In the era of artificial intelligence, how to cultivate students' creativity

Weini Weng[1,2], Xingli Zhang[1,2,*]

[1]Institute of Psychology, Chinese Academy of Sciences,
[2]Department of Psychology, University of Chinese Academy of Sciences

[*]Corresponding author email: zhangxl@psych.ac.cn

Abstract. Against the backdrop of rapid development of artificial intelligence, cultivating the creative self-efficacy and curiosity of primary and secondary school students is crucial for their competitiveness in the future intelligent society. This study summarizes the important factors of curiosity and creative self-efficacy development and their relationship in creativity cultivation. Research has shown that in the era of artificial intelligence, parents should not overly rely on technology and neglect the role of positive education. Parents' positive parenting styles play a key role in cultivating their children's creative self-efficacy and curiosity. There is a significant positive correlation between self-efficacy and curiosity, and parents and schools should pay special attention to the education methods in primary school. The effective combination of AI technology, personalized learning paths, and creative educational tools can effectively promote the development of students' confidence and curiosity.

Keywords: Parenting style, Self-efficacy, Curiosity, Artificial intelligence, Positive education.

1 Introduction

The ability of technological innovation has become a key factor in determining a country's overall national strength, which is not only related to the country's economic development, but also to its security and international status[1]. At present, we have moved from the Internet era to the era of artificial intelligence. The key characteristic of talent is creativity [2]. At the same time, the cultivation of creativity is also a challenge of today's education [3-5]. Artificial intelligence is a convergent thinking and divergent thinking that spans cognitive, behavioral and psychological fields and affects creativity [6]. The development of artificial intelligence has profoundly influenced the learning and lifestyle of teenagers, as well as the educational methods of parents. How to cultivate the creativity of young people in the context of artificial intelligence is an issue that cannot be ignored. Artificial intelligence not only provides students with abundant learning resources and tools, but also brings new challenges. For example, artificial intelligence technology can help students improve learning efficiency and effectiveness, stimulate interest through personalized learning and intelligent tutoring

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systems [7,8], but it may also inhibit students' creative thinking due to highly automated and standardized teaching modes [9].

2 Question Raised

In this era of intelligence, it is particularly important to stimulate teenagers' curiosity and creative self-efficacy. Curiosity, as an important motivation, influences behavior in both positive and negative ways at various stages and is considered an important driving force for children's growth and creative development. No matter how education changes in the future, the role of the family is irreplaceable. The family environment, as the starting point of an individual's life, has a profound impact on their growth, development, and initial socialization process. However, the family is only a carrier for children's growth, and the way parents interact with their children and the family co parenting environment are important influencing factors in the process of children's growth. Artificial intelligence, social media, and other technologies provide parents with more educational resources and information support, while excessive reliance on technology may weaken the traditional educational role of parents[10]. Active family education should still be valued [11]. The application of AI technology in education presents challenges, and it is important for parents to continue playing a positive role in their children's education, rather than relying solely on technology.

The founder of social learning theory, Albert Bandura, emphasized the decisive role of individual factors in unleashing individual potential, believing that self-efficacy can directly determine an individual's level of motivation for creative activities[12]. Another motivation that inspires children's development is curiosity, which has always been considered an important motivation that influences behavior in both positive and negative ways at various stages of their life cycle[13]. It has been identified as an important driving force for children's growth and creativity development.

According to the theoretical model of creativity [12,14], the environment not only directly shapes the formation and development of creativity, but also has an impact on creativity through a series of individual variables. In this context, it is of great significance to conduct in-depth research on the family environment, especially the sustained way parents treat their children, and the development of individual factors such as creative self-efficacy and curiosity in the era of intelligence [15]. In addition, exploring how to effectively cultivate students' creativity in the context of artificial intelligence also provides new perspectives and directions for educational research. Based on the above analysis, this study focuses on elementary school students and analyzes the relationship between self-efficacy, curiosity, and parental upbringing in the context of AI technology, providing an educational perspective.

3 Research Objects and Tools

3.1 Research Object

This study used a questionnaire survey method, and all variables in this study were measured by self-reported participants. A primary school was selected from a city in Zhejiang Province, and students from grades 3, 4, and 5 were randomly selected as the research subjects. 113 participants participated in the survey, as shown in Table1.

Table 1. Description of demographic variables (N=113)

Var	Type	frequency	%
Sex	Boy	65	57.52
	Girl	48	42.48
Grade	3	38	33.63
	4	38	33.63
	5	37	32.74

3.2 Research Tools

1. Creative self-efficacy questionnaire

This study used the revised "Creative Self Efficacy Scale" by Zhang Jinghuan et al. to measure students' sense of creative self-efficacy. The original scale was developed by Taiwanese scholars Hong Suping and Lin Shanru in 2004 [16], using a 4-point scoring method, divided into completely consistent, basically consistent, basically inconsistent, and completely inconsistent. The higher the score, the higher the level of creative self-efficacy, with a total of 17 questions. The scale consists of three subscales: belief in creative products, belief in creative thinking strategies, and belief in resisting external negative evaluations. The test-retest reliability of the scale is 0.823. Zhang Jinghuan, Wang Xiaoling et al. (2011)[17] revised the scale before formal testing, deleting the third and tenth questions with a discrimination level below 0.40; Delete questions 4, 11, and 15 based on the correction index and the meaning of the questions. The revised title consists of 12 questions.

2. Curiosity questionnaire

The Curiosity Scale was developed by Littman and Spielberger (2003) and revised by Renner (2006) [18] in Germany. The Chinese translation of the scale was used in this study. The Perceived Curiosity Scale was developed by Collins, Littman, and Spielberger (2004) [19]. The scale consists of 25 items, and each item is rated on a five point scale ranging from 1 (not at all like me) to 5 (very like me).

3. Parenting Questionnaire

The Parenting questionnaire developed by Pomerantz and colleagues was used to measure parental autonomy support, psychological control, and behavioral control[20-22]. Previous studies have shown that this questionnaire is suitable for measuring parental parenting behavior in Chinese cultural samples and has good reliability and validity[23]. In this study, the internal consistency coefficients of the measurement was

0.93. The measurement of parental self-directed support includes a total of 12 items, the measurement of parental psychological control includes a total of 18 items, and the measurement of parental behavioral control includes a total of 16 items. Participants are required to make choices for each item based on their degree of conformity with their parents, using a 5-point scoring system, with 1 to 5 representing "completely inconsistent", "not very consistent", "uncertain", "somewhat consistent", and "very consistent", respectively. The average score of all items is taken as the final score, and the higher the score, the higher the degree.

3.3 Research Methods

Randomly select students from three classes within the school to distribute survey questionnaires, and select research subjects based on the content filled out by the students. Distribute questionnaires to the selected participants for testing, with each class's homeroom teacher as the main examiner. The main examiner explains the time and requirements for filling out the questionnaire, emphasizes the confidentiality of the survey, and requires students to answer truthfully. Students should answer the questionnaire in the order of binding, and students with questions can raise their hands to ask the main examiner. This survey will be conducted collectively on the selected participants, with a questionnaire filling time of 60 minutes.

3.4 Data Analysis Tools

SPSS26.0, a data analysis library in Python, uses text recognition technology (Tesseract) to extract scanned text into machine-readable format content, writes Python scripts, and automates data processing in Python.

4 Analysis Results

4.1 Scores of Self Efficacy and Curiosity Tests

The average and standard values of each task completed by the subjects before and after the two surveys are shown in Table 2.

Table 2. Scores of Self Efficacy and Curiosity Tests

	N	M	SD
Creative self-efficacy	113	3.01	0.54
Creative Strategy Belief	113	3.05	0.62
Creative Product Belief	113	3	0.65
Anti negative evaluation belief	113	3	0.64
Curiosity	113	3.84	0.84
Knowledge curiosity	113	3.87	0.9
Perceived curiosity	113	3.82	0.88

The scores of self-efficacy and curiosity are shown in Table 2. The overall average score of creative self-efficacy is 2.84 points, and the average scores of each dimension are between 2.79 and 2.96. The rating level of the creative self-efficacy questionnaire is 0-4 points, with a median of 2 points. This indicates that the total score and scores of each dimension of primary school students' creative self-efficacy are higher than the median, and are at an above average level. The overall average score of curiosity is 3.61, with an average score of 3.5 and 3.69 for the two dimensions, respectively. The curiosity questionnaire is rated on a scale of 1-5, with a median score of 2.5. This indicates that the total score of the curiosity test and the scores for each dimension are higher than the median and above average.

4.2 Correlation Analysis Between Parenting Styles, Self-efficacy, Curiosity, Etc

Analyzing the correlation between variables can provide a clearer understanding of their mutual influence. In order to explore the Pearson correlation coefficients between various dimensions and more intuitively demonstrate the relationship between self-efficacy, parental parenting behavior, curiosity, and parental education, a correlation analysis was conducted on the four variables. The results are shown in the table 3:

Table 3. Correlation coefficients between various data

	1	2	3	4	5	6	7	8	9	10
Self support	1									
Psychological control	-0.160	1								
Behavioral control	0.175	.542**	1							
Creative Strategy Belief	.429**	0.023	0.173	1						
Creative Product Belief.	.404**	0.045	0.175	.689**	1					
Creative efficacy	.469**	0.029	0.210	.837**	.877**	1				
Anti negative evaluation belief	.388**	0.008	0.190	.566**	.584**	.863**	1			
Recognizing Curiosity.	.416**	0.084	.281**	.545**	.424**	.532**	.432**	1		
Perceived Curiosity.	.378**	0.077	.273*	.468**	.440**	.522**	.446**	.723**	1	
Curiosity.	.423**	0.086	.297**	.537**	.466**	.566**	.474**	.900**	.952**	1

Note: * represents P<0.05, * * represents P<0.01; Questions 1-10 are consistent with the title in the first column

As shown in the table 3, creative self-efficacy and its three dimensions are significantly positively correlated with parental autonomy support ($p<0.05$), curiosity

($p<0.05$), and its two dimensions [cognitive curiosity ($p<0.05$), perceptual curiosity ($p<0.05$)]. Among them, creative self-efficacy and its three dimensions are strongly positively correlated with curiosity and its two dimensions; There is a significant correlation between parental autonomy in parenting and various dimensions of creative efficacy and curiosity.

4.3 Regression analysis of parental parenting style and curiosity on self-efficacy

Based on the previous research results, it is known that there is a correlation between parental parenting behavior, curiosity, and creative self-efficacy. In order to further clarify the causal relationship between them, this study further conducted regression analysis, refer to table 4.

Table 4. Regression analysis of parental parenting style dimensions on self-efficacy

Dependent	variable	β	R^2	t
Creative self-efficacy	Independent support	0.527	0.277	4.717**
Creative Strategy Belief	Independent support	0.091	0.213	4.35**

The regression equation in the above table 4 examines the predictive effect of parental parenting style on self-efficacy, with creative efficacy and creative strategy beliefs as dependent variables and autonomous support as independent variable. Regression analysis was conducted, and the results showed that the correlation coefficient R2 of creative efficacy was 0.277, indicating that autonomous support could explain 27% of the variance in creative efficacy overall. In addition, $F=22.247$， $p<0.001$, This indicates that the regression model is effective. The correlation coefficient R2 of creative strategy is 0.759, indicating that autonomous support can explain 21.3% of the variance in creative strategy beliefs overall. $F=15.699$, $p<0.001$, indicating the effectiveness of the regression model.

Table 5. Regression analysis of parental parenting style dimensions on curiosity

Dependent	variable	β	R^2	t
Curiosity	Independent support	0.351	0.123	2.855**

The regression equation in the above table 5 examines the predictive effect of parental parenting style on curiosity. With curiosity as the dependent variable and self-supporting as the independent variable, regression analysis was conducted. The results showed that the curiosity correlation coefficient R2 was 0.123, indicating that self-supporting can increase the variability of curiosity by 12.3%. In addition, $F=8.148$, $p<0.001$, indicating the effectiveness of the regression model.

Table 6. Regression analysis of curiosity on creative self-efficacy

Dependent	variable	β	R^2	t
Creative self-efficacy	curiosity	0.692	0.479	7.309**

The regression equation in the above table 6 examines the predictive effect of curiosity on creative self-efficacy. With creative self-efficacy as the dependent variable and curiosity as the independent variable, regression analysis was conducted. The results showed that the correlation coefficient R2 was 0.479, indicating that curiosity can explain 47.9% of the variance in creative self-efficacy overall. In addition, F=53.471, $p<0.001$, This indicates that the regression model is effective. Curiosity is the most significant predictor of creative self-efficacy.

5 Discussions

5.1 The relationship between parental upbringing, self-efficacy, and curiosity

Research has found a significant correlation between parental parenting behavior and self-efficacy, which is consistent with previous study [24]. This indicates that in the process of children's growth, parental autonomy, respect for their unique needs and feelings, and support and encouragement can help cultivate and improve their self-confidence. Due to parental respect, understanding, and support, children can establish a positive and stable self-awareness, accept themselves, tend to self affirm, and show confidence, which is consistent with the research results. The family is the main place of socialization, as well as the first and fundamental executor of socialization. As an important aspect, self-confidence is often influenced by family, and the parenting style of parents can directly affect the development of their children's self-confidence.

One of the key findings of this study is that creative self-efficacy is significantly positively correlated with various dimensions and total scores of curiosity, indicating that confidence and curiosity are two complementary abilities of individuals. These two abilities are important components of creativity, curiosity helps children discover problems, and self-efficacy supports children in analyzing and solving problems. In the creative process, both important traits are indispensable. In addition, Csikszentmihalyi pointed out that self-confidence is an important psychological characteristic of human beings, and individuals' perception and understanding of these aspects can affect the development of creativity. Analysis also found that one of the dimensions of parental parenting behavior, psychological control, is not significantly correlated with creative self-efficacy, curiosity overall, and dimensions. There is a weak correlation between parental behavior control, curiosity, and creative efficacy. Proper control of children's behavior, decision-making, and life by parents can cultivate their autonomy and independence, but excessive control may have negative effects. This indicates that positive parenting styles of parents significantly help promote self-confidence and curiosity, and similar conclusions have also been found in research on college students [25].Family is the cradle of children's growth, and the parenting style of parents has a crucial impact on children's confidence and curiosity.

5.2 The Development of Self Efficacy and Curiosity

Research has found that self-efficacy changes with age, with younger students experiencing greater changes and the greatest improvement, while other grades show a slow

increase. Curiosity and self-efficacy have similar patterns of change, and the reason for the highest score in third grade may be that students in this grade have the lowest levels of academic and environmental pressure compared to fourth and fifth grade students. Parents' educational methods are mainly based on positive parenting styles, and previous research analysis shows significant differences in parental self-directed support styles among grades.

6 Conclusion

(1) There is a significant correlation between parental parenting behavior and self-efficacy, curiosity score, and dimensions. Self efficacy is significantly correlated with curiosity and various dimensions. This significant correlation indicates that positive parenting styles can help build children's confidence and maintain curiosity, all of which contribute to the cultivation of their creativity.

(2) There is a significant strong relationship between self-efficacy and the total score and various dimensions of curiosity, and the two are strongly positively correlated. From this, we can see that under the independent support and upbringing of parents, cultivating children's confidence can not only improve their creative self-efficacy, but also enhance their curiosity, thus revealing the important impact of positive education and confidence on individual qualities.

(3) Based on the above research, suggestions for cultivating creative self-efficacy and curiosity are proposed. Positive parenting styles of parents are important for the development of these two abilities in children, which should include more independent support, appropriate behavioral control, and less psychological control over parenting behavior. The primary school stage is a critical period for the development of creative self-efficacy and curiosity. At this stage, children begin to think independently and explore their interests, so schools and parents should pay special attention to the educational methods during this period. Parents should encourage their children to boldly try new methods in learning, while schools should design more challenging courses to stimulate their creative thinking.

7 Suggestions

(1) Suggestions for education in the era of artificial intelligence are proposed from the perspectives of schools and parents[26]. Parental autonomy can promote students' creativity. 1. Creating a comfortable home environment, parents can provide personalized learning experiences for their children, meet their different interests and needs, and a relaxed and positive atmosphere can stimulate children's curiosity; 2. Encourage questioning and exploration. With AI technology, children can easily solve problems and also ask new challenging questions. Parents can have more space to support their "why" and recommend suitable learning resources and activities for them, thereby enhancing their interest; Parents support their children's desire to explore; 3. Establish a good parent-child relationship, communicate and interact with children, and participate in creative activities together.

(2) Improving students' creativity through AI technology can be considered from the following aspects: 1 Customization of personalized learning paths, such as using companion based AI products to recommend relevant resources and inspiration based on students' interests and creativity levels, and stimulate their desire to create; 2. Intelligent feedback and guidance, such as AI adaptive learning platforms, where creative efficacy positively predicts creativity. In problem-solving, using AI can monitor students' task progress in real time, provide intelligent feedback, and give positive feedback and evaluation during the creative process; 3. Technical assistance, providing knowledge; By using the language model Chat GPT, students can learn independently, acquire knowledge, solve problems encountered, and improve their creativity.

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