Analysis of the Impact of Artificial Intelligence on College Students' Learning under the Background of New Quality Productivity--Taking K University as an Example

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Abstract. In the context of the era of new quality productivity, the artificial intelligence industry is developing rapidly, in order to further explore the impact of artificial intelligence on students in Xinjiang universities. This article takes K University students as the research object, constructs a subjective and objective evaluation model combining Analytic Hierarchy Process and Entropy Weight Method based on the data obtained from a questionnaire survey, and conducts research. Research has found that the impact of artificial intelligence on men is greater than on women; Artificial intelligence has the greatest impact on art, followed by science and engineering and management, with the least impact on cultural and historical fields; Compared to other grades, juniors and freshmen are more interested in artificial intelligence; Artificial intelligence has a significant impact on quiet and firm personalities. Boys in the fields of literature, history, and management are less affected by artificial intelligence than girls, and girls with all personalities are more susceptible to the influence of artificial intelligence compared to boys. The trend of students in science and engineering and management majors being affected is similar, with a smaller impact in their freshman and senior years, and a greater impact in their sophomore and junior years. Students with gentle personalities in various majors are not significantly affected by artificial intelligence. Based on the analysis results, propose corresponding policies and suggestions for enterprises, schools, and governments.

Keywords: Artificial intelligence, AHP, Entropy weight method, Subjective objective comprehensive evaluation.

1   Introduction

In September 2023, General Secretary Xi Jinping first proposed the concept of "new quality productivity" during his inspection and research in Heilongjiang, pointing out the need to integrate scientific and technological innovation resources, lead the devel-

opment of strategic emerging industries and future industries, and accelerate the formation of new quality productivity. On March 5, 2024, Premier Li Qiang emphasized in his government work report the need to vigorously promote the construction of a modern industrial system and accelerate the development of new quality productive forces. It can be seen that the digital economy has become a major trend in social development. Under the background of China's overall construction of Chinese path to modernization, the new quality productive forces have distinctive characteristics of the times.

Artificial intelligence has given birth to and led a new round of technological revolution and industrial transformation, and will become an important engine for developing new quality productivity [1]. In recent years, with the continuous iteration of ChatGPT, ERNIE Bot and other big models, the application of AI in the field of education has become increasingly prominent. Artificial intelligence has been widely applied in the learning, writing papers, homework, and daily life of college students, and further will have an impact on students' integrity, outlook on life, values, and even their future life development.

Therefore, in the context of the significant impact of artificial intelligence on college students, it is extremely important to analyze the impact of artificial intelligence on the learning of college students. This study starts from actual research data, case analysis, empirical research, and other aspects. Based on the analysis of the impact of artificial intelligence on the learning of college students, the impact is studied from actual case studies of college students, revealing the current situation and value of artificial intelligence technology in the field of education. Based on the analysis results, countermeasures and suggestions are proposed to optimize the application of artificial intelligence technology in the field of education.

2   Literature Review

At present, domestic scholars' research on the relationship between artificial intelligence and student learning mainly focuses on several aspects. Some scholars have used meta-analysis methods on 40 samples to analyze the positive impact of artificial intelligence technology on students' learning outcomes; Factors such as different stages and subjects have a positive impact on learning outcomes, but there are significant differences in the degree of impact [2]. Individual studies have found that gender and grade level have no significant impact on deep learning in primary school artificial intelligence courses, but individual factors have a significant impact on deep learning in artificial intelligence courses [3]. Some research shows that "Internet plus" has changed the learning style of vocational college students, enriched learning resources, and changed the way of communication, playing a positive role; However, students have a high degree of dependence on the Internet, which affects their normal learning. At the same time, Internet resources are mixed, which can easily mislead students [4].

Through literature analysis, it was found that there is currently limited research on the impact of artificial intelligence on the learning of college students, especially in

Xinjiang. This project is based on the actual situation of students in Xinjiang universities. By exploring the impact of artificial intelligence on the learning of students in Xinjiang universities, an evaluation system is constructed to analyze the impact of artificial intelligence. The research of this project can enrich the comprehensive study of students in Xinjiang universities, provide support for the academic development of students in Xinjiang universities, and promote the high-quality development of education in Xinjiang, which has practical significance.

3   Questionnaire Design and Research Methods

3.1   Questionnaire Design

This article designs a survey questionnaire and constructs an indicator system from the aspects of students' exposure to artificial intelligence, internet time, use of artificial intelligence, and the impact of artificial intelligence on students [5]. The indicator system table is shown in table 1. Conduct a survey of students at K University through a questionnaire.

Table 1. Index system.

Index	Index
Ways to get in touch with artificial intelligence	Expectations for Artificial Intelligence
Online time	The level of trust in artificial intelligence
Proportion of using artificial intelligence	The purpose of using artificial intelligence
Exposure to artificial intelligence	The development trend of artificial intelligence
Recommended level of learning	Attitude towards artificial intelligence
Degree of autonomous choice	Advantages of Artificial Intelligence
Select the degree to which artificial intelligence completes homework	The Security of Artificial Intelligence
Choose artificial intelligence to complete the quiz level	Important content of artificial intelligence
Proportion of papers completed using artificial intelligence	Expectations for the functionality of artificial intelligence
Reasons that influence self selection of artificial intelligence	Applicability of Artificial Intelligence
The degree of agreement with college students using artificial intelligence	

3.2   Research Methods

Analytical Hierarchy Process. Analytic Hierarchy Process (AHP) is a decision anal-
ysis method that combines qualitative and quantitative approaches to solve complex
multi-objective problems [6,7]. This method decomposes the problem into different
constituent factors based on the nature of the problem and the overall goal to be
achieved, and combines all factors at different levels according to their interrelation-
ships, influences, and membership relationships, forming a multi-level analytical struc-
ture model. Ultimately, the problem boils down to the determination of the relative
importance weights of the lowest layer relative to the highest layer, or the ranking of
relative advantages and disadvantages (see figure 1).

Firstly, a multi-level hierarchical decision structure model is constructed, and an
evaluation index system is established in three layers from top to bottom according to
the dominance relationship. The objective layer (also known as the highest layer) is the
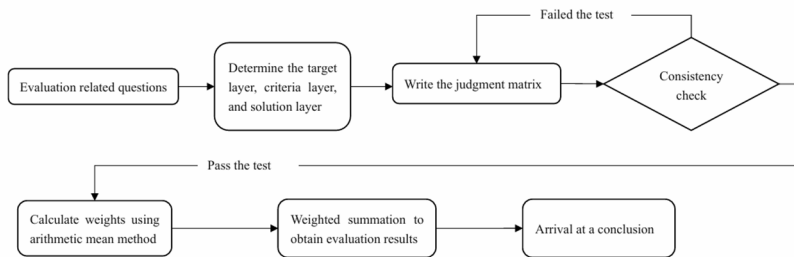desired goal or result, and is the first criterion for system evaluation.

Fig. 1. Analytic Hierarchy Process Steps.

Secondly, construct a pairwise comparison judgment matrix $A = (aig)$, where the ratio
of the relative importance of element i to element j is represented by aig and has the
following relationship:

(1) $a_{ij} = 0$

(2) $a_{ij} = \dfrac{1}{a_{ij}}$

(3) $a_{ii} = 1, i = 1,2,3,\dots,n, j = 1,2,3,\dots,n$

The larger the ratio, the higher the importance of i. In order to quantify the judgment,
the relative importance of each element is generally determined based on a scale of 1-
9 (see table 2).

Table 2. Judgment matrix scaling method.

Scale	Index
1	Comparing two elements, equally important
3	Comparing two elements, one element is slightly more important than the other
5	Comparing two elements, one element is significantly more important than the other
7	Comparing two elements, one element is much more important than the other

9   Comparing two elements, one element is absolutely more important than the other

If an element is compared with another element using the above element values, then the latter is taken as the reciprocal of the former

Then use the root finding method to calculate the approximate value of the eigenvectors of the judgment matrix.

$$W_i = \frac{(\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}}}{\sum_{i=1}^{n}(\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}}}, ij = 12kn \tag{1}$$

Normalize the feature vectors to obtain weight vectors $w = (w_1, w_2, w_3, \dots, w_n)^T$.

Entropy weight method. This article chooses to use the entropy weight method for objective calculations. Entropy is a measure of the degree of disorder in a system [8]. The fundamental idea of entropy weight method is to determine objective weights based on the variability of indicators. According to the definition of information entropy, generally speaking, if the information entropy e_j of a certain indicator is smaller, it indicates that the degree of variation of the indicator value is greater, the role it plays in the comprehensive evaluation is greater, and the corresponding weight is also larger [9]. Conversely, if the information entropy e_j of a certain indicator is larger, the role it plays in the comprehensive evaluation is smaller, and the corresponding weight is also smaller.

(1) Firstly, normalize each factor according to the quantity of each option. For positive indicators:

$$x'_{ij} = \frac{X_{ij} - \min(X_{1j}, X_{2j}, \cdots, X_{nj})}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} \tag{2}$$

For negative indicators:

$$x'_{ij} = \frac{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - X_{ij}}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} \tag{3}$$

(2) Then, calculate the entropy value of the jth indicator:

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}), j = 1, \cdots, m \tag{4}$$

(3) Calculate learning entropy redundancy:

$$d_j = 1 - e_j, j = 1, \cdots, m \tag{5}$$

(4) Calculate the weight of each indicator:

$$w_j = \frac{d_j}{\sum_{j=1}^{m} d_j}, j = 1, \cdots, m \tag{6}$$

(5) Calculate the comprehensive score of each sample:

$$s_i = \sum\nolimits_{j=1}^{m} w_j x_{ij}, i = 1, \cdots, n \tag{7}$$

Among them, X_{ij} is the normalized data. According to the score, the importance ranking of all factors can be obtained.

Determination of subjective and objective weights. The process of calculating weights mentioned above has a certain degree of subjective data distortion, which is easily influenced by the evaluator's consciousness, while the objective aspect can truly reflect the problems in the data, but cannot reflect the evaluator's emphasis on certain indicators. In order to scientifically and reasonably determine the weight of the evaluation indicators in this article, a combination of subjective and objective weights is adopted. By referring to relevant literature [10], the weights of subjective and objective indicators are directly added or multiplied in the form of equal preferences, and normalized to obtain the weights of each indicator. The evaluation results have high accuracy.

$$w_j = \frac{\sqrt{\alpha_j \beta_j}}{\sum_{j=1}^{n} \sqrt{\alpha_j \beta_j}} \tag{8}$$

Among them, α_j is the weight obtained by the Analytic Hierarchy Process, and β_j is the weight obtained by the Entropy Weight Method.

4   Results and Analysis

This study focuses on K University students as the survey subjects, with a sample covering students in grades 1-4, as well as disciplines such as humanities and history, science and engineering, management, and arts and sports. A total of 1500 questionnaires were distributed and 1151 valid questionnaires were collected. The basic information of the survey respondents is shown in the table 3 below.

Table 3. Participate in investigating the basic situation of students.

Basic information	attribute	number	Proportion
gender	male	733	63.7%
	female	418	36.3%
major	literature and history	84	7.3%
	science and engineering	707	61.4%
	management	236	20.5%
	arts and sports	124	10.8%
grade	freshman	445	38.7%
	sophomore	327	28.4%

	junior	311	27%
	senior	68	5.9%
character	quiet type	375	32.6%
	export-oriented	252	21.9%
	gentle type	90	7.8%
	firm type	85	7.4%
	sensory type	151	13.1%
	other	198	17.2%

4.1   Descriptive Analysis

Through the analysis of questionnaire data, it can be seen from figure 2 that more than 80% of male and female students choose artificial intelligence, with male students accounting for 80.83% and female students accounting for 83.74%, respectively. Among college students who do not choose artificial intelligence, male students account for only 19.17% and female students account for 16.26%.
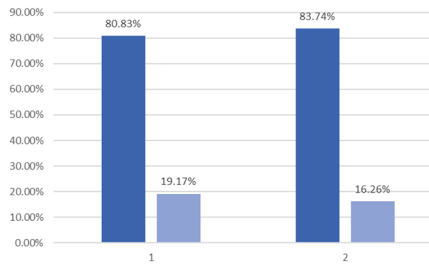
Fig. 2. The situation of college students choosing artificial intelligence.

Conduct research on whether students have used learning software. From the results in figure 3, it can be found that students who have previously used learning software have an impact on whether they will choose to use artificial intelligence tools.
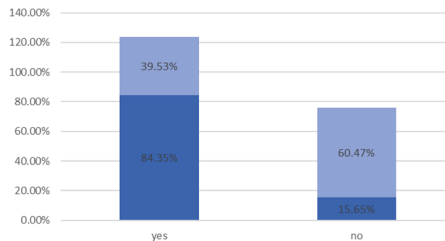

Fig. 3. Secondary selection of artificial intelligence situation.

From the above figure, it can be seen that among the students who have previously used learning software, the proportion is 84.35%, while among those who have not used

learning tools, the proportion is 39.53%. Among these students, the proportion who did not choose artificial intelligence in the future is as high as 60.47%, and the proportion who continued to choose artificial intelligence is only 15.65%.

4.2   Subjective Objective Comprehensive Evaluation

Classify by gender, major, grade, and personality, use Analytic Hierarchy Process and Entropy Weight Method to obtain the weights of each indicator, and use subjective and objective comprehensive weighting method to obtain the comprehensive weight of each indicator. Based on the comprehensive evaluation model, the weight of each secondary indicator is used to obtain the impact index of artificial intelligence on the learning of college students of different genders, majors, grades, and personalities (see table 4).

Table 4. Artificial intelligence affects the overall score.

Basic information	attribute	Comprehensive score
gender	male	0.7247
	female	0.2753
major	literature and history	0.3720
	science and engineering	0.3858
	management	0.2917
	arts and sports	0.7312
grade	freshman	0.4615
	sophomore	0.4456
	junior	0.5094
	senior	0.4160
character	quiet type	0.5422
	export-oriented	0.3688
	gentle type	0.5130
	firm type	0.4804
	sensory type	0.3939
	other	0.5831

From the data in the table above, it can be seen that boys have a higher impact index on artificial intelligence, while girls have a lower impact index. This indicates that artificial intelligence may be more widely used among boys, but it may also be due to the fact that this study focuses more on boys. All other conditions being equal, college students majoring in art have the highest impact index on artificial intelligence, reaching 0.73. College students majoring in literature and history have the lowest impact index on artificial intelligence, at 0.29. The impact index of management and engineering college students on artificial intelligence is not significantly different, at 0.37 and 0.38, respectively. The impact index of junior students on artificial intelligence is slightly higher than that of other grades, while the impact index of senior students on

artificial intelligence is relatively low. However, it can be found that the overall impact index varies greatly, indicating that the influence of grades on artificial intelligence is not significant. College students with quiet, firm, and other personality traits have a relatively high impact index on artificial intelligence, while those with emotional, extroverted, and gentle personalities have a relatively low impact index on artificial intelligence.

4.3   Multivariate Correlation Analysis

To explore the different impacts of artificial intelligence under diverse conditions, this article presents a heat map of correlation analysis in four aspects: "gender major", "gender personality", "grade personality", and "personality major" (see figure 4).
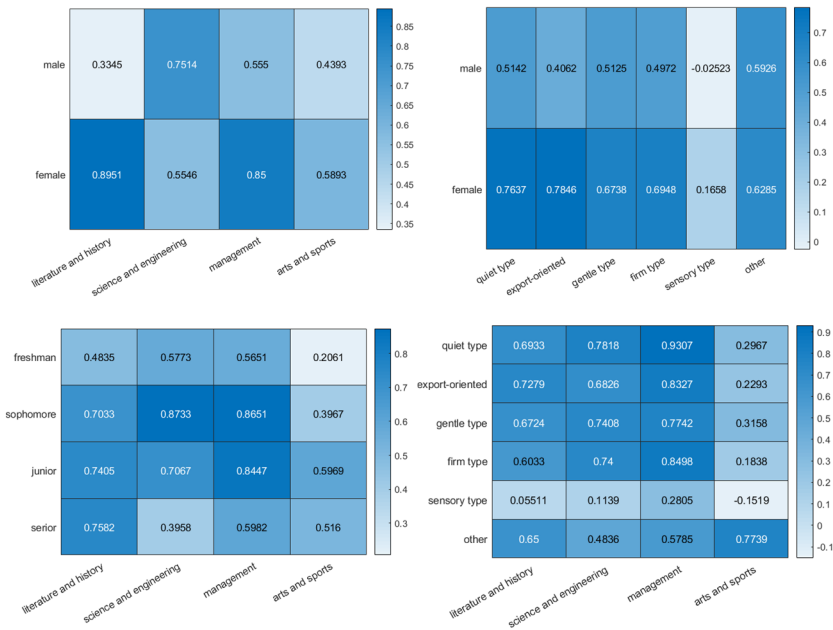
Fig. 4. Related relationship heatmap.

From the results, it can be seen that male students majoring in literature and history and management are less affected by artificial intelligence than female students, while male students majoring in science and engineering are more affected by artificial intelligence than female students. Both male and female students in the arts and sports category are similarly affected. Girls with all personalities are more susceptible to the influence of artificial intelligence compared to boys. Especially, boys with gentle personalities are affected in the opposite direction compared to girls. The influence of students majoring in literature and history has been increasing year by year since their freshman year. The trend of students in science and engineering and management majors being affected is

similar, with a smaller impact in their freshman and senior years, and a greater impact in their sophomore and junior years. Art and sports students have a relatively small impact in their freshman and sophomore years, while their junior year has the greatest impact. Students with gentle personalities in various majors are not significantly affected by artificial intelligence. Students with a quiet personality in management are most susceptible to the influence of artificial intelligence. Art and sports students, apart from other personalities, have relatively little influence.

5   Conclusion and Recommendations

Based on the data, using male and female students as evaluation indicators, the impact of artificial intelligence on male students' learning is significantly greater than that of female students. However, the non randomness of the data cannot be ruled out, which may be due to differences in sample selection. When analyzing the majors of college students as evaluation indicators, the proportion of art majors is relatively high compared to other majors. Using grade as the evaluation indicator, the impact of artificial intelligence on the lives of college students is comparable, with similar proportions across different grades. However, the scores for juniors and freshmen are still higher compared to sophomores and seniors. Evaluating based on personality indicators, it can be seen that emotional and gentle personalities have little impact on artificial intelligence. Provide some targeted suggestions for the phenomenon that has occurred:

(1) Scientific and rational use of artificial intelligence. Teachers should scientifically and reasonably guide students to use learning software correctly, without overly relying on artificial intelligence software or holding negative attitudes towards it [11]. (2) Fully understand the advantages and disadvantages brought by artificial intelligence. Students should approach problems with a dialectical perspective, understand that the resources that artificial intelligence can bring are limited, and not blindly immerse themselves in the ocean of big data, which can easily lead to loss of focus and direction. (3) Enhance the richness of practical teaching [12]. Enable students to truly appreciate the importance of teachers and the positive trend of integrating teachers with artificial intelligence. (4) Implement resource standardization and classify resources. Schools can establish specialized resource zoning areas [13]. (5) For the phenomenon of resource charging, artificial intelligence itself is a business that promotes social progress in the economy and technology. It can be solved at the school level, which can not only adapt to the current school education and teaching management mode but also alleviate the financial burden on college students to a certain extent. (6) Strengthen education management institutions to prevent students from using artificial intelligence to take shortcuts, increase supervision, and guard against academic fraud. (7) The national government implements investment plans for the corresponding artificial intelligence industry. To a certain extent, it not only reduces the burden of student resource fees, but also promotes national economic income and development planning through the development of enterprises.

Acknowledgments

References

1. Qi Yudong, Shen Tianyang. Empowering New Quality Productivity with Artificial Intelligence: Logic, Mode, and Path [J]. Economic and Management Research, 2024, 45 (07): 3-17.
2. Hu Dexin, Wang Yaorong. Research on the Impact of Artificial Intelligence Technology on Student Learning Effectiveness: Meta Analysis Based on 40 Experiments and Quasi Experiments from 2010 to 2022 [J]. Journal of Tianjin University (Social Sciences Edition), 2022, 24 (06): 493-502
3. Chen Hong. Research on the influencing factors of deep learning in primary school artificial intelligence courses [D]. Sichuan Normal University, 2021.
4. Song Baili, Wang Xuexian, Xu Jianxin The impact of "Internet plus" on the learning of vocational college students [J]. Heilongjiang Science, 2018,9 (07): 32-33.
5. Liu Naikang. The Impact of Artificial Intelligence Era on the Employment of Art and Design Vocational College Students and Countermeasures [J]. Employment and Security, 2024, (07): 20-22
6. Lazim A, Norliana N M. Sustainable development scores using spatial information systems-analytic hierarchy process [J]. Kybernetes,2023,52(11):4897-4912.
7. Liu Yuanyuan, Wang Shaoqiang, Wang Xiaobo, et al. Flood Disaster Risk Assessment in the Mengyinmian Region Based on AHP Entropy Weight Method [J]. Geographical Research, 2020, 39 (08): 1892-1906.
8. Azadfallah M. Improving the entropy weighting method performance by using alternative normalisation procedures [J]. International Journal of Society Systems Science, 2020, 12(3):
9. Li Fang, Li Dongping. Combination evaluation model based on entropy weight method [J]. Information Technology and Informatization, 2021, (09): 148-150.
10. Liu Qiuyan, Wu Xinnian. Review of Methods for Determining Indicator Weights in Multi factor Evaluation [J]. Knowledge Management Forum, 2017, 2 (06): 500-510.
11. Yu Shengquan. The Future Role of Artificial Intelligence Teachers [J]. Open Education Research, 2018, 24 (01): 16-28.
12. Zhu Guiwei. Research on the Role Transformation and Innovation of College Teachers in the Era of Artificial Intelligence [C]//Proceedings of the 2023 Academic Symposium of Guangdong Higher Education Association and Guangdong Higher Education Association. Jiangmen Preschool Teachers College, Guangdong;, 2023:10.
13. Zheng Xiaoyu. An Analysis of the Impact of Artificial Intelligence on Higher Education and Teaching in the New Era [C]//Hong Kong New Century Culture Press. Proceedings of the 6th International Conference on Smart Education and Artificial Intelligence Development in 2023 (Volume 3). Shanghai University;, 2023:2.