



Meeting the Needs of Metropolitan Learners: Implementing Agile-Blended Learning in Higher Education

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Abstract

In the evolving higher education landscape, students increasingly demand flexible and accessible learning opportunities that transcend traditional classroom boundaries. This article introduces agile-blended (AB) learning as a transformative educational approach that integrates the adaptability of agile methodologies with the versatility of blended learning. By combining these innovative strategies, AB learning aims to create a dynamic, learner-centred environment that enhances academic performance and engagement. This study explores the theoretical foundations, key features, and practical implementation of AB learning, focusing on metropolitan students who face unique challenges such as balancing work, family responsibilities, and a strong inclination towards technological integration in education. A case study conducted at a Hong Kong university illustrated the application of AB learning in a module designed for early childhood education students. The experiences and outcomes of 180 third-year Bachelor of Education students were examined through an AB approach facilitated by a video platform (YouTube). According to the results, AB learning significantly improves flexibility, learner autonomy, and the effective use of educational technology, thereby addressing the diverse needs of metropolitan learners. The implications of AB learning for future educational practice and research are highlighted, and its broader adoption is advocated to meet the evolving demands of modern students.

Keywords Blended learning · Agile learning · Metropolitan · Higher education

Introduction

In today's universities, students are strongly inclined towards accelerated learning and are no longer satisfied with the traditional confines of the classroom [1]. They seek learning opportunities that are not limited by time or place [2]. In response to these evolving demands, agile learning has emerged as a pedagogical strategy that effectively caters to their changing requirements [3]. It allows students to access knowledge conveniently and to engage in learning activities anytime and anywhere. Blended learning, on the contrary, improves student learning in response to the changing nature of higher education. This approach combines traditional classroom instruction with digital resources and interactive technologies. Blended learning aims to create an innovative and engaging learning environment that

caters to various learning styles, fosters active participation, and promotes academic success [4].

Recognising the advantages and potential of integrating these two approaches, the concept of agile-blended (AB) learning has emerged as a transformative force in education. AB learning capitalises on the strengths of both agile and blended learning, offering a novel approach to improve the quality of education and enhance students' learning experience. By combining the agility and adaptability of agile learning with the flexibility and accessibility of blended learning, AB learning provides a dynamic, learner-centred approach to education [5].

This paper explores the concepts of AB learning and its value in facilitating students' academic performance. It begins by examining the distinct qualities of metropolitan learners and examining how AB learning can effectively cater to their needs. Metropolitan learners are learners living in an economic metropolis such as Hong Kong, who, in addition to their learning, may have other work and family obligations that render their education needs unique. A case study conducted at a Hong Kong university is introduced to

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illustrate the implementation of AB learning and its potential impact on students' learning experiences.

The research objectives of this study enable an exploration of the theoretical foundation of AB learning and the multi-disciplinary nature of its related concepts in the education field. Using the economic metropolis of Hong Kong as an example, the study examines the qualities and needs of university learners. The research objectives are to implement and evaluate AB learning in a practical educational setting and to analyse the effectiveness of AB learning in enhancing student engagement and learning outcomes. Finally, recommendations are provided for the broader adoption of AB learning in higher education.

Concepts of Agile-Blended Learning

Features of Agile-Blended Learning

Recent studies have highlighted the transformative potential of both agile and blended learning approaches in educational settings, particularly in higher education. The agile methodology, originally designed for software development, has been recognised for its adaptability and iterative nature. In learning, agile principles emphasise flexibility, teamwork, and continuous improvement to create an environment conducive to addressing the dynamic needs of learners, which can significantly enhance educational outcomes in higher education [6]. Agile learning has been successfully applied in various industries [3, 7], confirming that these principles can be effectively adapted to educational contexts to create customised learning paths that cater to individual student needs.

Conversely, blended learning combines in-person and virtual learning, leveraging technological resources to enhance educational offerings. For example, blended learning facilitates access to educational materials and enables the customisation of learning environments [8, 9]. This

approach merges traditional teaching methods with digital tools, promoting group projects and collaborative initiatives, which foster student accountability and prepare them for the technological demands of the modern world.

Recognising the strengths and advantages of both agile and blended learning, Li [5] developed an educational approach for AB learning, which incorporates principles from agile methodologies and blended learning, including flexibility, learner autonomy, collaboration, and technology mediation [10]. Figure 1 shows the theoretical framework of AB learning.

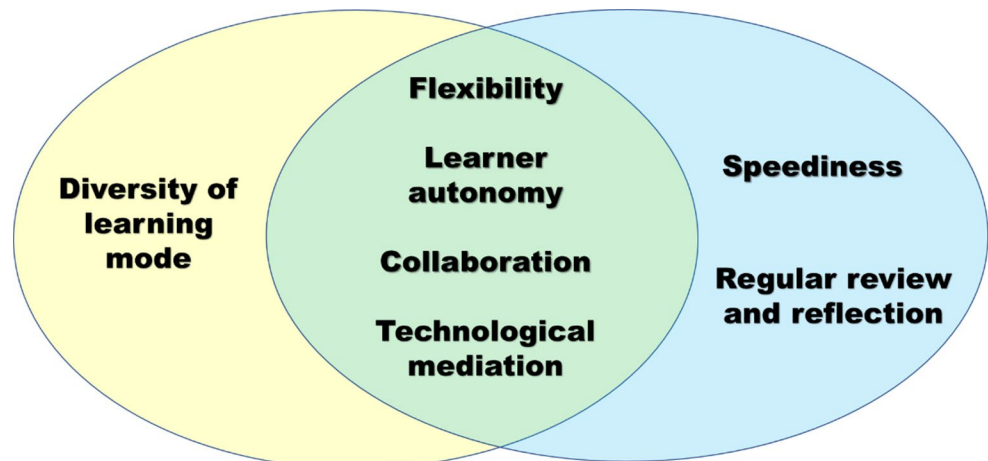
By combining these elements, a robust and dynamic AB learning framework is provided that addresses the evolving needs of modern learners. The characteristics of AB learning are described next.

Flexibility

Flexibility is at the core of AB learning, which caters to diverse educational strategies and accommodates different learning styles. Flexibility enables learners to access educational resources anytime, anywhere, and on any device that suits their needs [8]. In agile learning, flexibility refers to the adaptability and responsiveness of the syllabus, considering students' input, skills, interests, challenges, and experiences [12]. Similarly, in blended learning, it pertains to students' ability to access course materials and resources from any location and on any appropriate device [8, 13].

AB learning integrates the flexibility of agile and blended learning to create a dynamic and adaptable learning environment. Some studies [5, 14] have argued that either onsite or online classes should be the flexible choice for students to enhance student–instructor interaction. AB learning offers several ways for students and instructors to interact based on recognising that students might have obligations to their families or jobs. As such, it recommends combining online and onsite learning modes so that students can choose the

Fig. 1 Theoretical framework of agile-blended learning. (Source: [11])



most suitable option and enhance their interaction with instructors [5].

Learner Autonomy

AB learning fosters learner autonomy by empowering students to take control of their education, define their objectives, and make informed decisions about their learning. Agile learning emphasises the importance of learners' self-regulation and independence to foster their autonomy. Blended learning provides opportunities for personalised learning and flexible access to resources [15], affording students more control over how and when to participate in their learning [5]. Combining these principles, AB learning fosters an environment that promotes learner autonomy and allows students to personalise their learning experience, set their own pace, and take responsibility for their education [16, 17].

Collaboration

Collaboration is an important aspect of AB learning. It provides opportunities for students to engage in collaborative activities and discussions and receive constructive feedback from their peers, fostering information exchange and comprehension. Both agile and blended learning approaches highlight the importance of communication, cooperation, and teamwork in the learning process [16, 17]. Importantly, the learning process should not overwhelm learners with excessive workloads as active collaboration is only possible when the workload is optimal [5]. Collaboration in the context of AB learning should foster mutual understanding and lead to positive learning outcomes. As such, it plays a vital role in enhancing the effectiveness of the AB learning approach.

Technology Mediation

Educational technologies are leveraged to improve the quality of instruction by expanding the range of teaching methods and incorporating digital tools such as virtual reality, artificial intelligence simulations, and hypertext. In AB learning, technology mediation empowers learners to choose their preferred learning methods, leading to significant improvements in their learning experience [5]. It may also prompt the investigation of various assets and develop students' digital literacy abilities, thus preparing them to traverse the digital terrain and giving them the tools they need to thrive in the digital era [18, 19]. By leveraging digitalisation, technology mediation in AB learning provides learners with choices and creates an optimal learning environment.

In summary, by integrating the strengths of agile and blended learning, AB learning provides a comprehensive and robust theoretical foundation for modern education. This approach promotes individualised learning paths, collaboration among students, and the effective use of technology to enhance the learning experience. Consequently, AB learning offers a dynamic and learner-centred educational model that is well suited to meeting the diverse needs of metropolitan learners.

Examining an Agile-Blended Learning Design in a Metropolitan Area

Significant strides have been made in terms of understanding the efficacy of AB learning, particularly in metropolitan areas. However, a research gap exists in the design and implementation strategies for this unique urban context, especially regarding metropolitan learners' view of educational technology and regarding how they want to use it in their educational endeavours [20].

We focus on the design of an AB learning course to ensure a meaningful learning experience for students and enable teachers to align their teaching approaches with the intended learning objectives. Key elements of the AB learning course design are explored and delineated into the phases encompassing before, during, and after the class.

For instance, pilot testing teaching objects and iterative approaches for outcomes have been shown to enhance the adaptability and responsiveness of the AB learning framework, which aligns the teaching approaches and learning objectives of teachers and students, respectively [21, 22]. Ongoing support is needed in the preparation of AB learning courses in integrating resources, developing instructions, and advancing technology to create technology-driven education programs that can equip students with the necessary skills and resources and ensure their participation. Comprehensive evaluation and feedback mechanisms are also essential for improving the effectiveness of AB learning implementation [5, 23].

Despite these advancements, research that integrates these elements into a cohesive framework for metropolitan students is lacking. These students have distinct learning needs that underscore the significance of AB learning in addressing their unique challenges and requirements. In this context, AB learning is designed to address the unique learning requirements of people living in the metropolis who have various responsibilities including long job hours, family duties, and a strong desire to use technology for learning [5].

This study aims to fill this gap by investigating the potential of implementing AB learning via a video platform (YouTube channel) to support students before, during, and

after class. By addressing this gap, the research could significantly enhance our understanding of metropolitan students' distinct qualities and needs, as well as how to design, implement, and evaluate AB learning in the metropolitan context, ultimately leading to more effective and responsive educational practices. Furthermore, recommendations are provided for the broader adoption of AB learning across disciplines in higher education.

Methodology

Background and Participants

This study investigated the use of the features and design principles of AB learning to clarify how it can be effectively implemented to enhance the overall learning experience.

The study included 180 participants enrolled in the module 'Leading Innovation and IT Applications in Early Childhood Teaching' in the Spring 2023 semester at a university in Hong Kong. They were third-year students pursuing a Bachelor of Education in Early Childhood Education. This module aimed to equip students with theoretical knowledge and practical IT skills for early childhood teaching. Referring to previous teaching experiences in this module, it was observed that many students tended to struggle and potentially give up when faced with challenges during the learning process. Consequently, their understanding of the course content was limited, resulting in fragmented memories of the learning content.

In the study, 180 students enrolled in the course were considered appropriate and representative of metropolitan learners, having the competence and knowledge to participate in the designed AB learning experiment, which included the abovementioned module.

The 180 student participants were in the researchers' class. Ethical standards were adhered to, and approval to conduct the study was obtained from the Research Ethics Committee. The handling of the data ensured that participants' rights and well-being were protected. Following the approval, the researcher distributed consent forms to all potential participants, clearly outlining the study's purpose, procedures, potential risks, and benefits. It was highlighted that participation was entirely voluntary and that students could withdraw at any time without any repercussions. All 180 students reviewed the consent forms and provided their informed consent, thereby agreeing to participate in the research. The qualitative data was also de-identified to ensure no sensitive information was included. An online mini-scale survey was conducted, and the original data was stored on a university official Drive account. Access was granted only to the university and research team.

At the beginning of the course, the students were informed that all lesson materials would be available on YouTube, which they could access voluntarily. They were also instructed on how to use the platform effectively. Student feedback was collected and reviewed to inform future course design and to refine the course's implementation of technology, specifically using a video platform.

Design of Agile-Blended Learning

The design of an AB learning course follows a systematic and reflective process including course planning, design, implementation, and evaluation. In the course planning stage, educators should engage in teaching reflection and identify areas for improvement. Building on this, the course design stage focuses on creating learning activities and materials with technology that support some features of AB learning. Finally, the implementation stage involves delivering the course and evaluating the effectiveness of the AB learning approach.

Course Planning

The design of an effective AB learning course begins by reflecting on teaching practices and identifying areas of improvement. Based on the literature review, the following questions should be considered when designing a course reflecting the principles of AB learning:

Flexibility

1. How can we provide learners with the flexibility to access learning resources and materials anytime and anywhere?
2. What strategies can be used to accommodate different learning styles?

Collaboration

1. How can we encourage or support learners to collaborate and share their knowledge and experience?
2. What are some ways to effectively facilitate group projects or discussions?

Learner autonomy

1. How can we enhance the self-regulation and/or self-directed learning of our students?
2. How can we provide students with the autonomy to choose their own learning paths and activities?

Technology mediation

1. How can we use technology to enhance the learning experience and make it more engaging and interactive?
2. What are some ways to effectively use multimedia to support learning?

As mentioned, students encounter challenges during the learning process, leading to potentially fragmented memories of the learning content. To address this issue, this study proposes using the video platform YouTube as an integral component of an AB learning approach. YouTube is a public platform on which students can access course materials before, during, and after class, allowing flexibility in their learning journey. The content needs to remain updated and relevant. To this end, new videos can be uploaded as needed to the channel to accommodate different learning styles. This approach prioritises flexibility, technology mediation, and learner autonomy to enhance the learning experience. We hypothesised that YouTube would facilitate self-paced learning for students in an AB learning environment.

The integration of technology including video lessons helps navigate complex concepts and enables students to gain a deeper understanding of the material. YouTube can be integrated with other platforms such as blogs and educational websites to enable access to more resources, suggesting the potential of multimedia alignment.

Furthermore, the video platform supports learner autonomy by empowering students to choose their own learning paths and pace. The chapter feature, which indexes videos into manageable sections, makes it easier for learners to navigate the content based on their learning needs.

In the comments section under YouTube videos, viewers can leave their comments, ask questions, and participate in discussions; however, there is still room to design effective ways to facilitate group projects or discussions.

Thus, by leveraging the video platform in this manner, this study aims to foster a flexible and technology-enhanced learning environment on YouTube that promotes learner autonomy and enhances understanding of the course content.

Course Design and Implementation

The course was designed and implemented on YouTube, the largest online streaming service in Hong Kong that students often use as a free self-study resource. Technically, YouTube uses two main playlist categories: active and reference playlists. For the AB learning course, an active playlist was used to cover updated content including tutorials for the current and upcoming weeks, with a focus on the current week, and assignments. Reference playlists were used

to provide additional support materials such as FAQs and complete course videos, including class discussions, lectures, and tutorials. By leveraging a YouTube channel as a teaching tool, teachers can adapt to their students' learning styles, promote self-directed learning, and encourage learner autonomy. This adaptability allows for personalised education and accommodates diverse learning methods, making YouTube an effective platform for learning and teaching.

The course design and implementation in this study were delineated into three stages: before, during, and after class.

Before class, the students were asked to watch YouTube videos on a YouTube channel and complete a specific task. The teachers carefully designed these tasks and prepared relevant YouTube videos at least one week in advance.

During class, the teachers showed the task requirements, and the students reviewed the concepts and confirmed the task requirements for that lesson. To reinforce the course concepts, the teachers highlighted critical points from the video, emphasising the importance of referring to the video for further details.

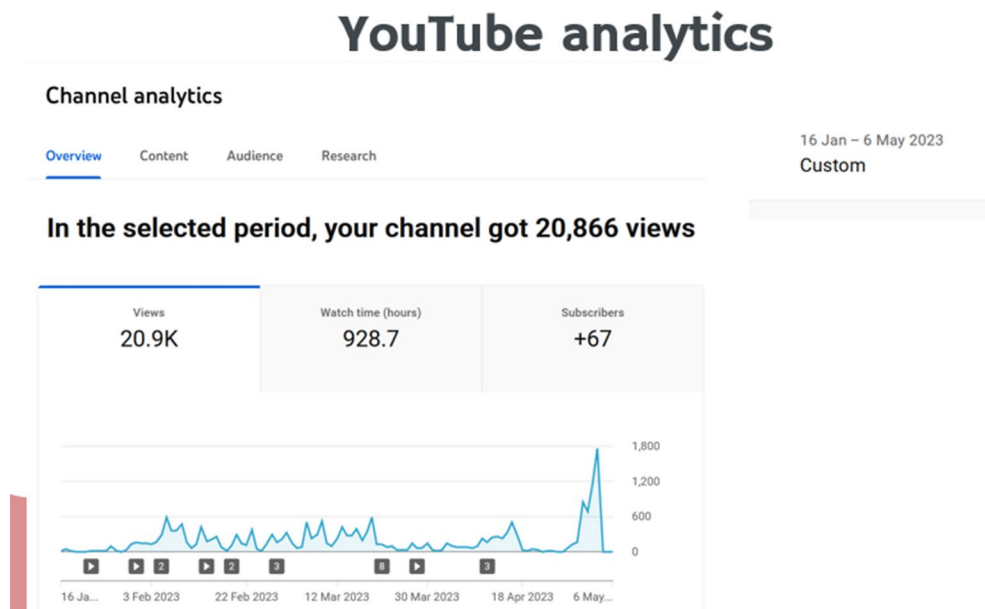
After class, the teachers provided the students with an FAQ website containing an FAQ playlist on the YouTube channel, where they could share their opinions and ask questions related to the course. This encouraged them to actively engage in discussions and explore further learning opportunities beyond the classroom.

Course Evaluation

To evaluate the effectiveness of AB learning, this study employed YouTube analytics, quantitative survey items, and qualitative questions. YouTube analytics was used to track and analyse metrics associated with the videos in the AB learning environment to garner insights into student engagement with these videos.

YouTube analytics enables educators to gather learning data. For example, in Fig. 2, the X-axis represents the timeline, spanning the semester from 16 January to 6 May 2023, as the dependent variable. The data is marked every 18 days on average to indicate specific periods within this range. The viewing data serves as the independent variable, ranging from 0 to approximately 1,800. This allows for observing fluctuations in review numbers over the selected period. The light blue line represents the trends in viewing numbers over time, distinguishing each data point.

In addition, quantitative survey items were employed to gather numerical data on student engagement and their satisfaction with the AB learning environment. This data improved understanding of the students' overall experience and their perception of the approach's effectiveness. Furthermore, qualitative questions were employed to gather descriptive data to capture the students' experiences,

Fig. 2 YouTube analytics

perceptions, and attitudes towards the AB learning environment. This qualitative data offered valuable insights into the students' learning experiences, highlighting the strengths and areas for improvement in the implementation of the approach. In addition to the survey items, simple questions were asked during the implementation of AB learning.

The combination of YouTube analytics, quantitative survey items, and qualitative questions provided a comprehensive and holistic understanding of the effectiveness and impact of AB learning on student learning outcomes. The results are examined and discussed in the next section.

Results and Discussion

Appreciating High Flexibility

This study confirms the significance of AB learning in enhancing students' learning flexibility throughout the semester. We hypothesised that YouTube would facilitate self-paced learning for students in an AB learning environment. The findings support our hypothesis, as most students utilised YouTube as a primary learning tool.

We analysed YouTube analytics data to evaluate the effectiveness of AB learning in the video environment. During the analysis period, the YouTube channel accumulated 20,866 views, with a cumulative watch time of 928.7 h, indicating a high level of engagement with the video content. With a cohort of 180 students, we observed an average of approximately 100 views per day. Our analysis revealed that initially, only a small number of students accessed the videos. However, after a few weeks, the views increased significantly, peaking at nearly 600. In addition, the highest

number of views was recorded on the day before the examination, peaking at 1,800. This demonstrates that the students had the flexibility to choose when to engage with the learning materials and revise their knowledge through this channel. This was further supported by the survey item, 'This learning mode allows me to learn more flexibly', which had a mean score of 4.4 out of 5 and a standard deviation of 0.794.

In addition to the quantitative analysis, the qualitative aspect of this study revealed positive feedback regarding the flexibility of AB learning. One student stated, 'This learning approach is highly flexible and truly caters to the needs of students'. Another acknowledged the customisation of the YouTube channel, stating, 'Students who have difficulty understanding can slow down the video's playback speed to complete the steps at their own pace'. Furthermore, a student expressed that this learning model allows for efficient time allocation, saving time and facilitating individualised learning.

These results highlight the effectiveness of AB learning in providing students with the flexibility to tailor their learning experience. By using YouTube as a learning platform, students can access course materials at their own pace and revise them as needed. This flexibility enhances student engagement and facilitates a more personalised and effective learning process. Future research on AB learning flexibility and iterative pedagogical content delivery methods, such as incorporating both synchronous and asynchronous activities, should not be limited to the YouTube platform. Any delivery approach that ensures students can access and interact with course materials in ways that suit their schedules and learning preferences is encouraged [24].

Increasing Learner Autonomy

This study confirmed that AB learning enhances students' autonomy, allowing them to take control of their journey. The number of views on each playlist showed that the majority of views were on the examination playlist. As this activity was not compulsory for the module, it highlighted the significant use of the YouTube channel by the students and aligned with the expectation of learner autonomy. Moreover, we observed that the view count for the next week's tutorial exceeded that of this week's tutorial. This indicates that the students could manage their study pace and choose a faster learning approach through the YouTube channel. In addition to the quantitative analysis, we included the survey item, 'This learning mode can cater to my learning needs'. This item had a mean score of 4.36 out of 5 and a standard deviation of 0.815. This indicates that the students perceived this learning mode as capable of meeting their individual learning needs. The high mean score suggests strong overall agreement among the students regarding the effectiveness of the learning mode in addressing their requirements.

Regarding the qualitative findings, a student elaborated on how the videos clearly explained the material, allowing the students the autonomy to complete the exercises step-by-step and at their own pace. This approach resulted in higher motivation than that in traditional classroom learning. Some students were able to grasp the concepts faster, while others preferred revisiting the material multiple times. The students also appreciated the availability of short videos, which allowed them to prepare for the class content in advance. In contrast to the traditional classroom setting, this method provided the students with more time to identify and address any issues they encountered. Another student shared their positive feedback, highlighting the student-friendly nature of this study mode, which facilitated asking questions and solving problems at any time. Furthermore, this student considered this learning approach good for self-directed learning, stating, 'The current learning model is more suitable for individuals who enjoy self-learning and exploration, such as myself'.

Overall, these findings demonstrate that the YouTube channel, as a platform for AB learning, promotes learner autonomy by providing students with flexibility and personalised learning experiences. Increasing learners' autonomy has been one of the pedagogical benefits of the AB learning approach. This model empowers students to take control of their learning, fostering independence and self-directed learning. By providing flexible pathways and personalized learning experiences, it allows learners to set their own goals, manage their time effectively, and engage with materials at their own pace [24]. In future elaborations of AB learning autonomy, pedagogical objectives, such as critical

thinking and decision-making skills in learners' autonomy, could guide students through various learning activities and resources [25]. Moreover, the iterative feedback loops inherent in AB learning encourage students to reflect on their progress, make adjustments, and continuously improve their understanding. This not only enhances their autonomy in academic performance but also prepares them for lifelong learning and adaptability in an ever-evolving world.

Appropriate Technology Mediation

We assumed that the YouTube channel would lead to positive outcomes in the learning process. The findings confirmed our assumption that using a YouTube channel as a learning platform is an effective tool for students to learn in the AB learning environment. The average ratings on relevant survey items exceeded 4 out of 5, indicating that the students were highly receptive to and satisfied with this course arrangement. Specifically, the survey item 'Learning in the YouTube channel is very effective for my learning' reflected the strong adoption of this learning system ($M=4.47$, $SD=0.820$). The students also agreed that the YouTube channel promoted independent learning, as supported by the survey item 'This learning mode enables me to learn more independently' ($M=4.42$, $SD=0.770$). These findings suggested that integrating the YouTube channel was not only effective but also aligned with the students' learning preferences. The findings further indicated that the students experienced a high level of satisfaction with a more self-directed approach to using technology.

Furthermore, the qualitative inquiry provided valuable insights from the students, who had new feelings about their learning experience. One student stated, 'I think this learning model is very innovative, and I appreciate the teacher's creative approach. Learning through YouTube videos can cater to different understandings and the progress of each student'. This further demonstrates the effectiveness of using YouTube as an appropriate technology in the context of AB learning.

Sustaining Agile-Blended Learning

At different stages of the course, three key questions were posed to the students, allowing for feedback on the study mode:

In week 3 of the semester, the students were asked to choose between the new learning mode and the traditional face-to-face teaching mode. The majority (98%) expressed a preference for the new learning mode, indicating a strong acceptance of the approach. This overwhelming preference suggests that students are not only open to innovative educational methods but also eager to engage with

learning environments that accommodate their needs and preferences.

In week 8, the same group of students was asked to describe their learning experience with the blended learning approach. Of the 156 respondents, 90.17% considered the approach more suitable for themselves. This high percentage reflects a significant shift in the students' perceptions of their learning environment, highlighting the effectiveness of AB learning. The remaining respondents viewed the suitability of the blended learning and traditional face-to-face approach as being the same. These findings provide strong support for the blended learning approach, with the majority of the students endorsing and desiring to continue with this study mode.

Finally, in week 13, the study examined whether the students believed this learning model could be applied to other courses. A significant 80.2% agreed that the learning model could be effectively applied to other subjects. This overwhelming acceptance of the model further demonstrates that the students not only embraced the model for their own learning but also recognised its potential for wider application. Such a high level of acceptance indicates that the AB learning approach is an effective method that could enhance educational experiences across diverse contexts, suggesting a broader potential for implementing AB learning in future curricula.

Considering these results, engaging students in the future development of the AB learning approach is essential for its success and sustainability. In this study, the students served as active participants, offering feedback and insights throughout the 13 weeks of teaching. In the long term, continuous student feedback could improve and facilitate the adoption of AB learning methods. In addition, involving stakeholders, such as faculty members, who play a crucial role in designing and delivering content that is both flexible and engaging, could ensure that the AB learning approach meets the diverse needs of students [24]. University administrators could support this initiative by providing the necessary resources, infrastructure, and policy support, thereby creating a conducive environment for agile practices [25]. Furthermore, considering that educational technologies ensure the digital tools and platforms used are effective and user-friendly, the inclusion of technological industry partners could assist both instructors and learners. Working with these three different stakeholders would enhance the agility and blended nature of university education, ultimately leading to a more dynamic and responsive educational experience in the implementation of AB learning in the future.

Difficulties in Implementing Agile-Blended Learning

It is vital to consider the challenges and difficulties of implementing AB learning. Even though AB and online learning provide flexibility and portability, numerous learners still prefer in-person instruction. Face-to-face connections with instructors and fellow students in physical educational environments are highly beneficial as they facilitate real-time conversations, ensure prompt feedback, and encourage the growth of social ties. Likewise, a set schedule provided by instructors in person keeps students inspired and engaged. Furthermore, collaborative tasks, studies, and hands-on activities are more accessible and easier to facilitate in a conventional educational setting.

Based on one student's feedback, the downside of this learning mode is that it lacks 'freshness', as students feel bored with the learning content beforehand. The desire for in-person instruction arises from the unique advantages of human contact and a conventional educational experience despite the numerous advantages of online and AB learning. As confirmed, in-person interaction increases students' perception of 'freshness', meaning that the pedagogical setting should remain an onsite lesson [26]. Regarding workload, YouTube videos require significant individual effort, which may increase pressure on students and violate Mohamed's [16] view regarding learners' learning at an optimal workload level.

Conclusion

In summary, the findings of this study confirm AB learning as a suitable pedagogical approach for promoting meaningful learning and teaching in metropolitan areas of Hong Kong. These findings align with the demands of the digital era in education, emphasising the importance of incorporating technology into teaching and learning practices. By embracing AB learning, educators can effectively leverage digital tools and resources to enhance the educational experience for students in urban settings. This study contributes to the growing body of research supporting the effectiveness of AB learning in the context of digital education, providing valuable insights for educators and policymakers seeking to optimise teaching and learning outcomes in metropolitan areas.

The study has some limitations that can be addressed in future research. First, the participants are part-time students in an undergraduate program; thus, future studies could include full-time students, which may yield more significant challenges for AB learning. Moreover, YouTube channels act as student-friendly platforms, fostering flexibility, learners' autonomy, and technology mediation. However,

we did not pay much attention to students' collaboration in this study. Therefore, more consideration is needed regarding encouraging or supporting learners to collaborate and share their knowledge and experience in collaborative projects, and more effective ways are needed to facilitate group projects or discussions in YouTube-based learning. Here, future research could focus on various YouTube settings and delivery methods in educational contexts.

Practically, workload is another issue for both teachers and students and another limitation of this study. Given this, future research must redefine the problems associated with heavy workload, lack of collaboration, and video quality. Studies could seek more insight into AB learning, including reducing workload by incorporating more collaboration activities in class and improving video quality by redeveloping playlist videos. Teachers and students should work together and communicate synchronously, which is an AB learning principle. Theoretically, addressing these limitations can also guide further research on applying AB learning principles to more courses. By embracing all the challenges and addressing the limitations, future AB learning can evolve into an emerging and well-discussed pedagogical education approach for teachers and elaborate meaning in students' learning.

Author Contributions William Ko-Wai Tang supervised the project, conducted the experiments, and wrote the manuscript. Ao Zhang analysed the data and wrote the results and discussion section.

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Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Research Involving Humans and/or Animals This study was approved by the Research Ethics Committee of Hong Kong Metropolitan University.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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