

A Dynamic Modeling Framework for Assessing the Impact of Generative AI on Occupational Evolution and Curriculum Adaptation

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Abstract

The rapid development of generative artificial intelligence Gen-AI can replace practitioners to complete a large number of repetitive cognitive work, can also help improve decision-making efficiency, and can also build a new model of human and AI collaboration, from multiple dimensions to the existing professional system to bring changes. This article wants to clarify the various effects of this technology, and specially built a dynamic model that reflects the correspondence between career change and higher education adjustment. This article from the O*NET database to collect relevant data, combined with the Dutch occupation code, entropy weight calculation method and K-means clustering algorithm, screened out a number of representative occupations, including bioinformatics, film and video editing, as well as telecommunications line installers and maintenance personnel, just to correspond to the science and technology, art and skills practice of the three different career directions. This paper uses the Bass diffusion model to simulate the penetration process of Gen-AI in different industries, and also uses the Evolution-Vector-Dynamics model to disassemble labor processes into four different types: conventional tasks, cognitive tasks, physical tasks, and sudden-like tasks. From the final calculation results, the market demand for science and technology occupations will follow up, art occupations may face relatively large structural substitution pressure, skills practice occupations will basically remain stable, because a large number of physical operations in this type of occupation can not be replaced by technology for the time being. Combined with the conclusions of these studies, this paper proposes that the existing skills training direction can be adjusted to add artificial intelligence verification, algorithm audit, intellectual property-related training, and AI-assisted infrastructure operations to the training system. This research framework built in this paper has a relatively strong practicality, which can be used to evaluate the career changes brought about by the development of artificial intelligence, and can also provide a clear direction reference for subsequent course adjustments.

Keywords

Generative AI, occupational transformation, labor demand, Bass diffusion model, higher education, curriculum reform.

1. Introduction

This paper found that the development speed of generative artificial intelligence has long exceeded the development level of traditional automation, and has gradually entered various industries that originally relied mainly on human intelligence, creativity and expert professional opinions . Now the common large-scale language model and multi-modal generation system can provide programming assistance to users in the actual application

scenario,[1] help complete the daily information search work, support the generation of various text content, and complete different styles of image creation, and provide corresponding support for various decision-making scenarios. This technological breakthrough and the expansion of practical applications have also triggered relevant discussions in academia and industry, and everyone is discussing whether the follow-up of artificial intelligence will take over the existing human work on a large scale, or will give birth to more new career directions that have not appeared before .[2]

The impact of Gen-AI is clear. In science, technology, engineering, and mathematics, which are STEM-related fields, Gen-AI can speed up the types of work of coding, data processing, and information collection, but when using such tools, it also has to focus on content verification, system construction, and interdisciplinary knowledge integration. Falling into the work related to artistic creation, Gen-AI can reduce the cost of making commercial art works, which may cause the number of general-purpose jobs to be reduced, but in turn, the appreciation value of the work itself and the role of narrative has been improved. As for the technology industry, most of the main tasks of practitioners should be completed in the real actual scene, so it is not easy to be directly replaced by the direct operation of the digital AI system.[3]

The research done in this article mainly focuses on a core issue, that is, how to simulate the heterogeneous influence of Gen-AI on the occupational structure and higher education in a specific way that can be quantitative and easy to understand. We did not directly consider the changes in the overall employment trend, but first disassembled the daily work of various occupations into a specific task carrier, and then linked the micro-level task restructuring situation with the change of labor demand at the macro level, and the relevant research foundation can refer to the literature labeled . Our final analytical framework allows governments and educational institutions of all kinds to evaluate which skills need to be slowly reduced in investment,[4] which skills need to be maintained, and which skills need to be further enhanced in the resource tilt of cultivation, and the specific use instructions of the framework can be referenced to the content of the literature labeled .[5]

The key contributions of this paper are displayed as follows:

- 1) The framework set up in this paper refers to the O*NET index, as well as the Dutch code model, entropy weight technology and K-means clustering four commonly used analytical tools, for the fields of science, technology, engineering, mathematics, as well as the common typical occupations in the art direction and skilled technology industry, have done the corresponding classification combing work.
- 2) The E-V-D model proposed in this paper is related to the penetration of Gen-AI, and also includes the relevant content of task rearing, while adding the relevant dimension of efficiency adjustment, and also covering the actual factors of market demand and labor demand, in order to give a digital method that can be used to evaluate the evolution of the career process, so that relevant researchers can directly use it when doing career development analysis.
- 3) Combined with the previous forecast of the career transformation direction, this paper collated the three areas of STEM, art and technology trade education adjustment specific measures, we also put the artificial intelligence verification related content, intellectual property rights training arrangements, as well as relying on artificial intelligence to build technical ability training module these specific content, are put into these adjustment measures.

2. Methods

In order to investigate the actual impact of Gen-AI on various types of work, this paper has established a complete modeling method that integrates the content of work selection, technology dissemination, changes in task arrangements, and changes in labor demand. The entire modeling process is mainly divided into four large stages. In the first stage, this paper

refers to the O*NET standard and clustering technology to select some representative typical jobs from science, technology, engineering, mathematics, art and various types of skilled work. In the second stage, this paper uses the Bass diffusion model to describe the propagation of Gen-AI in different work scenarios.[6] In the third stage, this paper builds a model that presents the practical role of Gen-AI in conventional tasks, cognitive tasks, physical tasks, and creative tasks. In the final stage, this article combines the improvement of mission efficiency and market expansion, as well as other kinds of constraints, to simulate changes in labor demand.

2.1. Occupational Selection Framework

In the first phase of this research, this paper will first select a representative typical occupation from the fields of STEM, art and technology trade. Throughout the selection process, this article mainly takes the O*NET occupation index as the core source of information acquisition, and the relevant career basic information is extracted from here. This paper uses the Dutch Code to sort out the interest structure of different occupations, and to refer to the relevant content of the work area to mark the actual requirements for training and education corresponding to the occupation.[7] When selecting a career, you will first refer to the core professional characteristics of each occupation for preliminary screening, and after the screening is completed, it will show the three different ability dimensions of logic, emotion, and operation to match these professions.[8]

When dealing with each capability index, this paper will first calculate the product of the importance score and the level score, take this product as the corresponding total strength value, and we will check the value of each step repeatedly during the calculation process to avoid unnecessary calculation errors. Next, this article will use the entropy weight method, starting from two different directions of logic and emotion, assigning the corresponding objective weight to each indicator, and we will adjust the calculation range of the weights in the distribution process to ensure that the results will not deviate from the attributes of the index itself. In the processing of the operation dimension, this paper will use the two methods of principal component analysis and K-means clustering, first gradually eliminate the multi-collinearity problem in the data, and then further determine the more representative clustering center, the whole process we will also compare the cluster effect under different parameters, and select the most suitable result as the final clustering center.

Table 1. Representative occupations selected for analysis

Category	Representative occupation
STEM	Bioinformatics scientists
Arts	Film and video editors
Skilled trade	Telecommunications line installers and repairers
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STEM	Bioinformatics scientists
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2.2. Bass Diffusion Model

This article wants to explain the spread of Gen-AI in different occupations, specifically chose the Bass diffusion model to do the relevant analysis, reference is marked as related research content,[9] here first set the $G(t)$ symbol, to represent the specific penetration value of Gen-AI at a certain point in time t . The whole process of diffusion can be defined in the following ways:

$$dG/dt = (p + qG)(1-G) \quad (1)$$

This article first explains the definition of two coefficients, p represents the innovation coefficient, and q represents the imitation coefficient. If the value of p is larger, it means that the trend of active adoption of related things will be greater, and if the value of q is larger, it means that the imitation pressure in the industry will be higher, and this correspondence has been verified in previous research . In this research work,[10] we have classified different subject areas according to the adoption speed, STEM fields are assigned to the group of moderate adopters, art disciplines are classified into the rapid adoption group, and the fields related to technology trade are classified into the group of slow adopters.

Table 2. Bass diffusion parameters for three occupational categories

Parameter	STEM	Arts	Skilled trade
p	0.00075	0.00125	0.00025
q	0.075	0.150	0.0375

2.3. Task Structure Evolution Model

This article wants to use data to visualize the specific situation of occupational reorganization, and to describe each individual occupation with a corresponding human working hour vector, which contains a total of four components, namely, regular tasks, cognitive tasks, physical tasks and new tasks.[11] The specific definition of the vector is as follows:

$$\tau(t) = [\tau_{routine}(t), \tau_{cognitive}(t), \tau_{physical}(t), \tau_{new}(t)]^T \quad (2)$$

As the use of Gen-AI continues to rise in all walks of life, the proportion of many routine repetitive work we do every day is slowly getting lower, and the quality of cognitive work that needs to be put into more energy has improved, but this kind of work has not completely disappeared from everyone's work content. Those who need people to operate in the field of physical work overall state is relatively stable, the work process needs to do content verification, cross-departmental coordination, copyright control, project rapid construction and AI output content verification these links have to be followed up, many of these links related to the new jobs also slowly appear.

The evolution of each component is described as follows:

$$\tau_{routine}(t) = \tau_{r0} \exp[-\alpha G(t)] \quad (3)$$

$$\tau_{cognitive}(t) = \tau_{c0} / [1 + \beta G(t)] \quad (4)$$

$$\tau_{physical}(t) \approx \tau_{p0} \quad (5)$$

$$\tau_{new}(t) = \gamma G(t)^2 \quad (6)$$

Table 3. Initial task-vector values

Occupation	Routine	Cognitive	Physical
Bioinformatics scientists	0.23	0.47	0.30
Film and video editors	0.22	0.42	0.36
Telecommunications line installers and repairers	0.19	0.31	0.51

2.4. Labor Demand Dynamics

The total human hours needed for one unit of output is the sum of the four task parts:

$$H(t) = \tau_{\text{routine}}(t) + \tau_{\text{cognitive}}(t) + \tau_{\text{physical}}(t) + \tau_{\text{new}}(t) \quad (7)$$

In addition to being affected by efficiency, labor demand is also affected by market expansion and various external constraints. So when building this model,[12] this paper specifically adds the corresponding labor demand equation, which contains fluctuating market constraints, as well as the spillover effect of infrastructure, and the key elements of negative externalities[13]. After we have passed the derivation and calculation of various variables, we finally determined the specific calculation formula for labor demand as:

$$L(t) = D(t)H(t) \quad (8)$$

The content mentioned next in this article describes a very critical process of real change, if the productivity is increased, the final result is to expand the actual demand of the entire market, rather than directly compressing the working hours of existing workers[14], the probability of the increase in the employment of the whole market, if the replacement effect in the production process slowly occupies the dominant position, the market demand can not be expanded enough, the number of employment may be reduced[15].

3. Results and Discussion

This article introduces the model results obtained by this study in this section, and also explains one by one the different effects of Gen-AI on STEM, art, and skilled trade. Our discussion mainly revolves around several directions, first, the results of the career choices of different groups, the proliferation trend of artificial intelligence generation, and the task rearing of positions in various industries, as well as the changes in demand in the labor market, and finally talk about the relevant impact these changes will have on the existing education reform.

3.1. Occupational Selection Results

The career selection framework reference in this paper is divided into three different occupational categories. Bioinformatics scientists fall into the STEM category, and their daily work needs to integrate bioinformatics, programming, statistical analysis, and scientific interpretation, so it is reasonable to be divided into this category. Film and video editing belong to the art professional group, and their entire work process is mostly based on digital technology, and the video generation, image production of these contents of the relevance is very high, classified as art professional groups meet the criteria of division. Telecommunications line installers and repairers are classified into the category of skilled industries, and the main tasks they usually have to complete are climbing high, line laying, fault diagnosis and physical structure maintenance, and the characteristics of skilled industries are exactly matched.

3.2. Gen-AI Penetration Across Careers

The relevant conclusions of the Bass diffusion model show that Gen-AI is the fastest in all industries in the popularity of art-related occupations, and the threshold for art practitioners to contact and use such tools in their daily work is relatively low. As long as the creative tools are open to the market for ordinary users, they have the characteristics of being easily copied and disseminated quickly, and they do not need to be adapted to be directly put into the creation of scenes. The diffusion curve of STEM-related occupations is at a medium level, and

the popularity of such tools will be significantly limited by the practical efficiency requirements of research and practical projects, and many scenarios need to be adjusted in combination with specific research needs. The diffusion rate of skilled trade occupations is relatively low, and the development of such work is highly dependent on specific professional equipment, strict safety operation regulations, fixed project construction cycles, and a large number of practical operations that need to be completed on site, and it is difficult to directly apply Gen-AI tools to replace the existing workflow.

3.3. Task Restructuring Patterns

This paper organizes the current development of STEM fields and finds that the frequency of manual coding and formatting is slowly decreasing in the daily work of researchers, but the cognitive understanding of relevant content by practitioners is still of great significance in actual work. Now the direction of bioinformatics scientists, the daily work tasks are also different from the previous, no longer need to develop from scratch all the programs used, more is to do a good job of organizing and organizing different research programs, but also to do the correctness of the AI output results, and finally the results of the corresponding biological meaning. Now there are some new jobs that were not previously found, such as those that specifically identify the illusion of AI[16], and those that are specifically evaluating the reasonableness of various calculations, and these positions are becoming more and more important in the entire scientific research process.

When discussing the relevant content of the art profession, this article proposes to make a new type of restructuring plan that conforms to the current development trend of the industry. Regular content editing, rough cutting of materials, subtitle file generation, and visual effects based on the adjustment of such repetitive tasks can be completed with Gen-AI, which can greatly reduce the time it takes to do this work. Expertise will not lose its value because of the use of AI tools, let alone disappear completely[17] The importance of human play in the work has slowly turned to the adjustment of narrative structure, the aesthetic evaluation of content, the unification of the brand style of the entire project[18], the copyright protection of the work, and the selection of the most suitable content from the various options generated by AI.

For trade occupations that have accumulated enough experience, physical labor is still the main component of daily work, and there has not been much change since so long. After combing through the actual operation of the relevant industries, this article found that the use of Gen-AI can indeed help practitioners save time on manual operation work, daily scheduling, written documentation, and equipment failure to troubleshoot these things, but it is completely unable to replace those that need to be completed on the site of the complex installation work, and can not directly handle all kinds of maintenance work that needs to be performed. Combined with this, the future of technology practitioners can actually be defined as craftsmen who use digital tools to improve their working ability, and there is no need to worry about becoming ordinary workers replaced by AI.

3.4. Labor Demand Evolution

The models studied in this paper have a total of three completely different career paths, each corresponding to the growth direction of practitioners with different abilities. In STEM-related careers, the number of research projects continues to increase, the coverage of drug testing work continues to expand, the demand for data analysis is increasing year by year, and the practical application scenarios of various system combinations are becoming more and more abundant. The operating logic behind this phenomenon and the mechanism mentioned by Jevons are very similar, the efficiency improvement of production or service links will directly cause the cost of unit output to be reduced, under the influence of price advantage, the overall market demand corresponding to related products or services is also likely to be significantly expanded.

This article mainly focuses on various alternative problems encountered by the art industry at this stage. Now a lot of production-related work is basically done by computers, the commercial content produced in various fields has almost reached a state of saturation, and even if the efficiency is raised, it is difficult to cause the corresponding demand to grow simultaneously. As this continues to develop, the number of middle- and lower-level editorial positions is likely to decrease, and the importance of high-level creative leadership positions will become much higher than before.

This paper found that the development of mature trade-related occupations has formed a very stable employment area at this stage. The actual demand of the relevant labor force in the entire trade industry will be mainly affected by the local physical infrastructure construction, the overall economic development speed, the normal replacement cycle of industry personnel, and the new demand brought about by the expansion of data centers and communication networks. The gradual application of artificial intelligence technology may provide more support for relevant decision-making, but it seems impossible to achieve a complete reduction in the industry's basic demand for practical basic skills in a short period of time.

4. Conclusion and Future Work

This paper proposes an analytical model that can change over time around the different effects of Gen-AI on occupational changes and higher education adjustments. This model integrates the research content related to career selection, the Bass diffusion model, the task vector analysis method, and the law of change in labor market demand, which can clearly explain why Gen-AI has a completely different impact on different occupations, some occupations will be broadened, some occupations will be completely modified, and those jobs that are biased towards physical operations will be affected relatively small, and the overall state will remain relatively stable.

The results of this paper can be seen in the research results, and now the continuous development of artificial intelligence technology can not only effectively improve the production efficiency of various industries, but also give birth to a lot of new research activities, and science, technology, engineering, mathematics related to bioinformatics related occupations, the subsequent market demand probability will rise significantly. Movies and video editing such a profession, the next is likely to encounter a structural replacement situation, after all, now a lot of repetitive creative work, has already achieved a high degree of digitalization. Telecommunications line installation and maintenance of such related occupations, the development seems to be relatively stable, the core tasks of this kind of work need to rely on actual physical operations to complete, but also by the local infrastructure construction constraints, not easy to be directly replaced by technology.

The next research in this article can also be adjusted and optimized from several different directions. The first thing we need to do is to collect more information with a longer time span and specialize in different occupations, so as to obtain more accurate model parameters and make the results of subsequent calculations closer to the actual situation. Next, we can try to further expand the existing research framework so that it can contain more different occupational types and cover more different countries, and slowly build a complete artificial intelligence occupational risk chart to facilitate subsequent research calls. Finally, we can also try to use the employment statistics, industry wage data and different stages of curriculum data to verify the relationship between the spread of Gen-AI and the actual results of education reform.

References

- [1] Eloundou, T., Manning, S., Mishkin, P., & Rock, D. (2023). GPTs are GPTs: An early look at the labor market impact potential of large language models. arXiv Preprint arXiv:2303.10130. <https://doi.org/10.48550/arXiv.2303.10130>
- [2] Moravec, H. (1988). *Mind children: The future of robot and human intelligence*. Harvard University Press.
- [3] Nye, C. D., Su, R., Rounds, J., & Drasgow, F. (2012). Vocational interests and performance: A quantitative summary of over 60 years of research. *Perspectives on Psychological Science*, 7(4), 384–403.
- [4] Bass, F. M. (1969). A new product growth for model consumer durables. *Management Science*, 15(5), 215–227.
- [5] Peng, S., Kalliamvakou, E., Cihon, P., & Demirer, M. (2023). The impact of AI on developer productivity: Evidence from GitHub Copilot. arXiv Preprint arXiv:2302.06590. <https://doi.org/10.48550/arXiv.2302.06590>
- [6] Pfeiffer Consulting. (2023). *Adobe generative AI: Redefining productivity in creative imaging [Report]*. Pfeiffer Consulting.
- [7] Brynjolfsson, E., Li, D., & Raymond, L. (2025). Generative AI at work. *The Quarterly Journal of Economics*, 140(2), 889–942.
- [8] Dell'Acqua, F., McFowland, E., Mollick, E. R., et al. (2023). Navigating the jagged technological frontier: Field experimental evidence of the effects of AI on knowledge worker productivity and quality [Working paper]. Harvard Business School.
- [9] Adobe & Econsultancy. (2024). *2024 digital trends: Asia Pacific and Japan*. Adobe.
- [10] Ericsson. (2021). *AI: Enhancing customer experience in a complex 5G world [Report]*. Ericsson Mobility Report.
- [11] Acemoglu, D., & Restrepo, P. (2019). Artificial intelligence, automation, and work. In A. Goldfarb, A. G. Teodoridis, & J. Tucker (Eds.), *The economics of artificial intelligence*. University of Chicago Press.
- [12] Autor, D. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, 29(3), 3–30.
- [13] Felten, E. W., Raj, M., & Seamans, R. (2021). Occupational, industry, and geographic exposure to artificial intelligence: A novel dataset and its potential uses. *Strategic Management Journal*, 42(12), 2195–2217.
- [14] Webb, M. (2020). The impact of artificial intelligence on the labor market. *SSRN Electronic Journal*.
- [15] Bessen, J. E. (2018). *AI and jobs: The role of demand [Working paper]*. NBER.
- [16] Frank, M. R., Autor, D., Bessen, J. E., et al. (2019). Toward understanding the impact of artificial intelligence on labor. *Proceedings of the National Academy of Sciences*, 116(14), 6531–6539.
- [17] World Economic Forum. (2023). *The future of jobs report 2023*. World Economic Forum.
- [18] U.S. Department of Labor. (n.d.). *Occupational Information Network (ONET) Database*. National Center for ONET Development.