International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: *26 August 2023* ***Revised:*** *20 October 2023* ***Accepted:*** *02 November 2023*

Development of P-TMDRE Blended Teaching Mode on E-Commerce Foundation Course in Secondary Vocational School

Yanyan Li[1], Thosporn Sangsawang[2], Piyanan Pannim Vipahasna[3]
[1]Vocational Education Division, Faculty of Technical Education, Rajamangala University of Technology, Thanyaburi, Pathum Thani, 12110, Thailand
[0009-00002-5444-1437]
[2]Educational Technology and Communications Division, Faculty of Technical Education, Rajamangala University of Technology, Thanyaburi, Pathum Thani, 12110, Thailand
[0000-0002-7926-6949] (corresponding author)
[3]Educational Technology and Communications Division, Faculty of Technical Education, Rajamangala University of Technology, Thanyaburi, Pathum Thani, 12110, Thailand
[0000-0002-7795-9776]

Abstract: This research originates from the challenges faced in the teaching of depth, systematization, and coherence in the current blended teaching mode, which is based on an innovatively constructed P-TMDRE blended teaching mode of the "E-commerce foundation course" in secondary vocational schools, which is belived to improve students' grades, due to its emphasis of in-depth systemic learning. The sample uses the method of target sampling to select 17 experts; the course practice is aimed at 80 sophomores majoring in e-commerce, divided into 40 participants in the experimental group and 40 participants in the control group. Four rounds of expert review using the Delphi method: first round: brainstorming; second round: expert opinion review stage; third round: re-evaluation stage based on the previous round of evaluation opinions; fourth round: identify, resolve, and report Workable ideas. Through the pre-test and post-test of the quasi-experimental method, the student's grades and deep system learning ability are tested, and the effectiveness of the P-TMDRE blended teaching mode is further confirmed. Using Delphi technology to build five modules of the P-TMDRE blended teaching mode of the "E-commerce foundation course" course. After the teaching application, the average post-test scores of the control group and the experimental group were 64.765 and 75.252, with a difference of 10.487 points, indicating that the learners' academic performance has been significantly improved. On the motivation dimension of deep systems learning, the pre-test and post-test averages are 2.91 and 4.14. In terms of learning engagement, the mean values of the pre-test and post-test were 2.93 and 4.15. In terms of deep system learning strategies, the mean values of the pre-test and post-test of the learners in the experimental group were 2.96 and 4.17, indicating that the deep system learning ability of the learners has been significantly improved.

Keywords: P-TMDRE Blended Teaching Mode, Delphi Technique, E-commerce Foundation Course, Secondary Vocational School.

1. INTRODUCTION

According to the International Research Institute, Research and Markets, e-commerce is set to expand its share of global retail sales to 20.8% by 2023, accruing a staggering $5.7 trillion in sales. Notably, China is expected to account for over half of these global e-commerce sales (e-commerce platform, 2022). Between 2012 and 2022, China's e-commerce market transaction volume experienced significant growth, increasing annually from 8.11 trillion yuan to 43.83 trillion yuan. This reflects e-commerce's comprehensive integration into China's three main industries, driving the digital transformation of traditional industries and turbocharging economic growth (Ministry of Commerce, 2023). Concurrently, the e-commerce job market has also expanded. In 2022, the number of e-commerce employees in China hit 69.371,800, a 3.1% rise from 2021. Despite this, a 2022 report revealed that 76% of small and medium-sized enterprises face a critical shortage of secondary vocational e-commerce specialists. Still, less than 15% of e-commerce graduates from secondary vocational schools find employment in e-commerce. This underlines a major structural disconnect in the demand and supply of e-commerce talent (Zhao, 2022).

In the current phase, the Ministry of Education actively promotes teacher involvement in competitions related to innovative teaching and information-based pedagogy. This has spurred some exploration and implementation of blended teaching in secondary vocational schools, though efforts remain limited and largely rudimentary (Liu et al., 2020). Implementations like the flipped classroom and other blended teaching models face considerable challenges, hindering their widespread application and preventing them from achieving expected outcomes (Lin, 2023). These impediments are diverse, ranging from inadequate policy guidance and unsupportive environments to deficient teaching support and flawed

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: *26 August 2023* ***Revised:*** *20 October 2023* ***Accepted:*** *02 November 2023*

evaluation systems. Fundamentally, teachers grapple with how to effectively execute blended teaching due to unfamiliarity with the approach and an inability to efficiently converge its components (Shui & Yanran, 2019). Some attempts at blended teaching reform have yielded surface-level engagement without substantive impact (Thomas Perry et al., 2021). Currently, most blended teaching in secondary vocational schools melds traditional teaching with online methods like PowerPoint presentations, videos, and online courses (Jiangbo et al., 2019). However, there are persistent problems with blended teaching, such as the lack of systematic, cohesive, and holistic course development, inadequate learning investments, and superficial learning, leading to poor learning coherence and inefficient classrooms (Waheeb& Khlood, 2019). Blended learning has reached a quality 'plateau,' affecting its overall effectiveness and teacher implementation rates (Huandong et al., 2020). The current state of blended learning significantly lags behind the national aspirations for advanced, innovative, and challenging goals of vocational education's digitization. Consequently, there's a critical need to explore strategies for enhancing the efficacy of blended teaching, specifically in the context of the 'Basis of Electronic Commerce' course.

There is a progressively increasing demand for e-commerce skills, advancing rapidly each year. Despite this, the employment rates of secondary vocational school graduates in e-commerce fields remain inadequate, thereby leading to a significant disparity between the supply and demand of such talents (Aparicio et al., 2019). Current curriculum digitalization within vocational schools is insufficient, making it difficult for traditional classroom pedagogy to meet the Ministry of Education's standards for digital instruction (Morteza & Marzieh, 2020). This situation complicates the cultivation of e-commerce talents able to meet the specialized needs of the 'Internet +' age. Blended teaching methodologies like the flipped classroom are still experimental within vocational schools and have not yet achieved the expected impacts or widespread use (He, 2020). Current curriculum development faces limitations in systematization, integrity, and depth of learning. Hence, addressing the pressing issues in current mixed-teaching methodologies for foundational e-commerce courses and pioneering the P-TMDRE mixed-teaching strategy is a crucial research subject.

2. LITERATURE REVIEW

Blended Teaching Mode

Blended teaching modes, also known as blended learning, involve the intentional fusion of traditional face-to-face instruction with online learning activities. Garrison and Vaughan (2008) describe it as an orchestrated interplay between physical classroom interactions and digital resources. In the contemporary landscape, the concept has evolved to encompass a spectrum of approaches, from the flipped classroom model to hybrid courses that seamlessly integrate in-person and online components (Perera et al., 2020). This expanded understanding underscores the importance of pedagogical alignment, technological integration, and learner engagement. Benefits of Blended Teaching Modes was Recent studies validate numerous benefits linked to mixed learning modalities. The main advantage is flexibility, which gives students the freedom to interact with the materials and assignments at their own pace and develops a sense of independence (Muir & Geiger, 2016). By accommodating a variety of learning styles and improving conceptual understanding, the use of multimedia components, such as interactive simulations and virtual labs, strengthens the educational process (Ng, 2022). According to Osborne et al. (2018), blended learning environments also help students become more collaborative and engage in deeper critical thinking by means of online conversations and group projects, which better equips them to meet the challenges of the digital age. Educators can also use data-driven insights from digital platforms to customize learning paths and offer focused assistance. (Guan et al., 2020).

Obstacles and Things to Think About Although blended learning approaches hold great potential, they also come with drawbacks that have been highlighted in current research. Significant faculty development is required for pedagogical change in order to provide teachers with the technology know-how and online facilitation skills they need (Ahmed, 2022). A persistent challenge is ensuring equal access to technology and digital resources, especially in light of the digital divide that some student populations face (Lembani et al., 2020). Designing meaningful blended experiences is complicated because it requires balancing synchronous and asynchronous interactions while maintaining social presence in virtual places (Wadley & Carter, 2015). Practical Repercussions: A diverse approach is necessary to establish effective blended learning modes in the post-2019 landscape. Initiatives for faculty development should concentrate on equipping teachers to create integrated learning experiences that match technology tools with educational objectives (Blankenship & Davis, 2022). By focusing on universal design principles, one can lessen the effects of technology inequities and enhance accessibility and inclusivity (Giannoumis & Nordli, 2020). In order to guarantee social interaction and a positive learning environment, it is also essential to cultivate a feeling of community in both real and virtual environments (Power, 2019). Using technology to improve learning, blended learning approaches are always evolving in response to the shifting demands on education. Even though there are still difficulties, research conducted after 2019 has shown that flexibility, engagement, and personalized learning have numerous advantages. Ongoing research and pedagogical innovation will influence blended learning's future

trajectory and impact on student performance as educators and institutions work through its difficulties.

The Foundation Course for Blended Learning in E-Commerce

Blended learning techniques are becoming a part of e-commerce teaching methodologies. These methods offer a thorough educational experience by combining conventional in-person instruction with online materials. For example, flipped classrooms, blended learning, and hybrid courses can improve student learning results in basic e-commerce courses. This strategy guarantees that children receive a well-rounded education (Tiwari, 2022). Combined Instructional Approaches, Blended teaching tactics integrate online learning with traditional face-to-face instruction, taking advantage of the advantages of both modes. These approaches give students a well-rounded educational experience by combining the flexibility and accessibility of online resources with in-person interaction. Flipped classrooms, blended learning, and hybrid courses are only a few of the methods that make up blended teaching approaches (Almandrawi & Ahmad, 2022). A growing body of research demonstrates how blended learning methodologies can enhance learning results and student engagement, especially in basic e-commerce courses. (2020, Isabelle). By integrating multimedia resources into the course, blended learning encourages students to study actively. Through the integration of multimedia elements such as interactive simulations, virtual tours, and video lectures, students can improve their ability to comprehend concepts practically and solve problems. Blended learning with multimedia resources improves the efficacy of e-commerce courses. A flexible approach enhances critical thinking and problem-solving skills by enabling students to access course materials at any time. Interactive simulations and virtual tours are examples of multimedia elements that improve practical comprehension while supporting different learning styles (Sasan & Rabillas, 2022). In order to maintain relevance and consistency, classroom conversations require technology and good curation abilities. Finding a balance between classroom discussions and online knowledge can be challenging, as can making sure internet connectivity and equal access. (Dawadi and others, 2021). Perfectly integrating active learning methodologies, the e-commerce sector raises the standard of training in basic courses. In order to prepare students for the digital age, teachers need carefully plan and implement blended learning strategies. They can do this by using multimedia assets to create an engaging learning environment.

Delphi Technique for Blended Learning in E-Commerce

This technique makes use of written questionnaires to prevent personal influences or the power of forceful personalities. The method is based on the results of a questionnaire system under which several rounds of questionnaires are sent to a panel of experts. Their anonymous responses are collected and sent to the panel after each round (Niederberge & Spranger, 2020). The members of the panel are allowed to adjust their answers in subsequent rounds. The multiple rounds of questions result in multiple answers, and the consensus for each round is given to each panel member, which eventually elicits a final“correct” response (Flostrand et al., 2020). It is said that the Delphi technique is a method for building a group communication process that allows a group of individuals to work together to find an answer to a complex problem. This technique gives more and different choices to researchers than does survey research. The communication process, a group of experts, and essential feedback are all necessary for this technique (Drumm et al., 2022).In 1953, to gain the views of military officers about ordnance requirements in wartime, the Delphi technique was formulated. It has been used since then and adopted as a method to prepare for a large number of difficult situations that might occur in the future (Chalmers & Armour, 2019). It comprises several rounds of questionnaires sent to a selected group of well-known people who are experts in their professions. The replies to each round are developed and used for questions in the next round, and so on, until a final consensus is reached (Niederberger & Köberich, 2020).

The Instructional Design Model for PMADE

The PMADE curriculum development model, conceptualized in 2020 by AACTP-certified lecturer Zhang Quanlian, emphasizes agile curriculum development and the importance of deriving insights from experience. Influenced by the agile concept’s impact on the education industry, the PMADE model delineates the core components of curriculum design: problem scenario analysis, method and strategy presentation, logic construction, teaching design, and element development. PMADE model positions ‘Problem’ as critical, focusing on demand analysis and precise topic selection; ‘Methods’ comprise the strategic framework, prioritizing knowledge system organization and experience extraction; ‘Architecture’ focuses on curriculum system organization, involving detailed curriculum outline compilation and content optimization; ‘Design’ encapsulates courseware design and production, aligning it with teaching norms; and finally, ‘Elements’ involves designing suitable teaching activities and forms based on course content. This approach ensures the course remains dynamic and engaging, conforming to the fundamental tenets and modes of curriculum architecture design (Cheng, 2021). PMADE (Performance Management and Development) is a crucial component of employee growth and organizational success. To design effective training and development programs, organizations must conduct a systematic process. This includes identifying specific goals and

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: *26 August 2023* ***Revised:*** *20 October 2023* ***Accepted:*** *02 November 2023*

objectives, defining learning objectives, designing instructional content, choosing an instructional strategy, and assessing and evaluating participants. The program should be designed to be SMART, measurable, achievable, relevant, and time-bound. Assessment methods should be developed to measure progress and success, and the sequencing of content and activities should be logical. Implementation should ensure resources are readily available to participants, and continuous improvement should be conducted through feedback and adjustments. Monitoring and support should be provided to help participants achieve their development goals. Program effectiveness should be evaluated, and detailed records should be kept to communicate the program's impact on employee performance and organizational goals.

The P-TMDRE blended teaching mode for the "E-commerce foundation course" was innovatively constructed using the Delphi Technique.

The Delphi Technique is a systematic method for gathering and synthesizing expert opinions on complex issues. It involves multiple rounds to reach consensus, narrowing differences and identifying challenges, opportunities, and strategies for developing a model, which serves as a foundation for future research (Sangsawang, T., 2020) The Delphi Technique is a valuable tool for developing an international higher education model in Sichuan Province, China. It involves selecting a panel of experts with diverse perspectives, generating ideas through a questionnaire, and gaining feedback and consensus through rounds. The process may involve multiple rounds to reach a shared understanding of challenges, opportunities, and strategies. Once consensus is reached, essential findings and recommendations can be summarized, serving as a foundation for a coherent and evidence-based model. This consensus-driven approach ensures the proposed model is robust, relevant, and tailored to the unique needs and context of Sichuan Province. By incorporating experts' diverse perspectives, the region can make well-informed decisions, address potential challenges, and capitalize on opportunities to enhance its global competitiveness and promote academic excellence (Li, Y., Sangsawang, T., & Vipahasna, K., 2023). The P-TMDRE (Problem-based Learning, Team Collaboration, Multimedia Resources, Discussion, Reflection, and Evaluation) blended teaching mode for the "E-commerce foundation course" is a cutting-edge approach that incorporates problem-based learning, team collaboration, multimedia resources, discussion, reflection, and evaluation. The Delphi Technique, a structured communication method, is used to achieve consensus among experts on a particular topic. The P-TMDRE model encourages active learning and critical thinking by placing students in real-world e-commerce scenarios. The course also incorporates multimedia resources, such as video lectures, interactive simulations, and infographics, to enhance the learning experience. Regular discussions and reflection sessions are essential for deeper understanding of e-commerce concepts. The P-TMDRE model is adaptable to different learning environments and encourages continuous improvement through feedback from students, instructors, and industry experts. This innovative approach equips students with essential e-commerce knowledge and skills, fostering critical thinking, teamwork, and adaptability.

3. METHOD

Participants: the participants in this study are composed of 17 experts, all of whom are based in China. Experts are selected through a purposeful sampling method. Eight experts in education and nine experts in e-commerce and computer science are from the same university. All of them have worked for more than five years, at least as assistant professors. Seventeen interviewees were selected for this study, and the interview forms were face-to-face interviews and telephone interviews.

First Round: In the brainstorming session, the above-influencing factors and the results of these analyses were used in the framework of open-ended questionnaire interviews. Questionnaires were sent to 17 experts who had two to two and a half weeks to complete and return the questionnaire. After receiving the responses, the answers were classified, integrated, and developed into another questionnaire.

Second Round: This is the assessment of the assessment phase of the expert's ideas, including the assessment of the expert's responses using a five-level Likert scale. In the second round of evaluation, questionnaires were used to evaluate Teaching Targets, Teaching Management, Teaching Design, Teaching Resources, and Teaching Environment.

Third Round: In this reassessment phase, include all the principles from the results of the questionnaire, Teaching Targets, Teaching Management, Teaching design, Teaching Resources, Teaching Environment, and related teaching model factors that are similar or different. While these similarities mean that most of the 17 experts agree, these differences are just the opposite. The results of the comprehensive survey were used to compile a Questionnaire and sent out to experts for a third.

Fourth Round: By the time of this round, viable ideas have been identified, resolved, and reported. All Panel comments were admitted by experts on the basis of their ideas or strategies and implementation details.

Determine the influencing factors of the blended teaching mode and construct the P-TMDRE blended teaching mode and detailed modules of the basic course of secondary vocational e-commerce.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: 26 August 2023 Revised: 20 October 2023 Accepted: 02 November 2023

Quasi-Experimental Method

Participants: This experiment will be based on the blended teaching practice model (P-TMDRE) of secondary vocational schools and carry out research practice in combination with the characteristics of e-commerce disciplines. The target of the internship is A secondary vocational school, which is a national key secondary vocational school and offers basic e-commerce courses. Teacher M has taught this course for 9 years, with solid subject knowledge and rich teaching experience. Passionate about using information technology to optimize and transform teaching and learning. The teaching objectives of this course are 80 senior high school students majoring in e-commerce. These students have a good foundation in e-commerce and a strong ability to analyze and deal with practical problems of e-commerce. This experiment adopts the experimental research method of equal group arrangement before and after and designs the experimental group and the control group, with 40 people in the experimental group and 40 people in the control group.

The teaching process of this research can be divided into the following three stages:(1) Pre-test stage. (2) The stage of teaching development.(3) Post-test stage. Use the course content to test the learners' academic performance. Use the "Learner Systematic Learning Questionnaire" to investigate whether the learners' systematic and in-depth learning ability has been improved.

4. RESULTS AND DISCUSSION

Delphi Technical Data Results

After four rounds of investigation and research by 17 experts using the Delphi expert consultation method, 17 experts gave feedback on the fourth round of the "Questionnaire on Elements of Blended Teaching Construction in Secondary Vocational Schools" and, at the same time, fed back to the experts on the statistics of the proportion of questions in the previous round of investigation and The modification of the survey content will be explained. The distribution, collection, and statistical methods of this questionnaire are the same as those of the previous round.

The recovery rate of valid questionnaires in the fourth round and the positive coefficient of experts were both 100%. Key points for this round of consultation: (1) Describe the blended teaching management from the three aspects of scientific research promotion, team training, and cooperation system. The importance of each feature is above 4.00. (2) 70.59% of the experts agreed to delete the "big conceptualization of learning content," with a score of 2.610 in this round, so it was deleted as a modal feature and incorporated into the teaching strategy. (3) After deleting "initiative of the learning process" and "innovation of teaching mode," the importance of expert evaluation of "teaching strategy efficient" increased by 0.087, "Teaching Philosophy" has not changed. (4)76.47% of the experts agreed to delete the "Learning Resources Task," which scored 2.83 in this round, so it was deleted as a modality feature. (5) "Enriching Learning Resources" mode contains "Breadth" respectively and the description of "depth," delete the description of "feature," and the importance evaluation of the feature of this pattern increases by .085.

Table 1. Statistical Results of Experts' Scoring on Construction Dimensions of Blended Teaching in Secondary Vocational Schools

Name	Full Score Ratio	Mean	Standard Deviation	Variable Coefficient
Blended Teaching Targets	94.12%	4.96	0.203	0.041
Blended Teaching Management	88.24%	4.91	0.28	0.057
Blended Instructional Design	100%	5	0	0
Blended Teaching Environment	52.94%	4.52	0.497	0.11
Blended Teaching Resources	76.47%	4.74	0.441	0.093

Table 2. Statistical results of expert scores on the construction dimension pattern characteristics of Blended teaching in secondary vocational schools

Name	Full Score Ratio	Mean	Standard Deviation	Variable Coefficient
Integration of teaching and research	82.35%	4.83	0.382	0.079
Cultivation of teaching team	64.71%	4.65	0.474	0.102
Integrated curriculum education	64.71%	4.65	0.474	0.102
Innovation of teaching concept	94.12%	4.96	0.203	0.041
Precise teaching process	64.71%	4.52	0.651	0.144

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: 26 August 2023 Revised: 20 October 2023 Accepted: 02 November 2023

Great conceptualization of teaching content	0%	2.61	0.572	0.219
Diversified teaching methods	64.71%	4.65	0.474	0.102
Refinement of teaching evaluation	70.59%	4.7	0.461	0.098
Comfortable teaching equipment	52.94%	4.3	0.688	0.16
Self-sustaining learning equipment	58.82%	4.48	0.65	0.145
Intelligent virtual environment	64.71%	4.1	0.381	0.093
Task-based learning resources	0%	2.83	0.379	0.134
Enrichment of learning resources	64.71%	4.65	0.474	0.102
Generation of learning resources	41.18%	4.35	0.635	0.146
Systematization of knowledge construction	100%	5	0	0
Positive collaboration and communication	94.12%	4.91	0.28	0.057
Teaching results are depth	52.94%	4.52	0.497	0.11
Discriminating thinking ability	70.59%	4.7	0.461	0.098

Table 3. Statistical Results of Expert Scoring on Dimension Relationship of Blended Teaching in Secondary Vocational School

Name	Number	Full Score Ratio	Mean	Standard Deviation	Variable Coefficient
Blended teaching management affects the construction of Blended teaching resources	H1	41.18%	4.43	0.523	0.118
Blended teaching management affects the achievement of Blended teaching Targets	H2	52.94%	4.52	0.497	0.11
Blended teaching management affects the use of Blended teaching environment	H3	70.59%	4.7	0.461	0.098
Blended teaching management affects the choice of blended teaching methods	H4	52.94%	4.48	0.582	0.13
Blended teaching design affects the construction of blended teaching resources	H5	82.35%	4.83	0.382	0.079
Blended teaching design affects the use of blended teaching environment	H6	47.06%	4.48	0.502	0.112
Blended teaching design affects the achievement of blended teaching Targets	H7	94.12%	4.91	0.28	0.057
Blended teaching resources affect the use of blended teaching environment	H8	35.29%	4.35	0.479	0.11
Blended teaching resources affect the achievement of blended teaching Targets	H9	76.47%	4.74	0.441	0.093
Blended teaching environment affects the achievement of blended teaching Targets	H10	82.35%	4.83	0.382	0.079

It is generally believed that if the coefficient of variation is greater than .25, it indicates that the degree of expert coordination of this indicator is not enough. At present, the coefficient of variation of the construction dimension and description of the blended teaching model characteristics in secondary vocational schools is less than .25, and the coefficient of variation of the model dimension relationship is also less than .25. It can be seen that the degree of expert coordination is good. In addition, the full marks of these questions are high, and the average importance value is greater than 4. The average value is relatively large, which further confirms that experts have reached a consensus on the construction elements of blended teaching in secondary vocational schools. The specific statistical data are shown in Tables 1, 2 and 3. Therefore, the fifth round of expert consultation will not be held.

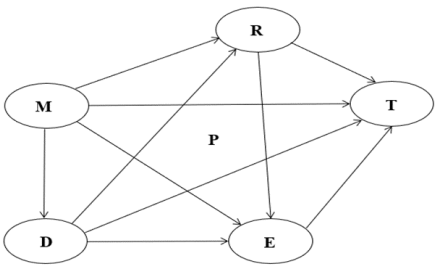

Figure 1. Blended Teaching Practice Model in Secondary Vocational School (P-TMDRE)

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
***Article Received:** 26 August 2023 **Revised:** 20 October 2023 **Accepted:** 02 November 2023*

After four rounds of expert consultation, 17 experts have reached a high degree of consensus on the elements, pattern characteristics and relationship of constructing blended teaching in secondary vocational schools, and then summarized it as P-TMDRE model, P refers to blended teaching problem, T refers to blended teaching Targets, M refers to blended teaching management, D refers to blended teaching design, R refers to blended teaching resources and E refers to blended teaching environment. The relationship of the five elements is shown in Figure 1.1. The specific pattern characteristics and descriptions are shown in Table 4.

Table 4. Explanation of Elements of Blended Teaching Practice Model (P-TMDRE) in Secondary Vocational School

Key Element Dimension	Essential Pattern Characteristics	Specific State Description
Teaching Targets	Systematization of Knowledge Construction	From the perspective of objectivity of knowledge, subject knowledge itself has many connections, such as successive generations, father and son, and so on. Deep learners will move from dispersion, separation and independence to integration, aggregation and correlation and build a systematic knowledge network about subject content. From the perspective of active construction of knowledge, learners need to build their understanding of disciplines around the concept of disciplines and, at the same time, build their overall understanding of different disciplines with the help of interdisciplinary concepts.
	Positive Collaboration and Communication	By providing students with the social situation of developing advanced mental functions and gaining peer support, we can guide students to carry out cooperative learning and interactive communication, resulting in positive social interdependence. In blended teaching, cooperative ability is embodied in students' active participation, empathy, mutual trust and effective communication, and in students' active sharing of resources, mutual communication and mutual help to promote interaction and produce positive interdependence and learning results.
	Teaching Results are In-Depth.	Teaching encourages students to engage in independent study, delve into areas of interest, and think deeply. Students can deepen their mastery and understanding of knowledge through independent scenario creation, case teaching, discussion, etc.
	Discriminating Thinking Ability	In the process of self-determination, inquiry and cooperative learning, based on reliable reasoning and effective evidence, through examination, evaluation and analysis, students' problem-solving ability and decision-making abilities are improved so that they have the necessary character and key ability to adapt to the rapid development and change of knowledge.
Teaching Management	Integration of Teaching and Research	Provide teachers with project research opportunities and research ways, enrich teachers' Blended teaching theories and methods, and encourage teachers to transform the latest scientific research achievements into educational and teaching content in time.
	Cultivation of Teaching Team	Strengthen the construction of a multi-role team, establish an incentive mechanism, protect and stimulate the initiative, and sum up effective experience in time.
	Integrated Curriculum Education	Through the establishment of cooperation mechanisms between government and enterprises and inter-school cooperation with social employment departments and management institutions, curriculum construction can be promoted, and collaborative education can be implemented.
Teaching Design	Innovation of Teaching Concept	Student-centered learning: adopt independent, inquiry and cooperative learning methods to guide and promote students' active participation and development. Lifelong learning: according to the country's major strategic needs, students are trained so that they can learn, enjoy learning and be good at learning, constantly update and optimize their knowledge, have feelings and good character, and better adapt to future social development. Creative learning: adhering to the principle of respect and creation, we should innovate teaching organization, resource service and learning process through various forms such as problems, projects, tasks and research, and transform static knowledge transfer into dynamic knowledge creation, and develop students' innovative thinking through

Key Element Dimension	Essential Pattern Characteristics	Specific State Description
		innovative teaching forms. Technology-enabled learning: the acquisition and sharing of high-quality learning resources, the selection and application of appropriate learning environments, the experience and optimization of personalized learning places, and the connection and interaction of learning partners can all make full use of technology support. At the same time, artificial intelligence, data mining and other pilot applications will also provide learners with learning diagnosis, evaluation and decision-making suggestions.
	Precise Teaching Process	Precision of teaching implementation: In the implementation of the teaching process, it is necessary to provide precise support from the aspects of learning Targets, learning contents, learning tasks, learning activities, learning evaluation, learning intervention, etc., according to the learning situation, as to effectively realize personalized learning. Dynamic learning path: There are differences between students in intellectual factors such as cognitive ability and prior experience and non-intellectual factors such as interest, motivation and personality. It is necessary to identify, recognize and respect the individual differences of students and then provide targeted and appropriate resources, learning support and intervention for different types of students, reflecting the multi-faceted assistance and promotion of students' personalized learning.
	Diversified Teaching Methods	Diversified teaching strategies: Various teaching strategies are used in the teaching process, including case analysis, group discussion, simulation experiments, role-playing, etc., to meet the learning styles and needs of different students and stimulate students' interest and participation. Inquiry learning activities: Guide students to conduct inquiry learning, design open questions and projects, encourage students to actively explore, discover and solve problems, and cultivate their independent learning ability and innovative thinking. Collaboration and cooperative learning: Through group cooperation and mutual assistance of partners, students can promote cooperation and cooperation, solve problems together, and develop teamwork and communication skills. Personalized learning path: According to students' learning progress and interests, provide personalized learning paths and content so that students can carry out in-depth learning in their comfort zone. Cases and actual situations: Integrate real cases and actual situations into teaching, help students apply theoretical knowledge to practical problems, and promote the cultivation of in-depth understanding and practical application ability. Technical support and innovation: Integrate advanced technical tools, such as virtual experiments, simulation software, etc., innovate teaching methods, and enhance students' practical ability and digital literacy. Critical thinking training: Guide students to think critically about problems, analyze different views and evidence, and develop their critical thinking and analytical skills.
	Refinement of teaching evaluation	The whole evaluation process focuses on students' preview, study, review and other links through the explicit behavior and results of students' participation, interaction and results, connecting students' cooperative learning, emotion, thinking development and other dimensions to conduct a process and accompanying evaluation. Diversification of evaluation methods: to stimulate learning motivation and professional interest as the focus, complete the evaluation system of good process, strengthen research-based and project-based learning, and enrich the evaluation methods of homework such as inquiry, thesis and report defence.
Teaching Resources	Enrichment of learning resources	Emotional, ideological, and political: through the integration of national education and professional frontier and trend, professional orientation and content, through the combination of mainstream values, professional knowledge and ability training and professional practice, through the combination of home and country feelings training and students' growth and development needs, things are moistened silently. Breadth: the course content has a clear, logical structure, emphasizing the breadth of the course content and laying solid professional knowledge for students. Depth: Emphasize the depth of course content and promote students' higher-order

Key Element Dimension	Essential Pattern Characteristics	Specific State Description
		thinking and ability training through the study of complex and profound content. Frontier: the content of blended teaching should permeate the value and characteristics of discipline development and professional talents in national major strategies and economic and social development needs. Practicality: the course content is connected with the future career and work design practice. Correspondingly, it includes practical cases, work tasks, venue resources and other resources. Research-oriented: the curriculum content is connected with the theoretical frontier design exploration and research theme, which reflects the academic achievements and scientific and technological achievements. Correspondingly, it includes research cases, investigation reports, experimental reports, academic papers and other resources. Diversification of forms: The resource requirements of blended teaching include micro-courses, courseware, learning resources, expanding resources, exercises, cases and other types, while the resource forms include not only traditional PPT, text, audio and video types but also emerging types such as 3D virtual images, MOOC, SPOC, micro-courses supported by technologies and tools such as VR, AR, Prezi and mind map, and resources can also be nested and interacted.
	Generation of learning resources	Resources reflect the generation of students: the resources in blended teaching are not only the resources prepared by teachers unilaterally but also the resources serving teachers themselves. The resources referred to in blended teaching are the resources facing students' learning, the resources supporting students' internalization and creation, and the resources that will be optimized, perfected, evolved and generated in the learning process.
Teaching Environment	Self-sustaining learning equipment	Learners use mobile devices such as tablet computers as their learning terminals and rely on cloud computing, wireless networks and other facilities to form a learning environment where they can learn everywhere and at all times.
	Intelligent virtual environment	Intelligent technology: It involves not only the Internet, mobile computing, Internet of Things and other technologies but also artificial intelligence technologies such as big data, learning analysis, pattern recognition and data mining so that it can provide adaptation for teachers, students and teaching. Space Individualization: On the basis of students' mobile terminal equipment, independent and personalized design of learning space is required, and appropriate systems, services, resources and services are integrated according to individual needs to meet multiple functions such as learning, inquiry, communication, interaction, display, creation and review. Whole-process data: construct an educational knowledge map, collect all the data from courses, teachers' lesson preparation, teaching, after-class counseling and other links, and collect all the data on students' resource use, learning behavior, learning process and academic performance, analyze the whole teaching process through visualization technology, and collect the complete data flow of teaching and learning.
	Comfortable teaching equipment	Reliability of technical equipment: Provide stable and reliable technical equipment to ensure smooth connection and operation during online and offline teaching. Students and teachers can seamlessly switch teaching platforms and application tools, reducing the interference of technical failures in learning. User-friendly interface: The teaching platform and application tools should have a user-friendly interface design so that students and teachers can easily operate and navigate, reduce the threshold of use, and improve learning efficiency. Comfortable Learning Environment: Provide an appropriate learning environment, including good lighting, ventilation and seating arrangements, as well as ergonomic equipment to help students stay comfortable and focused during the learning process. Diversified device support: Provide diversified device support, including personal computers, tablets, smartphones, etc., to meet the needs of students with different device preferences and learning scenarios. Technical training and support: Provide teachers and students with necessary technical

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: 26 August 2023 Revised: 20 October 2023 Accepted: 02 November 2023

Key Element Dimension	Essential Pattern Characteristics	Specific State Description
		training and support to help them skillfully use teaching equipment and tools, solve technical problems, and improve teaching quality. Data privacy and security: Ensure that teaching equipment and platforms have high-level data privacy and security measures to protect the personal information and learning data of students and teachers. Flexibility and Adjustability: Teaching equipment should be flexible and adjustable to adapt to different teaching scenarios and needs and support online and offline switching and multiple teaching modes.

In the design of the blended teaching practice model in secondary vocational schools, based on the dimension design of blended teaching elements in secondary vocational schools, the hypothetical relationship between the elements is put forward. After four rounds of expert consultation, the P-TMDRE model including P is blended teaching problem, T is blended teaching Targets, M is blended teaching management, D is blended teaching design, R is blended teaching resources, E is blended teaching environment, 5 key elements, 10 related relationships and 16 sample characteristics are put forward.

The Data Results of the Quasi-Experimental Method

Comparative analysis of the results of the experimental group and the control group

With the help of an independent sample T-test on the post-test scores of students in the experimental group and the control group, it is shown whether there are significant differences in the scores of different learners, as shown in Table 5:

Table 5. The study provides statistical data on the post-test scores of learners in both the experimental and control groups.

Group statistics				
Group	Number of Cases	Average Value	Standard Deviation	Mean Value of Standard Error
Experimental Group	40	75.252	9.389	1.484
Control Group	40	64.765	7.484	1.169

The post-test scores of the experimental group and the control group were 75.252 and 64.765, with a difference of 10.487. Independent sample test of post-test scores of learners in the experimental group and control group, as shown in Table 6:

Table 6. The study conducted an independent sample test to compare the post-test scores of learners in both the experimental and control groups.

Independent Sample Test								
Levin variance equivalence								
Sex test			Mean equality T-test					
F	Significance	T	Freedom	Sig. (double tail)	average value differential value	Standard error difference	Difference 95% confidence interval Lower limit upper limit	
Assumes Variance	1.332 .252	4.391	78.891	0	8.254	1.884	4.522 12.022	
Do not assume equal variance		4.378	74.452	0	8.254	1.889	4.508 12.036	

Through the independent sample T-test, it can be seen that the significance level of variance homogeneity test is .000< .05, which shows that there is a significant difference in the post-test scores between the experimental group and the control group. It can be seen that the teaching activities under the P-TMDRE practice model of Blended teaching in secondary vocational schools have significantly improved the learners' academic performance compared with the ordinary Blended teaching model, as shown in Figure 2.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: *26 August 2023* ***Revised:*** *20 October 2023* ***Accepted:*** *02 November 2023*

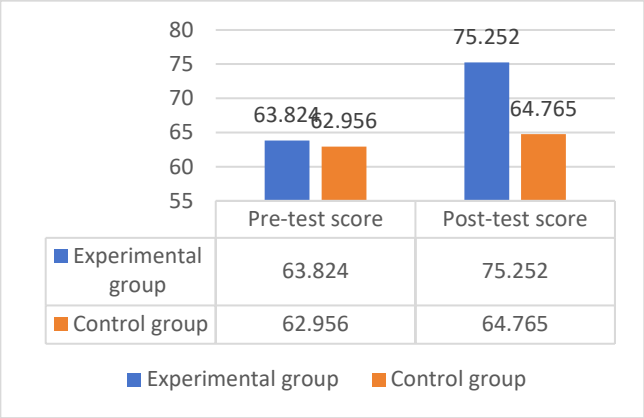

Figure 2. Comparison of the average scores of learners in the experimental class and the control class before and after the test

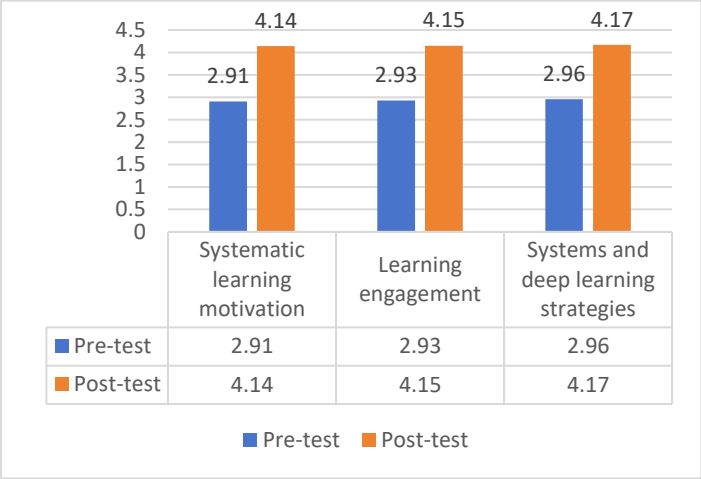

Figure 3. Systematic and Deep Systematic Learning of Learners in Experimental Group and Control Group

To sum up, by analyzing the students' pre-and post-test scores under the P-TMDRE practice model and the ordinary Blended teaching model in secondary vocational schools, we can draw the following conclusions: firstly, the students' test scores under the P-TMDRE practice model and the ordinary Blended teaching model in secondary vocational schools have improved, and the students' pre-and post-test scores under the two teaching models have shown significant differences; Secondly, in view of the post-test results, the student's performance under the P-TMDRE practice model of Blended teaching in secondary vocational schools is significantly improved compared with that under the ordinary Blended teaching model, which shows that the P-TMDRE practice model of Blended teaching in secondary vocational schools is more conducive to improving the student's performance compared with the ordinary Blended teaching model.

Analysis of the influence of the P-TMDRE practice model of blended teaching in secondary vocational schools on learners' systematic and deep learning.

Comparative analysis of deep systematic learning between experimental group and control group

Analyze the three dimensions of the deep learning of the learners in the experimental group and the control group, as shown in Figure 3:

The results show that in the dimensions of systematic and deep learning motivation, the average value of learners in the experimental group is 4.14, while that in the control group is 2.91. In the dimension of learning engagement, the average value of learners in the experimental group is 4.15, and that of the control group is 2.93. In the dimensions of systematic and deep learning strategies, the average value of the learners in the experimental group is 4.17, while that in the control group is 2.96. There are some differences between the experimental group and the control group in systematic and deep learning. The systematic and deep learning of the experimental group is better than that of the control group, which shows that classroom teaching activities under the P-TMDRE model of Blended teaching in secondary vocational schools are more conducive to cultivating learners' deep learning ability.

The experimental results show that the experimental results well support these hypotheses. First, compared with the ordinary Blended teaching mode, the P-TMDRE practical model of Blended teaching in secondary vocational schools is more conducive to improving learners' academic performance, and the learners' academic performance is significantly different from that before learning and under the ordinary Blended teaching mode; Secondly, compared with the ordinary Blended teaching mode, the P-TMDRE practical model of Blended teaching in secondary vocational schools is more conducive to promoting learners' systematic and deep learning. Learners' systematic learning motivation, learning input, and systematic and deep learning strategies are better than those of ordinary Blended teaching mode. Thirdly, compared with the common Blended teaching mode, the P-TMDRE practice model of Blended teaching in secondary vocational schools presents a deep integration of "mixed" classroom teaching mode and effectively changes the classroom teaching mode of the "E-commerce Foundation" course.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10
Article Received: *26 August 2023* ***Revised:*** *20 October 2023* ***Accepted:*** *02 November 2023*

5. CONCLUSION

The findings suggest that blended instruction increases instructional effectiveness, develops lifelong learning skills, provides flexibility, and emphasizes online technology integration, emphasizing the importance of systems and depth of instruction.

1) Blended teaching in secondary vocational schools needs to promote the construction of five core elements: blended teaching objectives, blended teaching management, blended teaching design, blended teaching environment, and blended teaching resources.

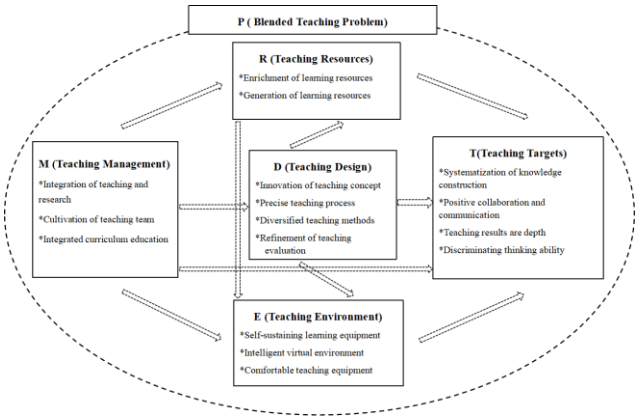

Figure 4. P-TMDRE blended teaching mode in secondary vocational school

P-TMDRE blended teaching needs analysis based on curriculum problems, and it is concluded that the goals of blended teaching significantly affect teaching outcomes, which need to promote systematic knowledge development, active interaction and cooperation, creative and insightful learning outcomes, and discriminative thinking skills. Blended instructional management is critical to enhancing and developing blended teaching practices, requiring the integration of pedagogical research, teaching team building, and curriculum education. Blended teaching design assists teachers and students in achieving teaching goals and tasks, emphasizing the creation of innovative teaching concepts, precise teaching processes, effective teaching strategies, and accurate teaching assessment. The quality of blended teaching resources directly corresponds to the quality of teaching content, which requires the development and enrichment of learning resources. A blended learning environment is critical to the delivery of learning activities, requiring the creation of comfortable physical experiences, independent learning tools, and smart virtual environments. In addition, the implementation of blended teaching in secondary vocational schools requires systematic coordination of teaching targets, management, design, resources and environment.

2) Verify the effectiveness of the application of the blended teaching model of the E-commerce foundation course in secondary vocational school.

The P-TMDRE blended teaching approach in secondary vocational schools is evaluated through quasi-experimental research. The implementation of the P-TMDRE model involves designing, executing, and evaluating practical activities, as well as creating a practical framework that includes teaching research, preparation, implementation, and reflection. This helps guide teachers in changing their educational perspectives and encourages in-depth, two-way interaction between teachers and students within an intelligent learning environment. The P-TMDRE model assists teachers in comprehending blended teaching from various angles. It facilitates a shift in the teaching structure from “teacher-centric” to “student-centric” and supports teachers in designing and practicing blended teaching. In addition, the P-TMDRE model helps students build a knowledge system and strengthen their in-depth learning capabilities, enabling them to achieve the purpose of the curriculum system and in-depth learning to a certain extent.

REFERENCES

[1] Ahmed Hussien Khalaf, M. (2022). E-learning environment in Egypt. International Journal of Education and Learning Research, 5(2), 116-144.

[2] Almandrawi, M. A., & Ahmad, E. S. B. (2022). Blended Learning Online Strategies Into The Product Design Curriculum. Journal of Positive School Psychology, 6(9), 3960-3975.

[3] Aparicio, M., Oliveira, T., Bacao, F., Painho, M. (2019). Gamification: a key determinant of massive open online course (MOOC) success. Inf. Manag. 56(1):39-54.

[4] Blankenship, R. J., & Davis, S. A. (2022). The Pivot: Implementing Best Effective Teaching Practices for Pre-Service Educators – Transitioning From Virtual to Hybrid Clinical Experiences. Experiences and Research on Enhanced Professional Development Through Faculty Learning Communities, 141-177.

[5] Cheng Danni. (2021). "Introduction to Python and Artificial Intelligence" for secondary vocational schools based on the E-SAM model curriculum development research.Master thesis of GuangDong Polytechnic Normal University.https://mall.cnki.net/magazine/Article/CMFD/1021628701.htm

[6] Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-methods research: A discussion on its types, challenges, and criticisms. Journal of Practical Studies in Education, 2(2), 25-36.

[7] Department of Electronic Commerce and Information Technology, Ministry of Commerce. (2023). China Electronic Commerce Report 2022. Beijing: China Commercial Press.5(1),8-20.

[8] Drumm, S., Bradley, C., & Moriarty, F. (2022). More of an art than a science’? The development, design and mechanics of the Delphi Technique. Research in Social and

Administrative Pharmacy, 18(1), 2230-2236.

[9] E-commerce platform. (2022).Official forecast of global e-commerce development trend. https://pndszx.com/nd.jsp?.id=378

[10] Flostrand, A., Pitt, L., & Bridson, S. (2020). The Delphi technique in forecasting–A 42-year bibliographic analysis (1975–2017). Technological Forecasting and Social Change, 150, 119773.

[11] Garrison, D. R., & Vaughan, N. D. (2008). Blended learning in higher education: Framework, principles, and guidelines. John Wiley & Sons.

[12] Giannoumis, G. A., & Nordli, L. H. (2020). Institutionalizing universal design:How to rganizational practices can promote web accessibility. HCI International 2020 – Late Breaking Papers: Universal Access and Inclusive Design, 87-102.

[13] Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. International Journal of Innovation Studies, 4(4), 134-147.

[14] He, J. (2020).Research and practice of flipped classroom teaching mode based on guidance case.Education and Information Technologies.25,2337-2352.

[15] Huandong Chen, Shulei Wu, Jinmei Shi. (2020). Design of Online and Offline Blending Teaching Mode. International Conference on Computer Science and Educational Informatization.8(3),268-271.

[16] Isabelle, D. A. (2020). Gamification of entrepreneurship education. Decision Sciences Journal of Innovative Education, 18(2), 203-223.

[17] Jane Chalmers,Mike Armour. (2019). The Delphi Technique.Handbook of Research Methods in Health Social Sciences.29(7),715–735.

[18] Jiangbo Shu,Qianqian Hu,Min Zhi. (2019). Research on the Learning Behavior of University Students in Blended Teaching.International Journal of Information and Education Technology.9(2),92-98.

[19] Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2020). The same course, different access: the digital divide between urban and rural distance education students in South Africa. Journal of Geography in Higher Education, 44(1), 70-84.

[20] Lin Liu,Kai Liu & Jianbao Zhao. (2020). Development of Online Flipped Blended Teaching Mode in Higher Vocational Education during COVID-19 outbreak: A Case Study.International Conference of Educational Innovation through Technology.10 (1),193-198.

[21] Lin Zhipeng. (2023). Research on blended teaching evaluation based on online open course platform-- Taking the course "HTML5 and CSS3 Development Technology" as an example. Journal of Heilongjiang Ecological Engineering Vocational College. (03):152-156.

[22] Li, Y., Sangsawang, T., & Vipahasna, K. (2023). Utilizing the Delphi Technique to Develop a Self-Regulated Learning Model. Journal of Applied Data Sciences, 4(3), 254-263. doi:https://doi.org/10.47738/jads.v4i3.124

[23] Morteza Mellatia , Marzieh Khademi. (2020). MOOC-based educational program and interaction in distance education: long life mode of teaching.Interactive Learning Environments.28(8),1022-1035.

[24] Muir, T., & Geiger, V. (2016). The affordances of using a flipped classroom approach in the teaching of mathematics: a case study of a grade 10 mathematics class. Mathematics Education Research Journal, 28, 149-171.

[25] Ng, D. T. K. (2022). Online aviation learning experience during the COVID-19 pandemic in Hong Kong and Mainland China. British journal of educational technology, 53(3), 443-474.

[26] Niederberger, M., & Spranger, J. (2020). Delphi technique in health sciences: a map. Frontiers in public health, 8, 457.

[27] Niederberger, M., Spranger, J. (2020). Delphi Technique in Health Sciences: A Map. Frontiers in Public Health, 8 http://doi.org/10.3389/fpubh.2020.00457

[28] Osborne, D. M., Byrne, J. H., Massey, D. L., & Johnston, A. N. (2018). Use of online asynchronous discussion boards to engage students, enhance critical thinking, and foster staff-student/student-student collaboration: A mixed method study. Nurse education today, 70, 40-46.

[29] Perera, C. J., Zainuddin, Z., Piaw, C. Y., Cheah, K. S., & Asirvatham, D. (2020). The pedagogical frontiers of urban higher education: blended learning and co-lecturing.Education and Urban Society,52(9), 1305-1329.

[30] Power, K. (2019). Creating a sanctuary of learning spaces in universities teaching for diversity in use of spaces, both physical and virtual to ensure a best learning and inclusive experience for students. Learning Connections 2019: Spaces, People, Practice. https://doi.org/10.33178/lc.2019.11

[31] Sangsawang, T. "An instructional design for online learning in vocational education according to a self-regulated learning framework for problem solving during the COVID-19 crisis," Indonesian Journal of Science and Technology, vol. 5, no. 2, pp. 283–298, 2020. doi:10.17509/ijost.v5i2.24702

[32] Sangsawang, T. "Instructional Design Framework for Educational Media," Procedia - Social and Behavioral Sciences, vol. 176, pp. 65–80, 2015. doi:10.1016/j.sbspro.2015.01.445

[33] Sasan, J. M., & Rabillas, A. R. (2022). Enhancing English proficiency for Filipinos through a multimedia approach based on constructivist learning theory: a review. Science and Education, 3(8), 45-58.

[34] Shui Jin,Yanran Shang. (2019). Basic Research on Blended Teaching Mode in Colleges and Universities.International Conference on Advanced Education Research and Modern Teaching.350(1),277-279.

[35] SRJ, S. (2021). A Decade of Building a Global Community of Scholars . School of Information Student Research Journal, 11(1), 10.

[36] Thomas Perr, Madeleine Findon, Philippa Cordingley. (2021). Remote and Blended Teacher Education: A Rapid Review.Education Sciences. 11(8),453.

[37] Tiwari, A. (2022). An in-depth analysis of the e-commerce sector. Journal of Northeastern University, 25(04):20-31.

[38] Wadley, G., Carter, M., & Gibbs, M. (2015). Voice in virtual worlds: The design, use, and influence of voice chat in online

play. Human–Computer Interaction, 30(3-4), 336-365.

[39] Waheeb S. Albiladi,Khlood K.Alshareef. (2019).Blended Learning in English Teaching and: A Review of the Current Literature.Journal of Language Teaching and Research.10(2):232-238.

[40] Zhao Wen. (2022).Investigation report on the employment situation of students majoring in e-commerce. https://wenku.baidu.com/view.

[41] Zhang, Y., Sangsawang, T., & Vipahasna, P. (2023). Assessing Factors and Simulating Innovation: A Study of Innovative Capacities Among Data Science Professionals in China. Journal of Applied Data Sciences, 4(3), 213-228. doi:https://doi.org/10.47738/jads.v4i3.123