

ANALYSIS OF ARTIFICIAL INTELLIGENCE ASSIGNMENT AND CLASSIFICATION EVALUATION EFFECT OF ECONOMIC SCIENCE DISCIPLINE OF MANAGEMENT SCIENCE DEPARTMENT

Feng Chen¹, Pei Yang^{1,2,*}, Xi Cai¹

¹ School of Information and Safety Engineering, Zhongnan University of Economics and Law, Wuhan 430073, Hubei, China;

² School of Information Science, University of Illinois Urbana-Champaign, Champaign, 61820, USA.

Abstract: This paper analyzes the effect of the artificial intelligence assignment and classification review of the 2022 general project of the Economic Science Discipline (G03) of the Management Science Department of the National Natural Science Foundation of China and the Youth Science Fund project. Based on the randomized controlled trials in the field of economic science and international economics and trade, it was found that artificial intelligence assignments can efficiently match "small peers" to carry out communication reviews, and effectively improve the consensus degree of review projects and the meeting rate. According to the statistical test, there is no significant difference between the distribution and mean of the project review scores of the artificial intelligence assignment experiment group and the control group samples, which means that the artificial intelligence assignment will not systematically affect the peer communication review results. In 2022, the discipline of economic science will comprehensively carry out classified review based on the attributes of scientific issues. Statistics show that classified review can effectively enable peer review experts to form consensus according to the attributes of scientific issues, and significantly reduce the gap between original, cutting-edge, interdisciplinary projects and demanding projects. rate difference.

Keywords: Artificial intelligence assignment; Classification review; Department of management science; Effect analysis

The National Natural Science Foundation of China (hereinafter referred to as "Natural Science Foundation of China") is one of the main channels for supporting basic research in my country. It has been established for more than 30 years and has played an important role in the national scientific and technological undertakings[1,2]. In response to the challenges faced by the leapfrog development of basic research, the Natural Science Foundation of China has continued to explore and deepen reforms in recent years, and has continuously introduced new measures in the management mechanism to meet the new requirements of the new round of scientific and technological revolution for the national scientific research funding system.

Peer review is the main mechanism for NSFC-funded project applications [3,5]. The Natural Science Foundation of China attaches great importance to the application of technical means in the organization and management of peer review, actively carries out the pilot work of introducing artificial intelligence (AI) technology into peer review, and continuously improves the intelligent assistant assignment system in practice[6, 8]. In 2022, the economic science discipline of the Ministry of Management Science will carry out the pilot work of artificial intelligence assignment. After selecting the pilot field of disciplines, we used the method of randomized controlled trials to randomly group the research subjects. During the peer communication review stage, we assigned the experimental group artificial intelligence, and the control group adopted the usual group assignment. By comparing the communication review results, scientific Analyze the impact of adopting artificial intelligence assignments on the acceptance rate of application projects.

1. ANALYSIS OF THE EFFECT OF ARTIFICIAL INTELLIGENCE ASSIGNMENT IN ECONOMIC SCIENCE DISCIPLINE

In order to do a good job in the pilot work of artificial intelligence assignment, the discipline of economic science has designed an experimental plan and technical route for the analysis of the effect of artificial intelligence assignment after multiple rounds of investigation and discussion before the centralized review.

1.1 Pilot Program Design for Artificial Intelligence Assignment

(1) Carefully analyze the application situation and characteristics of various fields of the discipline, select the subject code G0306 "International Economics and Trade" general project and the Youth Science Fund project as the pilot field of artificial intelligence assignment, and adopt the method of randomized controlled trials to observe the results of artificial intelligence assignment. Implementation Effect. In the field of "International Economics and Trade" in recent years, the number of applications for general projects and youth science fund projects has stabilized at more than 200. The overall research level of scholars in the field is relatively high, the research methods are relatively innovative, and the research topics are relatively concentrated. Therefore, it was selected Subject areas that serve as pilots for AI assignments.

(2) According to whether the last digit of the number of the Ministry of Science is odd or even, the "International Economics and Trade" general project and the Youth Science Fund project are divided into the experimental group and the control group.

- (3) Artificial intelligence is used to assign one-to-one single item assignments to the application projects of the experimental group. The information system of the Science Foundation will match the communication review experts recommended by artificial intelligence, and assign experts according to the degree of matching from high to low. For the experts in the experimental group whose number of review items recommended by artificial intelligence is less than 5, the project director will make adjustments and select experts with a slightly lower degree of matching for communication review to ensure that the number of communication review experts reviewing items this year is at least 5 or more, which is convenient. Experts will objectively evaluate the application projects through horizontal comparison.
- (4) The control group was divided into groups according to the classification review requirements and the relevance of research topics, and comprehensively used methods such as "group information recommendation", "keyword matching recommendation" and "expert familiarity field recommendation" to assign communication review to the whole group through the intelligent auxiliary assignment system expert.
- (5) After this year's communication review, organize the staff of the discipline department to carry out special research, count the differences in the review results between the experimental group and the control group, test the scientificity of the experimental results, and summarize the implementation effect and improvement measures of artificial intelligence assignments.

1.2 Effect Analysis

The process and results of the effect analysis are as follows:

- (1) AI designation ensures the efficiency and effectiveness of the review organization. When the project director uses the artificial intelligence assignment system to assign communication review experts, it is generally reflected that the artificial intelligence assignment is better in the single assignment, and can quickly list the communication review experts with similar research directions, and the research topics and academic knowledge of the communication review experts. Online profiling helps to accurately find "small peers" to carry out project review work.
- (2) Based on the comparison of the communication review results of the experimental group and the control group, the artificial intelligence assignment more accurately invites "small peers" to carry out project review work, which improves the consensus of the project and greatly increases the rate of project participation. Table 1 summarizes the attendance rate results of the "International Economics and Trade" experimental group and control group participating in the randomized controlled trial. The experimental group was assigned by artificial intelligence, and the meeting rate of surface projects was higher than that of the control group 10.38%, the participation rate of the Youth Science Fund project was 14.01% higher than that of the control group. One-to-one use of artificial intelligence to assign review experts enables "little peers" to have a deeper understanding of academic frontiers and key scientific issues, increases the consensus of review projects, and thus increases the attendance rate of excellent projects. While the control group adopts the usual way of group assignment to carry out communication review, the attendance rate is basically the same as the average attendance rate in other fields of the subject. Therefore, the artificial intelligence assignment of a single project can more accurately match the "small peers", and it is not troubled by the avoidance of group assignments, and the consensus degree is greatly improved.

1.3 Statistical Test

From the above statistical analysis, it can be found that the AI assignment can effectively improve the consensus degree of peer review experts on the application project, and increase the meeting rate of the project. So are these statistical results scientific? Is there any statistical bias? We also need to conduct several tests on randomized controlled trials assigned by artificial intelligence, including t-test and Wilcoxonrank-sum test on the mean scores of the experimental group and the control group. The purpose of the test is to help judge whether the assignment of artificial intelligence has changed the score distribution and average score of science fund projects. If yes, it indicates that the AI assignment will produce systematic score deviation; otherwise, it indicates that the design of the AI assignment pilot program is reasonable, that is, it will not change the score of the science fund project.

Through the t test and Wilcoxon rank-sum test, it can be found that the artificial intelligence assignment does not systematically change the review results, ensuring the scientific nature of the review.

The results showed that the difference between the two was not statistically significant. Similar statistically insignificant results for comprehensive evaluations, grant proposals, and general projects, implying that AI assignments did not change the overall scores in the communication review between the experimental and control groups.

From a statistical point of view, the t-test needs to meet the normal distribution conditions, but the letter evaluation scores of science fund projects do not necessarily meet the normal distribution conditions. In this regard, this paper uses the Wilcoxon rank-sum test with relaxed assumptions to judge whether there is a significant difference between the scores of the experimental group and the control group. The specific results are shown in Table 2. The results showed that the differences between the experimental group and the control group in terms of total scores, comprehensive evaluation, and funding suggestions did not pass the significance test, that is, the difference in scores between the two groups was not significant.

Table 1 Statistics on attendance rate assigned by artificial intelligence (2022)

		surface project	youth science Fund project	count
Experimental group (take	Total number of applications35 (items)		76	111

artificial intelligence can assign)	Number of meetings (items)	12	20	32
	Attendance rate (%)	34. 29%	26. 32%	28. 83%
control group	Total number of applications	46	65	111
	(items) Number of admissions	11 23. 91%	8 31%	19 17. 12%
	(items) Admission rate (%)		12.	

2. ANALYSIS OF THE EFFECT OF CLASSIFICATION AND REVIEW OF ECONOMIC SCIENCE DISCIPLINES

Basic research has differentiated problem attributes, and it is impossible to use a ruler to measure its research value and significance. Since 2019, the Natural Science Foundation of China has fully deployed the pilot work of classification and review based on the attributes of scientific issues, and has continuously explored and improved related mechanisms. The discipline of economic science has carried out the pilot work of classification review based on the attributes of scientific problems for two consecutive years.

Since the deepening reform of the Science Fund in 2018, in order to better help scientists condense scientific issues, the Natural Science Foundation of China has adopted a clear funding-oriented classification review mechanism that matches and adapts to the attributes of scientific issues, and divides scientific issues into "encourage exploration, Highlighting originality (attribute I); focusing on the frontier and pioneering new approaches (attribute I); demand traction and breaking through bottlenecks (attribute I); commonality orientation and cross-incorporation (attribute IV)" [9]. In 2021, the discipline of Economic Sciences adopted a randomized controlled trial method in some discipline codes to analyze the effect of the classification review pilot and found that classification review can effectively improve the consensus degree of peer review experts on original, cutting-edge and cross-category projects [10]. In 2022, the Department of Management Science will extend the classification review to all general projects of the economic science discipline and the Youth Science Fund project, and re-test the implementation effect of the clear funding-oriented classification review mechanism.

Table 2 Wilcoxon rank-sum test

Statistics		Total Score	Overview	funding advice	Number of samples
Youth Science Fund Project	Z value p-value	0. 162 0. 872	0. 156 0. 876	0. 365 0. 715	141
surface project	Z value p-value	1. 357 0. 175	1. 362 0. 173	1. 315 0. 188	81

In recent years, the number of applications for general projects, youth science fund projects and regional science fund projects of the discipline of economic science has stabilized at around 3,000.

From 2019 to 2022, Attribute I and Attribute I will dominate the general projects, youth science fund projects and regional science fund projects of the economic science discipline, accounting for about 70% and 20%. The proportions of attributes I and IV show a downward trend year by year.

2.1 Classified Review Scheme Design

In 2021, the discipline of economic science adopts the method of randomized controlled trials, and selects general projects and youth science fund projects of the three discipline codes of G0306 "International Economics and Trade", G0307 "Financial Economics", and G0311 "Agriculture and Forestry Economic Management" as the research objects. And distinguish the experimental group and the control group, and analyze the impact of the classification review mode based on the attributes of scientific problems on the review quality [10].

In 2022, the economic science discipline will carry out classification review based on the attributes of scientific problems in all discipline code surface projects and youth science fund projects. Concrete implementation scheme is as follows:

(1) In the process of assigning groups, the groups will be grouped according to the attributes of the four types of scientific problems I, I, I, and IV selected in the application form. For groups with more application projects grouped by scientific problem attributes, continue clustering and grouping according to the similarity of research topics; for groups with fewer application projects (less than or equal to 5 application projects) grouped by scientific problem attributes, select For application projects with attributes of scientific issues other than category I projects in the same subject code, the number of projects in different groups should be kept basically the same. In the end, the Youth Science Fund projects are divided into 65 groups in Attribute I, and there are 29 groups in total for Attribute I, Attribute I and Attribute IV projects; the Attribute I category of general projects is divided into 41 groups, and there are 16 groups in total for Attribute I, Attribute I and Attribute IV projects .

(2) For Attribute I and Attribute IV projects, senior scholars who are active in the academic frontline are given priority when assigning communication review experts.

(3) At the beginning of the communication review, send a letter of classification review pilot work, and inform the communication review experts in advance that the economic science discipline will comprehensively carry out the classification review pilot work in the peer review stage of G03 economic science discipline general projects and youth

science fund projects. Inform the review experts to review the application according to the criteria for dividing the attributes of four types of scientific problems.

2.2 Effect Analysis

In 2022, the discipline of economic science will comprehensively carry out classified review. On the one hand, compared with the situation in which the discipline of economic science has not fully carried out classified review in 2020, we can objectively observe the impact of different review modes on the attendance rate of projects with attributes of various scientific issues ; On the other hand, the attendance rate of the 2022 economic science discipline classification review can further verify the results of the 2021 randomized controlled trial-based economic science discipline classification review pilot effect analysis, and obtain a more robust classification review effect conclusion.

Table 3 counts the attendance rate of each scientific problem attribute project in the economic science discipline that will fully carry out classification review in 2022, and the attendance rate of the three discipline code experimental groups and control groups that participated in the randomized controlled trial in 2021 and the meeting rate that will not be fully developed in 2020. The results of the attendance rate of the classification review.

The following findings can be obtained from Table 3:

(1) Categorized review is conducive to the formation of consensus among review experts, and increases the attendance rate of Attribute I, Attribute I, and Attribute IV projects. Since 2022 will comprehensively carry out the classification and review of scientific issues by attribute, the participation rates of Attribute I and Attribute I projects in the General Program of Economic Sciences and the Youth Science Fund Project are 1.83% and 1.86% higher than the overall participation rate, and Attribute IV projects are 1.83% higher than the overall rate. The pass rate of the project is lower than the overall project pass rate of 1.80%. In 2020, when the attribute classification review of scientific issues is not implemented, the acceptance rate of attribute I and attribute IV projects is 1.23% and 5.34% lower than the overall acceptance rate, while the attribute I category is 1.71% higher than the overall acceptance rate.

What needs to be emphasized is that, for attribute I projects, the attendance rate of the experimental group of randomized controlled trials in 2021 is only 14.29%, which is lower than the overall attendance rate of the experimental group projects. However, after a comprehensive classification review, in 2022, the participation rate of category I projects exceeds the overall participation rate of the project.

For Attribute IV projects, in the controlled experiment in 2021, the effect of classification review is very significant, the attendance rate of the experimental group is 15% higher than that of the control group, and higher than the overall attendance rate of the experimental group. When the classification review is fully extended to all disciplines in 2022, the attendance rate of Attribute IV projects is slightly lower than the overall participation rate, but the situation is much better than that in 2020 when no classification review is carried out. This phenomenon may be mainly caused by the selection of three subject directions for pilot projects in 2021.

Table 3 The attendance rate statistics of the four types of projects

			attribute I	attribute I I	attribute I	Attribute IV	total
2022 Year	Carry out comprehensive classification review (general projects, youth science fund projects)	Total number of applications (items)	70	592	1928	121	2711
		Number of meetings (items)	17	144	423	25	609
		Attendance rate (%)	24. 29%	24. 32%	21. 94%	20. 66%	22. 46%
2021 Year	test group	total number of applications)	35	104	392	48	579
		Number of meetings (items)	5	26	86	12	129
		Attendance rate (%)	14. 29%	25. 00%	21. 94%	25. 00%	22. 28%
	control group	Total number of applications (items)	6	103	392	30	531
		Number of meetings (items)	1	twenty one	86	3	111
		Attendance rate (%)	16. 67%	20. 39%	21. 94%	10. 00%	20. 90%
2020 Year	Classification review has not been carried out (general projects, youth science fund projects)	Total number of applications (items)	163	581	1640	280	2664
		Number of meetings (items)	30	124	329	40	523
		Attendance rate (%)	18. 40%	21. 34%	20. 06%	14. 29%	19. 63%

(2) Classification review narrows the difference in attendance rate between Attribute I, Attribute I, Attribute IV projects and Attribute I projects. In 2020, the meeting rate of attribute I projects is 0.43% higher than the overall meeting rate, and in 2021, the meeting rate of attribute I projects in the control group is 1.04% higher than the overall meeting rate; on the contrary, the attribute I projects of the experimental group are meeting The meeting rate is lower than the overall meeting rate of 0.34%, and the meeting rate of attribute I projects in 2022 is lower than the overall meeting rate of 0.52%.

3. MAIN CONCLUSIONS AND IMPLICATIONS

3.1 MAIN CONCLUSIONS

(1) AI assignment improves the work efficiency of the Science Fund review organization, especially in the selection of matching review experts. The pilot results of the economic science discipline show that the "small peers" communication review experts assigned and selected by artificial intelligence have improved the consensus of the project, which in turn has greatly increased the project participation rate.

(2) The t test and Wilcoxon rank-sum test showed that AI assignment had no significant systematic effect on the overall review score, ensuring that AI assignment had no effect on the scientific nature of the review work. At the same time, this comparative analysis is limited to the single discipline of international economics and trade, and the specific effect of AI assignment needs to be further verified by expanding the scope of the pilot.

(3) The statistical analysis data of the comprehensive classification review in 2022 will be verified again. The classification review will prompt the review experts to form a consensus on the projects of attribute I, attribute I and attribute IV, and no longer use "one ruler" to measure all projects. It is beneficial to eliminate the difference in attendance rate between attribute I, attribute I and attribute IV projects and attribute I projects. The effect of classification review based on the attributes of scientific issues is obvious, and the academic community has initially formed a consensus on writing project applications and reviewing applications based on the attributes of scientific issues.

3.2 Research Implications

(1) Combining the pilot practice and the feedback from the review experts, the relevant working mechanism needs to be further improved in the future. For example, the assignment of artificial intelligence is based on the research and judgment given by historical knowledge, which poses certain challenges to the review of Attribute I and Attribute IV projects. How to ensure the germination of academic innovations and the diversification of academic ecology needs further discussion.

(2) The classification review work still needs to be further explored, including the application, review, conclusion, and post-evaluation of projects with different classification attributes, and different links should be designed differently, so as to better guide scientists to clarify the direction of funding and better design And carry out research tasks, and help scientists condense scientific problems based on the attributes of scientific problems through perfect mechanism design.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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