to disciplinary information during this procedure.

The *Compulsory Education Course Standards (2022)* advocate theme-based and project-based learning as viable methods for fostering the holistic development of students. In theme-based learning, teachers use instructional resources from several disciplines to construct tough assignments revolving around a particular theme and students acquire knowledge relevant to this theme in a variety of subject areas through cooperative learning. In project-based learning, students are tasked with addressing a real-world issue. To do this, they collect data, make plans, do the project, and evaluate it with the help of their teachers, which helps them develop a wide range of skills.

Encouraging Personalized Education

Revisions to the curricular program and course standards included proposals for personalizing education. First, create a student-centered learning environment and emphasize students' roles in education. A personalized education involves educating students in accordance with their talents, personalities, and interests. Individualized education requires a learning environment in which students' inherent tendencies are fully acknowledged. Respecting the autonomy of students in learning and inquiry is a good method for promoting their individualized study. Second, differentiate instruction for students

of varying intellectual levels. More elective courses will be added, and individualized tutoring will be made available, in order to fulfill the different educational needs of students. Third, educational technology should be utilized to the fullest extent to popularize personalized instruction. Educational data mining and analytics systems can collect student learning behavior data for intelligent analysis and provide relevant learning recommendations for the learner. Blended education, which combines online and offline learning, facilitates individual assistance.

Tips for Implementing the Compulsory Education Curriculum Program and Standards 2022

Understand the Document's Implications for the Curricular Reform

The redesigned curriculum program and course standards are meant to accelerate the curriculum reform in order to assure the achievement of the new era's training objective and the development of high-quality compulsory education. To maximize the efficacy of the reform, it is vital to analyze prior curricula and identify their fundamental flaws. On the basis of scientific investigation, solutions must be discovered for these serious problems. Also, cutting-edge teaching methods from other countries can be used to help China's curriculum reform.

Enhance Teachers' Professional Competencies

The implementation of the new curriculum program and course standards imposes stricter and more extensive requirements on instructors' professional competencies. First, training sessions should be held across the nation to ensure that teachers comprehend the significance of the training objective of compulsory education, the necessity of adjusting curriculum structure and course categories, and the specific requirements for course objectives, course contents at different learning phases, academic quality, classroom procedure, etc. Second, it is vital to broaden the professional horizons of teachers so that they can comprehend the richness and diversity of disciplinary material and teaching duties, as well as the significance and interconnectedness of disciplines. At the same time, it is essential for instructors to be aware of the importance of consistently enhancing their professional expertise and disciplinary knowledge. Third, the adoption of the redesigned program might also give teachers an opportunity to improve their teaching techniques. Teachers will get better at teaching if they take part in practical education, individualized instruction, and holistic education.

Guide Students to Improve their Learning Methods

Revisions to the curriculum program and course standards are intended to enhance the growth and development of students. To apply the new program, the students' learning strategies must be modified accordingly. To emphasize the predominance of students in classroom instruction, schools should provide a student-centered learning environment and promote student autonomy. In addition, they should strive to establish a closer connection between school education and students' life experiences, as well as a deeper

integration of disciplinary knowledge with labor education and social practice; interdisciplinary learning and project-based learning should be increased to a suitable degree. All of these initiatives emphasize the overall development of students.

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