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PERCEPTIONS OF SCIENCE HIGH SCHOOL STUDENTS TOWARD BLENDED TEACHING

Hua Hong Hieu[i],
Phuong Hoang Yen
Can Tho University,
Vietnam

Abstract:
Under the impact of the COVID 19 pandemic, it is a must for education institutes all over the world to incorporate online teaching into their teaching program. In Vietnam, high school teachers and students are now familiar with blended teaching in which students will learn from at least 30% of their lessons online and 70% face-to-face. This research aims at investigating Vietnamese high school students' perceptions toward the benefits and challenges of blended teaching. Two research questions will be answered (1) "What are high school students' perceptions toward the benefits of blended teaching?" and (2) "What are high school students' perceptions toward the challenges of blended teaching?". There were 200 sciences students (72 participants majoring in Physics, 60 in Chemistry, and 68 in Biology) from 3 high schools for the gifted in Vietnam who participated in the study. The results of the research show that the majority of participants agreed on the benefits and challenges of blended teaching in the context of high school for the gifted in Vietnam. The current study suggests that teachers should have an effective lecture design to help their students acquire science knowledge better in blended classes.

Keywords: blended teaching, perceptions, science students, high school for the gifted

1. Introduction

In the 21st century, thanks to the rapid development in information technology (IT), the modalities of education and training have been transformed. In fact, IT seems to dominate all over the world, appearing in all fields from science to life, society, and education. Education and training processes are continually changing and improving with the advent of many learning forms such as online or blended learning and teaching. In the past decades, online learning started to appear very early when IT started to develop. Much research has been done to find out about the effectiveness of these new

[i] Correspondence: email hhhieu@ctu.edu.vn

learning methods with all the positive results. Since then, along with the development of IT, learning through computer devices (computer-based learning) and networking sites or software (Internet-based learning) has flourished. Online education begins with the appearance of distant classes regardless of both large distances and different periods of time. Later, blended education also appeared with online applications to support teaching and learning in the classroom. Lameras, Paraskakis and Webber (2012) stated that the increased prevalence of digital technologies in education and academic investigations leads to the concentration of institutions on blended teaching (BT) in educational evolvement initiatives. Blended forms of teaching have become increasingly popular (Garrison & Kanuka, 2004; Garrison & Vaughan, 2008; Graham, 2006; Spanjers, Könings, Leppink, Verstegen, de Jong, Czabanowska, & van Merrienboer, 2015).

Despite various definitions, blended teaching is commonly considered as an instructional model that employs different media and takes place on different time scales (synchronous, asynchronous) with the face-to-face (f2f) method of instruction (Roseth, Akcaoglu, & Zellner, 2013). BT combines f2f learning with an online learning style, where 30–79% of the content is delivered online (Graham, 2006). Pereira *et al.* (2007) defined blended teaching as a teaching modality which is the synergic combination between attendance-based distance teaching or traditional classroom-based teaching and non-attendance-based distance teaching or e-learning. Meanwhile, Garrison and Vaughn (2008, p.148) state that blended teaching is "*the organic integration of thoughtfully selected and complementary face-to-face and online approaches and technologies*". Alternatively, BT can also be considered a useful mixture of technology-based and classroom-based teaching methods that allow students to gain complementary experiences through being proficient in using IT tools for study purposes and to acquire more helpful knowledge by doubling the instructions of teachers from online to f2f classes.

In the COVID 19 context, Vietnam is now adapting its educational, economic and social activities to the "new normal". Educational institutions are paying more attention to the application of blended teaching in education, by incorporating the use of IT applications, and electronic devices from the online format to support the students' learning in many ways and many fields of study including science subjects such as Physics, Chemistry and Biology. The system of high schools for the gifted has been established since 1966 in Vietnam to nurture and develop the talent of students with high achievement capability. The concept of "gifted students", which reads "học sinh chuyên" in Vietnamese, has been employed to refer to those who have excellent academic achievements in specialized high schools, which "*are founded at the general secondary education level for those students who achieve outstanding results in studies aimed at developing their aptitude in a number of subjects on the basis of assuring all-round general education*" (Article 61, Vietnamese Educational Law, 2005). Since these students specialized in a specific science domain, the current study was conducted to explore if blended teaching would bring them various challenges so that solutions can be proposed to enhance science education in gifted high schools. To our knowledge, studies have yet been conducted to explore the benefits and challenges as perceived by science students in high

shools for the gifted in Vietnam. Therefore, the currrent study has been conducted to answer the two following research questions:

1) What are science high school students' perceptions of the benefits of blended teaching?
2) What are science high school students' perceptions of the challenges of blended teaching?

2. Literature review

2.1 Blended teaching

The term 'blended' teaching has risen in popularity in the past two decades when information technology and the Internet have begun developing quickly. It is a teaching strategy also known as semi-attendance-based teaching (Pereira *et al.*, 2007). In addition, it is also called a hybrid course delivery method. However, due to the wide recognition, the term 'blended' teaching is used for the whole study.

Indeed, although there is no official definition of blended teaching, the majority of its definitions are given by researchers. Gilbert and Flores-Zambada (2011) used to state that blended teaching is a method conjoining all of the greatest aspects of online and on-ground instruction. Pereira *et al.* (2007) defined blended teaching as a teaching modality which is the synergic combination between attendance-based distance teaching or traditional classroom-based teaching and non-attendance-based distance teaching or e-learning. The definition of Garrison and Vaughn (2008, p.148) is that blended teaching *"is the organic integration of thoughtfully selected and complementary face-to-face and online approaches and technologies*". In a short way, blended teaching is generally considered a combination of online and f2f instruction (Graham, 2006).

2.2 Benefits of blended teaching

Various benefits have been found in BT classes.

A. Flexibility

Investigations reveal the flexibility of the BT method (Sadeghi, Sedaghat & Ahmadi, 2014). The combination of traditional f2f training with online learning is actually more flexible than other methods in EFL education. This mixed educational delivery benefits synergistically from the two teaching methods. Online teaching helps to bring educators and students together, regardless of physical distance with the aid of IT, equipment and online tools. Meanwhile, on-ground teaching provides direct interactions with more English discussions, debates and presentations. Therefore, the flexibility of training opportunities is mentioned first. By reducing the amount of time spent on f2f education, blended teaching creates a balance between the two methods and generates new approaches to learning and teaching. It furnishes multiple learning styles such as visual, auditory, and hands-on experiences that are essential for the process of learning language skills to facilitate regular practices. Moreover, the reduced period can be invested in acquiring other knowledge or practicing assignments related to the lessons. From

connection to practice, integrating practitioner-based experiences with classroom-based learning doubles the learning abilities of high school students. Most of the time in class, students mainly concentrate on selective learning through the process of selective listening and passive learning, while they are completely active in online classes where student-centered activity happens. That is how blended teaching helps students to coalesce many different learning styles in order to achieve better results in learning and modernizes teaching methods that have traditionally been used in high school education.

The flexibility in space and time is the second to mention. When the time for f2f learning is not as much as before, it is used more effective. The world now is the era of IT, so students tend to use smart devices to find documents and information supporting their English language learning. The application of this blended teaching attracts such students. They will find this learning style engaging, relevant and accessible. It provides students with concrete, reliable and updated materials (Pereira et al., 2007). In fact, a variety of information or documents are available on the Internet. To prepare for the next classes, students just need to access any websites to look for the necessary materials. Even if they cannot go to school due to their illness, and then they also understand the lessons with the help of online courses. Blended teaching brings continuity between traditional f2f classrooms. Thus, high school students are able to review the lessons whenever and wherever they want. It is really an approach to creating convenience.

B. Increasing interpersonal interaction

Interaction is a situation where two or more people or even things communicate with each other or react to each another. When studying in class, it is unlikely that teachers can exchange or communicate directly with all students in one lesson. While online learning is a learning environment that allows all students to interact both synchronously and asynchronously. Regular interaction is very important. More interactions will result in better learning. Interacting, exchanging among friends and exchanging between teachers and students increases the ability to absorb lessons, and to practice students' initiative. The application of blended teaching can facilitate learner-centered interaction to happen. With asynchronous interactions, students can construct knowledge through collaboration in groups with no limit on time and space. This increases participation among students because it permits all students an equal opportunity to respond to a topic (Birch & Volkov, 2007; Branon & Essex, 2001; Ortega, 1997). Associated with classroom-based communication, a blended environment is able to augment the interaction among students and between students and teachers.

C. Developing virtual teaming skills

In addition to several activities in traditional classroom-based courses such as direct debates and presentations, holding some online discussions is really beneficial to develop students' virtual teaming skills. This is a necessary skill in the working environment due to the increasing global business (Kim, Liu & Bonk, 2005). Being high school students, having skills in virtual teamwork through the assistance of applications is a need when

people now spend more time working online than before. Having virtual teaming skills is a benefit achieved from blended education.

D. Enhancing students' self-confidence

Normally, students tend to be passive when they have to raise their voices to the teacher's questions. Since this situation continually occurs, there are often cases where a few students will not be remembered by their teachers. Consequently, in such cases of students feel inferiority complex, and dare not speak more, leading to a lack of confidence. On contrary, when participating in blended classes, students have more opportunities to express their opinions on online forums through making comments and freely practice exercises. Thanks to technology devices, students can feel more comfortable when not being noticed directly by everyone. Subsequently, students' confidence is increased, and they begin not to hesitate to give opinions, feedback and discussions even when facing the teachers in the classroom.

E. Enhancing students' self-directed learning skills

Preconditions for succeeding in the business world are skill and knowledge at present (Hijazi, Crowley, Smith & Shaffer, 2006). However, not everyone knows the way to acquire knowledge and skills to become successful. The self-directed learning method is the answer. Blended education provides students with knowledge through practices, and directs them to arrange their self-set personal schedules due to the flexible class time. With practical exercises and IT support, students can access all the learning websites, so they take a more active role to find any information or documents serving their learning process. Ordinarily, learning a language requires more practices to enhance language skills, so checking, taking notes and correcting the mistakes in class time are the self-directed skills or independent learning methods to acquire more essential information.

F. Enhancing students' critical thinking

With the assistance of blended courses, students evolve their critical thinking skills and become self-supporting thinkers (Masalela, 2009). Once working in groups, students need the ability to judge to produce coherent and high-quality documents. Mutual evaluation creates success for the students in collaborating with different people and then enhances the competence of challenging their theories and providing a rationale for their rejoinders (Gilbert & Flores-Zambada, 2011). Through the available IT in blended language education, students can get a great amount of useful information related to science subjects to give feedback on others' assignments and correct their own works both in online classes and in classrooms to develop critical thinking and collaboration abilities.

G. Developing IT skills

When it comes to blended teaching, online tools used in this format must be mentioned. Learning online means that students, as well as teachers, must know how to use technological devices in a proper way and be proficient in using tools to support learning. There are many tools to use while incorporating online with the on-ground teaching

methods. These online tools are not only beneficial for science education but also helpful for training computer skills. Once working and studying on the computer regularly, the skills and knowledge of IT are increased remarkably.

In general, using a blended teaching strategy accomplishes the improvement in students' academic performance (Pereira et al., 2007). Thanks to the advantages mentioned above, blended teaching can be considered the most effective teaching method together with the outstanding development of technology today.

2.3 Challenges of using blended teaching

Taken as a whole, blended teaching positively affects high school students' learning process in different aspects. However, any teaching approach has strengths and weaknesses. Blended teaching also has disadvantages for both teachers and students.

A. Difficulty in online group discussions

Blended teaching is divided into online and on-ground delivery formats. In fact, students often have some online discussions before going to class to understand the lessons more deeply. Although working offline will not have enough materials to support the English learning process, it facilitates students to interact directly with each other at a synchronous time once operating group discussions, and online forums cannot afford it. When working online, the discussions can hardly take place in a synchronous manner in terms of time due to a couple of reasons. The first is the disagreement about the meeting time. The second is being in an awkward situation when talking to others through a screen. Therefore, online discussion is often in the form of asynchronous time, i.e. exchanging ideas and, finishing exercises via text messages at different times of the day, and it can be flexible according to the students' free time. Moreover, online activities cannot be substituted for human interaction and f2f communication (Sadeghi, Sedaghat & Ahmadi, 2014), and the students also could not show or feel more interestingattractiveting about the discussed topics.

B. IT problems

Once applying the blended teaching method to teaching, the use of technology devices is required. Therefore, the use of information technology is also beneficial and challenging for those who use it for learning and teaching purposes. Masalela (2009) mentioned technology infrastructure as the most frequent challenge for teachers and students in both physical and human forms. As for physical infrastructure, it depends on the provision of IT equipment from the school, including the personal possession of students. There will be cases where students or teachers do not have the technical equipment to work online. Therefore, it is extremely necessary to have a full range of equipment and tools to support the online teaching and learning process. Additionally, connection breakdown is also a challenge to online education that must be overcome. Besides, the lack of IT skills is also inevitable for both students and teachers. This is maybe a big problem if they cannot use the online tools properly due to the lack of training time.

C. Teachers' difficulty in designing lectures

From f2f to blended teaching, having a good and attractive lecture is the responsibility of teachers to interest students in learning. Know-how of designing and performing a successful blended course professionally are a challenge for teachers (Kennedy & Archambault, 2012). Changing the teaching method will be somewhat difficult for the teacher. They must ensure their lecture is effective and reliable when combining the two delivery approaches.

D. High risk of online exam cheating among students

Cheating when doing the exams is common stuff among students in class. Generally, the choice of using online tools to deliver assignments for students to do before studying in class is an effective way of teaching, increasing practicality and knowledge for students. On the contrary, adopting an online test can be seen as a bold idea. In fact, the class tests can also be the result of cheating, let alone the online tests. Once the online exams are taken, the percentage of correct results due to cheating may be higher with the help of ITs such as Google and related websites.

E. Students' fear factor

Teaching using a blended method means that there are many learning activities going on. A large number of exercises are given in the course leading to students' dissatisfaction (Gilbert & Flores-Zambada, 2011). For this reason, group work is the most frequent activity. Some students prefer to work individually instead of working in groups. They are afraid of facing disagreements and unnecessary arguments. Sometimes, they are afraid they will not be able to state their own opinion or even reject someone's opinion in the group. A few students even find learning through IT applications quite inconvenient. Such students require f2f classes at school. They tend to dislike learning new and complicated things like online tools. But if they learn how to use it in a proper way, they will have a huge amount of data that is useful for learning English. The nature of fear actually stems from anxiety, laziness and lack of confidence. Once the efforts are made, the fear will be nothing for students.

3. Methods

3.1 Research tool

In order to investigate the high school students' perceptions of blended teaching, the quantitative data was collected by developing a questionnaire. Based on the summarized ideas from different studies in the chapter of Literature Review and the adaptation of some questionnaires from previous studies, this questionnaire was formed. According to the section on benefits and challenges of blended teaching, the ideas were picked up one by one and expanded into some relevant items. Correspondently, the questionnaire was designed with 50 items in total. There are thirty close-ended questions for the benefits section, and twenty for the challenges. As these two questions were designed independently, the ordinal of each survey question was separate. All thirty items in the

first question were numbered from 1 to 30 and divided into seven clusters in accordance with the seven benefits discussed in the division of Literature Review, and twenty items in the second question were in order from 1 to 20 and divided into five main clusters through five challenges mentioned previously. They were presented as the following tables.

Table 1: Clusters of the questionnaire

Benefits of blended teaching		
Cluster 1	Flexibility	Item 1 – 11
Cluster 2	Increasing interpersonal interaction	Item 12 – 13
Cluster 3	Developing virtual teaming skills	Item 14 – 16
Cluster 4	Enhancing students' self-confidence	Item 17 – 19
Cluster 5	Enhancing students' self-directed learning skills	Item 20 – 23
Cluster 6	Enhancing students' critical thinking	Item 24 – 25
Cluster 7	Developing IT skills	Item 26 – 30
Challenges of blended teaching		
Cluster 1	Difficulty in online group discussions	Item 1 – 6
Cluster 2	IT problems	Item 7 – 11
Cluster 3	Teachers' difficulty in designing lectures	Item 12 – 14
Cluster 4	High risk of online exam cheating among students	Item 15 – 16
Cluster 5	Students' fear factor	Item 17 – 20

3.2 Participants

A number of 200 students (64 females and 136 males) from 3 high schools for the gifted were invited randomly as the participants to take the questionnaire in this research. These students came from Grade 10, 11 and 12 (with 81, 76, and 43 students respectively) and their ages range from 15 to 17 years old. Among these students, 72 major in Physics, 60 in Chemistry, and 68 in Biology.

3.3 Data collection and analysis

An online form of the questionnaire was sent to the students of the Physic, Chemistry and Biology classes in three gifted high schools in Vietnam. They were required to complete all the items by choosing one of the five-point Likert scales in which 1 means Completely Disagree and 5 means Completely Agree. Then, those questionnaires were gathered after the students had finished them. The data collection process continued in many different classes until the number of students participating in this survey reached 200. The collected data from those questionnaires were then analyzed with the help of IBM SPSS Statistics 20 software.

4. Results

4.1 Benefits of blended teaching

With regard to the first question "What are high school students' perceptions toward the benefits of blended teaching?" the results are divided into detailed subdivisions below.

Table 2: Students' perceptions toward the benefits of blended teaching

	N	Min	Max	Mean	Std. Deviation
Developing IT skills	200	1	5	3.99	.636
Flexibility	200	2	5	3.89	.520
Developing virtual teaming skills	200	2	5	3.67	.637
Enhancing students' self-directed learning skills	200	2	5	3.55	.654
Enhancing students' self-confidence	200	2	5	3.49	.675
Enhancing students' critical thinking	200	1	5	3.44	.684
Increasing interpersonal interaction	200	1	5	3.42	.933
Valid N (listwise)	200				

Overall, all the benefits shown in the table receive a high mean score (M>3.40). In detail, 'Developing IT skills' gets the highest mean score (M=3.99; SD=.64). Meanwhile, 'Enhancing students' self-confidence', 'Enhancing students' critical thinking', and 'Increasing interpersonal interaction' share the low mean score, with (M=3.49), (M=3.44) and (M=3.42) respectively. Also receiving the high mean score are the benefits of 'Flexibility' (M=3.89), 'Developing virtual teaming skills' (M=3.67), and then 'Enhancing students' self-directed learning skills' (M=3.55). In brief, the students' perceptions of each item according to these seven main benefits are illustrated in detail as follows.

Table 3: The percentage of students' perceptions toward the flexibility of blended teaching

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
4	Students' science knowledge is improved thanks to videos, audio files, and other media presented in blended classrooms.	2.5	5.0	92.5
10	Students can search for all necessary information related to science subjects easily.	8.0	10.0	82.0
3	Applying blended teaching helps students improve their science knowledge with the help of information technology (IT).	4.5	14.0	81.5
6	Assignment completion skills are improved with the help of a variety of online information resources.	3.5	18.5	78.0
5	Experiment skill is improved through watching modelled clips with the help of IT tools.	4.5	21.0	74.5
11	Students can update the content of missed lessons when absent in class.	6.5	19.0	74.5
1	Applying blended teaching helps students improve their knowledge of a specific topic of science subjects.	8.0	20.5	71.5
7	Students are attracted when applying IT to science learning.	7.0	28.5	64.5
8	The lecture content is improved in terms of viewing through a slideshow (PowerPoint).	8.5	30.0	61.5
9	Students' ability to focus on and absorb lessons is enhanced.	13.0	40.0	47.0
2	Learning English in blended classes is more effective than face-to-face classes.	28.0	40.0	32.0

As can be seen in Table 3, the majority of participants agree with these given items. The highest percentage of agreement falls into item (4) 'Students' science knowledge is improved thanks to videos, audio files, and other media presented in blended classrooms' (92.5%). They show their high consensus degree (from 70 to 80%) on such items of (10) 'Students can search for all necessary information related to science subjects easily' (82%), (3) 'Applying blended teaching helps students improve their science knowledge with the help of information technology (IT)' (81.5%), (6) 'Assignment completion skills are improved with the help of a variety of online information resources' (78%), (5) 'Experiment skill is improved through watching modelled clips with the help of IT tools' (74.5%), (11) 'Students can update the content of missed lessons when absent in class' (74.5%), and (1) 'Applying blended teaching helps students improve a specific topic of science subjects' (71.5%). The lower percentage of consensus places at item (7) 'Students are attracted when applying IT to science learning' (64.5%), items (8) 'The lecture content is improved in terms of viewing through a slideshow' (61.5%), and item (9) 'Students' ability to focus on and absorb lessons is enhanced' (47%). The only exception of the benefit items that did not get the majority of the approval in item (3) 'Applying blended teaching helps students improve English language skills with the help of IT' with 32% of agreement. This was a neutral item with 40%, and also one of the benefits with the high percentage of disagreement at 28%. Hence, students agree with the benefits of blended teaching, especially the flexibility of time and space, and the combinability of some teaching approaches at the same time, but still not effective as high as expected.

Table 4: The percentage of students' perceptions toward the interpersonal interaction in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
12	Interaction with friends is increased both in-class and online.	17.5	30.0	52.5
13	Interaction with teachers is increased both in-class and online.	19.5	35.5	45.0

Talking over the interpersonal interaction, the table shows that the two items have the percentage of agreement higher than 'Disagree' and 'Neutral'. However, it is not high as expected, with 52.5% of item (12) 'Interaction with friends is increased both in-class and online' and 45% of item (13) 'Interaction with teachers is increased both in-class and online'. The high percentage of disagreement leads to concerns about the actual amount of interactions in blended classes.

Table 5: The percentage of students' perceptions toward the virtual teaming skills in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
16	The ability to discuss is improved through working in team.	4.0	16.0	80.0
15	The ability to debate is improved through working in team.	6.5	20.5	73.0
14	Team working skills are enhanced.	23.0	29.5	47.5

In the matter of working in online groups, the percentage indicates the students' agreement degree on the improvement of discussion and debate abilities higher than the skill of team working as a proof of item (16) 'Discussing ability is improved through working in team' with 80%, item (15) 'Debating ability is improved through working in team' with 73% and item (14) 'Team working skills are enhanced' with only 47.5%. The percentage of consensus on item (14), however, is still at a high level, while the percentage of disagreement and neutrality reaches 23%, and 29.5% respectively. On that account, not many students agree that teamwork skills have been improved through an online platform, instead of discussion and debate skills.

Table 6: The percentage of students' perceptions toward their self-confidence in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
17	Every student has a chance to express their opinion both in-class and online.	12.0	30.0	58.0
19	Students are more confident in making comments on others.	14.0	36.0	50.0
18	Students are more confident in giving their opinions at class.	14.5	37.5	48.0

The percentage of 'Disagree', 'Neutral' and 'Agree' is quite similar in terms of students' self-confidence of the above three items. With the consensual percentage ranging between 48 and 58%, the participants also agree on the self-confidence improvability once applying blended methods in EFL teaching environment, but it is not high as expected, particularly the percentage is at 58% for item (17) 'Every student has a chance to express their opinion both in-class and online', 50% for item (19) 'Students are more confident in making comments on others' and 48% for item (18) 'Students are more confident in giving their opinions at class'. Besides, the percentage of disagreement is quite high (over 10%) leading to the result of achieving an improvement in self-confidence but not fully enhanced.

Table 7: The percentage of students' perceptions toward their self-study in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
21	Students are more active to finding materials assisted their science learning.	10.5	20.5	69.0
20	Students' self-study ability is enhanced.	15.5	27.0	57.5
22	Students' ability of taking notes is enhanced.	13.0	32.0	55.0
23	Students' self-detection and error correction are enhanced.	10.5	42.0	47.5

Concerning the self-directed learning skill, the respondents also give their agreement on given items that are (21) 'Students are more active to finding materials assisted their science learning' (69%), (20) 'Students' self-study ability is enhanced' (57.5%), (22) 'Students' ability of taking notes is enhanced' (55%), and (23) 'Students' self-detection and error correction are enhanced' (47.5%). However, item (23) shows its high degree of neutral opinions with 42%, almost equal to the percent of approval (47.5%). As a result, due to the moderate percentages of consensus (from 47.5 to 69%), some science students show their consent to the enhancement of their self-study ability.

Table 8: The percentage of students' perceptions toward the critical thinking in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
25	Students' ability of assessment is enhanced.	8.0	40.0	52.0
24	Students' critical thinking is enhanced.	13.0	37.5	49.5

Regarding critical thinking, the percentage of agreement is not high, with item (24) 'Students' critical thinking is enhanced' (49.5%) and item (25) 'Students' ability of assessment is enhanced' (52%). In contrast, the majority of students have the neutral opinion shown at 40% and 37.5% respectively for the two items of (25) and (24). For that reason, many students still do not fully agree with this benefit of the blended teaching method although the results still show the highest percentage of the agreement in general.

Table 9: The percentage of students' perceptions toward the IT skills in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
30	Students know more useful online learning resources.	4.0	7.0	89.0
29	Students know more useful science learning websites.	4.5	7.5	88.0
28	Students know more useful science learning applications.	4.0	12.0	84.0
26	Students' IT skills are enhanced.	7.5	18.5	74.0
27	Students' ability of selecting the right information for use is enhanced.	9.0	23.0	68.0

Dealing with the IT skills, surprisingly the results of the agreement are good as expected, with the percentage ranging between 68 and 89%. The highest percentage falls into item

(30) 'Students know more useful online learning resources' with 89%, and the lowest for item (27) 'Students' ability to select right information for use is enhanced' with 68%. Consequently, it can be seen that students pay much attention to IT, and consider IT as a practical benefit that positively affects the learning process of science at high school.

Summarily, the overall percentage of consent was not much high, there were still many benefits resulting from high neutrality and disagreement. Through this result, it showed that science students in high schools for the gifted agreed with the given benefits but did not fully agree, and they still had 'neutral' and 'disagree' opinions.

4.2 Challenges of blended teaching

Dealing with the second research question that is "What are English-majored students' perceptions toward the challenges of blended teaching?" the overall results are shown as the following table.

Table 10: Students' perceptions toward the challenges of blended teaching

	N	Min	Max	Mean	Std. Deviation
High risk of online exam cheating among students	200	2	5	3.83	.685
Difficulty in online group discussion	200	2	5	3.70	.565
IT problems	200	2	5	3.70	.692
Teachers' difficulty in designing lectures	200	1	5	3.69	.652
Students' fear factor	200	1	5	3.54	.620
Valid N (listwise)	200				

In regard to the disadvantage of blended teaching, the mean score is remarkably high, which indicates the high agreement degree on the challenges happening during blended classes. The challenge of 'High risk of online exam cheating among students' accounts for the highest mean score (M=3.83) comparing to others, while the lowest mean score is (M=3.54) for the fear factor of students. There are two challenges sharing the same mean score (M=3.70), namely 'Difficulty in online group discussion' and 'IT problems'. The slightly lower mean score falls on teachers' problem when designing lectures, with (M=3.69). In addition, the participants' viewpoints on each item from these five main challenges are illustrated in detail as follows.

Table 11: The percentage of students' perceptions toward the online group discussions in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
3	It is hard to set a meeting time convenient for all members of the group.	10.5	14.0	75.5
2	It is hard to have an online group discussion with all members at the same time.	12.0	13.5	74.5
1	There are a lot of online group discussions.	8.0	24.5	67.5
6	Lack of interest and attraction on the discussed topics without face-to-face human interactions.	12.5	29.0	58.5

4	It is awkward to have an online face-time group discussion.	12.5	34.0	53.5
5	Online group discussions at different time of a day are time-consuming.	11.0	37.5	51.5

As for the difficulty of online group discussion, the participants find the blended teaching method the most challenging for item (3) 'It is hard to set the meeting time convenient for all members in group' with 75.5%, and the least one for item (5) 'Online group discussions at a different time of a day are time-consuming' with 51.5% of agreement opinion. The percentage keeps the average on items consisting of (2) 'It is hard to have an online group discussion with all members at the same time' with 74.5%, (1) 'There are a lot of online group discussions' with 67.5%, (6) 'Lack of interesting and attracting on the discussed topics without face-to-face human interactions' with 58.5%, and (4) 'It is awkward to have an online face-time group discussion' with 53.5%. For the percentage of disagreement, only item (1) accounts for the lowest percentage with 8%, the rest are above 10%; the highest is the two items (4) and (6) with 12.5% of disagreement. On that account, the participants agree entirely on the challenge of online group discussion through the above items.

Table 12: The percentage of students' perceptions toward the IT problems in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
11	Connection breakdown is a big challenge of learning.	6.5	17.0	76.5
9	Free Wi-Fi is not fully provided on campus.	15.0	18.0	67.0
10	Some students do not have IT devices to support their learning.	11.0	22.5	66.5
8	IT facilities are not fully furnished for all classrooms at school.	12.0	35.0	53.0
7	IT devices do not operate properly.	18.5	36.5	45.0

About IT problems, it is the same result as the disadvantage of online group discussion with all consensual viewpoints. The percentage of the 'Agree' opinion descends in order of listing the following items: (11) 'Connection breakdown is a big challenge of learning' with 76.5%, (9) 'Free Wi-Fi is not fully provided on campus' with 67%, (10) Some students do not have IT devices to support their English learning' with 66.5%, (8) 'IT facilities are not fully furnished for all classrooms at school' with 53%, and (7) 'IT devices do not operate properly' with 45%. However, most students did not agree with item (7), with the highest disagreement percentage of 18.5%.

Table 13: The percentage of students' perceptions toward the lecture design in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
14	Students play games and surf social media when being bored at class.	6.0	14.5	79.5
13	Some lectures are designed in a boring style.	10.0	28.5	61.5
12	Both teachers and students lack IT skills for using the online tools properly.	16.0	40.0	44.0

With regard to the difficulty of teachers, designing an approachable and understandable lecture is mentioned. The item that reflects the current situation, and also the one that receives the most percentage of the agreement is the item (14) 'Students play games and surf social media when being bored at class' with 79.5%; item (13) 'Some lectures are designed in a boring style' ranks second with 61.5% of agreement, and item (12) 'Both teachers and students lack IT skills for using the online tools properly' ranks last with 40%. One more time, the result shows the agreement of English-majored students on such given items of the challenge of designing lessons.

Table 14: The percentage of students' perceptions toward the online exam cheating in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
15	Online exams bring a high risk of cheating among students.	6.0	24.5	69.5
16	IT devices (smartphones) are misused in class exams.	5.5	32.5	62.0

Relating to the problem of online examination cheating, there are only two items, namely item (15) 'Online exams bring a high risk of cheating among students and item (16) 'IT devices (smartphones) are misused in class exams'. These two items receive a low percentage of disagreement, with 6% for the item (15) and 5.5% for the item (16). Likewise, the consensual percentage is high, reaching 69.5% and 62% for the item (15) and (16) respectively. This indicates that online cheating with the help of IT devices is currently ongoing.

Table 15: The percentage of students' perceptions toward the fear factor in blended context

Item	Statement	Percent (%)		
		Disagree	Neutral	Agree
18	Students find it uncertain without using their e-dictionaries.	9.0	26.0	65.0
17	Students find it unsafe without using their smartphones to find the right information to do homework.	9.5	29.0	61.5
20	Students are lazy to work with online tools and require face-to-face discussions.	15.0	36.5	48.5
19	Students do not like to work in online group discussions.	18.5	39.5	42.0

In connection with the fear factor of high school science students, the percentage of agreement is quite low, ranging between 42 and 65%. The highest agreement percentage is for item (18) 'Students find it uncertain without using their e-dictionaries' (65%), and the lowest for the item (19) 'Students do not like to work in online group discussions' (42%). Item (17) 'Students find it unsafe without using their smartphones to find the right information to do homework' and item (20) 'Students are lazy to work with online tools and require face-to-face discussions' account for 61.5% and 48.5% respectively. Besides, the percentage of neutrality is high among the participants for this challenge, fluctuating from 26 to 39.5%. For the disagreement, the percentage of the first two items (18) and (17), with 9% and 9.5% respectively, is much lower than the two items left, with 15% for the item (20) and 18.5% for the item (19). From that result, the students do not worry much about the online group discussions, but they fear doing English-related assignments without the help of e-materials.

Overall, according to the tables above about the challenges of blended teaching, the results showed that although the participants entirely agreed with these challenges (100%), they still found blended teaching beneficial through the high percentage of disagreement and neutrality.

4.3 Discussion

Firstly, for the benefits of blended teaching, Pereira *et al.* (2007) mentioned that blended education is more effective than the traditional f2f method. Concerning the findings of the research of Gilbert and Flores-Zambada (2011), blended teaching provides students with additional information resources that are more accessible in an online forum, and with multiple teaching approaches – visual, auditory and practical; and this helps students develop better knowledge and skills than they did in f2f environment. Besides, critical thinking was also mentioned as a pedagogical outcome when applying blended teaching. Compared to the findings of this study, these findings are very similar but more particularly blended teaching has a beneficial influence on flexible aspects of time, space, and teaching approaches through students' perception that applying blended teaching help students improve English language skills with the help of IT through audio files, videos, applications and online resources whenever and wherever. Moreover, students' concentration was also increased, and they knew more about IT skills to facilitate their learning while having IT in the high school context. In addition, for interpersonal interactions, the participants said that in learning in a blended environment, the interaction has already been actually increased between students and teachers, and among students in both in-class and online lessons. Besides, students also gained more confidence to express their opinion and make comments on the problems of others, and thence their critical thinking was enhanced. With lots of group assignments and available information resources supporting students learning, team working and self-directed learning skills have been improved among students. So, it is safe to say that using a blended teaching strategy accomplishes the improvement in students' academic performance (Pereira *et al.*, 2007).

Secondly, for the challenges of blended teaching, based on the study of Masalela (2009), it was stated that technology infrastructure was the most frequent challenge for teachers and students, and the results of this study revealed that lacking IT skills, IT facilities, Internet connection are the big disadvantages. Actually, working in a group seems not interesting and attractive to students as interacting directly. Furthermore, with boring-designed lectures, the students cannot focus on the lessons and play games more leading to the misuse of IT devices. Cheating when taking examinations is also a concern that students cannot fully acquire knowledge and need invalid help right away.

5. Conclusions

According to the results of this study, it is evident that blended teaching is an effective teaching method suitable for the current situation and IT orientation in the future, bringing good teaching effectiveness to help students to learn and acquire knowledge easily through useful information related to the learning and knowledge improvement process, especially for science knowledge. In addition, especially for students specializing in science subjects such as Physics, Chemistry and Biology, blended teaching also helps them enlarge their knowledge and skills through useful applications and websites with the support of IT. Overall, the research results are very positive, proving the usefulness as well as the disadvantages of blended teaching so as to help both students and teachers understand what they need to do and to pay attention when applying this teaching method to export an attractive, receptive, interesting and effective science learning environment.

The findings of this research are useful in relation to pedagogical implications. Based on the research results, teachers know what blended teaching in students' minds is, thereby grasping students' thoughts and offering appropriate teaching methods, improving their ability to acquire knowledge of the students. Moreover, blended teaching is a student-centered teaching method, so from the research results, teachers can design suitable teaching methods, which attract students and benefit both students and teachers. For students, blended teaching is really beneficial, but it is not completely more beneficial than the traditional f2f environment. Therefore, teachers need to have a solution that can both teach in class well and balance the use of online devices in a blended context.

For further research, there are some suggestions. Because this is just a general study of the benefits and challenges when applying blended teaching in Physic, Chemistry and Biology classes, it is necessary to have more specific studies and in-depth analysis of benefits and challenges through empirical studies, for example, conducting an investigation of a particular benefit or challenge of blended teaching between different groups of students. From there, analyzing the collected data with more instruments, for instance, a pre-test and post-test, will give a more specific and empirical results. Additionally, expanding the number of participants into a variety of disciplines is also a good idea for further study.

Conflict of Interest Statement
The author declares no conflicts of interest.

About the Authors
Hua Hong Hieu is a lecturer at School of Social Sciences and Humanity, Can Tho University. His research interests include various issues of social sciences and education. **Phuong Hoang Yen** is currently an associate professor at the School of Foreign Languages, Can Tho University, Vietnam. She carries studies on language teaching approaches, students' learning autonomy, self-regulated learning strategies and teachers' professional development. She published articles in different journals and is the editor of one book on formative assessment in language teaching.

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