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PIPE-ID: Pipelined Innovative Teaching Architecture for Interdisciplinary Design in Vocational Education using Information and Communication Technology

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Abstract. Universities are increasingly grappling with the problem of activating the risky interconnection of fields of study practices, which has traditionally been indicative. Students cannot be able to investigate complicated concepts and theories of societal concern by figuring out relationships between subject areas, research methods, and teaching and learning practice in a pipelined manner. The importance of vocational education and training in fostering economic growth, increasing the number of people employed, and improving the standard of employment cannot be overstated. Hence Pipelined Innovative Teaching Architecture for Interdisciplinary Design in Vocational Education using Information and Communication Technology (PIPE-ID) is proposed. Making skilled workforces through computer-based vocational education is crucial to help China shift from labor-intensive, low-skilled industries to more capital-intensive ones. This framework has four primary assumptions: the Acquisition-Learning Hypothesis, the Natural Order Hypothesis, the Monitor Hypothesis, and the Input Hypothesis. Integrative strategies are relevant to empirical from China's vocational education programs. The problem-based learning (PBL) is used to create a framework for teaching and learning that enables student-level technical courses in a sustainable and self-directed manner to overcome the unemployment problem. An interactive game-based approach (IGA) is used for problem-solving and encourages students to think critically and creatively. The study examined 90 students' experiences involving perceptual, affective and social cognition. The results showed improved self-employment ratio of 92.7% in students. Students also demonstrated enhanced capacity of 95.1%, better schedule management of 90.7%, upgraded interoperability of 90.7%, and higher engagement levels of 88.5%.

Keywords: innovative teaching, interdisciplinary design, vocational education, communication technology, interactive

1 Introduction

Qualitative education in sustainable development is an essential component of the process. According to some recent graduates, novel vocational teaching resources such as building performance effectiveness tools are not used during their education in architecture [1]. The interdisciplinary design in current sustainable architectural practice, in which the learners lead a team of experts from diverse fields connected to overcome the problems in the educational pipeline [2]. Real-world exposure to design should be a goal of education is especially true for programs that aim to produce more theoretically trained architects. It is vital to understand both architectural practice and the needs of the investors to do this [3]. Game-based in various educational settings, teaching students how to learn is a widely accepted pedagogical strategy [4]. To evaluate the actual performance of the GBL strategy, our proposed method combined findings from various earlier literature studies given in the next section [5]. GBL can potentially increase learning because of the qualities and affordances built into activities [6].

Sustainable development and project-based learning are frequently discussed when incorporating an interdisciplinary curriculum in technology and engineering classes [7]. The interactive nature of design and architecture education extends beyond the simple problem, and a classroom is where designers try to devise creative solutions to difficult problems [8]. With the advancement of technology geared toward education, the Internet as a medium for education and training offers academics a wealth of information researchers [9]. Intergenerational transition is facilitated by students from working-class backgrounds completing their secondary vocational education [10].

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Before starting work, new generations of migrant workers can get this type of pre-employment training in addition to their high school diplomas [11].

There are new ways to study in the 21st century, such as e-learning, digitalization, and ICT-enhanced learning. This idea reinterprets the conventional purpose of education using students' present behaviors as a guide, [12]. There has been a shift in the demographics of faculty development programs and vocational studies in China [13]. The situation in the game-based approach might be useful in misleading since it suggests something to be solved, even though the PBL learning cycle begins with the presentation of an unstructured problem [14]. Throughout elementary school, pupils should be exposed to mathematics to develop their critical, analytical, and innovative mental capabilities and their capacity to collaborate with others [15].

A cumulative, integrated approach to assessment is the most common in the classroom, focusing on the more cognitive parts analyzed using ICT [16]. A problem-based learning approach teaches students how to solve problems independently and work in groups to do the same [17]. An important function of vocational high schools is to turn out capable, skilled, and knowledgeable workers to succeed in the working world upon graduation [18]. The nation's economic, social, cultural, and technological needs have caused considerable shifts in China's interdisciplinary design in vocational education (IDVE) [19]. As part of a teacher pipeline, strength and conditioning teacher training programs can be in the middle [20]. The number of new qualified CS instructors joining the industry each year remains low, despite major efforts and resources to alleviate this shortage [21]. After consulting and designing their proposal with their teacher, students submit their work to the teacher for approval is considered the procedure in teaching.

1.1 Importance of Vocational Education Systems

Educational success is measured by how a graduate can provide solutions that satisfy all five 5Es: economic, efficiency, environmental stewardship, ethical considerations, and equality. Interconnected courses are used to accomplish this objective. Here the various research and their results are given in the below paragraphs.

Many professionals have found the competence-based vocational education and training (CBVET) approach attractive. Several competency theories have been created, and much competence research has occurred in the previous decade [22]. The competency-based education movement has also made significant inroads into vocational training and higher education in general. A survey of current competency practices, mature CBE system characteristics, and definitional discussions were discussed.

Educational technologists and anyone interested in technology-enhanced learning (TEL) research can benefit from considering how interdisciplinary fits into their work. Interdisciplinary is becoming more widely accepted to solve complicated research challenges in many scientific fields [23]. Learning with technology is a relatively new field that takes an interdisciplinary approach to examine how technology might be used to learn. It finishes with some practical advice to help students manage the obstacles of multidisciplinary collaboration in TEL research based on the findings of discussions.

Highway engineering is a good place to start when it comes to developing students' interdisciplinary design skills and developed building information modeling (BIM). Highway construction and its related facilities may now be integrated into the BIM platform for senior-year capstone courses based on the BIM platform [24]. This paper proposed a new highway design model and service lines focused on the BIM platform. A visualization tool enhances BIM education in transportation engineering when used in an interdisciplinary setting. The expectation of recent graduates must satisfy error-free architectural designs by utilizing correct pedagogy and content in the curriculum related to Building Information Modelling (BIM) software [25]. A technique that enhances information management and communication is becoming more widely known and used in architectural design development to enhance creativity and sustainability. The complete undergraduate (UG) level design education curriculum and syllabus have been revised to keep up with the fast-evolving technology landscape to cope with BIM software.

Science, technology, engineering, and mathematics (STEM) education has become a major research area worldwide, garnering substantial attention in recent years. This research aims to provide a critical assessment of empirical research published throughout the early development of the field in which STEM training and its interdisciplinarity were characterized and positioned [26]. Researchers urged intellectual growth and diversification for STEM education research beyond human capital and challenged the disciplinary hegemony. Various statements can be made for each issue for students to rate their level of agreement to evaluate the student's engagement in STEM Education.

1.2 Purpose of the Vocational Education System Analysis

To reduce the reliance on specialized modelers, the strategy reduces the issue owner's dependency on business process model notation (BPMN) process models and system installation structural components via module-based translation. Any major institution might adopt this innovative approach with adequate human resources and systems engineering assistance to digital technologies, allow new approaches to employee education, and analyze their resilience to volatility [27]. Two conceptual case studies illustrate a novel transformative method between the simulation and the managers of the defense educational personnel. Therefore the main intention of the PIPE-ID study is to manage student performance according to the parameters of enhanced self-employment, examine the improved student's ability, time scheduling management, interoperability up-gradation, resilience analysis, and effective participation of students. The major contributions of this paper are;

- Using problem-based learning (PBL), students can acquire technical courses in a sustainable and self-directed manner to tackle the unemployment problem.
- Economic growth, more employment opportunities, and increased wages can all be attributed to a strong focus on vocational education and training (VET).
- Students are encouraged to think about their challenges using an interactive game-based approach (IGA).

The remaining section of this study is given as section 2 deals with the materials and methods involved in the proposed method (PIPE-ID) in section 3. Section 4 discusses the results and discussion, and section 5 follows the conclusion of this paper.

2 Manuscript Preparation

2.1 Research Problem Design

Vocational Education (VE) is an inseparable and important part of the educational domain, an essential stage of higher education that supplies the labor market with qualified workers. The reform of the China education system, accompanied by the introduction of novel education standards, necessitates the search for solutions to issues related to changes in the design of the content of educational disciplines and the procedure for evaluating the formed competencies in learners, which cause problems for educators. As a first step in developing new curricula after the reform, educators turned their attention to adapting pre-existing course materials to the domains of the new learning paradigm. Since the student is the focus of any educational process, all reforms have focused on making education more accessible and effective. However, digital technologies are the most expensive and rapidly evolving. An understanding of the teacher pipeline's purpose will be critical. The pipeline aims to create relevant educators who can teach to state requirements in a subject area and help children advance toward being well-educated students.

2.2 Sample Collection

A qualitative approach uses more than 50 students around China to analyze the findings, interviews, and focus group dialogue based on the learning strategies students and teachers follow from the data source [28] using MATLAB R2020a. In addition, the findings of this paper reveal that the positions of students and teachers in the vocational learning program have improved significantly. The study included 90 students, and the results were tested using the F-Test and T-Test. The collected student information is processed by introducing pipelined innovative teaching architecture to evaluate the student efficiency.

2.3 Study Context

This section explains the pipelined innovative teaching architecture based vocational education system efficiency. The system's intention is to analyze student performance in the vocational education system. Rather than placing teachers in front of students to have an adult present to monitor children in learning environments, this is a quite different result; the below figures and mathematical equations explain the above issues.

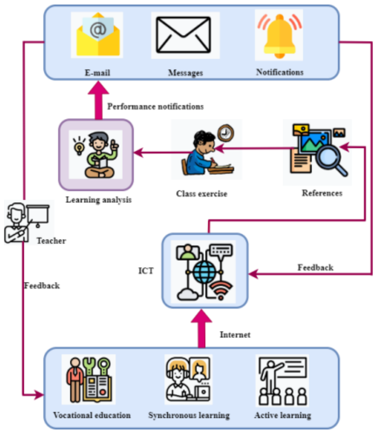

Fig. 1. Role of ICT in vocational education

Using ICT to enhance the remote education paradigm, the issues and components that contribute to this improvement can be identified. ICT technologies focusing on education can be integrated into a multi-layered architecture. It is shown in Fig. 1 how a vocational learning system is crucial to keep in mind that it is not intended to establish an interdisciplinary education. All the components are shown in the lower layer to address the previously noted issues. This layer includes interdisciplinary systems that can identify each classroom and active learning. In terms of integrating with ICT, they are the most important ones. They are followed through feedback. Since the system must provide comprehensive audits for both provider and user levels during a synchronous meeting in terms of technical requirements will receive notifications through mail, messages, and notifications. This architecture uses an active learning system to produce teacher-proposed tasks. The suggested architecture's strength is its ability to collect enormous amounts of data by integrating a wide range of ICT technologies. Data is the most valuable resource students gain from every activity.

$$id_n = \sum_{i=1}^{n} ec(Logs_{st}), ec(Logs_{id}) = \begin{cases} 1, & ls'_{st} - ls''_{st} \geq ot \\ 0, & 0 < ls'_{st} - ls''_{st} < ot \end{cases} . \quad (1)$$

$$V^c = \{ls_1, ls_2, ...ls_j, ...ls_n\} + S^c\{g_1, g, ...g_i, ...g_n\} * st = \{ls_{st1}, ls_{st2}, ...ls_{st}\}. \quad (2)$$

An example of this might be a series of lessons from a vocational class $V^c = \{ls_1, ls_2, \ldots ls_j, \ldots ls_n\}$ with a group of students $S^c = \{g_1, g_2, \ldots g_i, \ldots g_n\}$, here g_i and g_n indicates the ith lesson and nth student, respectively, for output . These are the characteristics from S^c in the design g_i indicated by $st = \{ls_{st1}, ls_{st2}, \ldots ls_{st}\}$.

The notation k_j w_i has been removed, and the correct notation g_i and g_n is placed instead of the to represent ith lesson and nth student are given in the full form of equation 3.

The student's final performance is depicted by fp_n .

The subscript has been correctly used, and the equation can be rewritten as

$$fp_n = V^c + S^c * st . \quad (3)$$

Hence equation 2 can be fully explained as

$$fp_n = \{ls_1, ls_2, ...ls_j, ...ls_n\} + \{g_1, g_2, ...g_i ...g_n\} * \{ls_{st1}, ls_{st2}, ...ls_{st}\}.$$

In addition, in every lesson, data has been collected and given in equations (1) and (2). Using interdisciplinary id_n by logarithmic functions $ec(Logs_{st})$ and $ec(Logs_{id})$ to deliver educational content ec, such as animation, simulation, role-playing, and engaging and authentic activities, to help students proceed through their studies.

$$dt_s = \sum_{i=1}^{n} f_{d1} = \{ls_{st1}, ls_{st2}, \ldots ls_{st}\} \in [0,1]. \quad \textbf{(4)}$$

Equation (2) illustrates these points of $\{ls_{st1}, ls_{st2}, \ldots ls_{st}\}$ signifies uploading, browsing, and commenting on other student content ls'_{st} is calculated from equation 3. The corresponding value is determined by the characteristics of the datasets dt_s examined in this study {0.1, 0.3, 0.5, 0.6, 0.7, 0.3}. Formal interdisciplinary learning f_{dl}, on the other hand, focuses on learning f_{dl} objectives and abilities and finishes with evaluation, certification, or approval. Vocational learning takes place in an unstructured, with little or no planning. Equations 1, 2, and 3 here discuss the participation of students in education with enhanced performance compared with other methods.

Equation 1 defines the student's interdisciplinary id_n with the help of educational content ec based on logarithmic functions $ec(Logs_{st})$ and $ec(Logs_{id})$ to evaluate students' advancement in their studies with the aid of animation, simulation, role-playing, and interesting activities that are authentic to the subject's learning system ls for all the students from 1 to n producing the learning outcome as output ot. In equation 2, the student's final performance has been calculated and represented as fp_n. Discussion of these points of $\{ls_{st1}, ls_{st2}, \ldots ls_{st}\}$ gives the information regarding uploading, browsing, and commenting on other student content ls'_{st} is calculated from equation 3. The series of lessons from a vocational class $V^c = \{ls_1, ls_2, \ldots ls_j, \ldots ls_n\}$ with a group of students $S^c = \{g_1, g_2, \ldots g_i, \ldots g_n\}$, here g_i and g_n indicates the ith lesson and nth student, respectively

Teachers and students in charge of ensuring academic quality will receive information from the warning and outcomes layers of the system. Various formats are used to convey the information to the intended audience.

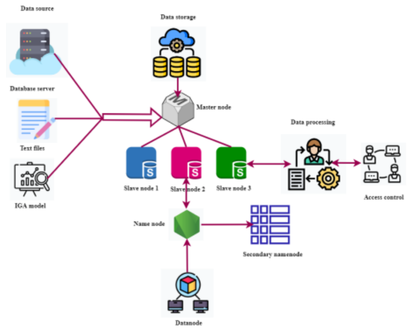

Fig. 2. Representation of the IGA model

ICT architecture in the educational environment relies heavily on learning analytics, which has two primary components. A data source framework analyses the educational data supplied by students. There is a primary node and several secondary nodes in the IGA architecture. The primary node manages the current requests and distributes them to the secondary nodes. As a result, the performance of the text files is critical to learning analysis. As seen in Fig. 2, the architecture and elements that are essential for learning are shown. The most comprehensive collection of information about student-generated content. Financial and academic systems are two of the most common sources of information. Unstructured data can be discovered in these systems; however, most data is structured. As a result, the representation aims at providing learning actors with information on the state of each academic achievement of students via access control. The preceding inverse linear relation is a reasonable approximation for calculating the interoperability analysis ratio.

$$ap_i \cong \frac{1}{\sum_{st_i \in v_S^i} \forall_{cs} +_{af}^{sp} + sc * (gr + ts) ea} * st = \{ls_{st1}, ls_{st2}, \ldots ls_{st}\}. \quad \textbf{(5)}$$

Academic processes ap_i are counted as a denominator in the formula, V_S^i is a list of the variables' values in Y_S for students, $\forall_{cs}$ is the contributing skill of the th factor to the range.

Equation 5 represents a student's accomplishments across all subject areas. *sp* represents student performances like classroom behavior, graduation, and test scores. Where *af* represents academic fields.

It is the total of a student's performance *sp* in various academic fields *af*. Student's classroom performance, graduation rates *gr*, and standardized test scores *ts* are commonly used by teachers and education administrators *ea* for improving interoperability based on the student list $st = \{ls_{st1}, ls_{st2}, \ldots ls_{st}\}$.

The findings enable the development of effective ways to monitor pupils' educational progress, and computer systems are created to serve as personal assistants that convey each student's learning status using these tactics.

$$id = \sum_{i=1}^{n} ed_i * \frac{ec_i}{2} + \left(\Delta = \sqrt{\frac{1}{ec_i * n} \sum_{i=1}^{n^2} (ap_c - \widehat{ie}_c)^2} \right) + us + \frac{(n * sg_i)}{cb}. \quad \textbf{(6)}$$

The interdisciplinary design *id* should educate students *ed* for real-world contemporary architecture ec_i, rather than favoring the development of architects with an operator Δ who will not be exposed to real-world projects for $\frac{1}{ec_i * n}$ from equation (6). The knowing architectural practice ap_c moreover, investors' expectations $\widehat{ie}$ is a must for this by squared function $\sqrt{\frac{1}{ec_i * n} \sum_{i=1}^{n^2} (ap_c - \widehat{ie}_c)^2}$. These specifications are site-specific and subject to change, *c* expressed in Fig. 3. As a result, the university setting should foster close collaboration *cb* with actors that meet these criteria in terms of developing concepts that last for several generations sg_i.

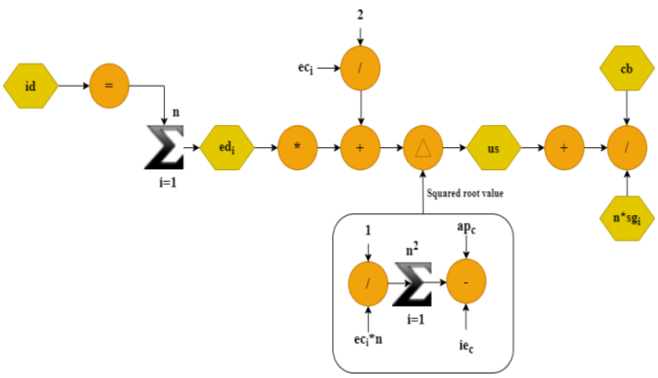

Fig. 3. Pictorial representation of the id

Students in a problem-based educational experience work together to solve complicated and demanding problems. Working together, teams determine what they currently know, what they still need to learn, and how and where they may get new information that could help them find a solution to the problem using the problem flow given in Fig. 4. During the PBL process, students learn critical thinking, issue solving, problem synthesis and creative thinking, the capacity to deal with uncertainty and ambiguity, oral and written communication skills, and teamwork abilities. The input methods used for solving the problems are illustrated using parameters (p), along with the help of teachers (t), to produce an accurate output (o) for any input (i). PBL has been shown to meet the need for students to be engaged, which is a critical factor in enhancing student results and satisfaction. This paper aims to demonstrate the selected novel pedagogical ways of teaching management science and their practical implementation in an interdisciplinary approach. As part of their education, university students studying management disciplines should gain wide, multidisciplinary knowledge that will enable them to find new solutions to future economic challenges based on a comprehensive framework.

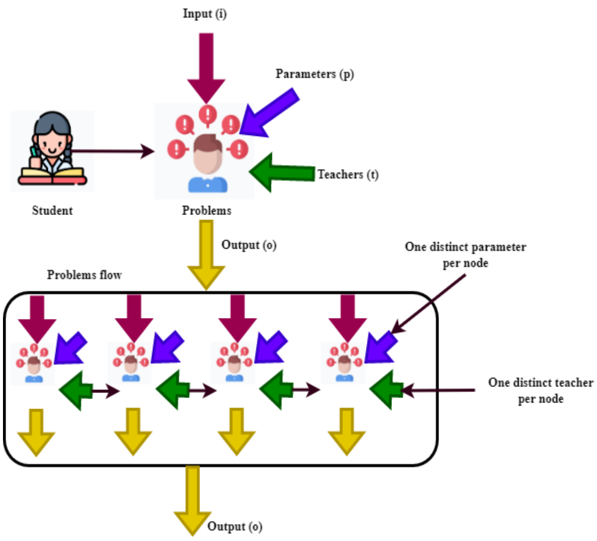

Fig. 4. Process in problem-based learning

$$\begin{cases} si(l)(1-pi)si(sim) = t(si) \\ t(si) = (1-it)pi(ia) + si(l) \\ where\ si > 0. \end{cases} \tag{7}$$

$$st(si, pi) = \begin{cases} 1\ if\ \left(\left|(1-pi)si(sim)\right| \le limit \right. \\ 0, \quad otherwise. \end{cases} \tag{8}$$

The paper compares the rate of student innovation learning *si*(*l*) with achieving the greatest performance indices *pi* while evaluating the students' interactions, monitoring sim to simultaneously determine the target *t*(*si*). In equations 2 and 7, the symbol *st* represents the student presented in the vocational class data source in combination with different descriptions like student interactions, performance, probability rate, etc. An interdisciplinary training system is used to model the framework as a collection of interconnected artifacts *ia* from equation (7). All kinds of artifacts ($(|(1-pi)si(sim)|$, specifications of $st(si, pi)$, and student interactions *st* are described in a stable framework $si(l)(1-pi)si(sim)$ using equation (8).

Students are frequently presented with a real-world issue that a business must address. They can build projects on real-world issues, both in operational and strategic administration and planning in specific sectors.

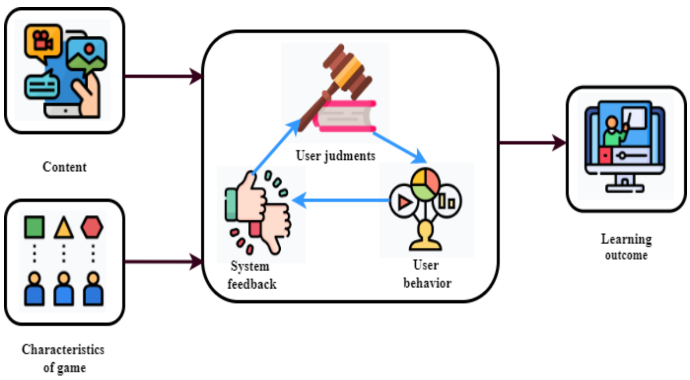

Fig. 5. Diagram for IGA

A new and fascinating medium, game-based learning, actively engages pupils through interactive enjoyment in learning. Learning content designed for gesture-based smart devices with game-based learning emphasizes that the mind and body are intertwined; consequently, bodily movements aid in learning shown in Fig. 5. A study of people engaged in activities like dancing discovered an additional benefit of the flow state: it improved children's ability to retain information. In a flow state, a person is completely immersed or engaged in an activity. The three components of the IGA model are indicated in the figure. Input is the instructional information design that integrates game qualities with six different game attributes: imagination, rule/goal; sensory inputs; difficulty; surprise; control; and stability. The outcome, which examines whether or not training objectives were met and particular learning outcomes were achieved, is based on three components: (1) the process, which depicts a game process and includes user decisions, enjoyment, or interest, (2) user behavior higher perseverance or time expended on a task, and (3) system feedback.

$$pt(st) = (1 - ia)\sum_{i=1}^{n} np(evr) - sp_i. \quad \textbf{(9)}$$

$$Vr(qs) = \sum_{i=1}^{n} \sqrt{rs_i * mt_i} + sc(np(evr)_i). \quad \textbf{(10)}$$

Equation (9) yields the probability rate *pt* of the students (*st*); many educational institutions' interdisciplinary approaches *ia* represent the students' educational level for limits with summation $i = 1$ to n; *m* represents the number of parameters *np* used to evaluate the learning rate *evr* and the scaling parameter sp_i represents the number of parameters. This equation provides a visual representation *Vr* of the questionnaire session (*qs*) and the responses from student srs_i provided in the equation for improving managing time mt_i and scheduling *sc* in every student for vocational students in this design (10).

The design of the strength training session in this research is based on the IGA game-based learning paradigm to improve children students' motivation and intellectual abilities and reinforce their motor abilities.

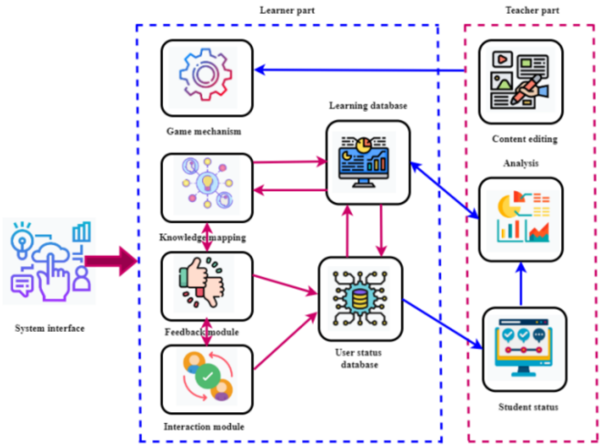

Fig. 6. The overall process between students and teachers

In IGA, learners, instructors, and the mathematical content structure can interact via a web application illustrated in Fig. 6. A knowledge and skill map organizes the pedagogical and instructional components in the digital interdisciplinary content module. Analysis and status databases are used to keep track of students' interactions and work. It's possible to arrange and send digital learning content to a student's browser by selecting a target topic in the knowledge map. Aside from that, the feedback module offers the learner immediate feedback and awards rewards to motivate them while they learn in the IGA. The interaction module allows students to share their learning experiences. Teachers as well can access databases containing information on students' education.

Additionally, the data includes the student's current status, such as their academic performance or virtual accomplishments in the game learning, and their processes, such as their learning records. Students should be able to use the construction management system to keep track of their progress and that of their peers. Aside from tracking students' progress, teachers can also use analysis to identify students' areas of weakness in mathematics and set them up with special homework assignments to address those shortcomings.

$$id_n = S^c = \{g_1, g_2 ... g_i ... g_n\} + \sum_{i=1}^{n} f_{dl*}\ us + \frac{(n * sg_i)}{cb} * \{ls_{st1}, ls_{st2}, ... ls_{st}\}. \quad \textbf{(11)}$$

Improved productivity, efficiency in the workplace, and the competitiveness S^c of the various countries $\{g_1, g_2, \ldots g_i \ldots g_n\}$ can all be attributed to increased access to quality vocational training $\sum_{i=1}^{n} f_{dl}$. It is critical to help those who are less fortunate in society, such as people with disabilities $\{ls_{st1}, ls_{st2}, \ldots ls_{st}\}$. As a general rule, companies prefer to recruit a student who has completed a certificate program rather than a college graduate since, in a program of study, a student is educated specifically for a specific ability of students $\frac{(n * sg_i)}{cb}$.

In most interdisciplinary classes in China, teacher-led instruction remains the primary mode of instruction. As a result of this type of training, the instructor cannot care for all her students adequately. Many students may fall farther behind in their performance and lose interest in the subject, leading to their eventual abandonment.

From the above figures and mathematical equations, it is given that our proposed method PIPE-ID based on the parameters of enhanced self-employment, examines the improved student's ability, time scheduling management, interoperability upgradation, and effective participation of students.

3 Results and Discussion

The experimental results of the proposed framework of interdisciplinary design in vocational education using information and communication technology have been performed. A qualitative approach uses more than 50 students around China to analyze the findings, interviews, and focus group dialogue based on the learning strategies students and teachers follow from the data source [28] using MATLAB R2020a. In addition, the findings of this paper reveal that the positions of students and teachers in the vocational learning program have improved significantly. The study included 90 students, and the results were tested using the F-Test and T-Test. Graphical representations and tabulations illustrate the differences in academic success between regular and vocational education students, respectively, based on the input parameters in Table 1.

Table 1. Input parameters

Parameters	Specifications
Threshold	32 GHz
No. of students	90
Processing time	0.22 m/s
Time resolution	5 hrs
No. of records	40,000

3.1 Enhanced Self-employment

Several empirical studies conducted in developing and developed nations concluded that employees who got vocational education were more likely to be employed, have higher pay, and be more satisfied with their work. Six out of ten full-time university students in China work part of the time while they are in school, according to a recent survey in Table 2. Most students have a full-time job throughout the academic year, although about a fifth work part-time. Student employment has evolved dramatically in recent years. Little is known about the characteristics of full-time undergraduates combining education and job, or the influence of this combination on student life satisfaction can be done using equation (1). Students' employment levels were predicted to vary across the country based on socioeconomic characteristics, financial assistance structures, and the education arrangement based on students' study workloads at the beginning of this study.

Table 2. Employability based on predictive factors

Number of students	CBVET	TEL	BIM	STEM	PIPE-ID
10	65.5	70.2	71.4	73.1	75.5
20	65.3	64.3	63.2	65.2	70.1
30	51.2	54.6	56.2	57.3	59.2
40	46.4	47.4	48.1	49.4	55.2
50	32.4	43.1	54.3	65.5	77.3
60	43.6	55.2	56.5	63.6	61.3
70	73.7	77.3	78.5	71.7	80.4
80	83.8	82.2	86.3	84.7	89.6
90	76.7	74.3	72.4	70.8	92.7

3.2 Student's Ability Analysis

Vocational education and training programs allow students to obtain work experience in their field of study before they graduate. Students who complete these comprehensive courses will be fully prepared to enter the workforce in their chosen fields. Students can better understand their studies using the PIPE-ID vocational learning resources. It helps students do better in school and reduces the stress of being a student worker. Vocational education performance has been much improved, and vocational students' ability to focus their careers on achieving their goals based on decision-making skills has been enhanced shown in Table 3. Students can improve their academic and professional performance using ICT in vocational education, compared to other techniques using equation (11). This research has two main goals. To begin, it emphasizes where pupils are in their learning process concerning the instructional sequence's beginning points. The second benefit is that it explains how the data collection process aids students in their grasp of what it takes to carry out real data analysis in the classroom.

Table 3. Analysis of student's ability

Number of students	CBVET	TEL	BPMN	STEM	PIPE-ID
10	53.7	63.7	75.7	85.4	91.7
20	54.8	65.8	76.8	85.5	92.8
30	55.7	67.7	77.7	86.7	92.7
40	56.7	68.7	78.7	87.9	93.7
50	57.9	69.9	79.9	88.3	93.9
60	58.8	70.8	80.8	88.1	94.8
70	60.6	71.6	81.6	89.3	94.6
80	61.8	72.8	82.8	90.9	95.8
90	62.5	73.0	83.9	90.5	95.1

3.3 Time Scheduling Management

It entails making a schedule for students to follow as they complete their tasks. Activities outside of the classroom may also count, such as homework, group studies, and extracurriculars. Effective time management necessitates a change in mindset from the student's emphasis on activities to their focus on outcomes. Proper time management helps students to do more in less time because their focus is on the task at hand, and they will not be distracted by other activities. As students cross things off their to-do lists, they feel less stressed, and they have compared in Table 4. Time management entails creating a schedule and tracking how much time they spend on each task to be more productive. Some people have a natural ability to manage their time more efficiently than others, and everyone can learn new habits to help them become better time managers based on the probability rate of the students and scheduling equations 8 and 9. A few advantages of effective time-management strategies are greater ability and self-assurance. In terms of academic performance and anxiety, students who manage their time tend to perform better academically. However, many students struggle to find the right balance between their academics and their personal lives.

Table 4. Time scheduling comparison

Number of students	CBVET	TEL	BIM	STEM	PIPE-ID
10	44.2	47.5	57.6	65.3	63.3
20	54.3	69.4	67.8	64.8	60.8
30	54.5	79.4	70.5	78.2	79.2
40	72.6	72.5	73.7	73.3	82.3
50	44.7	53.9	76.5	75.7	84.7
60	42.8	54.8	58.4	68.8	86.8
70	49.4	45.7	57.3	57.6	87.6
80	59.3	56.7	60.2	72.2	89.2
90	67.2	76.6	77.1	84.7	90.7

3.4 Interoperability Analysis Ratio

As a result and equation (4), educational technologists are increasingly concerned with interoperability, which refers to the capacity of different systems to exchange data or perform similar functions compared to Table 5. Enhanced accessibility to educational materials and methods is one example of the practical benefits of interoperability in the classroom. Data on students may be sent without concern of compromise during transmission. The ability to evaluate and track progress in real-time and connect and analyze data sets for reporting, all in one convenient online interface. The increasing focus on interoperability is motivated by the need to make material available across various platforms and by cross-organizational and collaborative teaching and learning. Each application connects to its database using a unique set of connection codes that are unique to that application. Therefore, the system dynamics connection mode and execution model of evidence obtained should not be applied to expand education management systems. Existing solutions are inefficient for transmitting huge amounts of data in small portions. This type of approach additionally ties together information and communication interpretations together.

Table 5. Interoperability ratio analysis

Number of students	CBVET	BPMN	BIM	STEM	PIPE-ID
10	44.2	47.5	57.6	65.3	63.3
20	54.3	69.4	67.8	64.8	60.8
30	54.5	79.4	70.5	78.2	79.2
40	72.6	72.5	73.7	73.3	82.3
50	44.7	53.9	76.5	75.7	84.7
60	42.8	54.8	58.4	68.8	86.8
70	49.4	45.7	57.3	57.6	87.6
80	59.3	56.7	60.2	72.2	89.2
90	67.2	76.6	77.1	84.7	90.7

3.5 Effective Participation of Students

It is helpful to have a deeper comprehension of the processes behind students' decision to participate in vocational education, particularly the differentiation between personal and social factors to manage and optimize student assistance. The framework described here may help measure and analyze the factors influencing people's decisions about their careers and education. Vocational education programmers aim to improve employability, and the academic performance of incarcerated individuals is analyzed and compared in our proposed method in Table 6. General vocational education programmers provide classroom chances for students to learn basic work-related skills, such as the math needed for automobile repairs or construction based on student activities equations (2) and (3). This learning programmer is generally available and typically required for more hands-on vocational or skills training experiences. The success of our proposed output resulted in reducing criminal conduct is the sole focus of this evaluation, which includes research that looks at the influence of programmer participation on readmissions.

Table 6. Participation analysis ratio

Number of students	CBVET	BPMN	BIM	STEM	PIPE-ID
10	46.3	53.5	47.2	54.6	60.01
20	48.4	56.6	48.4	57.8	64.11
30	44.5	58.8	51.6	56.6	66.16
40	45.6	60.9	53.7	58.7	68.12
50	47.8	62.1	54.8	61.5	70.19
60	51.7	61.4	55.9	63.4	75.12
70	53.9	65.2	60.8	65.7	77.89
80	55.1	67.2	68.9	75.7	85.2
90	56.0	63.1	75.7	89.2	88.5

3.6 Overall Performance of PIPE-ID

With the support of PIPE-ID, students at vocational schools can succeed in their chosen career paths. The study included 90 students, and the data were analyzed using the F-Test and T-Test. Graphical representations are used to illustrate the differences in academic success between students in regular and vocational colleges to show the performance of our proposed method and calculated in equation (10). Using these PIPE-ID models, teachers can assess students' involvement in learning concerning various tasks and resources and provide further interventions before the final test. Student engagement and course evaluation scores are assessed in this paper. Fig. 7 displays the percentage of people who are actively involved. Since ICT improves institutional performance and efficiency, it has generated a variety of tools that may be used to enhance the teaching methods of professionals and experts. Teachers may resolve issues during online learning activities, and students' abilities and progress can be accurately evaluated. Compared to other ways, student involvement in their education has been shown to improve vocational learning.

The suggested PIPE-ID model enhances the self-employment ratio of 92.7%, assesses the improved student's capacity of 95.1%, schedule management of 90.7%, interoperability upgradation of 90.7, and effective engagement of students by 88.5 % when compared with other CBVET, TEL, BIM, STEM, BPMN.

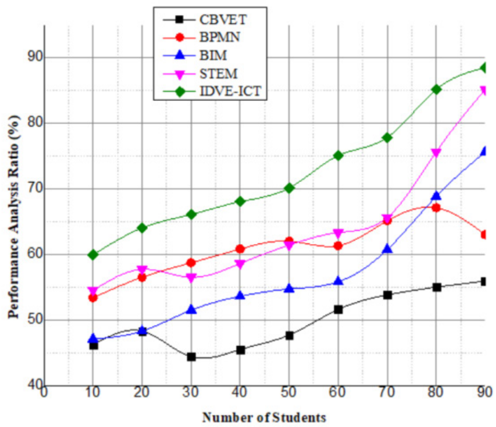

Fig. 7. Overall comparison analysis ratio

4 Conclusions

After reviewing the literature on vocational education, correctional industries, and community education, the conclusion is summarized. The paper is well-qualified since problem-based learning as an interactive approach can predict students' learning performance. The various comparison rates among participants in trials with acceptable scientific merit are higher in PIPE-ID than in other traditional methods and are considered tolerable. According to our research, modeling and analysis in professional employability pipelines have provided substantial useful benefits, especially in light of today's technological and cultural shifts. Defining competence will be briefly discussed by highlighting the importance of discussing and reflecting on competence as a future scope. Problem-based learning as an interactive approach can predict students' performance. As a result of improving students' critical thinking and reasoning abilities through vocational education, the employment rate rises. The suggested PIPE-ID model enhances the self-employment ratio of 92.7%, assesses the improved student's capacity of 95.1%, schedule management of 90.7%, interoperability upgradation of 90.7, and effective engagement of students by 88.5 % compared to other existing methods. One limitation of this study is the lack of data about the training program quality. A policy problem in this setting concerns the efficient allocation of limited resources across diverse types and formats of education and training.

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