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EFFECTIVENESS OF A TASK-BASED LEARNING (TBL) MODULE IN ENHANCING GOOD MANUFACTURING PRACTICE (GMP) MASTERY IN PHARMACEUTICAL ENGINEERING PROGRAMS AT CHINESE VOCATIONAL COLLEGES

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Abstract

The issuance of China's Guidelines for the Modernisation of Vocational Education by 2025, together with the Opinions on Promoting the High-Quality Development of Modern Vocational Education, underscores the urgent need to transform traditional teaching models and enhance instructional methodologies within vocational education. As a core and compulsory course for pharmaceutical engineering students in higher education institutions, Good Manufacturing Practice (GMP) plays a critical role in developing industry-ready competencies. However, existing GMP instruction remains largely reliant on conventional teaching approaches, which are often misaligned with contemporary educational reforms and evolving industrial demands. In response to this gap, the present study investigates the effectiveness of Task-Based Learning (TBL) in enhancing students' academic performance, learning interest, and practical proficiency in GMP courses. The study considers individual student competencies and learning abilities, while also examining the challenges encountered by instructors in implementing TBL to strengthen GMP mastery in pharmaceutical engineering programs at Chinese vocational colleges. To achieve an in-depth analysis, a survey was administered to 91 undergraduate students enrolled in pharmaceutical engineering programs in China. In addition, semi-structured interviews were conducted with four instructors from two classes, each possessing a minimum of five years of teaching experience in vocational GMP courses. The findings indicate that TBL has a significant positive impact on students' academic performance and skill development. Moreover, the results suggest that the TBL approach enhances instructional effectiveness and supports more engaging learning environments in vocational education settings. Nevertheless, the study also reveals that instructors' pedagogical competence – particularly their ability to stimulate students' critical thinking – plays a pivotal role in the successful implementation of TBL. Overall, this study contributes to the integration of theoretical and practical perspectives by highlighting the pedagogical value of TBL in improving GMP education within pharmaceutical engineering programs in the Chinese vocational education context.

Keywords

Industrial Robotics Automation; Reinforcement Learning Adaptation; Data Quality And Accessibility; Safety Governance Readiness; Smart Manufacturing Performance;

INTRODUCTION

Good Manufacturing Practices (GMP) specifies general measures to guarantee that processes required for production and testing are precisely defined, validated, reviewed, and documented and that the people, facilities, and materials are appropriate for the production and quality control of pharmaceuticals and biologicals. According to Chen et al. (2023), there is a lack of coherence in skills, competence, and training among the employees in pharmaceutical companies in China, thus resulting in poor attention to the storage and maintenance of items, incomplete or sloppy self-inspection measures, and others. Furthermore, 98% of pharmaceutical companies are small and medium-sized enterprises with low barriers thus making the industry competitive and demanding practical skills thereby highlighting the importance of practical knowledge. Therefore, the existing traditional teacher-oriented form of learning is no longer viable and necessitates a TBL approach. An exclusive focus on theoretical exposition is not only less effective but may also lead to a diminution in student engagement and motivation as has been opined by Wong & Liem (2022). Policy direction should be reconsidered to counter incompetence in knowledge, abilities, and readiness to adopt novel teaching and learning approaches to increase student learning outcomes. Furthermore, reflecting on the *World Health Organization's (WHO) "Global Strategy on Human Resources for Health Workforce 2030"* for attaining the "*United Nations Sustainable Development Goals (UN SDGs)*" necessitates practical education of the workforce for the advancements of health services thus serving as the foundation for this research (Etukakpan et al., 2023).

Research Objectives

- To evaluate effectiveness of task-based learning (TBL) in enhancing mastery of GMP in pharmaceutical engineering courses for Chinese vocational colleges
- To explore challenges faced by instructors in conducing TBL in enhancing mastery of GMP in pharmaceutical engineering courses for Chinese vocational colleges.

Research Questions

- Does this TBL have an influence on students' GMP mastery?
- Compared with traditional teaching methods, can this TBL enhance students' post competency, improve students' academic performance?
- How to design an operable and effective GMP teaching task module?

Throughout the pharmaceutical engineering courses, good manufacturing practices are essential to guarantee the consistency, security, and superiority of products. This offers rules and specifications to which every manufacturing procedure must conform to satisfy the requirements of the engineering courses. In current years, the vocational institutions of China have expanded quickly, placing a greater focus on instruction in applied competencies. Being an extremely tightly controlled field, the pharmaceutical sector demands that employees have both a practical and theoretical understanding of GMP procedures (Etukakpan et al., 2023). Task-Based Learning is an approach to education that uses real-world activities which mimic real-world work environments to improve the practical abilities of learners. Through offering a more interesting and hands-on learning environment, TBL in pharmaceutical engineering programs at vocational colleges in China has the potential to improve students' comprehension of Good Manufacturing Practices (Jia, 2023). Students may close the disparity between classroom instruction and practical usage by directly applying theoretical understanding in a safe environment via the completion of GMP-linked tasks.

The findings from this study could be beneficial in informing the vocational colleges in China on the strategies to be implemented to stimulate enthusiasm among the students towards learning along with initiative to make the learning process more interactive. Based on the findings from this research the institutions can acquire insights on how to disseminate GMP principles among the students more effectively to produce highly efficient and skilled professionals for the pharmaceutical industry in the future. Additionally, quality control in the pharmaceutical industry is a key component wherein the findings of this research with a focus on TBL can be beneficial in drawing an alignment between industry requirements and educational practices. Similarly, the findings from this research could be beneficial in

the development of a curriculum that is specifically focused on the advancement related to TBL thus potentially leading to improved educational practices.

The methodology employed in the study is contingent upon educational contexts and student demographics, hence constraining the generalisability of the results to alternative settings or educational systems. Additionally, confounding factors that might influence the study's findings include individual learning style variations, the student's experience in the pharmaceutical manufacturing sector, and the quality of the teacher's instruction which has not been considered thus serving as limiting factors for the research. Similarly, limitations are also intertwined with the data collection methods as a small or non-representative sample of students might not be able to accurately reflect the broader population of vocational students in China.

LITERATURE REVIEW

This chapter has systematically reviewed the student-cantered teaching practices and theories focusing on TBL in the foreign countries for a long time as it provides references for the TBL model in China. It has summarised three development stages of TBLT in China including suitable theories and models based on the topic. Reviewing all the factors can help to maintain the high-quality development of higher vocational education based on the GMP curriculum for pharmaceutical engineering in China.

Current situation of GMP course education in vocational colleges mixed

Good Manufacturing Practices (GMP) are a set of standards that should be followed in the production and manufacturing of medical devices and drugs. The GMP is essential for pharmaceutical engineering courses in the Vocational College of China that cannot be overstated. A large part of students in the pharmaceutical engineering course in this vocational education school can be engaged in the production of drugs after completing their graduation. Chen et al. (2023) believes that GMP is an essential technical course in pharmaceutical studies that helps the student understand the basic principles, standards, and requirements of GMP. It also allows the students to improve their skills in cleaning and hygiene, quality control, equipment maintenance including other skills that can be required for the production process of drugs. Hu (2021) shares that using the teaching method students can only focus on the teachers and cannot continue with self-exploration, self-thinking, and self-innovation.

Main Studies International and Local Context

Foreign Research Status

The concept of the TBL model is developed from constructivism which can be used for outlining the educational ideas of American educators like John Dewey. His educational ideas and thoughts have encouraged the students to explore different things for more experience in education. He believed that students with knowledge of the English language could be exercised and supported by designing new activities for teaching and providing proper guidance to the students (Hou, 2021). On the other hand, an Australian linguist, Nunan (D) has classified the tasks into two different kinds in his book ***Task Design in Communicative Classroom,*** which includes educational tasks and objective tasks. On the contrary, a British linguist, Willis (J) has categorised the model of TBL into three different stages in Task-Driven Learning Framework. The stages are pre-task activities, the work cycle of tasks, and language focus, practice, and analysis (Hurtado,2022). However, exploring and researching TBL have been maintained previously in foreign countries which have become important theories for in-depth content.

Domestic Research Status

(1) Introduction phase

The concept of TBL has started lately in China as it was introduced into English teaching in 1990. Professor Wu Xudong conducted research on TBL in 1997 focusing on the principles for determining the difficulty level of foreign language learning tasks including three factors: input language, learner, and activities. The distinguishing factor of TBL is that it is focused on the student in the method of implementation which focuses proper attention on the social reality that helps the student in clarifying their role in the society. Thus, Chen et al. (2023) claim that the introduction of the English curriculum can help to promote an understanding of the TBL approaches that can help accelerate the research methods for relevant

achievements.

(2) Diversification stage

The TBL has become more diversified and richer as it helps to maintain the social constructivist theory and curriculum theory. It is used by the teacher to reflect the teaching skills and thoughts to improve the classroom and existing knowledge of the students stated by Zhang et al. (2024).

(3) Discipline application stage

In this stage, Liu Xiaoping explained seven design principles of task design that involve operable, interesting, driving, goal-oriented, enthusiasm, and other initiatives for improving the students with the implementation of different theories. On the other hand, Guan et al. (2020) stated that Peng Qian assumes the task-driven method in computer teaching in the Vocational College where the teachers can develop reasonable evaluation systems to maintain complexities, diversity, and others.

Theories and concept underpinning the study

Constructivism learning theory (CLT)

Constructivism is an educational philosophy that places a strong emphasis on the search for situation-specific, learner-focused, learner-discovered truth. This philosophy is often employed by the students to construct meaning from their experiences by concluding and actively participating in the learning process by illustrating insights from their prior knowledge, interactions, and reflection (Banafi, 2023). Regarding this research, the inclusion of this framework can afford to develop and refine the knowledge of the students through practical application. CLT supports the idea that social interaction and collaboration are key to learning, thus students can gain from diverse perspectives, and collectively build their knowledge on GMP.

Humanistic Learning Theory

It is a student-centric approach that emphasises the importance of personal growth, self-direction, and the holistic development of learners (Xue et al., 2023). Humanistic education refers to an educational methodology that fosters the advancement of an individual's cognitive, affective, and interpersonal development where priority is often imposed on the needs, interests, and experiences of learners (Bigdeli et al., 2023). In the context of TBL for GMP, this approach ensures that the learning activities are tailored to meet the individual needs and interests of students. TBL encourages students to manage their learning processes, make decisions, and solve problems independently which aligns with the principles of humanistic theory empowering students to take ownership of their mastery of GMP practices.

Learning motivation theory

The learning motivation theory highlights the factors that motivate learning and draws attention to two significant ones that are intrinsic motivation and extrinsic motivation (Gopalan, Bakar & Zulkifli, 2020). Intrinsic motivation is associated with inherent satisfaction and personal interest, whereas extrinsic motivation is often associated with some external incentives such as verbal praise, honorary certificates, material rewards, and so on stated by Mansfield et al. (2020). The inclusion of the framework can help the students comprehend the importance of competence in GMP with TBL as well as significantly enhance motivation and performance by incorporating clear learning objectives and milestones related to GMP.

The context of the study is based on high-quality vocational education and China which included different previous studies on the same concept combined with effective teaching and job knowledge. However, the previous research has not properly aligned and focused on GMP courses in primary and secondary schools. This needs to highlight some more information regarding the high vocational GMP curriculum and courses as it provided less information. The present low interest, academic performance, ability, talent cultivation, and future job hunting of the students in the Vocational College are not properly discussed. Based on this context of teacher innovation, there is also less information regarding traditional teaching and innovation which has created gaps in this study.

METHODS

Research design

The study has followed a mixed approach of research designs that would enable in generating in death data regarding the research in concerned. Both quantitative and quantitative research designs have been adopted for the study. As a part of the quantitative research design, numeric data collected through a primary survey would be collected that is interpreted (Ghanad, 2023). Such quantitative information is effective in generalizability of information towards a larger population while interpreting hypotheses that have been developed for testing relationships between variables. On the other hand, a qualitative approach has been adopted for analysing text-based information for generating richness of the study (Muzari, Shava & Shonhiwa, 2022). Such qualitative information is effective in gathering deeper insights regarding the impact of certain factors on the study that are not identified through a quantitative approach.

Data collection

A primary data collection approach has been adopted in this research for gathering information. Primary data collection can either be qualitative or quantitative based on the type of information to be collected following the developer research questions. This study is utilising both quantity and quantitative for the research. Under the quantitative data collection approach, a survey method is to be used for collecting data from identified samples of the study (GHR & Aithal, 2022). The survey questions will collect responses based on a 5-point Likert scale that will generate numeric and precise information relevant to the study. On the other hand, a qualitative approach will be followed in order to gather information that is rich and has in-depth quality of textual data (Taherdoost, 2021). Qualitative data is to be collected from the respondents with the help of an interview process. The transcripts of the interview will be recorded and interpreted in future in order to generate quality information.

Sample

The researcher of this study selected two separate groups as a sample to conduct quantitative and qualitative analysis methods. A total of 11,156 sophomore students are selected as the sample size who have bachelor's degrees (Xinhua, 2024). Among all of these, a total of 91 students are selected finally to conduct the survey. Furthermore, two individual groups are also developed from 91 sample sizes- 45 students for the experimental group and 46 students for the experimental group. On the other hand, the qualitative analysis is also included in this research paper. In this case, to conduct the semi-structured interview a total of 4 teachers from two classes are selected. Before selecting the sample size, for both survey and interview some criteria are highlighted. It is mentioned that students from 18 to 21 years of age from vocational colleges in China are selected. Similarly, for interview teachers who have minimum 5 years of experience are chosen as a sample size.

Data analysis

The method of data analysis is one of the vital parts in research methodology that is placed after the data collection method. Here, for this study both quantitative and qualitative data analysis methods are utilised for this study (Muijs, 2022). For quantitative data analysis method, descriptive inferential statistical method is applied. This statistical analysis helps to explore the significance of TBL compared to traditional teaching methods in GMP courses. Moreover, IBM SPSS software as a data analysis software is also utilised to test all of the factors of this study and answer the research questions. Apart from that, for the qualitative data analysis method all of the collected data through interviews are interpreted by NVIVO (Allsop et al., 2022). Along with this, some key themes are also developed based on the analysis result. In this way, both quantitative and qualitative data analysis methods are used for this study to generate valid findings.

FINDINGS

Measures of Central Tendency

Table 1: Descriptive Statistics

Statistics				
		GMP	AP	A
N	Valid	91	91	91
	Missing	0	0	0
Mean		2.6410	2.8516	2.8132
Median		2.6667	3.0000	3.0000
Mode		2.67	3.00	3.00
Std. Deviation		.93258	.94132	.85114

The data presented above indicate that the mean for is variables do not have significant differences. Therefore, it is understandable that the values of most of the variables are consistent. However, the mode and median values of A and AP indicates that they are bigger than that of GMP. The broader range shown by GMP indicates that it is more consistent compared to A and AP. However, the trends of the data show a marginal difference.

Reliability Test

Table 2: Reliability Analysis

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.865	.865	9

The reliability statistics presented in the table indicates that the Cronbach Alpha value of the variables is 0.865. Therefore, it can be stated that the variables have the required reliability to be integrated in the regression table.

KMO and Bartlett's Sphericity Test

Table 3: KMO and Bartlett's Sphericity Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.873
Bartlett's Test of Sphericity	Approx. Chi-Square	347.339
	df	36
	Sig.	.000

The KMO value presented in the table is 0.873. Therefore, it can be stated that the range of the KMO statistics can be considered from zero to one. Due to this range, it is possible to conduct factor analysis of the data. Bartlett test presented in the table indicates that the null hypothesis can be rejected due to the significant value of 0.0. A significant difference can be identified in the correlation between the variables from the identity matrix, which has a significant value of 0.0.

Regression Analysis

Table 4: Multiple Regression Analysis by Academic Performance

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.102	.305		3.617	.000	.497	1.708
	GMP1	.055	.092	.057	.597	.552	-.127	.237
	GMP2	.429	.108	.404	3.990	.000	.215	.643
	GMP9	.276	.103	.269	2.676	.009	.071	.480

a. Dependent Variable: AP4

The data presented above indicates that two or three variables have a significant value less than 0.05. Therefore, it can be stated that the GMP courses founded on the task-based learning approach can have significant impact on the academic performance of the students.

Table 5: Multiple Regression Analysis by Ability

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.026	.268		3.825	.000	.493	1.559
	GMP1	-.064	.081	-.073	-.799	.426	-.224	.096
	GMP2	.539	.095	.547	5.693	.000	.351	.727
	GMP9	.221	.091	.233	2.439	.017	.041	.401

a. Dependent Variable: A5

The data presented in the table above indicates that two of three variables have the significant score less than 0.05. Therefore, it can be stated that GMP courses founded on the task-based learning approach can have significant impact on the ability to promote higher teaching results.

Hypotheses Testing

Table 6: Hypotheses Testing

Hypothesis	Result
GMP courses founded on the Task-based learning (TBL) approach have a significant impact on academic performance that ensure better teaching results.	Satisfied
GMP courses founded on the Task-based learning (TBL) approach have a significant impact on ability that promote higher teaching results.	Satisfied

Both the hypotheses are satisfied due to most of the variables having a laser value then 0.05.

Qualitative Analysis

Role of teaching and activities to enhance Task-based learning

Activity based teaching is very effective in providing interactive learning activities to the students so that the students can engage themselves in the learning atmosphere without any challenges. According to the study of Syauqi, Munadi, & Triyono, (2020), the performance of the students has increased significantly under activity-based teaching after the shift in teaching strategy. Therefore, it can be stated that identifying better models and teaching techniques can be beneficial for the educational institutions so that they can

use activity-based teaching approaches in a better way.

It is also found that the motivation of the students to participate in the learning activities has been increased significantly. The study conducted by Rabiman, Nurtanto, & Kholifah (2020) has indicated that the students are provided with the opportunity to make their own decisions in the learning activities. This is found to be the main reason behind such motivation level of the students. However, it is also necessary to mention that involvement and contribution of the teachers in this teaching method also cannot be neglected as the teachers are required to focus on providing better opportunities to the students to make their own decisions. The study conducted by Nguyen & Ng (2022) has stated that the teachers are required to develop better teaching approaches by implementing new teaching models in the learning atmosphere so that the efficiency of the activity-based teaching can be optimised to a significant level.

Significance of Implementation process of Task-based learning and significance of skills in this context

The result of the study indicates that teachers have a significant role to play under an activity-based learning framework. One of the major opportunities that can be achieved by the teachers under such a process is enhancement in innovation and creativity to develop better teaching approaches and models. According to Ovcharuk et al. (2020), focusing on designing engaging activities can significantly increase the collaboration between the students, which is necessary to achieve the optimum outcome from the learning framework. Additionally, the problem-solving tasks can also be developed with the use of the performance of the students under activity-based learning. Therefore, it can be stated that the teachers can identify better approaches that can be essential to develop cognitive skill sets among the students in the most efficient way possible.

Additionally, the teachers can also improve their adaptability to new approaches of teaching as they will participate under the activity-based learning framework. According to the study conducted by Drljača, Opić, & Matijević (2020), it is the responsibility of the teachers to show flexibility through activity-based learning processes, so that students from different intelligence backgrounds can be provided equal opportunity to improve their skills sets. Therefore, it can be stated that the teachers will be able to improve their adaptability and flexibility significantly under this type of learning process. The challenges that can be faced by the students are required to be addressed by the teachers. With increased flexibility and adaptability, the teachers will be able to communicate with the students in a better way so that they can collaborate with the students to improve their interpersonal skills. Therefore, it is found from the result of the study that the teachers can also improve their skills by participating in activity-based learning processes.

Importance of classroom control and course teaching in the context of task-based learning

It is understandable that the classroom atmosphere is required to be maintained and controlled so that the challenges that can be faced by the students in the real manufacturing world can be experienced by them. By integrating activity-based learning, it is possible for the Teachers to implement classroom control and core teaching methods under the good manufacturing practices. According to the study conducted by Coimbra et al. (2020), it is necessary for the Teachers to focus on skills required to maintain the knowledge standards for GMP regulated factories. Therefore, it is necessary to develop suitable protocols so that the manufacturing and quality control process required in the real world can be mirrored in the classroom without any challenges. Additionally, the result of the study indicates that implementation of case-based learning, simulation best training, project based learning and continuous assessment are very important to achieve such an atmosphere to improve the required skill sets of the students.

According to Syauqi, Munadi & Triyono (2020), evaluation of the performance of the students in the classroom under the teaching method focused on GMP is very important and use of activity-based teaching can provide the opportunity to the teachers to develop an efficient evaluation framework so that continuous monitoring of performance can be possible. However, it is also necessary that maintaining quality standards and work collaboration are also required to be evaluated at the same time so that the improvement among the students can be identified properly.

DISCUSSION

The researcher of this study used mixed-method research design for a better analysis on the proposed research topic. The discussion of this study mainly summarised the effectiveness of task-based learning module (TBL) in order to enhance mastery of good manufacturing practice (GMP) in pharmaceutical engineering courses for Chinese vocational colleges. According to Chen et al. (2023), it is found out that GMP is very essential to improve the technical courses in phrenetical studies. Similarly, the sig value for the second item of GMP is also ensure that the recommendations for GMP course is very popular. Therefore, it can be proposed based on the findings of quantitative study that GMP is beneficial for vocational students to improve their skills. On the other hand, the previous study conducted by Hou and published in 2021, also explored that designing new activities for teaching can be helpful to incorporate TBM method in GMP curses in a significant way. The sixth item for GMP also supported through the regression test that support by incorporating GMP, it allows students to evaluate their active and communication skills.

The previous study conducted by Hurtado (2022), explored that before implementing task-based learning method for vocational students, focusing on language, cycle of tasks, practices are also very important. Based on the findings from multiple regression analysis, it is clearly demonstrated that the value of TBL in teaching for GMP courses is more effective instead of traditional teaching method. Apart from the, quantitative analysis, the researcher also used qualitative analysis method to provide a valid discussion by reviewing the previous studies, articles, and journals. According to Rabiman, Nurtanto & Kholifah, (2020), it is clearly identified that through TBL method, students are capable to make their own decisions and enhance more learning activities. On the other hand, based on the findings from study conducted by Nguyen & Ng (2022), it is also revealed that teachers can also evaluate their teaching methods and approaches by TBL method that permit GMP courses for the development of vocational students' skills. According to Drljaca, Opic & Matijievic (2020), it is found out that teachers can take more responsibilities, showcase activity- based learning process, and flexibility for vocational students by incorporating TBL method in GMP courses. Following the outcome of both quantitative and qualitative studies, it can be discussed that TBL method is very helpful for classroom control and course teaching. On the other hand, to evaluate the learning skills of vocational students in pharmaceutical field, the recommendation for GMP course is effective.

CONCLUSION

From the analysis it can be concluded that GMP permits students to develop their skills in cleanliness and hygiene, quality control, upkeep of equipment, and various other skills that may be required during the medication production process. Task based learning encourages students to manage their learning processes, make decisions, and solve problems on their own, which is consistent with the concepts of humanistic theory and empowers students to take ownership of their mastery of GMP practices. GMP with TBL improves motivation and performance by including specific learning objectives. Good manufacturing processes are vital in the pharmaceutical engineering courses to ensure product uniformity, security, and superiority. This provides rules and criteria to which all production procedures must adhere to meet industry standards.

Activity-based learning is an educational strategy in which students learn by participating in hands-on and practical activities instead of passive learning approaches like lectures. This encourages active learning, intellectual curiosity, and practical application of information. In terms of improving pupil achievement via activity-based instruction, it is critical to create projects that represent real-life issues connected to the curriculum. For instance, in science classrooms, students can concentrate on projects such as building models or experimentation. Classroom management and suitable teaching methods are critical for effectively evaluating students' performance throughout pharmaceutical programs that include Good Manufacturing Practices education. Managing time is essential in technical education. It is also critical to set out time periods for theoretical training, practical application, and assessments to ensure students remain engaged and follow timetables.

RECOMMENDATIONS

Curriculum Linkage with Market Needs:

It is essential for Chinese vocational colleges to collaborate with pharmaceutical firms to verify that TBL courses meet real-world business requirements. Integrating industry norms, case studies, as well as real-world scenarios will provide students with a thorough grasp of Good Manufacturing Practices in operation. It is further needed to regularly upgrade the curriculum to reflect new GMP rules and technological breakthroughs in pharmaceutical design.

Hands-On Practical and Simulation Activities:

It is critical for Chinese vocational colleges to provide GMP-related projects that simulate real-life issues in a safe environment. Realistic tasks like assembling clean rooms, adjusting equipment, and conducting audits allow students to implement concepts from theory. It is critical for Chinese vocational colleges also to create virtual laboratories or simulators wherein students can communicate with Good Manufacturing Practices procedures and guidelines in a secure and inexpensive environment.

Tailored Instructional Modules:

Chinese vocational colleges must modify TBL programs to accommodate students' different competency levels. Newcomers, for example, might concentrate on fundamental GMP norms, whilst experienced students can learn about complicated pharmaceutical procedures. It is also critical for Chinese vocational colleges to use adaptive learning technologies to tailor classes and allow learners to proceed at their individual speed.

LIMITATIONS

Changes in college varieties, student populations, or geographic locations may have an impact on how broadly the findings can be applied. The amount of time learners spent with the TBL courses could influence how well they understood GMP. The lasting impact of TBL upon student achievement might not be completely captured by a brief intervention session. Variations throughout the motivation of students, their familiarity with GMP beforehand, and their involvement within TBL assignments may impact the results they acquire. Individual learners may react significantly to TBL techniques depending on how interested or proficient they are in the topic area. The application of TBL may be impacted by the differences in vocational institutions' access to assets, such as lab space, technology tools, along with updated materials. It is likely that some universities do not have the infrastructure necessary to provide realistic, task-based educational settings.

TBL components can also be used in additional highly scrutinised sectors including biotechnology, food manufacturing, and medical equipment production. Increasing its application in these fields can help vocational college learners improve their abilities and meet worldwide standards. Modern technologies like Artificial Intelligence, Virtual Reality and Augmented Reality can be used within TBL courses to deliver comprehensive GMP instruction. This would improve practical, direct experience, even within a simulated setting, resulting in better learning outcomes. Strengthening partnership among vocational colleges as well as pharmaceutical businesses can help maintain TBL courses current with the newest GMP requirements and industry standards. Apprenticeships, training programs, and direct involvement from industry throughout curriculum creation can all improve the learning environment.

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QUESTIONNIARES

1: Strongly disagree, 2: Disagree, 3: Generally, 4: Agree and 5: Strongly agree

Question	**Options**				
1.You like the course of GMP	1	2	3	4	5
2.If you are invited to choose a course, you will recommend GMP	1	2	3	4	5
3.You think that GMP is very helpful for your future work	1	2	3	4	5
4.You think that your motivation to study GMP comes mainly from the exams	1	2	3	4	5
5. Before taking GMP courses, you often take the initiative to preview before class	1	2	3	4	5
6.In class, you think actively and interact actively	1	2	3	4	5
7.After class, you can summarize the classroom knowledge into a knowledge system	1	2	3	4	5
8.You can use GMP independently to solve some practical problems	1	2	3	4	5
9.Compared to traditional teaching, you prefer a teaching full of discussion and inquiry	1	2	3	4	5

II.

Interview questions

1. Do you agree with the use of TBL in GMP course?
2. Compared with traditional teaching, what are the obvious advantages and disadvantages of task-driven teaching method?
3. In the process of implementing TBL in GMP course teaching, is the difficulty of classroom control within your control?
4. What do you think are the difficulties in implementing TBL in GMP course?
5. What suggestions do you have for the difficulties in the implementation process?