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The Role of Gender and Year of Study on Learning Engagement in a Blended Learning Context

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ABSTRACT

With the development of science and technology, blended learning (BL) has replaced traditional face-to-face teaching to become the mainstream learning mode in colleges and universities. This shift has led to the emergence of various teaching and learning challenges, particularly concerning students' learning engagement (LE) within the BL environment. Previous research indicates that students' learning engagement is greater in face-to-face teaching environments compared to online teaching modes. Conversely, some scholars hold a differing viewpoint. The purpose of this study was to investigate the factors that influence student engagement in blended learning environments, with a particular focus on the effects of gender and years of study. This research employed a quantitative approach utilizing a questionnaire, with a sample of 936 participants selected through random sampling. The findings revealed that there was no significant difference in LE between male and female students, but there was a significant difference in engagement between different years of study, with third-year students being significantly more engaged than students from other years of study in a blended learning context. Conversely, second-year students are significantly less engaged in learning than students in other grades. The research findings may provide theoretical support and practical guidance for educational reform in higher education institutions, promoting flexibility and personalization in teaching. The implications of the study were discussed.

Keywords: Gender Study; Year of Study; Learning Engagement; Blended Learning Context

1. Background of Study

Blended learning is a combination (or blend) of Web-based technologies (such as live virtual classrooms, collaborative learning, streaming media, and text) to achieve a specific teaching goal; it is a combination of multiple teaching methods (such as constructivism, behaviorism, and cognitivism) and teaching technologies (or non-teaching technologies) to achieve the most ideal teaching effect; it is a combination of any form of teaching [1]. It takes numerous forms in higher education, ranging from integrating digital and face-to-face activities to using adaptive, non-rotational tactics to tailor virtual and physical learning environments [2]. In the post-epidemic period, blended learning can accommodate a varied student population and enrich the educational experience [3,4].

Bokolo et al. discovered that the influence of blended learning on learners' effectiveness is positively predicted by achievement, engagement, involvement, retention, and cognitive outcomes [5]. Increasing student engagement has been one of the goals of blended learning in higher education, since it is a critical driver of student learning, both on campus and in online environments [6]. Learning engagement refers to students' degree of attention, interest, and participation, which includes behavioral, emotional, cognitive [7], and social components. To be more explicit, cognitive engagement refers to students' mental energy applied to learning, and emotional engagement refers to their positive emotional responses to learning [8]. At the same time, behavioral engagement emphasizes student participation in classroom and online learning activities. It refers to students' active participation in classes, assignments, online platforms, and collaborative activities [9]. Social engagement refers to the interactions that students have with their peers and teachers [10].

Gender may vary depending on the context and learning modality. However, it has long been established in educational research as a predictor of learner engagement. Male and female participants exhibit distinct behaviors in online settings. Liu et al. indicated that females outperformed males in all three areas of online self-learning: preparation, performance, and evaluation [11]. Furthermore, females demonstrate greater behavioral and emotional engagement. Bru et al. showed that males had a larger link between learning activity structure and engagement [12], whereas females had a stronger association between learning process support and emotional involvement.

On the other hand, students of different grades may have different engagements in participating in a blended learning environment. One experiment by James, Jason, and Caroline on predictors of student involvement in learning communities found that older, out-of-state, and underrepresented in medicine (URiM) students reported lower levels of engagement than younger, in-state, and non-URiM students [13]. Furthermore, Heilporn, Lakhal, and Bélisle emphasized that at the undergraduate level, several digital technologies were used to encourage student behavioral and emotional engagement [14], whereas graduate students' cognitive and emotional engagement was largely targeted through experience-sharing and learning co-construction among students.

Otherwise, technology improvements may create distractions that negatively affect students' focus and inhibit optimal learning [15]. Recent studies indicate that our ever-evolving technology can actually make it harder for students to stay focused and involved. "Digital addiction" in particular has become a major concern. In a 2022 bibliometric review, Karakose et al. pointed out how overreliance on devices can lead to cognitive overload and emotional withdrawal in the classroom [16]. Building on that work, Tülübas et al. mapped out how digital addiction intersects with grades [17]. They showed that the problem has broadened from simple smartphone overuse to include excessive social-media scrolling, weakened self-confidence, and drops in overall well-being. Together, these studies make it clear that digital addiction not only undermines students' mental and behavioral engagement but also often translates into poorer academic results.

Given that blended learning introduces greater autonomy and asynchronous components, the risks of distraction and disengagement become more pronounced [6]. Thus, promoting student engagement in blended learning may be more complicated than in face-to-face learning.

In order to create inclusive and equitable learning environments in blended settings and ensure that all students, regardless of gender or grade, are actively engaged, this study will look into whether gender and years of study are factors that may predict learners learning engagemen.

Therefore, the objectives of present study would be:

- To explore how gender and year of study, respectively, impact student engagement in blended learning contexts;

2. Literature Review

2.1. Theoretical Framework

This study looks at the role of gender and year of study on learning engagement in a blended learning context. It is based on four main theories: Gender Schema Theory [18], Social Cognitive Theory [19], the Technology Acceptance Model (TAM) [20], and Learning Engagement Theory [7]. In combination, these theories may provide a complete perspective for understanding the individual and contextual elements that influence involvement.

Gender Schema Theory discussed how societal norms and stereotypes influence gender-specific behaviors and attitudes [18]. In education, these schemas can influence students' confidence, interests, and involvement. Gendered perceptions of technology use and academic aptitude may contribute to inequalities in involvement. Female students, for example, may experience problems as a result of perceptions about technology being dominated by men.

In terms of social cognitive theory [19], it emphasized the interaction of human thoughts, behaviors, and contexts in learning. In a blended learning environment, self-efficacy and observational learning were important factors in determining student engagement. Referring to this study, gender differences in self-efficacy, especially in terms of technology use, may affect engagement. On the other hand, years of study may affect students' confidence in gaining experience in academic and technological environments.

In addition, the Technology Acceptance Model (TAM) stated that users' acceptance of technology was determined by their perceptions of ease of use and usefulness [20]. In blended learning, these perceptions were crucial to understanding how students interact with digital resources. This theory may be relevant to the current study as it claims that gender and year of study may influence technology acceptance. Senior students may find blended learning approaches more useful, while first-year students may face barriers due to unfamiliarity or lack of confidence.

Furthermore, the Learning Engagement Theory considered engagement as a combination of behavioral, emotional, and cognitive qualities [7]. Behavioral engagement was defined as involvement, affective engagement as interest and motivation, and cognitive engagement as deeper learning strategies. This theory may provide us with a framework to assess engagement and examine how gender and school year may influence differences in these characteristics in a blended learning environment.

Thus, these theories combined provide a comprehensive perspective to examine how gender and years of study affect learning engagement in blended learning environments. Social cognitive theory and learning engagement theory provide insights into the cognitive and behavioral components of engagement [7,19], while gender schema theory and TAM focus on the sociocultural and technological dimensions [18,20]. This integrated approach allows for a holistic approach to the research question by linking human attributes, social norms, and technological interactions.

2.2. Learning Engagement in Blended Learning Contexts

Blended learning started in corporate training and development in the United States and is thought to have first surfaced in the late 1990s. And it is gaining popularity in corporate and academic settings [21]. In terms of its definition, it is often called hybrid learning or mixed-mode education, which is a teaching approach that combines one or two alternative learning methodologies with a more traditional classroom instruction paradigm [4]. Recent research emphasized the varied character of blended learning in higher education, focusing on its effectiveness [22], the learners' desire to transition to blended learning to evaluate their efficiency in preparing future university graduates [23], and so on.

However, Bokolo et al. discovered that the influence of blended learning on learners' effectiveness is positively predicted by achievement, engagement, involvement, retention, and cognitive outcomes [5]. Among these factors, the one that is relevant to our study is learning engage-

ment. Learning engagement referred to students' active participation and interest in their learning, as evidenced by behavioral, emotional, cognitive [7], and social engagement in the educational process.

Behavioral engagement was multidimensional in such contexts, driven by variables such as student-content interactions and perceived learner control [6,24]. To be more explicit, Mamun and Lawrie found that students who actively engaged with content through interactive features such as quizzes and discussion forums have higher levels of participation and academic success [24]. Moreover, Wang et al. discovered a positive association between perceived learner control and student engagement in blended courses [6], implying that when students felt empowered to choose their own learning routes, their behavioral engagement rises.

In addition, characteristics that influence cognitive engagement have been found, as well as consequences for educational practice. Metu examined behavioral and cognitive involvement through reflective activities and concluded that reflective capacity enhanced learning and knowledge gains [25]. Furthermore, learning analytics research in higher education has found that engagement was frequently approached through observable behavioral indicators such as clicks and task duration. One study promoted a more complex approach that encompassed cognitive and emotional elements to improve learning design and treatments [26].

Amjaad's stated that the COVID-19 pandemic has prompted a shift towards online and blended learning, but challenges persist in social interaction and engagement among students and faculty [27]. On the one hand, emotional engagement was defined as the activation of discomfort, fear, or anxiety during exposure approaches [28]. Blended learning boosts students' emotional engagement, psychological capital, and academic achievement through digital active learning methods and interactive courses, enhancing social and emotional skills. Meanwhile, one result from the research of Liu, Ma, and Chen revealed that intrinsic motivation, extrinsic motivation, emotional engagement, and psychological capital all had a substantial impact on academic achievement [29]. Notably, intrinsic motivation controlled the association between extrinsic motivation and academic achievement, emphasizing the

necessity of developing internal impulses for learning. Moreover, Amjaad's study discussed the shift to online and blended learning due to COVID-19 [27], focusing on interactive blended courses with 90 graduate students. The study found significant differences in social-emotional learning skills and engagement between experimental and control groups, with self-awareness and social awareness being the dominant skills.

On the other hand, social engagement is defined as the willingness to socialize with others and the sense of belonging [30]. Lu and Churchill found that digital social interaction tends to be brief and self-focused, requiring enhanced communication strategies [31].

Lavidas et al. added to this conversation by highlighting what shapes teachers' willingness to take part in web-based surveys-factors like perceived authority, how the survey is structured, and when it's distributed [32]. Their findings underscore the importance of thoughtful research design, particularly when studying social engagement in digital environments.

Although cognitive and behavioral engagement have received considerable attention, the emotional and social aspects are still often overlooked. At the same time, digital addiction is not yet fully integrated into most engagement frameworks, despite its growing impact. As shown in the work of Karakose et al. and Tülübaş et al. [16,17], tackling digital dependency is essential for creating blended learning approaches that are not only effective but also inclusive and responsive to students' real needs.

Therefore, the COVID-19 pandemic has led to a shift towards online and blended learning, despite challenges in social interaction and engagement. Blended learning enhances emotional engagement, psychological capital, and academic achievement. Current research focuses on cognitive and behavioral engagement, neglecting social and emotional engagement. Additionally, most research concentrates on one or two measures of engagement, frequently missing how these factors interact in blended learning settings. Research aims to address these gaps among different students.

2.3. Gender Differences in Learning Engagement

Gender differences in learning engagement have

been a key topic of educational research. The following is a discussion about whether gender differences can be influenced by blended contexts in learning engagement.

Due to the impacts of COVID-19 epidemic, in blended learning environments, Seyyed, Noroozi, and Khaneh discovered that female students frequently reported higher levels of perceived teacher support, intrinsic value, and overall learning engagement than their male counterparts [33]. However, no significant gender differences were observed in competency beliefs for digital learning. In addition, an androgynous gender role self-concept has been associated with better outcomes in many domains of digital learning. In addition, Campos and Scherer expressed that girls outperform boys in digital knowledge and skills, largely due to gender differences in attitudes towards technology [34]. Moreover, female students outperformed male students in terms of engagement and self-regulation in online constructivist learning environments. This implied that females may find such learning designs more engaging and were better at self-regulating their learning processes [35].

At the same time, recent research suggests that digital addiction, a growing issue in tech-enhanced learning environments, may show up differently across genders. Karakose et al. (2022) found that male students tend to engage more with video games and specific digital platforms [16], but both male and female students are susceptible to different types of digital dependency. These variations can affect their ability to concentrate and stay academically engaged in unique ways.

Interestingly, female students have reported more technical obstacles with remote learning than male students, including difficulties adapting to course designs and shifting from face-to-face to online learning environments. These issues have resulted in an increasing gender gap in education during the pandemic [36]. While in the field of active learning classes, male students participate more than expected based on class composition. Its gap underlined the need for initiatives to promote gender-balanced engagement in active learning contexts [37].

Gender does not significantly impact students' performance in academic work with emerging technologies. Performance is largely influenced by what is learned and the use of materials that present opportunities. Distrac-

tions in learning methods are influenced by the student, not learning resources. Emerging technologies present both relevant information and distractions, requiring guidance to avoid. There is no significant difference in the contribution of emerging technologies between men and women. Use of emerging technologies should be cautious due to potential positive and negative impacts [38].

In this regard, gender differences in digital learning vary, with female students reporting higher teacher support and engagement in blended learning environments. However, no significant differences in competency beliefs exist. Girls outperform boys in digital knowledge and skills due to attitudes towards technology. Male students participate more in active learning classes, but use of emerging technologies should be cautious. Thus, addressing these discrepancies requires personalized interventions that take into account each learner's individual needs and experiences.

2.4. Influence of Year of Study on Learning Engagement

As previously said, blended learning, which combines face-to-face and online learning experiences, is growing more popular in higher education. While it provides flexibility and accessibility, student involvement with this learning style varies widely according to the year of study. However, course structure, teacher contact, and peer connections, which can change from year to year, all have an impact on participation.

For first-year students, they often have difficulty adapting to a blended learning environment due to their unfamiliarity with online platforms and self-directed learning. According to Kahu and Nelson [39], first-year students' engagement is largely influenced by their sense of belonging and the availability of academic support. Initial engagement may be limited as students adjust to college life and the blended model. In contrast, second-year students (often referred to as the "forgotten year") may experience a decline in engagement [40]. This phenomenon is attributed to the lack of targeted support and the lack of novelty associated with the first year. In blended learning, they tend to show greater adaptability to online platforms, but may still have difficulty maintaining motivation and consistency. In addition, final-year students often show

higher engagement because they focus on career preparation and academic achievement [41]. In a blended environment, final-year students often use online resources to deepen their understanding of advanced topics and participate in research-based activities. In addition, the relevance of the course to career aspirations becomes a key factor in later engagement [42]. However, time constraints and external responsibilities such as internships may affect their participation in hybrid activities.

2.5. Interaction Between Gender and Years of Study

The combination of gender and year of study has a substantial influence on learner engagement in blended learning settings. Students of different genders exhibit variances at various ages. More particularly, female first-year students exhibit greater levels of intrinsic motivation and active involvement in collaborative activities in blended learning contexts. This tendency is linked to their inclination for organized and socially involved settings [43]. Male first-year students, on the other hand, have higher comfort in utilizing digital tools but may be less involved in reflective or collaborative work, preferring to focus on individual learning practices [44].

Gender differences in engagement change as students progress through their academic careers. Older female students tend to draw on their experience with collaborative learning and demonstrate greater technical proficiency, resulting in consistently higher levels of engagement [43]. Older male students often prefer self-directed, task-oriented activities but may disengage from group discussions as their academic workload increases [33].

What's more, gender and academic seniority also play a role in shaping participation in research, a key factor to consider in engagement studies. Lavidas et al. found that female educators were more likely to respond to web-based surveys, often due to greater sensitivity to ethical concerns, clear communication, and perceived institutional credibility [32]. This suggests that female students, particularly those in later years of study, might also be more inclined to participate in engagement-related research. Without deliberate efforts to reach male and lower-year students, these imbalances could lead to skewed findings and limit the representativeness of the data.

While engagement patterns vary significantly across disciplines. In STEM (Science, Technology, Engineering, and Mathematics) fields, male students tend to dominate discussions and technical activities in earlier years, while female students excel in collaboration and theoretical understanding as they gain confidence [45]. Humanities courses, with their emphasis on discussion and collaboration, often see consistently higher engagement among female students.

Sociocultural factors significantly influence engagement patterns. For instance, in collectivist societies, female students are often encouraged to participate actively in collaborative learning, leading to higher engagement levels. In individualistic cultures, male students may display greater autonomy and self-direction, particularly in advanced academic years [46].

In sum, the intersection of gender and year of study reveals distinct patterns of student engagement. Female students often start with higher levels of emotional and collaborative engagement but may become more susceptible to emotional burnout over time, especially due to digital and social overload. In contrast, male students may show early confidence with technology but often face challenges in maintaining collaborative engagement as studies progress. These differences point to the importance of nuanced, flexible teaching strategies that recognize and respond to these inter-sectional dynamics when designing effective blended learning environments.

2.6. Hypothetical Model

This chapter discussed the impact of gender, year of study, and learning engagement in blended learning. It would be based on the theories with Gender Schema Theory [18], Social Cognitive Theory [19], the Technology Acceptance Model (TAM) [20], and Learning Engagement Theory to understand societal norms and attitudes [7].

Blended learning, especially in the post-pandemic landscape, offers both significant opportunities and notable challenges. On the positive side, it can boost students' emotional engagement, build psychological resilience, and support academic success through flexible and interactive learning environments. At the same time, it heightens concerns around digital autonomy—most notably, the growing risk of digital addiction, which can undermine

focus, motivation, and overall well-being if not carefully managed.

Furthermore, the intersection of gender and year of study adds layers of complexity to student engagement. Female students often show higher engagement in the early years, particularly in emotional and collaborative aspects, but are also more likely to experience stress and fatigue from multitasking and emotional labor as they progress. Male students, by contrast, may display early confidence with digital tools but are more prone to disengage from collaborative learning as academic pressures increase. These nuanced patterns underscore the importance of differentiated teaching strategies that consider students' developmental stages, gender-related tendencies, and the need to support digital well-being throughout their academic journey.

Despite the growing body of research on blended learning and learning engagement, studies focusing on the combined role of gender and year of study remain limited. Moreover, most existing studies are context-specific, making it difficult to generalize findings across diverse educational settings. There is a need for more comprehensive research that considers the interplay between these variables to inform inclusive and effective instructional design in blended learning contexts.

In this regard, based on the literature review discussed above and one research objective of this study, the following research hypotheses are constructed below and shown in **Figure 1**.
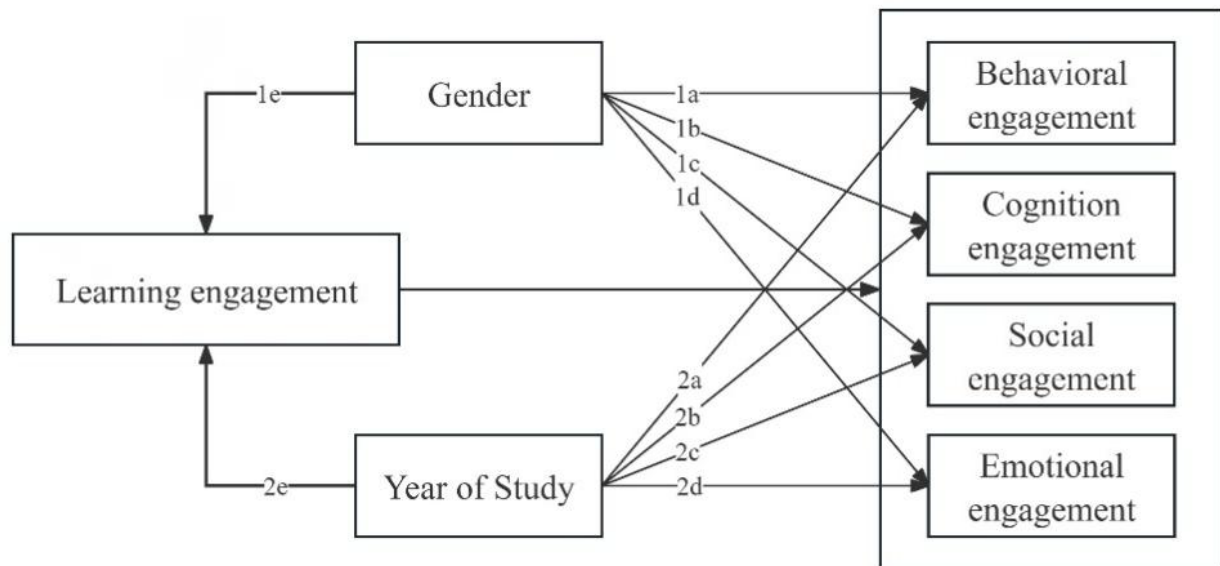

Figure 1. Research Hypothesis.

Hypothesis 1a. *There is a significant difference of BE between male and female.*

Hypothesis 1b. *There is a significant difference of CE between male and female.*

Hypothesis 1c. *There is a significant difference of SE between male and female.*

Hypothesis 1d. *There is a significant difference of EE between male and female.*

Hypothesis 1e. *There is a significant difference of LE between male and female.*

Hypothesis 2a. *There is a significant difference of BE in terms of years of study.*

Hypothesis 2b. *There is a significant difference of CE in terms of years of study.*

Hypothesis 2c. *There is a significant difference of SE in terms of years of study.*

Hypothesis 2d. *There is a significant difference of EE in terms of years of study.*

Hypothesis 2e. *There is a significant difference of LE in terms of years of study.*

3. Research Methodology

A quantitative survey was employed for addressing the research questions and evaluating the hypotheses outlined above.

3.1. Participants

The study included 936 randomly selected university students. There are 568 female students and 368 male pupils. There are 263 pupils in Year 1, 231 in Year 2, 265 in Year 3, and 177 in Year 4.

3.2. Research Instrument

Xiong's online learning engagement scale (OLES) was applied for assessing learning engagement among university students in a blended learning environment [47]. The OLES instrument comprises four dimensions: behavioral engagement, cognitive engagement, emotional engagement, and social engagement, with a total of 15 items. The instruments utilized a five-point Likert scale in table format, where the question sets are categorized into five levels: 1 signifies "Totally disagree," 2 indicates "Disagree," 3 represents "Neutral," 4 denotes "Agree," and 5 means "Totally agree." Furthermore, the OLES were chosen based on their established validity, with Cronbach's alpha values for behavioral engagement, cognitive engagement, emotional engagement, and social engagement noted at 0.862, 0.908, 0.811, and 0.825, respectively, in similar educational contexts.

In order to ensure the reliability of the questionnaire, a pilot study was conducted with 30 participants. The Cronbach's alpha of the OLES was within the range of 0.861 to 0.939 after EE3 was deleted [48]. Items EE3 were deleted due to a higher alpha value of more than 0.95, which indicates that items are similar or overlap with one another [48]. The result indicated that it has good internal consistency and reliability. Therefore, this verified questionnaire can be further used in future research related to this topic.

The recruitment period commenced on 15th January 2025 and concluded on 10th February 2025. The participants were assured that the information gathered in the questionnaire would remain confidential and would be utilized solely for research purposes. Participants were provided with the opportunity to voluntarily withdraw from completing the questionnaire at the beginning. The study included only adult undergraduate participants. The Ethics Approval has been included with this submission.

The Cronbach alpha for the questionnaire, indicating reliability, varied between 0.933 and 0.946, falling within the acceptable range of 0.65 to 0.95 [48]. The findings indicated that it demonstrates strong internal consistency and reliability. Furthermore, the convergent validity (AVE) of the survey questionnaire is evaluated to determine its validity. An AVE greater than 0.36 is deemed acceptable, while a value exceeding 0.5 is regarded as good. The AVE of the study ranged from 0.788 to 0.879, indicating that the AVE for all dimensions fell within acceptable limits. Consequently, the verified questionnaire can be utilized in future research on this subject.

4. Results

4.1. Test of Hypothesis

Here we intended to test the significant difference of LE between males and females. As can be seen in **Table 1**, the results obtained from T-test show that there are no significant differences between male and female students (t = 0.217, df = 934, $P > 0.05$) for the LE. Hence, Hypothesis 1e is rejected. In addition, the BE dimension (t = −0.053, df = 934, $P > 0.05$); EE dimension (t = −0.134, df = 934, $P > 0.05$); CE dimension (t = 0.399, df = 934, $P > 0.05$) and SE dimension (t = 0.433, df = 934, $P > 0.05$) of LE among male and female participants are not significant as well. Therefore, H1a, H1b, H1c and H1d are all rejected.

As can be seen in **Table 2**, the results of the data analysis show that there are significant differences in the LE of the participants in the four years F($df = 3, 932$) = 3.868, $P < 0.05$). Hence, Hypothesis 2e is supported. The ANOVA test indicated significant differences either in the three dimensions of LE: BE F($df = 3, 932$) = 3.740, $P < 0.05$); CE F($df = 3, 932$) = 3.836, $P < 0.05$); and SE F $df = 3, 932$) = 3.842, $P < 0.05$) among the participants in the four years of study, respectively. Therefore, H2a, H2c and H2d are supported too. However, **Table 2** also displayed

that there are no significant differences among the four years of students of EE F(df = 3, 932) = 1.650, P >0.05. Thus, H2b is rejected.

Table 3 indicates that Year 3 students exhibit the highest levels of behavioural engagement (BE), followed by Year 1 students in second place. In contrast, Year 4 students show the lowest levels of behavioural engagement in a blended learning context. Similarly, Year 3 students also demonstrate the highest levels of cognitive engagement (CE), with Year 1 students again coming in second. Year 4 students, however, rank lowest in cognitive engagement in the same blended learning environment. In terms of social engagement (SE), the Tukey table reveals that Year 3 students lead, with Year 1 students in second place, while Year 4 students have the lowest social engagement. Furthermore, when it comes to learning engagement (LE), Year 3 students again display the highest engagement, followed by Year 1 students, with Year 4 students at the bottom. It is worth mentioning that Year 3 students are significantly more engaged in their learning compared to Year 4 students in the blended learning context.

Table 1. Independent Sample T-Test.

	F	Sig.	t	df
BE	1.318	0.251	−0.053	934
			−0.053	743.426
EE	0.600	0.439	−0.134	934
			−0.133	755.163
CE	0.098	0.755	0.399	934
			0.396	765.121
SE	2.159	0.142	0.433	934
			0.425	735.648
LE	1.614	0.204	0.217	934
			0.214	747.012

Table 2. One-Way (ANOVA) Test Results in Terms of Year of Study.

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	114.290	3	38.097	3.740	0.011
BE	Within Groups	9494.321	932	10.187		
	Total	9608.611	935			
	Between Groups	15.003	3	5.001	1.650	0.176
EE	Within Groups	2824.663	932	3.031		
	Total	2839.666	935			
	Between Groups	126.000	3	42.000	3.836	0.010
CE	Within Groups	10205.332	932	10.950		
	Total	10331.332	935			
	Between Groups	120.589	3	40.196	3.842	0.009
SE	Within Groups	9750.384	932	10.462		
	Total	9870.973	935			
	Between Groups	1320.382	3	440.127	3.868	0.009
LE	Within Groups	106047.899	932	113.785		
	Total	107368.281	935			

Table 3. Tukey in Terms of Year of Study.

Dependent Variable	Independent Variable		(I-J)	Std. Error	Sig.
BE	Year 1	Year 2	0.08100	0.28781	0.992
		Year 3	−0.00842	0.27781	1.000
		Year 4	0.90945[*]	0.31030	0.018

Table 3. *Cont.*

Dependent Variable	Independent Variable		(I-J)	Std. Error	Sig.
CE	Year 1	Year 2	0.09700	0.29839	0.988
		Year 3	−0.09514	0.28802	0.988
		Year 4	0.91613*	0.32171	0.023
SE	Year 1	Year 2	0.17112	0.29166	0.936
		Year 3	−0.21970	0.28153	0.863
		Year 4	0.81629*	0.31446	0.047
LE	Year 1	Year 2	0.42734	0.96188	0.971
		Year 3	−0.41432	0.92845	0.970
		Year 4	2.91622*	1.0370	0.026

5. Discussion

5.1. The Influence of Gender in LE

According to data from the Ministry of Education, the share of women in general studies at universities in 2020 was 52.04 %, but there are still clear gender gaps in course choices and learning outcomes [49]. This is where we test for the significant difference in LE between men and women. The results showed that there were no significant differences between the male and female pupils. In particular, the LE dimensions (BE, EE, CE and SE) are all not relevant to men and women, i.e. in blended learning contexts, male and female learners are at the same LE level and gender predicts learners' LE. Therefore, all H1a, H1b, H1c and H1d are discarded. In this regard, the result consisted with findings of Ayite et al. and Seyyed et al. which also reported gender was not significant difference in the contribution of emerging technologies or digital learning [33,38]. In contrast, the result was inconsistent with past studies by Liu et al., Campos and Scherer, and Zhang et al. which discovered that female students frequently reported higher levels than their male students [11,34,50]. According to Li et al. [35], female students may find such learning designs more engaging and were better at self-regulating their learning processes, yet, female students have reported more technical obstacles with remote learning than male students, including difficulties adapting to course designs and shifting from face-to-face to online learning environments [36]. Besides, Bru et al. showed that males had a larger link between learning activity structure and engagement [12], whereas females had a stronger association between learning process support and emotional involvement. These issues have resulted to an increasing gender gap in blended learning context. For the participants of the study, gender issue is not significant factor which influence in their LE. In this regard, Zhang et al. stated that students are almost the same or comparable in age, have a similar level of psychological maturity, similar perspectives on life and values, and similar attitudes and actions toward learning [50]. Combined with comparable faculty strength in many subjects and specialties, educational concepts and methods are constantly evolving, yet overall educational quality remains consistent. Furthermore, Wollast et al. claimed that the impact of gender can vary significantly across cultural, educational, and institutional contexts [51].

5.2. The Influence of Years of Study in LE

Another uncontrollable internal element that significantly affects students' LE is their year of study [52]. We wanted to see if there were any notable changes in LE based on years of study. The current study found that the LE, as well as its three dimensions (BE, CE, and SE) varied significantly during the four years. Yet, the other dimension of LE (EE) showed non-significant differences among the different year of study students. Therefore, Hypothesis 2e, H2a, H2c, and H2d are supported, whereas Hypothesis H2b is rejected. Years of study are therefore a crucial component that determines learners' LE.

In a blended learning context, Year 3 students are significantly more engaged in their learning than other study year students, according to the Tukey analysis, which also clarified that Year 3 students exhibit the highest levels of LE, followed by Year 1 students in second place. In this regard, Kahu and Nelson suggested that Year 1 students' initial engagement may be limited as they adjust to college life and the blended model [39], and that Year 2 students may experience a decline in engagement due to the

lack of targeted support and the lack of novelty associated with first year [40]. The study's findings were inconsistent with those of Zhang et al. (2025) [50], who reported no significant difference in students' learning engagement across different years of study. However, they aligned with the results of Yeran et al. which indicated that the level of learning engagement among first-year students was significantly lower than that of students in higher grades [53]. The variation in LE among students in year 2, year 3, and senior year was not statistically significant.

Additionally, the results showed that Year 4 pupils consistently showed the lowest levels of engagement in the setting of blended learning. Among the reasons given by the study participants could be time constraints and fourth-year students' internships. The results were completely different with the findings of Thomas et al. [41], which suggested that year 4 students frequently exhibit higher levels of engagement due to their academic success and career preparation in a blended environment, their propensity to use online resources to enhance their comprehension of complex subjects, and their participation in research-based activities.

6. Conclusions

The findings of the study reported that Gender is not a significant factor which influence in students learning engagement, while the effects of years of study in LE in a blended learning environment were validated by this study. Additionally, third-year university students are more engaged in their studies, while fourth-year students are less engaged in their studies because of time restrictions and internships. The learning engagement of university-level students in grades 1–3 is therefore still very much in accordance with the findings shown by earlier studies [39,40]. This research offers significant insights into the implementation and assessment of students LE. Teachers, educational policy makers, and colleges or universities can all utilize the study's findings as a reference. Based on the findings of current study, educators ought to focus more on first-year students, future study are encouraged to investigate the challenges they face when enrolled in blended learning programs, and develop strategies to address these issues. Regarding the "forgotten year" phenomenon in the second year, educators and university pol-icy makers ought to be aware of it and give second-year students more consideration, particularly those who teach in-person, as this can significantly increase the students' motivation to learn.

Moreover, the research findings might offer theoretical support and practical assistance for educational reform in higher education institutions, foster flexibility and personalization in teaching methodologies, and augment students' capacity for autonomy learning. In the future, as technology advances and educational paradigms evolve, blended teaching will become predominant, and the research findings are anticipated to be disseminated and implemented statewide to enhance educational quality. For the limitations, the study's scope is limited to specific contexts and may not generalize to other domains or environments. The sample size utilized for testing and evaluation might be insufficient to guarantee the generalizability of the findings. Furthermore, the study concentrates on quantitative survey and may not encompass the full range of available solutions. Moreover, external factors like environmental impacts might influence the results, which weren't deeply analyzed in this research. Future research could overcome these limitations by incorporating a broader range of variables and expanding the evaluation's scope.

Author Contributions

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board OF Chiang Mai Rajabhat University in Certificate Number: IRBCMRU 2024/526.29.11.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Some or all data, models, or code generated or used during the study are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare no conflict of interest.

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