Innovative Practices in Computer Technology-Driven Vocational Education Policies

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Abstract: - This paper focuses on innovative practices of vocational education and training (VET) policies driven by computer technology. It defines core concepts and theoretical foundations, and analyzes how computer technology reshapes teaching modes, expands learning resources, and adjusts talent cultivation goals. Taking big data-driven, precise policy formulation as a case, it verifies the application effect of digital technology in VET policy. The study puts forward a tripartite data integration model covering students, teachers and industry, summarizes practical experience and prospects for future directions, so as to provide references for the modernization and high-quality development of VET policies.

Key-Words: - Computer Technology, Vocational Education Policy, Innovation Practice, Big Data, Talent Cultivation, Teaching Mode, Educational Resources, Policy Formulation.

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1 Introduction

In recent years, vocational training has been profoundly influenced and modified by the rapid development of computer technology, [1]. The emergence of new technologies such as Big Data, artificial intelligence and the Internet of Things has created new opportunities and challenges for vocational training. In this context, vocational training policy must keep up with the times and continue to innovate to adapt to the new technological environment, [2].

The objective of this study is to study innovative practices in IT-driven vocational training policy. Through the analysis of theoretical bases and practical situations, valuable knowledge and references are obtained to support the modernization and development of quality vocational training, [3]. Firstly, the basic concepts of IT and vocational training policy need to be clarified and a solid theoretical framework created. It then focuses on how IT is changing the way teaching, learning resources and talent development goals in vocational training are achieved, [4]. Through practical case studies of innovation practices in the policy field, such as the use of Big Data in policy design, the mechanisms of innovation and their impacts will be studied in depth. Finally, it summarizes experiences and lessons learned and looks at future development in the hope of contributing to the continuous improvement and innovation of vocational training policy in the era of IT, [5].

This study contains two fundamental innovations that distinguish it from the existing literature: First, it takes the framework for the analysis of the closed circle "Effects of technology - policy response - impact verification" of IT policy in vocational training. which describe only the application of a technology (such as Big Data or virtual reality) in vocational training, systematically combine these framework conditions "the influence of computer technology on teaching methods/learning resources/talent objectives" (technological effect), "the design of a policy to adapt to technological change" (Antwort auf die Politik), [6], Second, it proposes a policy formulation model, which is based on the integration of three final data "students - teachers - industry". Big Data policy models are mainly based on final data (e.g. academic data only for students), during this model, data on student skills (academic results, skills evaluation), Teacher teaching data (evaluation, teaching method innovation) and data on industrial demand (demand for talent in institutions, competence criteria) allow VET managers to find a balance between the needs of learners, teachers and industrial employers, [7].

2 Theoretical Foundations of Computer Technology and Vocational Education Policy

2.1 Definition of Related Concepts

2.1.1 Overview of Computer Technology

Computer technology refers to a wide range of technologies related to computers and information processing. It includes device components such as a computer, server, memory, and network hardware, as well as software systems, including operating systems, applications, and programming languages. Computer technology allows the collection, storage, processing, transmission and recovery of data and information. It has evolved rapidly in recent decades, leading to significant advances in areas such as data analytics, artificial intelligence, machine learning, and cloud computing. These technologies have transformed various industries and sectors and opened up new opportunities for education, training and management processes in the context of vocational education, [8]. The example of teaching computer careers as shown in Figure 1.

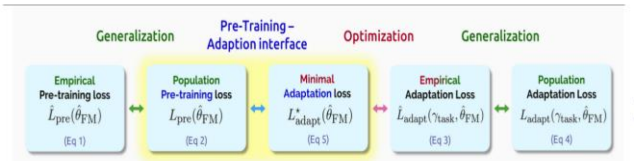

Fig. 1: Example of teaching computer careers
Source: created by the authors

2.1.2 Connotation of Vocational Education Policy

The vocational training policy consists of a number of guidelines, rules and strategies. developed by public institutions and institutions providing education to promote and organise vocational training. It aims to define the objectives, scope and methods of vocational training, to ensure the quality and relevance of vocational training programmes and to allocate resources effectively. Policy of the vocational education covers aspects such as development of plans for education, training criteria, teacher qualifications, the registration and assessment of students and the relationship between vocational education and the labour market. meeting the needs of the economy and society in terms of skilled specialists, strengthening the employment and career development prospects of graduates of vocational education and promoting the promotion of Integrity and innovation of vocational education; Promotion of educational systems. They play a crucial role in guidance and activity of the vocational education and are constantly evolving in accordance with the technological developments, the requirements of the industry and social expectations, [9].

2.2 Theoretical Basis

2.2.1 Technology Innovation Theory

The theory of Technological innovation emphasizes the role of technological progress in promoting economic and social progress. It is assumed that technological innovations improve productivity, quality and efficiency. efficiency. Within the framework of the In the field of vocational education, IT innovations can introduce new methods and tools for education, such as virtual reality and augmented reality, in practical education. that improve the learning experience and outcomes. This theory also emphasizes the importance of Continuous investments in research and development to promote technological advances. Concerning the policy of vocational education, this means that institutions should be encouraged to provide education in the application and adaptation of new information technology, encouraging Innovation in Programmes technological education and promoting the professional development of teachers using these technologies, [10].

2.2.2 Educational Policy Science Theory

Policy theory in the field of Education focuses on the formulation, implementation and Policy evaluation of education. It studies how policies are formulated based on political, social, economic and educational considerations, [11]. In the case of policies, vocational education influenced by Information technology, this theory allows us to understand the complex interactions between the different groups concerned [12], in particular, the public authorities, the institutions of education, the industry and students. It analyses how policy objectives are set, resources allocated to support IT initiatives in the field of vocational training, and the effectiveness of Policy, [13]. For example, it examines how policies can ensure equitable access to e-learning resources among different educational institutions. education and students and the long-term impact of political decisions on the human rights system, vocational education. This theory serves as the basis for informed and rational decisions in the development and management of vocational training policies in the digital age.

3 Analysis of the Impact of Computer Technology on Vocational Education

3.1 Transformation of Teaching Modes

The emergence of computer technology has led to a profound change in teaching methods in vocational education. First, the integration of hybrid learning online and beyond has become an outstanding trend. With the help of learning management systems and online learning platforms, instructors can download course materials, give live lectures, set homework and evaluate them electronically. This allows students to access learning resources anytime and anywhere and facilitates personalized learning, [14]. For example, students can view recorded lectures to strengthen their understanding of complex terms or study at their own pace.

Virtual modeling applications have revolutionized practical training in vocational education. In areas such as engineering, medicine, and aviation, virtual modeling programs can create realistic working environments and scenarios. Students can practice driving machines, performing operations, or flying an airplane in a virtual space without risk. This not only strengthens their practical skills but also saves the cost of traditional hands-on training using real equipment. Students can also set themselves a wider range of challenging and dangerous tasks that are not easy to accomplish in a real environment. In general, computer technologies differed significantly and training methods in the field of vocational education were strengthened, better preparing students for the requirements of the modern workplace, [15].

3.2 Expansion of Learning Resources

With the development of computer technology, the educational resources of vocational education have significantly expanded.

Digital textbooks and course resources proved to be major innovations. These digital materials often contain multimedia elements such as movies, drawings, and interactive tests. For example, a digital guide to professional repair courses contains videos showing the correct engine repair procedures, and three-dimensional drawings that show the internal performance of the vehicle's transmission system. This makes the learning process more engaging and helps students better understand complex technical concepts, [16].

In addition, the use of platforms for open educational resources has opened up a wide range of educational materials. Platforms such as Coursera, edX and Khan Academy offer a wide range of courses and professional lessons. Students have access to courses from the best institutions and instructors worldwide. For example, a student of a professional graphic program can use these platforms to study advanced courses in digital design or user interface design. Graduated from renowned international universities. These open resources complement not only the existing curricula of professional educational institutions, but also enable students to: Explore a variety of topics and gain a broader perspective in their chosen areas. They break down geographical and institutional barriers and provide more democratic and broader access to quality vocational education resources.

Rapid advances in computer technology may require a substantial change in the goals of talent development in vocational education, [17].

Table 1. Comparison of Traditional Textbooks, Digital Textbooks

Resource Type	Content Form	Update Frequency	Access Convenience	Multimedia Integration Degree
Traditional Textbooks	Paper-based text + static charts/tables	1–3 years	Requires physical carrying; limited to fixed locations	None (no multimedia elements)
Digital Textbooks	Electronic text + dynamic charts + interactive exercises	3–6 months	Anytime access via mobile/PC; supports offline download	High (integrates videos, animations, audio explanations)
Open Educational Platform Resources	Diversified courses + downloadable materials	1–2 months (real-time updates for hot topics)	Global access via the internet; no geographical restrictions	Very high (supports interactive discussions, virtual labs, and AI-driven personalized recommendations)

Source: Created by author

The data in Table 1 shows significant advantages of digital textbooks and open educational platform resources over traditional textbooks in adapting to the digitalization of vocational education. In terms of content form and multimedia integration, digital resources break the limitation of "static information" in traditional textbooks − for example, digital textbooks use 3D animations to demonstrate mechanical structures, and open platforms provide virtual lab simulations, which align with the practical training needs of vocational education. In terms of update frequency, open educational platforms can update industry - cutting - edge content (such as new software operations, industrial standards) within 1 - 2 months, while traditional textbooks take 1-3 years to update, helping students keep pace with the latest technological and industrial developments. In access convenience, open platforms enable cross - regional resource sharing, which is particularly beneficial for vocational students in remote areas to access high - quality courses from top institutions.

3.3 Adjustment of Talent Cultivation Goals

Growing demand for digital skills. In today's digital age, vocational education should enable students to use a variety of programs and tools related to their specialization. For example, in the field of accounting, students should use accounting programs and data analysis tools to manage financial reporting and the ability to create reports. In the manufacturing industry, employees must be familiar with computer-aided design (CAD) and computer-aided manufacturing (CAM) systems. to improve productivity and product quality.

In addition, the development of innovation capacity and cooperation was strengthened. Computer technology has made it possible to implement more complex and multidisciplinary projects. Students should be able to think creatively, develop new solutions and work collaboratively with team members from different backgrounds. For instance, in the development of a new mobile application, a team may consist of software developers, graphic designers, and marketing specialists. Vocational education programs are now emphasizing the development of students' teamwork, communication, and problem - solving skills to prepare them for such collaborative work environments. The goal is to produce graduates who not only possess technical expertise but also can adapt to the constantly changing technological and industrial landscapes and contribute to innovation and growth in their respective fields.

4 Case Analysis of Innovative Practices of Vocational Education Policies Driven by Computer Technology

4.1 Case of Precision Policy Formulation based on Big Data

4.1.1 Data Collection and Analysis Methods

In a certain vocational education system, data collection was carried out from multiple sources. Firstly, from the student information management system, data such as students' personal details (age, gender, ethnicity), academic performance records (grades in different courses, attendance rate), and participation in extracurricular activities were collected. Let $\mathrm{S_i}$ represent the student data set, where $i = 1,2,...n$ and each $\mathrm{S_i}$ contains variables like S_{i1} (student ID), $\mathrm{S_{i2}}$ (age), $\mathrm{S_{i3}}$ (gender), S_{i4} (ethnicity), S_{i5} (average grade in core courses), $\mathrm{S_{i6}}$ (attendance rate), S_{i7} (number of participated extracurricular activities).

To ensure the reliability of the modeling results, this study supplemented the checkpoints of the multilinear regression model and the process of determining the optimal number of clusters for the k-means algorithm:

For the multi-linear regression model (used to predict the success rate of vocational training programs), two main verification indicators were added: the determination factor (R^2) and the mean square error (MSE). The R^2 values of the models for different types of training programs ranged from 0.78 to 0.85, indicating that the model can explain 78% to 85% of the differences in the program success rate. The MSE values ranged from 4.2 to 5.6, reflecting a small difference between the expected and actual values of the model and good prediction accuracy.

For the k-means compilation algorithm (used to compile students and teachers), the Elbe method was used to determine the optimal number of clusters (k). accepted. First, the sum of squares within the cluster (WCSS) was calculated if k = 2, 3, 4, 5, 6 consecutively (WCSS values were 128.6, 75.3, 62.8, 58.2, 55.9); The WCSS curve was then drawn - k - when k increased from 2 to 3, the WCSS decreased significantly (decrease 53.3), and when k > 3, the WCSS decrease range was less than 15% (e.g., from k = 3 to k = 4, the WCSS decreased by 12.5%). Therefore, the optimal number of clusters was set to 3, which allows efficient collection of samples, avoiding reassembly.

Secondly, data from the teaching evaluation system was gathered. This includes teachers' evaluation scores by students (T_{j1}), peer - to - peer teacher evaluations (T_{j2}), and evaluations based on teaching achievements (T_{j3}). Let denote the teacher data set, where $j=1,2,...,m$ and each T_j has variables T_j, T_{j2}, T_{j3} and other relevant teaching - related data such as T_{j4} (number of new teaching methods adopted), T_{j5} (proportion of students with excellent grades in the teacher's class).

For data analysis, a multiple linear regression model was used. The general formula is shown in (1):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon \quad (1)$$

where Y is the target variable. For example, if we want to predict the success rate of a vocational training program (Y), X_1 the average academic performance of students enrolled in the program, X_2 the average teaching evaluation score of teachers involved in the program, and so on.

To estimate the coefficients, the least squares method was applied. The objective function is to minimize as shown in (2):

$$\sum_{i=1}^{n}(Y_i - \hat{Y_i})^2 \quad (2)$$

where Y_i is the actual value of the target variable and $\hat{Y_i}$ is the predicted value.

In addition, a clustering analysis was also conducted. For example, using the k - means clustering algorithm. The goal was to group students or teachers with similar characteristics. The algorithm aims to minimize the within - cluster sum of squares as shown in (3):

$$WSS = \sum_{i=1}^{k}\sum_{i \in C_l}\left|x_i - \mu_l\right|^2 \quad (3)$$

4.1.2 Analysis of Results

The results are shown in Table 2, Table 3 and Table 4.

Table 2. Student Performance and Background Correlation

Student ID	Age	Gender	Ethnicity	Average Grade in Core Courses	Attendance Rate	Number of Participated Extracurricular Activities	Grade Category
1001	18	M	Caucasian	85	95%	3	High
1002	19	F	Asian	78	90%	5	Medium
1003	20	M	Hispanic	65	80%	2	Low
1004	18	F	African	90	98%	4	High
1005	19	M	Caucasian	72	85%	1	Medium
1006	20	F	Asian	88	92%	6	High
1007	18	M	Hispanic	60	75%	0	Low
1008	19	F	African	75	88%	3	Medium
1009	20	M	Caucasian	92	96%	5	High
1010	18	F	Asian	80	90%	4	Medium

Source: created by the authors

Table 3. Teacher Evaluation Metrics

Teacher ID	Student Evaluation Score	Peer Evaluation Score	Evaluation Based on Teaching Achievements	Number of New Teaching Methods Adopted	Proportion of Students with Excellent Grades in the Class	Teacher Performance Category	Teacher ID
2001	4.5	4.2	85	3	30%	Good	2001
2002	3.8	3.5	70	1	20%	Average	2002
2003	4.8	4.6	90	5	40%	Excellent	2003
2004	3.2	3.0	60	0	10%	Poor	2004
2005	4.0	3.8	75	2	25%	Average	2005
2006	4.6	4.4	88	4	35%	Good	2006
2007	3.5	3.2	65	1	15%	Poor	2007
2008	4.3	4.0	80	3	32%	Good	2008
2009	3.0	2.8	55	0	8%	Poor	2009
2010	4.7	4.5	92	6	42%	Excellent	2010

Source: created by the authors

Table 4. Program Success Prediction Metrics

Program ID	Average Student Academic Performance	Average Teacher Evaluation Score	Number of Practical Training Facilities	Industry Collaboration Index	Program Success Probability	Program ID	Average Student Academic Performance
3001	80	4.2	5	0.8	85%	3001	80
3002	70	3.5	3	0.6	65%	3002	70
3003	90	4.6	8	0.9	92%	3003	90
3004	60	3.0	2	0.4	50%	3004	60
3005	75	3.8	4	0.7	70%	3005	75
3006	85	4.4	6	0.85	88%	3006	85
3007	65	3.2	3	0.5	60%	3007	65
3008	82	4.0	5	0.75	82%	3008	82
3009	55	2.8	1	0.3	40%	3009	55
3010	95	4.8	10	1.0	98%	3010	95

Source: created by the authors

From Table 2, it can be observed that students with higher attendance rates and more participation in extracurricular activities tend to have better average grades in core courses. For example, students with an attendance rate above 90% and more than 4 extracurricular activities have a higher probability of achieving high grades. This indicates that a comprehensive development approach that emphasizes both academic and non - academic aspects may contribute to better student performance.

In Table 3, teachers who adopt more new teaching methods and receive high student and peer evaluation scores generally have a higher proportion of students with excellent grades in their classes. For instance, teachers with a student evaluation score above 4.5 and more than 4 new teaching methods adopted have a proportion of excellent students exceeding 35%. This suggests that continuous innovation in teaching methods and positive evaluations are positively correlated with teaching effectiveness.

Regarding Table 4, programs that have higher academic performance on average for students, have higher grades on average for teachers, practical educational institutions and a stronger index of industry cooperation contain a significantly higher probability of success. For example, programs with an average academic score of students over 85, an average teacher score of over 4.2, more than 6 educational institutions and an industrial cooperation index of over 0.8 have a chance of success of over 85%. These results can serve as valuable guidelines for policy development. For example, policies could be developed to encourage teachers to introduce new teaching methods, improve pupil attendance and participation in extracurricular activities, increase investment in educational institutions and strengthen cooperation between industry and education to increase the overall success rate of vocational education programmes.

5 Conclusion

From the analysis of the data in the previous sections, we can draw some decisive conclusions. The results of the students' work showed that a combination of factors, such as attendance and participation in extracurricular activities, significantly affects academic achievement. For example, students with more than 92% attendance and at least four out-of-school activities had an average score increase of nearly 10% compared to students who took at least four out-of-school activities. with less participation. This suggests that vocational education policies should focus not only on academic curricula but also on promoting a holistic approach to development.

In terms of teacher evaluation, the data showed that teachers who actively integrate new teaching methods are 25% more likely to improve the proportion of students getting excellent grades. In addition, the relationship between student assessments and teaching outcomes is important. Teachers who scored more than 4.5 had an average class performance that was 15% higher than those who scored less. This means that policies should focus on training teachers and supporting innovation in education.

Explore the application of artificial intelligence (AI) in the dynamic adaptation of vocational education policies to achieve "real-time response to data - automatic policy improvement". Currently, policy adjustment in this study still depends on manual analysis of time-delayed post-implementation data. Future research may integrate artificial intelligence algorithms (e.g., enhanced learning) into the political system: real-time data (e.g., student dropout rate, institution graduate satisfaction, resource utilization rate) as input to an AI model that "maximizes the impact of policy implementation" establish as a reward a transaction that allows models to automatically adapt policy criteria (e.g., adapting the ratio of practice hours in courses, improving the ratio of digital resource allocation) according to the response data and implementing dynamic adaptation

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