Data Analysis of Cost Engineer Qualification Examination System Based on Data Analysis

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Abstract. In order to improve the throughput performance of the cost engineer's practice qualification simulation test system, on the basis of ensuring the normal functioning of the system, data analysis technology is used to optimize the design of the simulation test system. Refit the memory and microprocessor in the hardware system separately, and install remote communication equipment to ensure the real-time transmission of test data. Based on the completion of the hardware device connection, the system's human-computer interaction interface is designed, and the system database information is improved from various aspects such as test questions and candidate information. Based on the hardware equipment and database, the software functions of the cost engineer qualification examination system are realized from the aspects of system role, examination process, and score. Through the system test experiment, it is found that the average throughput of the system is high under the condition of ensuring the running function of the examination system.

Keywords: Data analysis · Cost engineer · Qualification examination · Mock examination · Examination system

1 Introduction

Cost engineer refers to the professional engineer of engineering economy who is authorized by the state to operate after registration, specially accepts the designation, entrustment or employment of a certain department or unit, and is responsible for and assists in the valuation, pricing and management of project cost, so as to safeguard its legitimate rights and interests. The state implements the practice qualification system of cost engineer in the field of engineering cost. All units and departments engaged in the construction, design, construction, engineering cost consulting, engineering cost management, etc. of engineering construction activities must have professional technical personnel with the qualification of cost engineer in the positions of valuation, evaluation, examination, control and management [1]. At present, among the engineering cost practitioners in our country, there are generally problems such as low professional quality, narrow scope of knowledge and single professional ability. Therefore, in recent

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years, to a certain extent, it is necessary to relax the entry requirements, so that more people are qualified to participate in the exam, and do a good job of pre-exam training, so that as many people as possible in a short time to better system learning engineering cost management professional knowledge, is very necessary. The pre examination training, which has been carried out in an all-round way throughout the country, is also more suitable for the development requirements at this stage. The cost engineer qualification examination belongs to the scope of the national unified planning professional and technical personnel qualification system, and has passed the national unified examination, obtained the cost engineer qualification certificate, and registered professional and technical personnel engaged in construction project cost business activities [2]. The Ministry of personnel and the Ministry of construction are jointly responsible for the policy formulation, organization and coordination, qualification examination, registration, supervision and management of the national cost engineer qualification system. We will adopt a unified national program, proposition and organization. In principle, it is held once a year. The Ministry of construction is responsible for the formulation of examination outline, the compilation of training materials and proposition, the unified planning and organization of pre examination training and other related work. The training work shall be carried out in accordance with the principle of separation from the examination and voluntary participation. The personnel department is responsible for reviewing examination outlines, examination subjects and questions, and organizing or authorizing the implementation of various examination tasks. Work with the Ministry of Construction to supervise, inspect, guide and determine eligibility criteria. At present, the qualification requirements for the cost engineer qualification examination are a college graduate, a bachelor, a second degree or a master's degree or a doctoral degree major in engineering cost, engineering economics, and engineering, and they are qualified to apply for the engineering cost business. Those who have obtained the qualification certificate may apply for initial registration within one year from the date of issue of the qualification certificate. The traditional test format is to specify the test time, and notify all candidates to focus on a unified test environment, distribute test papers for cost engineer qualifications, hire professionals to review the test papers, get the test scores of the candidates, and then determine whether the candidates have Professional qualification of cost engineer. However, the traditional examination form has the problems of a long examination period and a long marking period. As a result, candidates of the quarrel cost engineer qualification examination need to take a long time to obtain a practice qualification certificate.

For this qualification designed the simulation test system, the operation principle of the system is mainly use data analysis and transmission technique, the results of the student's answer to system server, and compared with the standard answer in the system database, and the final exam score results, compared with the traditional test model, simulated test system can shorten the test cycle. Cost engineer qualification at this stage the research achievements of simulation test system includes the examination system based on ASP technology, the examination system based on Java technology, and the examination system based on.net technology, however, when there is a lot of examinee in the examination system online at the same time, the system easy to appear the

phenomenon of information deviation and caton, introducing data analysis technology for cost engineer qualification mock exam system optimization design.

Data analysis refers to the process of using appropriate statistical analysis methods to analyze a large number of collected data, extract useful information and form conclusions, and then make a detailed study and summary of the data [3]. This process is also the support process of the quality management system. In practice, data analysis can help people to make judgments in order to take appropriate action. This technology is applied to the practice qualification simulation system, which can not only ensure the examination function of the system, but also improve the throughput of the system, so as to support a large number of candidates to take online examinations at the same time, and improve the application efficiency of the examination system.

2 Hardware System Design for Practicing Qualification Examination

In order to ensure the educational, scientific, and easy-to-use of the cost engineer qualification examination, we strive to make it a high-quality learning software. In the process of system design and implementation, it is inevitable that advanced learning theory guidance and science Method guide. Under the theory of autonomous learning and interaction theory, from the hardware system, system interface, database and software functions to achieve the optimization design of the traditional cost engineer qualification examination system. After analyzing the requirements of the examination system, the overall design architecture of the system is determined, as shown in Fig. 1.

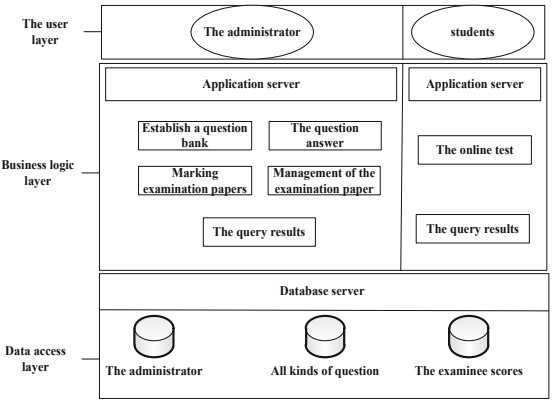

Fig. 1. Overall architecture of the mock test system

As can be seen from the figure, the entire cost engineer qualification examination system is mainly divided into three levels of structure, namely the user layer, business logic layer, and data access layer. The user level is mainly the role of teacher and student. The business logic layer includes the teacher's main business to establish classes, set up question banks, review test papers, manage test papers, and query results. Student's main

business online examination, results query [4]. The data access layer mainly includes the administrator database, various question banks, test scores, and test classes. According to the overall architecture of the system, on the basis of the traditional mock examination system, the hardware environment is modified, and the connection structure of the hardware equipment is shown in Fig. 2.

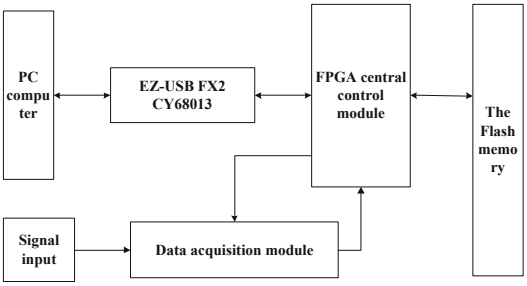

Fig. 2. System hardware equipment connection structure diagram

2.1 Memory

The storage module of the system includes SDRAM and ROM. In the embedded system, ROM is a kind of memory that can be erased by electricity and information will not be lost after power failure. It is used to store program code, constant table and some user data that need to be saved after power failure. SDRAM is the memory of the system, it does not have the characteristics of power down to keep data, but its access speed is much faster than the memory. It is mainly used as the running space, data and stack area of the program in the system. When the system starts, the CPU first reads the startup code from the reset address. After the initialization of the system, the program code is transferred in to run to improve the running speed of the system. The system uses 32M * SDRAM and 64M NAND flash to complete the design of system memory circuit.

2.2 Data Communication and Transmission Equipment

CPM module is a 32-bit RISC communication processor (CP) specially optimized for serial communication. It has a separate ROM and stores its own microcode, which can provide a flexible and complete solution for devices requiring communication capability, while reducing system frequency and energy consumption [5]. CPM supports multi-channel communication and can handle a variety of low-level protocols. By applying the communication transmission equipment to the simulation test system of cost engineer qualification, the system operation interruption caused by communication failure can be reduced.

2.3 Microprocessor

The PowerPC processor core was selected as the microprocessor device for the mock exam. The PowerPC core model MPC850 uses a fully static design. Its integer access

operations are directly performed by hardware. Its integer processing unit uses a full 32-bit internal bus and 32-bit. The hardware architecture has two instruction access queues, four instruction prefetch queues, and a six instruction cache. A 32-bit external operand instruction can be executed in one bus cycle, and there are 32 32-bit pass registers internally used as source and destination operands. The MPC850 integrates an MMU unit, a 2 KB instruction cache, and a 1 KB data cache. The MMU unit provides eight data and instruction TLBs, which can support multiple page sizes. Its instruction cache and data cache are two-way group cascade, which can be physically addressed, replaced by the LRU principle, and can be locked on a row basis to prevent important instructions or data from being replaced.

3 Human-Computer Interaction Design of Practice Qualification Simulation Examination System

The simulation test interface of the cost engineer's professional qualification needs to highlight the majesty of the test and meet the professional characteristics of the cost engineer [6]. When designing the system's interpersonal interaction interface, choose a color that matches the professional characteristics, such as white and blue. In addition, the test system administrator needs to enter a lot of basic information when entering candidates, so the interface design should fully consider the convenience of the system administrator when entering data, such as when viewing a large data page, up and down scroll bars and left and right The scroll bar should be fixed to the right and bottom of the page to facilitate checking of the entered data, and the system should always check the data format when entering the data to avoid errors when storing in the database. In order to fully reflect the human-computer interaction function of the simulation test system for the cost engineer's professional qualification, the user interface, the test main interface, and the submission interface are designed separately. The mouse and keyboard can be used on different interfaces to achieve Input and modification of interface content.

4 Database Design of Practice Qualification Examination System

The question management module is the most critical part in the system design process, it realizes the division, analysis and definition of the question database data, plays a crucial role in the efficiency of the system development and even the success or failure of the system. The system USES SQLServer 2005 to generate the corresponding database based on the designed data model. Database in the early design with Access to design the field, to the late release, imported into the SQL database. Program calls, calling SQL database data.

4.1 User Information Database

The user information database stores the information of all examinees, including the examinee's name, student number, examination permit number, gender, photo and examination result. The basic format of user information database table in the simulation test system is shown in Table 1.

Table 1. User information table

The field name	The data type	Whether null is allowed or not	Primary key	Describe
User_ID	int	no	A primary key	The user id
User_Name	Varchar(20)	no	no	The user name
User_Password	Varchar(20)	no	no	password
User_RealName	Varchar(20)	no	no	Real name
User_Sex	bit	no	no	gender
User_Role	int	no	no	The user types
User_RegisterTime	DateTime	no	no	Registration time
User_LoginTime	DateTime	no	no	Landing time
User_LoginNum	int	no	no	Log in number

4.2 Cost Engineer Qualification Examination Questions Bank

The cost engineer simulation qualification test question library includes a variety of question types such as filling in blanks, multiple choice questions, and judgment questions. A variety of cost engineer qualification qualification test questions are synthesized to obtain the test question bank construction results. The test paper information structure is shown in Table 2.

Table 2. Test Paper information form

The field names	The data type	Fields that
uuid	Character_carying	Unique code, primary key
name	Character_carying	Name of test paper
Subject_id	Character_carying	Said subject number, foreign key
papertype	Character_carying	The group type
totalscore	integer	Test scores
totaltime	integer	Total test time
sort	integer	Paper display order

Record the content of the questions, answer the questions correctly, and establish the time of the questions. The correct answers can be written in multiple semicolons, which can be matched with multiple answers filled in by students in the program [7]. For the record of adding time, you can know when this question is established, which is good for updating and consulting the test questions. The longer the time is, the more test questions the examinee has taken. When the time reaches a certain program, the test questions of a certain period can be cleaned up.

4.3 Database Relational Connections

In addition, data information such as the scoring mechanism of practice qualification test for cost engineer should be input into the database according to the prescribed format, and the connection between database tables should be realized according to the logical relationship shown in Fig. 3.

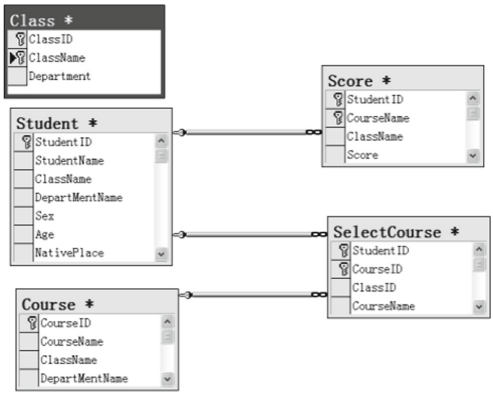

Fig. 3. Database logical relationship diagram

5 Functional Design of Practice Qualification Simulation Exam Software System

According to the needs analysis of the cost engineer's practice qualification simulation examination system, the functions of the examination system can be divided into three categories: online examination function, simulation exercise function and examination management function. Therefore, the design of software system functions can also be divided into three major functions. The modules include: an online examination function module, a simulation exercise function module, and an examination management function module. In the online exam function module, students can take the exam, modify information, and view grades, etc. In the simulation exercise function module, after successfully logging in to the system, students can perform simulation exercises before the exam and view the answer to the test questions; in the exam management function module In the administrator, the administrator can manage the related information of the exam, including student management, test question management, test paper management, exercise settings, subjective question scoring, score management, and system management [8]. In the process of practical application and operation of the simulation examination system of cost engineer's professional qualification, different roles have different rights and functions. Therefore, from the perspective of system administrator and examinee, we can simulate the actual process of the simulation examination of cost engineer's professional qualification and realize the software system functions of the simulation examination.

5.1 Role Function Design

5.1.1 Function Design of Management End

An administrator role is a user with advanced administrator privileges, all of which are granted by the system. Can use the test bank maintenance function, view and modify all the test questions can manage the marking of teachers and candidates information, add, modify and delete all the user information to be able to test paper development and maintenance of the test paper, with test paper review and performance management function of the use of authority. In short, the user master and control of all the test information administrator operating platform can achieve the management and protection of examinee information and teachers information, can add, modify or delete examinee users and teachers users. The examination system has higher requirements on data confidentiality and strict restrictions on user rights and functions. According to the system demand analysis, the system mainly realizes user management and user rights allocation and other management functions.

5.1.2 Functional Design of Examinee End

The function structure of examinee end mainly includes several function modules, such as personal information, simulation test, score query, etc. The personal information of candidates refers to the management of personal account information, such as password, contact information, etc. The function of simulation test is to promote the learning effect and improve the examinee's ability to take the test by means of simulation training. The simulation test environment is consistent with the real test environment, and the examinee can be familiar with and adapt to the test environment and rhythm through the simulation test. In addition, the online examination function collects the information of students' examination papers in real time through data transmission and analysis, and scores the final examination papers submitted, so as to obtain the simulated examination results of cost engineer's professional qualification.

5.2 Simulated Online Exam Function

The simulated test taker's behavior process during the simulation test of the cost engineer's qualifications, respectively, by determining the test content, generating test papers, and analyzing and saving the test paper data, realize the online test function of the test system.

5.2.1 Determine the Content of the Exam

There are four subjects in the qualification examination of cost engineer, which are: knowledge related to project cost management, determination and control of project cost, construction engineering technology and measurement, and case analysis of project cost [9]. At present, in addition to the case analysis of engineering cost, the subjective test question form of the case is adopted, the other subjects all adopt the objective test question form of single choice and multiple choice. In combination with the relevant questions of each subject mentioned above, the test questions are stored in the database

in the same way, and the relevant procedures are applied to ensure that the front-end interface can retrieve the data of exam content and questions in the database in real time.

5.2.2 Test Paper Generation and Management

The simulation test module mainly realizes the function of extracting questions from the question bank, generating test papers and statistics of wrong questions. Therefore, the examination module is composed of three parts: the extraction of questions, the composition of test papers and the statistics of wrong questions. The process of composing the test paper is shown in Fig. 4.

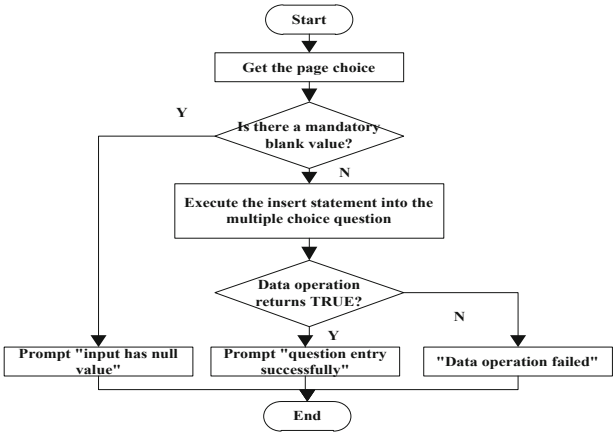

Fig. 4. Flow chart of test question entry and test paper formation

5.2.3 Test Data Saving and Analysis Function

During the operation of the system, it will involve the processing of data. Data will flow during the processing. Data flow analysis is to analyze the flow of data and express the results of the analysis in the form of a flowchart to facilitate design Personnel for system development. Data flow analysis is essentially a record of the direction of data flow and data processing flow during system operation. The purpose of data flow analysis is to analyze the flow of related data in the system. Through analysis, problems are found. Usually, these problems include: the data flow is not smooth during the operation of the system, and the same data is in the system. The types before and after do not match, and there is an unreasonable situation in the related data processing during the system operation [10]. The purpose of the analysis is to find many problems in the data and solve them. There are many reasons for these problems, and no matter which one causes them, the ultimate purpose of data flow analysis remains the same. It is to expose as many possible problems in the system as possible at this stage and then solve them accordingly. The specific analysis processing structure is shown in Fig. 5.

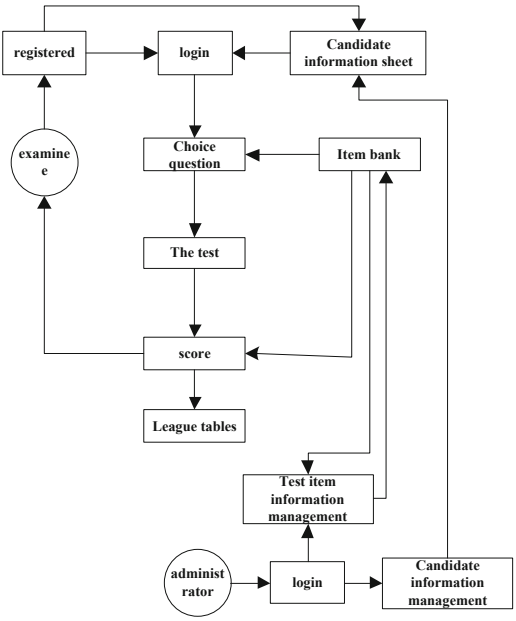

Fig. 5. Data analysis technology processing test data

Based on the processing structure of the above-mentioned data analysis technology, the input information of the candidates in the examination system is collected in real time, and the answer papers are submitted.

5.3 Statistical Scoring Function

The cost engineer qualification examination system can use the scoring statistics function to count the overall evaluation results of the candidates. When the grading teacher checks the candidate's results through the statistical scoring module of the candidate's online examination system, the online examination system will calculate the total score according to the following formula. Complete the calculation of all individual candidates.

$$score = N_x \times \eta_x + N_p \times \eta_p + N_t \times \eta_t + S_j \tag{1}$$

In the formula, N_x, N_p, and N_t are the correct numbers of multiple choice, judgment, and blank questions in the test paper, and η_i is the score corresponding to different question types. When an online formal exam candidate submits an answer or the test time is exhausted, the system will automatically submit the examination paper. The browser will judge the answer based on the answer made by the candidate. And use the test results announcement function to facilitate candidates query.

6 Test of the Simulation Examination System for the Qualification of Cost Engineer

Software testing is a necessary step to ensure the quality of software. Generally, software testing needs to occupy most of the time of software development in order to find the potential errors and problems of software. After the coding of the program design and the necessary interface design, the overall test can be started. According to the test sequence, first of all, a set of test cases including general input, critical input, error input and other data input conditions should be conceived according to the various situations and possible problems encountered in the use of the simulation test system for the professional qualification of police cost engineer. Input these test cases into the program one by one, observe whether there is an error in the operation of the cost engineer qualification simulation test system or whether there is a good fault-tolerant mechanism for illegal input, so that the designer can better improve the program to meet the needs of users. In the process of the system test experiment, the traditional simulation test system was used as the comparison system, and the system's function and performance were tested respectively, so as to prove the effectiveness and practicability of the system based on data analysis.

6.1 System Development and Test Environment

The development of the simulation examination for the qualification of cost engineer is developed in the web environment. Test the database deployment to not affect the data call speed. On SQL Server 2005, the program is deployed on another server. Local access is through the intranet and on the browser. Use two computers with good performance, one is installed with SQL Server database, and then attach the database in the system. Another deployment program page, the program calls the database directly. The distribution network, for aspect testing, is directly tested on the external network. As long as other users can access the Internet, they can directly log in the Internet IP to enter the system page. Contact 100 system users at the same time, and be able to log in to the system to take the exam at the same time. The specific environment is described as: hardware environment: the CPU of the client computer should be above 1 GHz, the memory of the computer is not less than 128 MB, the screen resolution is above 1024 * 768 The server needs a CPU with a main frequency above 1 GHz, no less than 512 MB of memory, and a hard disk capacity of no less than 40 GB. Software environment: Operating system: Windows XP SP3, development tools: Microsoft Visual Studio 2005, Web server: IIS 5.1, database: Microsoft SQL server 2005.

6.2 System Function Test

On the exam interface of practice test for cost engineer, input relevant information according to the normal answering process, observe the realization of system function.

Through the statistics of the system operation results, the comparison results about the system function tests are obtained, as shown in Table 3.

From the test results in the table, it can be seen that both test systems can successfully pass the function test of user login and password modification, but in the test process

Table 3. Comparison results of system function tests

Testing tasks	The test content	Traditional system test results	Design system test results
Change the password	Change your password and log in again	Through	Through
The user login	20 bits for username and 20 bits for password	Through	Through
Edit question information	Update question information	Update 322 questions	Update 345 questions
Examinee user submit test questions	Examinee user completes the test paper, submit the test question function	Successful after 3 submissions	Submit once and succeed
Examinee user query score information function	The examinee user inquires the result information function after the teacher marks the paper	The output result	The output result

of updating test questions, the number of design system updates is 23 more than the traditional system. In the data submission process of the test system, the success rate of the traditional system is 33.3%, while the success rate of the design system is 100%.

6.3 System Performance Testing

The performance test of the system is mainly used to test the throughput of the system. Under the test environment of two test systems, 100 examinees are controlled to be online at the same time, and the background data of the system is retrieved. The system designed in this paper, the online test system based on LoadRunner proposed in [11] and the man-machine dialogue teaching and test of medical image proposed in [12] are observed Test the concurrent data of the system and draw a comparison curve about the system throughput, as shown in Fig. 6.

It can be seen from the figure that with the gradual increase of the number of online people, the throughput of the three kinds of examination systems is gradually increasing. However, the average throughput of the online examination system based on LoadRunner proposed in literature [11] and the medical image human-computer dialogue teaching and examination system proposed in literature [12] are 70% and 78% respectively, while the designed cost engineer professional capital based on data analysis. The average throughput of the grid simulation test system is 85%. Compared with the traditional system, the throughput of the system designed in this paper is higher.

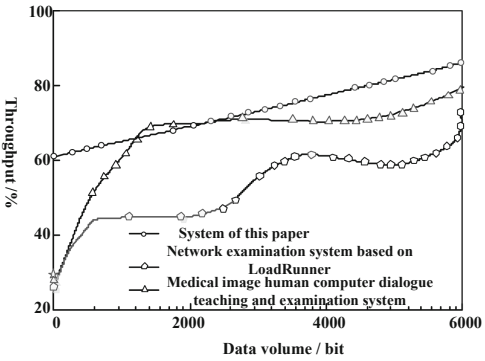

Fig. 6. System throughput performance comparison curve

7 The Conclusion

Since the introduction of the cost engineer qualification examination system, although it has been improved and improved, with the development of the project cost industry, it still needs to be adjusted to meet the new needs. In accordance with the qualification examination system of cost engineer, this paper uses data analysis technology to optimize the design of examination system, completes the hardware design of the system through memory, microprocessor and data communication transmission equipment, inputs and modifies the interface content through human-computer interaction, and completes the system software design from the aspects of system role, examination process and score According to the hardware and software of the system, the simulation examination system of cost engineer qualification is finally completed. Through the experiment, it is proved that the design of this paper can improve the throughput and application performance of the system, which lays the foundation for the qualification examination of cost engineer.

8 Fund Projects

2018GGJCKT193 Research on the Reform of Talent Training System from the Perspective of Key Competence of Higher Vocational Colleges.

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