

Developing Blended Learning Frameworks for High Schools: A Case Study in Nam Dinh Province, Vietnam

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Abstract

This study utilized a combination of reality surveying and pedagogical experimentation to explore the application of blended learning (BL) in the educational sector of Nam Dinh province, Vietnam. The objective was to develop a BL framework tailored for the tenth-grade curriculum in Literature, Chemistry, and Mathematics. This framework was then operationalized through experimental lesson plans, which were implemented in five high schools across Nam Dinh. Results from this study confirm the effectiveness of the BL framework, suggesting its potential for wider adoption within the province. The findings contribute significantly to the enhancement of research and teaching methodologies in high schools, aligning with the 2018 national curriculum for high school students in Nam Dinh. Furthermore, this research provides valuable insights into the broader educational context of Vietnam.

Keywords: blended learning, high school, Vietnam education, face to face learning

1. Introduction

Blended Learning (BL) amalgamates the advantages of face-to-face (F2F) and online learning modalities, yet research on its development in Vietnam exhibits notable gaps. Diverse conceptualizations of BL exist in literature (Bliuc et al., 2007; Oliver, 2013; Staker & Horn, 2012). For instance, Oliver and Trigwell (2005a) perceive BL as an amalgamation of various media and educational approaches, while Bliuc et al. (2007) define it as a fusion of physical and technologically mediated interactions. Staker and Horn (2012) classify BL as a formal training program that integrates online delivery with supervised brick-and-mortar sessions. Despite variations, these studies emphasize the dual nature of BL, incorporating both online and F2F components.

In this research, BL is defined as interactive learning delivered in real-time, either online or F2F, supplemented by homework or projects assigned through a web platform or learning management system (Pham, Nguyen, Nguyen, Phan, et al., 2022a). Although BL has been widely implemented internationally, its adoption in Vietnam gained prominence during the Covid-19 pandemic, showcasing its efficacy in maintaining learning continuity amidst lockdown measures (Pham, Nguyen, Nguyen, & Ngo, 2022; Pham, Nguyen, Nguyen, Phan, et al., 2022b). However, its novelty posed challenges for Vietnamese educators, particularly regarding IT infrastructure and familiarity with the model.

The most recent national curriculum introduced by the Ministry of Education and Training in 2018, along with the subject-based curriculum in Vietnam, were designed to enhance students' competencies. Among the ten identified competencies, three are overarching: autonomy and self-directed learning, communication and collaboration, and problem-solving and creativity. The remaining seven competencies are specific, focusing on exploration in areas such as nature and society, as well as various domains including technology, aesthetics, physical education, informatics, computational skills, and linguistic abilities. Adhering to a competency-based approach, the new curriculum outlines learning content, teaching strategies, and assessment methods to foster greater student autonomy. Consequently, teachers are empowered to select between online or face-to-face formats based on the specific content, objectives, and teaching methodologies. Given these developments, the implementation of blended learning in high schools is opportune. In Nam Dinh's high schools, the majority of educators possess robust professional training and adeptly utilize varied pedagogical approaches, notably problem-solving and project-based learning. They exhibit adaptability

in integrating interactive activities and assignments, while concurrently championing STEM education initiatives. This renders Nam Dinh an auspicious locale for conducting BL experiments.

In both Vietnam and globally, there has been extensive research conducted on blended learning (BL) (Oliver & Trigwell, 2005a; Staker & Horn, 2012). Some studies delve into the conceptual aspects of BL, such as inquiries into its redemption potential and its relation to e-learning and digital media (Oliver & Trigwell, 2005b). Other research focuses on methodological choices and student experiences with BL in higher education settings (A.-M. Bliuc et al., 2007). Furthermore, there are studies dedicated to the development of BL models, including classification schemes for K-12 education and identification of key design elements (Staker & Horn, 2012; Carman, 2005). Implementing BL in schools has proven effective, particularly in rural areas where teacher shortages and limited student-teacher interactions are prevalent (Ghimire, 2022). BL has also been credited with enhancing students' confidence in information acquisition and interaction with peers and educators (Gault & Cuevas, 2022). Additionally, research demonstrates BL's positive impact on student achievement (Ojaleye & Awofala, 2018; Seage & Türegün, 2020).

Although these sources provide useful insights, there is a notable dearth of research specifically examining the application of blended learning (BL) in high schools located in Nam Dinh province, Vietnam. Therefore, this study is dedicated to elucidating the content, format, and delivery methods of BL in Nam Dinh high schools, as well as proposing strategies for its effective implementation.

2. Method

2.1 Procedures

In their empirical study on blended learning (BL), Pham et al. (2022) categorized BL into two forms: serial and parallel. Serial BL organizes learning activities sequentially, alternating between online and face-to-face (F2F) modes. In contrast, parallel BL involves simultaneous engagement in online and F2F activities. Based on surveys and teaching practices in Nam Dinh, they proposed BL for flipped classrooms and project-based learning. Additionally, they developed curriculum frameworks for Literature, Mathematics, and Chemistry, with lesson plans totaling 84 periods. (30, 30 and 24 periods for Literature, Math, and Chemistry, respectively).

This study constitutes a continuation of prior efforts in developing BL models for Nam Dinh province's high schools. Its overarching objective is to assess the feasibility of the proposed lesson plans and tailor teaching methods to suit the province's unique characteristics and educational objectives. To achieve this, the authors conducted an experiment utilizing the aforementioned lesson plans, with specific aims including:

- (1) Develop an initial BL framework and lesson plans.
- (2) Obtain expert feedback for refinement before the pilot study.
- (3) Evaluate feasibility in selected high schools, considering infrastructure, implementation, and feedback from administrators, teachers, and students.
- (4) Gather feedback from teachers for further adjustments.

2.2 Study Design and Participants

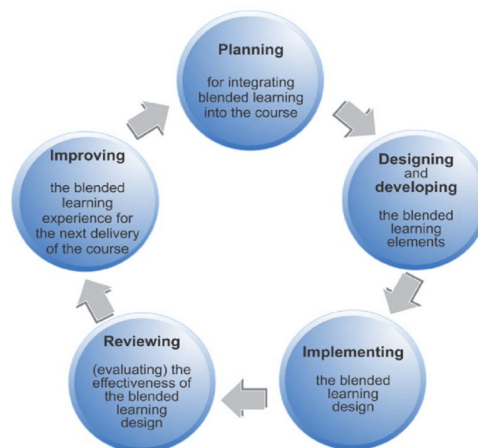


Figure 1. BL Design Process Implementing (Bath & Bourke, 2010)

In this study, we adhered to the BL design process proposed by Bath & Bourke (2010), which encompasses five stages: Planning, Designing and developing, Implementing, Reviewing, and Improving.

2.3 BL Design

To develop a comprehensive and optimum BL model for high schools, stages implemented include planning, developing initial model, expert consultation, experiments.

Planning: A comprehensive assessment of schools' conditions was conducted to determine their readiness for implementing blended learning (BL). This included evaluating facilities, technology infrastructure, teacher capacity, students' technological proficiency, access opportunities, and classroom size, with the goal of aligning BL implementation with the school's teaching organization.

Developing initial model: Staker and Horn (2012) categorized blended learning (BL) into various forms such as Rotational, Flex, Self-Blended, Enriched, and Virtual. However, in their empirical research, Pham et al. (2022) identified two primary forms: serial BL and parallel BL. Drawing from surveys and teaching practices in Nam Dinh province, they proposed two practical applications: BL for flipped classrooms and BL for project-based learning. Additionally, a three-subject curriculum framework was developed, along with lesson plans spanning 84 periods.

Expert consultation: Six experts hailing from The Vietnam Institute of Educational Sciences, Hanoi University of Education and Training, and Hanoi Pedagogical University 2 were enlisted to offer their expertise in assessing the scientific foundation and practical viability of the proposed program framework.

Experiment: From August to October 2022, a trial of the blended learning (BL) model was carried out for three subjects at Le Hong Phong High School and four others within the same province: My Tho, Le Quy Don, Nam Truc, and My Loc. A total duration of 84 periods was allocated for designing lesson plans and conducting trial teaching sessions. For each subject, suitable topics or lessons were selected for trial teaching. Teaching activities were tailored to the specific infrastructure and students' capabilities at each school, ensuring alignment with the intended learning objectives.

Selected topics/content were matched with appropriate teachers tasked with designing lesson plans in line with the proposed blended learning (BL) model. Outcomes for both online and F2F learning were reasonably determined. The research team collaborated closely with teachers throughout the process of material development and online class creation based on agreed-upon lesson plans, making the lesson plans and teaching materials collective efforts. Figure 2 illustrates the participation of teachers and students in the trial lessons, highlighting a predominance from Le Hong Phong High School.

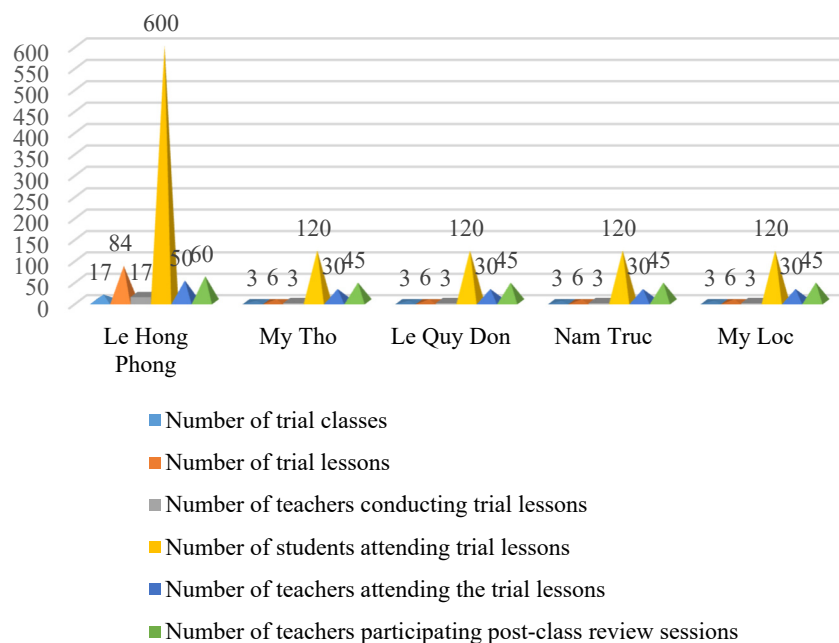


Figure 2. Number of Students and Teachers Attending the Trial Lessons

2.4 Materials

The development of lesson plans and creation of online and F2F learning materials are integral components of the research methodology. These processes fall within the broader framework of the Methods section.

Lesson Plan Development: Lesson plans are tailored applications of the BL framework, aligning with specific learning objectives for both online and F2F learning settings. Each lesson plan is meticulously crafted to correspond with defined learning outcomes. For instance, in the F2F environment, traditional materials such as textbooks, reference materials, and experimental tools are utilized. Conversely, priority is given to digital materials in the online learning environment, including video tutorials, virtual experiments, electronic textbooks, and interactive software.

Creation of Learning Materials: Teachers are tasked with deciding and developing materials that meet the designated learning outcomes. This process involves innovative approaches to learning methods and design, ensuring adaptability to students' needs and learning materials. Various digital resources such as PowerPoint presentations, instructional videos, and interactive exercises are employed to deliver core content effectively. Additionally, options for process review and assessment at the conclusion of each lesson are identified. The selection of appropriate learning platforms and tools is crucial, with preference given to platforms that support digital materials and facilitate student-teacher and student-parent communication.

Feedback Collection: Teachers' feedback is gathered through two primary methods. Firstly, through the utilization of a BL observation tool designed based on the teaching progress of experimental teachers. Secondly, through direct discussions with experts and teachers who participate in the classes.

3. Results

3.1 Developing BL Frameworks for Some Subjects in High School

Table 1. Framework of BL for Chemistry in 10th Grade (01 topic)

Content	Learning outcome	Online learning (2 periods)			F2F learning (2 periods)		
		Learning outcome	Content	Materials	Learning outcome	Content	Materials
Oxidation - reduction reaction (4 periods)	State the concept and determine the oxidation number of atoms of elements in compounds. Explain the concept of oxidation-reduction reactions and the meaning of oxidation-reduction reactions. Describe some important oxidation-reduction reactions associated with life. The oxidation-reduction reaction can be balanced by the electron balance method.	State the concept and determine the oxidation number of atoms of elements in compounds. Explain the concept of oxidation-reduction reactions and the meaning of oxidation-reduction reactions.	the number of Rules for determining g oxidation numbers; The concept of oxidizing agent, reducing agent, redox reaction and some important redox reactions	Video/lecture file on the concept and steps of determining redox numbers: https://cothuyhoavb.blogs.pot.com/2021/06/bai-giang-elearning-phan-ung-oxi-hoa.html Video demonstrating the application of some important redox reactions associated with life: simulation video: Fe nail reacts with CuSO4 (https://www.youtube.com/watch?v=rZnxZpIOc3E) Self-study guide card	Describe some important oxidation-reduction reactions associated with life. The oxidation-reduction reaction can be balanced by the electron balance method.	Set up the equation for the oxidation-reduction reactions in practice Practice reaction can be balanced by the electron balance method.	Diagram of steps to balance the oxidation - redox reaction; The video describes the process of donating electrons between atoms of substances in the reaction. Study sheet/self-contained questionnaire system; Product evaluation sheet; Mind map to synthesize knowledge about redox reactions; Experimental video of Fe reacting with H ₂ SO ₄

The authors have formulated the BL Framework for Mathematics, Literature, and Chemistry with the following guiding principles: (1) Alignment with Curriculum Goals: the framework is designed to meet the competency objectives outlined in both the subject-based curriculum and the national curriculum. (2) Achievement of Learning Outcomes: it aims to fulfill the learning outcomes specified in Circular No. 32/2018/TT-BGDĐT dated December 26, 2018, issued by the Ministry of Education and Training. (3) Flexibility in Implementation: the framework ensures adaptability to the varying facilities and human resources available at each school.

To effectively implement BL in the classroom, teachers are required to:

Define Learning Outcomes: For each topic or lesson, educators must identify specific learning objectives to be addressed in both the online and face-to-face learning environments. These objectives encompass various levels of cognitive engagement, including knowledge acquisition, comprehension, analysis, synthesis, and practical application.

Select Online Learning Content: The curriculum should include theoretical content that can be self-studied by students, along with materials that connect theoretical concepts to real-world scenarios. This content may be sourced from textbooks, online resources, videos, and other relevant materials.

Choose F2F Learning Content: In the face-to-face setting, emphasis is placed on practical activities, experiments, assessments, and reinforcement of previously covered online content.

By adhering to these guidelines, educators can ensure that BL implementation maximizes student engagement and promotes active learning and self-study opportunities.

3.2 Experts' Feedback on "BL Framework"

3.2.1 Positive Factors

The BL framework aligns with competency development goals and fulfills the requirements of the 2018 national curriculum and subject-based curriculum. This ensures its suitability and adaptability to the specific facilities and resources available in schools.

Clear and explicit definitions of learning outcomes for both online and face-to-face learning stages were provided, as indicated in the feedback on the Chemistry Curriculum Framework.

The curriculum framework comprehensively covers educational content in accordance with subject programs, aimed at enhancing students' capacity and quality, as noted in the feedback on the BL Framework for Literature.

3.2.2 Suggestions for Revision

The Mathematics curriculum should clarify learning outcomes in alignment with the subject-based curriculum outlined in Circular 32 by the Ministry of Education and Training.

Overlapping content and learning outcomes between online and face-to-face learning environments in the Math Curriculum Framework need to be reviewed and adjusted.

Additional resources are needed to support learning activities for several topics in the Literature, Chemistry, and Mathematics curricula.

The time distribution for online learning and face-to-face learning in the BL Framework for Literature requires review.

The research team has considered the feedback provided and finalized the BL framework for the three subjects, which will serve as the foundation for developing lesson plans and materials in the BL approach.

3.3 Results of Experiments in Nam Dinh Province

After completing lesson plans with feedback and recommendations from research experts, teachers trialed them at schools and obtained the following results:

3.3.1 Schools' Infrastructure

During the trial learning phase, the research authors observed that the infrastructure of the schools is sufficient for implementing BL. Specifically, the IT infrastructure and internet connection can meet the needs of online learning, while classroom equipment completely fulfills the requirements of active learning and IT application. Particularly, the number of classes equals the number of classrooms, which is very favorable for diverse learning activities when BL is implemented.

Table 2. Number of Classes, Classrooms, Students and School's Assessment of Infrastructure

Sequence	School's name	Number of classes	Number of students	Number of classrooms	School's assessment of infrastructure
1	Le Hong Phong	48	1666	48	Good technology background; stable Internet connection; classrooms well-equipped (computers, projectors, televisions, etc.) in every classroom. Digital transformation conducted in the school year 2021-2022; school management, teaching and learning conducted through Microsoft Office 365 software. Throughout the school year, IT training sessions provided for leading students; class IT Group formed to help students effectively utilize IT applications in learning. Internet, high-speed Wi-Fi Internet, desktop computers and smart TVs available in all 26 classrooms, ensuring favorable conditions for IT application in learning.
2	Le Quy Don	26	1104	26	All teachers and students have Office 365 accounts; students are categorized into groups to enable teachers to apply MS TEAMS in BL, deliver and receive homework from students. A document management system was built; records kept and managed on OneNote and OneDrive; online learning and conference management system based on MS TEAMS platform.
3	Nam Truc	33	1375	33	Sufficient infrastructure for implementation of BL, which include Internet connection, computers, projectors, and smart TVs.
4	My Loc	30	1210	30	With 3 high-speed Internet lines, all 30 classrooms equipped with smart TVs connected to the Internet, all teachers own computers and can use them effectively.
5	My Tho	33	1382	33	Meeting minimum requirements to deploy BL.

3.3.2 Teaching Process

Organization method: 100% of trial learning content/topics were designed for online learning and F2F learning activities. In the online learning phase, teachers sent materials (videos, reading passages, questions ...) and assigned tasks to individual students or groups of students via online learning platforms. Students completed the assigned tasks and submitted their work via the same platforms (Azota software, Teams, etc). Afterwards, teachers provided feedback to individual students on the tasks submitted by themselves or their groups, facilitated presentations, answered additional questions raised by students, deepened students' knowledge or provided further information.

Lesson plans were prepared on principle that teachers determined and distributed requirements of the whole lesson/topic in accordance with online and F2F learning. As a result, in both learning activities, lesson plans were designed in two main stages: (i) determining goals (Learning outcome) as a basis to define content and methods; (ii) selecting content and methods suitable for learning formats (F2F or online) before collecting or building suitable materials. In online learning phases, materials were provided with clearly-defined tasks and requirements for students. In F2F learning phases, active learning methods were adopted along with application of IT to promote active, proactive and creative activities from students.

Teachers participating in the experiment strictly followed the proposed BL process and guidelines for developing and conducting lesson plans in both F2F and online learning phases. Before class, teachers assigned tasks to students via an online learning platform with diverse materials: texts, videos, tests. During class time, teachers organized active learning activities based on knowledge that students had acquired themselves. At the same time, teachers demonstrated competence for IT and learning organizing. These are favorable preconditions for the successful implementation of the BL model in schools.

3.3.3 Participating Schools' Feedback

a. Le Hong Phong high school as a representative of high schools for the Gifted students

The BL model implemented in trial lessons proved to be compatible with the infrastructures and student demographics of the school, making it applicable not only to Le Hong Phong High School but also to other schools in Nam Dinh.

Le Hong Phong High School, with its mission of training gifted students to meet national and international standards, finds the Online Driver-Parallel Model suitable for optional learning. This model allows students to access global knowledge and participate in online courses provided by foreign experts, leading professors from universities, and research institutes nationwide. For students preparing for Provincial Excellent Student Competitions and university entrance exams, the school can adopt the Flipped Classroom-Series Model to expand learning space and time, as well as self-study opportunities, while tailoring them to individual competencies.

b. Nam Truc high school, Le Quy Don high school, My Loc high school as representatives of schools with good IT infrastructure and competent teachers:

The selected schools meet the requirements for infrastructure, awareness, and IT capacity of teachers and students, making the implementation of the BL model feasible within reasonable timeframes and requirements. The schools have the option to choose the Series Model for certain subjects/topics and the F2F Driver-Parallel Model for others.

Through BL, students had the opportunity to acquire knowledge via online lessons before attending F2F classes, which increased their learning enthusiasm and technology application skills. Most students actively participated in learning activities with joy and excitement, fostering their creativity.

Teachers employed various active learning methods to enhance engagement in the lessons, while students had access to new learning techniques for competency development aligned with educational standards. Both teachers and students benefited from modern learning methods, integrating online and F2F learning. Students improved their self-study abilities and gained new knowledge through e-learning lectures and other resources.

Furthermore, teachers made strides in utilizing flexible and effective F2F and online learning platforms such as Quizzi, Padlet, and Office 365, enhancing their IT skills. Overall, teachers and students have begun to meet the requirements of the national curriculum, as evidenced by the learning activities organized by teachers, which facilitated the development of necessary skills and qualities in students.

c. My Tho high school as a representative of high schools with inadequate IT infrastructure and capacity of teachers and students: Parallel Model can be applied to a variety of topics/activities to increase student learning enthusiasm.

BL can enhance students' self-study abilities by providing them with access to IT resources and practical exercises, allowing them to engage with software and accompanying models independently. Students are exposed to new learner-centered learning methods, where teachers provide guidance and students discover new knowledge on their own. This fosters solidarity among classmates and increases students' interest through the integration of innovative learning approaches. However, self-study remains challenging for students who lack diligence, and the quality of learning depends on both individual and school resources. Insufficient facilities in many institutions hinder effective learning and teaching activities.

3.3.4 Feedback from Teachers Attending Trial Lessons

Feedback from teachers who participated in the trial lessons was collected through an "Observation Sheet" and analyzed to assess various aspects of the blended learning (BL) model implementation. The feedback focused on four key areas: (1) Level of goal achievement, (2) Learning resources and materials, (3) Teaching methods and organization, and (4) Assessment activities during the teaching process. Additionally, insights were gathered from the "Minutes of Post-Class Review" conducted by professional groups in the five schools selected for the trial lessons.

According to the data presented in Table 3, the majority of experts and teachers noted positive indicators of the BL model in the observed lessons, with only a few indicating lower ratings. Notably, all teachers (100%) agreed that the trial lessons successfully achieved the predetermined goals outlined in the lesson plans. However, there were varying levels of satisfaction regarding learning resources and materials, particularly concerning the clarity of sources and compliance with copyrights, with Mathematics receiving the lowest rating at 89%. In terms of teaching methods and organization, the lowest ratings were attributed to tasks assigned to student groups of different abilities, particularly in Mathematics (61%), Chemistry (79%), and Literature (92%), highlighting a potential limitation in F2F learning compared to online learning.

Assessment activities in the teaching process also garnered attention, with concerns raised about the clarity of

grading criteria receiving low ratings across subjects (80% to 91%), especially for self-assessment and application parts. Experts and teachers emphasized the importance of clear grading criteria for accurate assessment of student abilities, as well as for enabling students to evaluate their peers and motivate self-improvement efforts.

Table 3. Observation Sheet

		Math	Literature	Chemistry
Level of goal achievement		100%	100%	100%
Learning resources and materials				
1	Diverse learning resources and materials (in multiple formats, compatible with many devices to facilitate user access and use).	100%	100%	100%
2	Resources and learning materials are designed in modular structure, friendly with computers, mobile or remote communication devices.	100%	97%	100%
3	Resources and learning materials are delivered to learners with detailed usage instructions to achieve learning goals.	100%	100%	100%
4	Resources and learning materials are cited from clear sources, complying with copyrights.	89%	100%	97%
5	Learning content and resources connect F2F and online learning.	100%	94%	100%
Teaching methods and organization				
1	A variety of learning activities (individual work, group work, ...) are organized.	100%	100%	100%
2	Connection between learning tasks in online learning and F2F learning is established.	100%	100%	100%
3	Activities are available to maintain interaction between subjects (teacher-student, student-student, student-content), question raising, task assigning for pairs/groups, etc).	100%	100%	100%
4	Attention and encouragement are given to students (both active and keen students and those who are faced with difficulty or do not actively participate).	96%	100%	97%
5	Learning tasks are assigned to student groups of different abilities.	61%	92%	79%
6	Students get support for problem-solving: technology (access to material, screen sharing, submission, question raising...), teamwork, use of learning materials/devices, etc.	100%	94%	100%
7	A variety of methods/forms/ content are applied to assign tasks to students (with clear instructions about content, time, products, ...).	100%	94%	100%
Teaching methods and organization				
1	The assessment method measures level of achievement for lesson goals.	93%	89%	100%
2	A variety of assessment methods are applied (multiple choice, short answer, drag and drop, gap-filling, ...).	91%	92%	88%
3	Criteria and grading scale are clearly stated.	80%	81%	91%
4	Evaluation tools are applied in various ways, corresponding to previously determined learning objectives and activities (self-assessment, peer assessment/student peer assessment, teacher assessment).	96%	83%	100%
5	Students can get assessment results of their learning activities, with quick and timely feedback from teachers and friends, etc.	98%	89%	100%
6	Assessment data is used by teachers to adjust teaching process and prepare customized learning for students (tasks for each student is defined based on assessment data).	96%	92%	100%

3.4 Results Obtained through “Minutes of Post-Class Review”

Requirements of the lesson fulfilled: Teachers diligently crafted lesson plans, meticulously following the blended learning (BL) model. They exhibited flexibility in employing innovative teaching methods, fostering a variety of engaging activities for students. These activities were strategically designed to promote learner engagement, in alignment with the competency development objectives delineated in the 2018 national curriculum. Both educators and students demonstrated adeptness in utilizing IT tools, effectively integrating technology into the learning process. Students showed notable progress in self-study, communication, teamwork, and IT proficiency, actively participating in classroom activities. Moreover, lessons effectively demonstrated the practical application of acquired knowledge, utilizing an array of diverse and relevant materials.

Limitations and challenges: Teachers encountered several challenges during the implementation of blended learning. Heavy workloads and the introduction of the new national curriculum resulted in time constraints for lesson planning and delivery. Additionally, variations in student learning awareness and motivation presented challenges both within individual classes and across different groups of students. Tension among teachers was observed due to the presence of external observers during lessons, which disrupted the teaching environment. Difficulties arose in managing tasks submitted by students during online learning sessions, highlighting the need for more efficient management systems. Moreover, the absence of diverse assessment and evaluation activities limited the ability to accurately gauge student progress and understanding.

Suggestions for improvement of teaching: It is recommended to gradually introduce the BL model in specific topics/lessons and across early grades to facilitate smoother implementation and adaptation. Additionally, closer examination of group task results from online learning sessions can provide valuable insights for integration into face-to-face classes, enhancing the overall learning experience. Flexibility in organizing activities, particularly for student groups, should be emphasized, accompanied by clear evaluation criteria to ensure consistency and effectiveness. Moreover, achieving a balance between online and face-to-face learning methods is essential to optimize learning outcomes and promote student engagement.

The application of the BL model demonstrated alignment with the goals outlined in the 2018 national curriculum, showcasing innovation in teaching methodologies. Positive and active student engagement was observed, indicating the feasibility of wider implementation of the BL model in educational settings.

3.5 Feedback from Teachers Delivering Trial Lessons

With all three subjects, all teachers considered their lessons successful, accomplishing predetermined goals. Students had positive and active responses, proving the BL model can develop their self-study ability. Students showed enthusiasm in lessons, while relatively competent with learning software. Some teachers acknowledged that they felt a little under pressure at the beginning of lessons. Both teachers and students found it difficult to apply IT in teaching and learning, especially at the beginning of lessons (My Loc high school). Some students were not active, and teachers had to motivate and provide much encouragement (My Tho high school). Despite various challenges (relevant to facilities, IT qualification of both teachers and students, learning resources) both teachers and students were very excited and recognized the benefits they could gain from BL. Therefore, they predicted high feasibility of the BL models deployed in schools.

4. Discussion

The pilot study of Blended Learning (BL) models at Le Hong Phong High School and other schools in Nam Dinh province has yielded positive results, demonstrating the scientific basis of the project. The study provides empirical evidence that the proposed BL models have the following advantages:

Achieving educational objectives: The lessons help students develop not only their specific competencies but also general competencies: self-research and self-study skills, collaboration, communication skills, etc. The applied model helps improve teaching and learning activities. Moreover, the designed model meets the objectives defined in the 2018 national curriculum while providing opportunities for ICT application and technology integration in the 4.0 era. Furthermore, the primary focus of each lesson is to align with the objectives outlined in the subject-based curriculum. These objectives serve as the central guiding principles for teaching activities. Accordingly, for every lesson, the research team selects a suitable BL model based on these objectives, along with appropriate learning materials tailored for both online and face-to-face (F2F) learning settings. When the content is fundamental, aiming to impart information or orient learning, teachers conduct online classes to facilitate independent study and exploration by students. Conversely, for content aimed at enhancing skills, providing practical experiences, or imparting advanced

knowledge, teachers arrange face-to-face classes to foster interaction, enabling teachers to provide feedback and guidance.

Ensuring adequate lesson content: The versatile and adaptable implementation of BL models allows for the provision of sufficient lesson content in alignment with current curriculum guidelines. Teachers have the flexibility to transition between face-to-face (F2F) instruction and self-study content delivered via the Internet and digital materials as needed. Moreover, online lessons offer opportunities for teachers to enhance and enrich students' knowledge for real-world application. Students not only acquire foundational knowledge but also expand upon it and gain practical experience, with varying levels of awareness, self-study skills, and enthusiasm for the subject. As a result, the BL model facilitates a more precise and expedited progression for students.

Saving learning time: The time allocation for the BL model is highly adaptable. Face-to-face (F2F) classes allow for adequate time, while online lessons offer flexibility to be conducted outside of regular school hours. To maximize the effectiveness of F2F classes, students are encouraged to engage seriously in online learning. Through the BL model, teachers employ innovative and contemporary teaching methods like problem-solving, project-based learning, and reverse classes, thereby saving considerable study time and ensuring heightened focus on lesson objectives.

Taking advantages of IT: The BL model has taken advantages of IT in the digital age. In addition to traditional learning resources (*textbooks, pictures, reference materials, homework*), teachers use digital learning resources (still images, virtual experiments, videos, diagrams, models, presentations, software, electronic textbooks, etc). Digital teaching materials can be designed by teachers themselves or extracted from digital sources such as <https://igiaoduc.vn>, <http://rgep.moet.gov.vn>, vietjack, OLM, etc. In the flat world, digital learning resources are extremely rich that teachers are responsible for choosing which is suitable for lesson content and students' level of awareness; teachers and students need to be IT-capable.

Diversifying assessment forms: Testing and evaluation are essential for determining achievement of teaching objectives which motivate and provide orientation for teachers to innovate teaching methods, while encouraging students to innovate learning methods.

Assessment in blended learning (BL) is efficiently conducted using platforms like Shub, Azota, OLM, as well as learning and evaluation cards. Moreover, students can participate in peer and self-assessment, augmenting traditional teacher evaluations. A deeper understanding of the BL model will foster its broader and more effective implementation. Successful BL application has revolutionized teaching methodologies and faculty training in Le Hong Phong and other high schools in Nam Dinh. However, the study revealed certain limitations. Discrepancies in teachers' IT proficiency hinder effective technology utilization, impacting lesson management. Unstable internet connectivity in some schools disrupts learning continuity, while classroom size influences group organization and study dynamics. To maximize BL effectiveness, enhancing school infrastructure and bolstering teacher capacity in professional knowledge and IT skills are paramount. BL implementation serves as a catalyst for advancing both pedagogical and technological competencies among educators and administrative staff in high schools.

4.1 Implications

4.1.1 Practical Implication

To address the research gap regarding the widespread application of the blended learning (BL) model in Vietnamese high schools, our study introduces BL frameworks tailored for Mathematics, Literature, and Chemistry subjects. These frameworks can also be adapted for use across other subjects, offering a comprehensive approach to BL implementation.

For educators, the BL frameworks serve as valuable tools for crafting detailed lesson plans utilizing BL methodologies. Teachers are encouraged to integrate these models with various instructional techniques and materials to enhance the flexibility and efficacy of learning experiences, thereby optimizing the effectiveness of the BL frameworks.

For school administrators, managers, and policymakers, the BL models provide insights for informing and shaping strategies related to BL integration within educational institutions.

4.1.2 Theoretical Implication

In response to the growing interest in BL and the necessity for a contextually appropriate model in Vietnam, our study makes a significant theoretical contribution by presenting BL frameworks applicable within a specific educational context. These frameworks are informed by the latest theoretical and practical research on BL, drawing from a diverse range of scholarly literature (Gault & Cuevas, 2022; Ghimire, 2022; Graham & Halverson, 2023;

Ojaleye & Awofala, 2018; Seage & Türegün, 2020; Singh et al., 2021; Tayag, 2020; Wang et al., 2015; Zhang et al., 2022).

5. Conclusion

Despite the global application of blended learning (BL) in high schools over recent decades, its adaptation within the Vietnamese educational system remains relatively unexplored. This study pioneers the development of comprehensive BL frameworks tailored to the Vietnamese context, particularly for tenth-grade Literature, Chemistry, and Mathematics. The primary contribution of this research lies in establishing a foundational approach for designing BL frameworks and lesson plans aimed at enhancing student engagement and competency development, offering benefits to a broad spectrum of stakeholders. Furthermore, this study's findings suggest avenues for future research, including the expansion of BL designs to encompass other subjects and grade levels, as well as the need for broader implementation and evaluation across different regions within Vietnam, to further validate and refine these frameworks.

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Authors contributions

LPTB and TBDP were responsible for study design and revising. LPTB, DNLV, THN, HHT and TBDP was responsible for data collection. HHT drafted the manuscript and TBDP revised it. All authors read and approved the final manuscript. In this paragraph, also explain any special agreements concerning authorship, such as if authors contributed equally to the study.

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