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Investigation of the factors affecting students' self-directed learning readiness in the blended learning model

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ABSTRACT

Many factors influence the level of readiness for self-directed learning. This study seeks to examine the relationship between learners' personal characteristics (gender, major, academic year), external factors (facilities, self-study time, peer influence, teacher support), internal factors (cognitive skills, metacognitive skills, attitudes, motivation), and self-directed learning readiness in a blended learning model. The aim is to identify the decisive influencing factors to promote learners' readiness for self-directed learning and improve blended teaching effectiveness. A survey was conducted with 1,276 students participating in the blended learning model at Hanoi National University of Education in Vietnam. The data were quantitatively analyzed using structural equation modeling with the partial least squares approach in SmartPLS 3, as well as regression analysis in SPSS 20. The findings showed that external factors accounted for 68.7% of the variation in internal factors and 41.6% of the variation in self-directed learning readiness. The study also found that factors such as major and academic year had significant impacts on self-directed learning readiness, as evidenced by statistically significant differences with p-values less than 0.05. These results suggest strategies for educators to effectively address these factors to enhance students' self-directed learning readiness in blended learning environments.

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1. INTRODUCTION

In recent decades, self-directed learning (SDL) has gained significant global traction in academic research and education. The academic community has seen a surge in research, scholarship, and interest in SDL. Consequently, new tools and resources have been proposed to measure SDL capacity and assist pedagogical researchers in developing programs, practices, and resources for students.

The concept of SDL was initially introduced by Knowles in his seminal work [1]. Knowles describes self-directed learners as proactive individuals who take charge of their learning, actively managing and influencing their educational processes. Since then, numerous studies have emerged with various interpretations of SDL. Recent research suggests that SDL and problem-solving are essential skills for professional development, enhancing the acquisition of knowledge and skills through independent learning

and interaction [2]. SDL is a strategy enabling students to take responsibility for their learning, set learning goals and identify resources, engage in relevant activities, and assess their learning outcomes [3]. SDL is recognized as a primary means for developing essential professional career skills [4]. To assess learners' readiness for SDL, a scale is required. Wiley [5] first introduced this scale, defining SDL readiness as "the degree to which an individual possesses the attitudes, abilities, and personality characteristics necessary for SDL." Among the most prominent scales for assessing students' SDL skills, the SDL readiness score, developed by Guglielmino in 1977 stands out [6]. This scale measures the complex array of attitudes, skills, and characteristics that reflect an individual's current level of readiness to manage their learning. McCune [7] noted that the SDL readiness score was the most frequently used instrument in studies of self-direction in learning, examining 67 studies conducted between 1977 and 1987. Murray [8] proposed an SDL readiness scale specifically for nurse educators to identify student learning needs, enabling the implementation of effective teaching strategies and plans. Similarly, Ayyildiz and Tarhan [9] developed a valid and reliable scale for assessing high school students' SDL skills, featuring a nine-factor structure with 40 items. This scale helps teachers identify students' strengths and weaknesses, aligning instructional design with students' readiness for SDL. Additionally, various other scales have been introduced to assess SDL readiness directly. Examples include Deng's Chinese version of Guglielmino's instrument [10], scales for nursing students developed by Cadorin *et al.* [11], Fisher *et al.* [12], and Williamson [13] self-rating scale for nurse students.

If SDL in a traditional environment is a core factor in determining effectiveness, then in a blended learning environment (B-learning), readiness for SDL becomes even more critical, as most learning tasks must be completed by learners independently online. B-learning, which integrates online and face-to-face teaching methods, is now deeply embedded in higher education practices. Understanding students' attitudes towards the online component of B-learning is crucial and necessitates tailored instructional designs to enhance learning outcomes. B-learning has the potential to develop professional skills more effectively than traditional face-to-face methods [14]. One objective of implementing B-learning is to advance students' pedagogical abilities, including scientific reasoning, critical evaluation, information literacy, SDL, and lifelong learning.

Recent studies also identify factors affecting learners' readiness when they engage in a B-learning model, including students' adaptability and independent working skills [15] autonomy and belongingness [16]; the utilization of information and communication technologies (ICT) [17]; and demographic factors such as gender, age, ethnicity, and field of study [18]. Instructors need to create assessments in various forms, including project assignments, online quizzes, and end-of-term tests, all designed to enrich the educational journey [19], and consistently support learners when applying a flipped classroom model [20]. Additionally, physical factors such as policy support and the preparedness of IT infrastructure are crucial [21]. To date, there has been no research evaluating the factors influencing learners' readiness for SDL within the B-learning model. This study aims to address that gap by identifying the influencing factors, with the goal of proposing measures to improve and enhance the effectiveness of teaching and learning in B-learning by strengthening learners' SDL readiness.

The factors influencing SDL competency can be categorized into internal and external factors. External factors (EF) pertain to the development of teacher-student relationships and the establishment of an appropriate learning environment. MacBeath [22] identified four external factors affecting self-study: i) facilities; ii) time spent studying; iii) influence from peers; and iv) reference and instructional materials provided by teachers. Facilities should provide a suitable and quiet space for learners. The second factor, study time, is defined as the period between the start and end of a learning task, helping learners set goals and track progress. It also allows for breaks and changes in learning direction and can be used by teachers to assign specific tasks. Peer influence is described as a "behavior set," which is the environment created by classmates or study groups. References include resources like books, audio materials, and online documents while learning resources from teachers encompass knowledge, skills, and guidance to help students find relevant materials. Regarding internal factors (IF), Meyer [23] defined all personal skills necessary for self-study as internal factors. These include cognitive skills, which involve the brain's ability to think, reason, read, learn, memorize, and focus, and metacognitive skills, which enable individuals to organize their thoughts and evaluate their learning and problem-solving processes.

At Hanoi National University of Education (HNUE), we have implemented a B-learning model for teaching foundational courses that serve as the basis for specialized studies in subsequent years. These selected foundational courses share common characteristics: students are required to spend significant time on SDL, reading materials, and watching videos before attending class, as well as engaging in self-practice and assessments after class sessions. In-class time is primarily devoted to discussions, analyses, and evaluations of the learning process. The adoption of the B-learning approach, which requires student engagement and autonomy, underscores the importance of a thorough understanding of SDL readiness and its determinants. The objective of this research was to explore the correlation between EF, including facilities, teacher support, tool support, teaching methods, peer influence, and time invested in learning, and IF, which

encompass students' self-perception and actions regarding learning and SDL, and their readiness for SDL. Thus, the research aims to address three research questions (RQ):

i) RQ1: in B-learning model, what factors influence SDL readiness, and to what extent do they influence it (including direct and indirect effects)?
ii) RQ2: which factors in each group have the greatest influence on SDL readiness?
iii) RQ3: how can the effectiveness of students' SDL in B-learning be improved?

2. METHOD

To address the research questions, we employed quantitative research methods. First, the proposed survey instrument includes demographic factors, independent variables: encompassing both EF and IF that influence the level of SDL readiness, based on the theories of MacBeath [22] and Meyer [23], and dependent variables: the level of SDL readiness, as measured by the instrument developed by Guglielmino [6], based on the theory of Knowles [1]. The instrument was structured using a 5-point Likert scale. A pilot survey was conducted, and SPSS software was used to assess the reliability of the scale through the Cronbach's Alpha coefficient. Following the standardization of the instrument, it was used in the official investigation. After collecting the official survey results, exploratory factor analysis (EFA) was performed to identify the underlying structure of the observed variables in the quantitative research [24]. These results were then utilized to calculate SDL readiness for subsequent analyses.

Next, PLS-SEM analysis was conducted to evaluate the model of influence on SDL, determine how external and internal factors impact SDL, and answer RQ1. Additionally, the Pearson correlation coefficient was calculated using linear regression [25] to quantify the strength of the linear relationship between two quantitative variables, addressing RQ2. Finally, RQ3 was addressed based on the analysis of the results from research questions 1 and 2.

2.1. Research samples

Information was collected from 1,276 students from 23 faculties who attended three subjects taught using the B-learning model through simple random sampling. The students come from different majors: educational sciences (25.5%), natural sciences (41.0%), and social sciences (33.5%). The natural sciences sector had the largest number of students participating in the survey, followed by the social sciences and educational sciences sectors. The student distribution by year is as: 1st year (61.9%), 2nd year (25.5%), 3rd year (10.3%), and 4th year (2.3%). The proportion of female students participating in the survey is approximately five times higher than that of male students. This distribution is because the subjects included in this study are foundational courses, primarily for first- and second-year students. Third- and fourth-year students are either retaking the courses or taking them to improve their grades. At teacher training institutions in Vietnam in general, and HNUE in particular, the proportion of female students is always significantly higher than that of male students.

Ethical considerations were carefully addressed in this study. Before their participation, all participants provided informed consent. They were explicitly informed that their involvement was entirely voluntary, and they retained the right to withdraw from the study at any stage. All collected data have been stored confidentially and anonymously, exclusively for research purposes.

2.2. Survey method

Data were collected from April to May 2024, covering the end of the 2023-2024 school year. Given that students use a learning management system (LMS) for blended learning, an online survey was deemed suitable for data collection. We distributed questionnaires via Google Forms to students enrolled in these courses.

2.3. Survey content and tools

This study employed a quantitative approach, using a survey to collect data on factors influencing the SDL readiness of students at HNUE when participating in a B-learning model. The survey consisted of three sections. The first section gathered demographic information, including name, gender (M/F), department, year of study, GPA, and subjects. The second section examined the IF and EF affecting the respondents' SDL readiness in the context of B-learning. The third section assessed the participants' SDL readiness. To ensure the validity of the survey, an expert in educational science and assessment collaborated with us in developing the survey instrument.

The second section, focusing on IF and EF, based on the theories of MacBeath [22] and Meyer [23]. A 17-item questionnaire was constructed to align with the B-learning model, comprising 6 EF and 11 IF, and was designed using a 5-point Likert scale, where 1 represents 'strongly disagree' and 5 represents 'strongly

agree'. In the third section, participants' attitudes, values, and abilities related to their SDL readiness were measured using the SDL readiness scale developed by Guglielmino [6], based on Knowles' theory [1]. According to this theory, SDL readiness, the dependent variable, consists of five latent variables corresponding to five characteristics of SDL: defining learning goals (SDL1), defining learning tasks (SDL2), choosing learning strategies (SDL3), planning learning (SDL4), and evaluating learning outcomes (SDL5). These five latent variables are measured using 55 Likert scale items, where respondents indicate the frequency of their behavior on a scale from 1 (never) to 5 (always).

The scale was pilot-tested with 210 students to standardize the tool. The test results showed that all scales had Cronbach's alpha coefficients greater than 0.7, confirming reliability [26]. However, the IF scale and the SDL5 group had Cronbach's alpha values greater than 0.95, indicating potential redundancy. To address this, the scales were recalibrated before the mass survey by omitting IF2, IF7, and IF10, as these items had content similar to other questions in the same group. The post-calibration test results, conducted with 1,276 students, demonstrated that the scales continued to maintain unidimensionality and reliability, making them suitable for further analysis. Consequently, after calculating Cronbach's alpha reliability and considering both internal and external factors, we retained 14 influencing factors, including 6 EF and 8 IF.

2.4. Data analysis

Data retrieved from the online survey (Google Forms) were cleaned and coded using Microsoft Excel. EFA was then conducted to identify the underlying structure of observed variables in the quantitative research [24]. The results indicated that the theoretical model of SDL, measured by five latent variables, is appropriate, reducing the initial 55 observed variables to 38 relevant ones. These results were used to calculate SDL readiness for subsequent analyses. Data processing and analysis were performed using descriptive quantitative techniques and structural equation modeling (SEM) with the partial least squares (PLS) approach, facilitated by Smart PLS version 3. SEM was employed to examine the relationships among the study variables (constructs). As a multivariate statistical analysis tool, SEM can simultaneously assess complex research models and analyze variables that cannot be directly measured. It is considered a more reliable, illustrative, and robust method compared to regression techniques for capturing interactions, nonlinearity, measurement errors, and correlations among multiple latent independent and dependent variables with multiple indicators [27].

This study involved three variables: one exogenous latent variable and two endogenous latent variables. The exogenous latent variable was EF, while the endogenous latent variables were IF and SDL readiness. The external factors included facilities (EF.1, EF.2), time spent studying (EF.3), peer influence (EF.4), and lecturer support (EF.5, EF.6). The internal factors encompassed cognitive skills (IF.1 to IF.4), metacognitive skills (IF.5 to IF_7), motivation (IF.8 to IF.10), and ICT skills (IF.11). Additionally, to determine the impact of individual factors within the IF and EF groups on SDL readiness, linear regression equations were employed using SPSS 20.

3. RESULTS AND DISCUSSION

To address the first research question, the PLS-SEM method is employed. For the second research question, the linear regression method is utilized. Following the presentation and discussion of the results for these two research questions, solutions aimed at enhancing the effectiveness of students' self-study in the blended learning model (addressing the third research question) are provided in sub-section.

3.1. Structural equation modeling analysis

In the PLS approach to SEM analysis, two types of model assessment were undertaken: evaluation of the measurement model (outer model evaluation) and evaluation of the structural model (inner model evaluation). The measurement model, also referred to as the outer model, illustrates the association between indicators and their latent variables. Through iterative algorithms, parameters of the measurement model, convergent validity, discriminant validity, composite reliability, and Cronbach's alpha, were derived, including the R2 value as an indicator of model predictiveness. On the other hand, the structural model, or inner model, anticipated the causal connections among the latent variables. The bootstrapping process generated T-statistic test parameters to forecast the presence of these causal connections [27], [28].

3.1.1. Outer model

Hair *et al.* [29] suggested that the outer loading factor should be greater than or equal to 0.7 to ensure the quality of the observed variable. Based on the initial model calculation results in Figure 1, the observed variable SDL4 was removed because its loading factor was 0.627. Additionally, specific indirect effects of academic year (YEAR), major group (GROUP), gender (SEX), and GPA indicate that these factors do not indirectly influence SDL through IF. The adjusted observed model is illustrated in Figure 2. The

results presented in Table 1 demonstrate that the scale exhibits reliability and convergence, with the composite reliability index (CR) exceeding 0.7 [30] and the convergent validity index (AVE) surpassing 0.5 [31]. Table 2 illustrates the cross-loading values between indicators and their respective overarching constructs exceed those with other constructs, indicating that the model satisfies the criterion for discriminant validity.

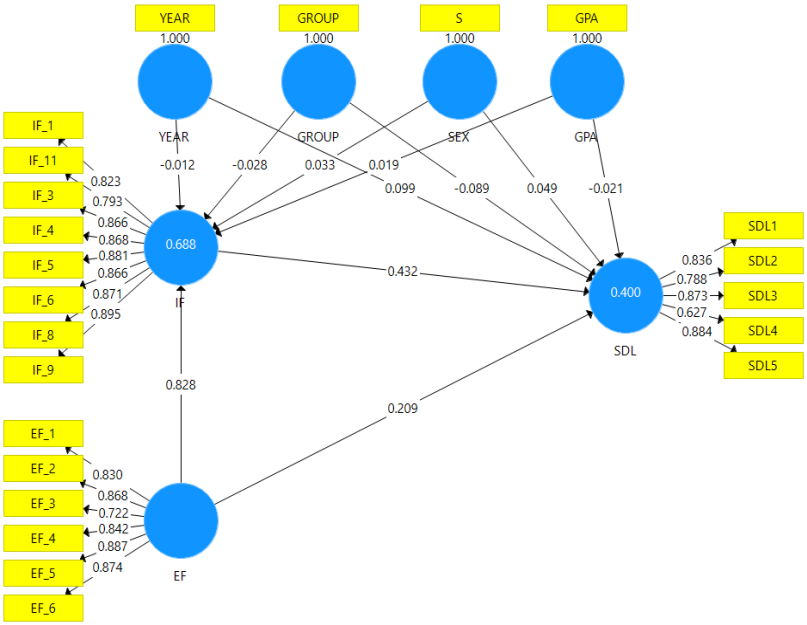

Figure 1. Early measurement model

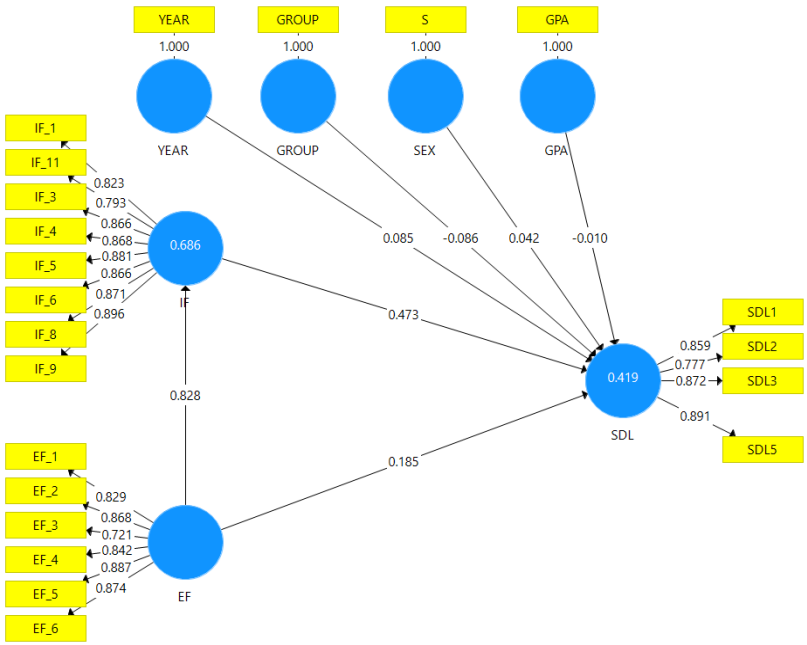

Figure 2. Final measurement model

Table 1. Value of AVE and composite reliability

Variable	Composite reliability	AVE
External factors	0.934	0.704
Internal factors	0.957	0.737
SDL	0.913	0.723

Table 2. Cross loadings between indicators and constructs

	Item	External factors	Internal factors	SDL
EF.1.	School's computer and network system suitable for self-learning on LMS	0.829	0.634	0.476
EF.2.	LMS facilitates SDL	0.868	0.705	0.474
EF.3.	Time spent self-studying on course-specific tool twice as much as time spent on the same subject in class	0.721	0.545	0.421
EF.4.	Diligence in self-study among peers	0.842	0.742	0.532
EF.5.	The lecturer supports my SDL by providing many reference materials and learning resources on the LMS	0.887	0.755	0.485
EF.6.	Lecturers employ various measures to encourage independent study	0.874	0.759	0.522
IF.1.	I consider SDL to be essential for every student	0.747	0.823	0.476
IF.11.	My IT skills are good enough to facilitate SDL on the LMS	0.648	0.793	0.535
IF.3.	I can recall the knowledge after reading the materials or watching videos on the LMS	0.733	0.866	0.551
IF.4.	Ability to apply acquired knowledge to solve practical problems	0.725	0.868	0.584
IF.5.	I know which learning style I prefer	0.708	0.881	0.562
IF.6.	Awareness of personal abilities, strengths, and weaknesses	0.685	0.866	0.547
IF.8.	Achieving high results in my studies motivates me to study harder	0.714	0.871	0.511
IF.9.	When I acquire new knowledge, I become more interested in continuing my SDL	0.727	0.896	0.558

3.1.2. Inner model

The results assessing the relationship between independent variables and the dependent variable (SDL) are presented in Table 3. Factors such as GPA (GPA) and gender (SEX), with p-values >0.05, are deemed to have no significant impact on readiness for SDL. Conversely, the remaining factors demonstrate varying degrees of influence on SDL, ranked in descending order of impact including: IF, EF, major group, and academic year.

Table 3. Path coefficients

Influencing factors	Original sample	p-values
IF→SDL	0.472	0.000
EF→SDL	0.185	0.000
GROUP→SDL	0.086	0.000
YEAR→SDL	0.086	0.000
SEX→SDL	0.042	0.076
GPA→SDL	0.010	0.616

The level of explanatory power of the model is assessed through the R-squared index. For the internal factor (IF), the R-squared index is 0.687, indicating that the adjusted model (Figure 2), accounts for 68.7% of the variance in IF. Regarding SDL, the R-squared value is 0.416, suggesting that the adjusted model explains 41.6% of the variance in SDL, with the remaining 58.4% attributed to factors outside the model. The SEM analysis results presented in Table 4 indicate, at a 95% confidence level, that with T-statistics=56.093>1.96, EF exerts a significant direct impact on IF. Moreover, IF directly influences SDL (T-statistics=12.481>1.96). While the influence of IF on SDL is direct, the impact of EF on SDL is both direct and indirect through IF.

Table 4. The result of SEM model estimation

Influencing factors	Loading factor			T-statistic	R-square
	Direct effect	Indirect effect	Total effect		
EF→IF			0.829	56.093	0.687
EF→SDL	0.185	0.392	0.577	26.466	
IF→SDL			0.472	12.481	0.416
GROUP→SDL			0.099	3.942	
YEAR→SDL			0.079	3.121	

3.2. Construct the standardized regression equation from EF and IF to SDL

Based on the adjusted model, the analysis highlights that two factors, EF and IF, have a significant influence on SDL. To further substantiate these findings, researchers are encouraged to employ SPSS software to derive a standardized linear regression equation for each influencing factor. The detailed equations for these factors are presented in sub section.

3.2.1. Standardized regression equation of EF to SDL

By excluding analytical results with a significance level (sig) greater than 0.05, the study ensures that only statistically significant variables are included in the analysis. Table 5 presents the findings of the standardized regression equation, as in (1), which illustrates the relationship between SDL readiness and EF. These results provide a robust basis for interpreting the impact of EF on the readiness for SDL. The regression formula confirms that EF.6 has the greatest influence on SDL. Following this are factors EF.3, EF.4, and EF.1.

$$\text{SDL} = 0.159\text{xEF}.1 + 0.174\text{xEF}.3 + 0.167\text{xEF}.4 + 0.252\text{xEF}.6 + \varepsilon \quad (1)$$

Table 5. EF Coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	2.208	0.069		31.958	0.000
EF.1	0.093	0.023	0.159	4.012	0.000
EF.2	-0.018	0.027	-0.028	-0.656	0.512
EF.3	0.095	0.017	0.174	5.722	0.000
EF.4	0.104	0.023	0.167	4.569	0.000
EF.5	-0.041	0.030	-0.063	-1.374	0.170
EF.6	0.162	0.028	0.252	5.757	0.000

3.2.2. Standardized regression equation of IF to SDL

After excluding analysis results with a significance level (sig) greater than 0.05, the study focuses exclusively on variables with statistically significant impacts. Table 6 presents the findings of the standardized regression equation, as in (2), which explores the relationship between SDL readiness and IF. These results contribute to a clearer understanding of how IF shape the readiness for SDL, providing valuable insights for further research and practical applications. The regression formula confirms that IF.4 has the greatest influence on SDL. Following this are IF.11 and IF.6.

$$\text{SDL} = 0.226\text{xIF}.4 + 0.107\text{xIF}.6 + 0.187\text{xIF}.11 + \varepsilon \quad (2)$$

Table 6. IF Coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	2.072	0.072		28.754	0.000
IF.1	-0.021	0.026	-0.031	-0.816	0.415
IF.3	0.042	0.028	0.065	1.500	0.134
IF.4	0.148	0.029	0.226	5.124	0.000
IF.5	0.049	0.028	0.075	1.757	0.079
IF.6	0.072	0.027	0.107	2.641	0.008
IF.8	-0.040	0.031	-0.061	-1.283	0.200
IF.9	0.062	0.032	0.093	1.898	0.058
IF.11	0.115	0.021	0.187	5.533	0.000

3.3. Analyze the differences in average SDL readiness based on students' characteristics

According to the analysis results in Table 3, the factors GROUP and YEAR significantly affect the average SDL. A one-way ANOVA [32] was conducted to test for differences in average SDL values based on each student's characteristics. At the 95% confidence level, results with a Welch's or F-test significance (Sig) value of <0.05 confirm that there is a statistically significant difference in the average SDL value based on each characteristic. The findings indicate that SDL differs between research groups across different school years or subject groups, and this difference is statistically reliable.

3.4. Discussion and suggestion

3.4.1. The influence of external factors on internal factors

The t-statistic value for the impact of EF on IF is 56.093 (Table 4), signifying a significant effect of EF on students' IF. EF exhibits a direct positive influence on IF with a coefficient of 0.829 (Table 4). These findings suggest that for each increase in the standard deviation of EF, there is a corresponding increase of 0.829 standard deviations in IF. Students who experience a supportive academic and peer environment tend

to exhibit higher levels of achievement motivation, learning interest, and academic self-concept. The presence of a supportive academic environment can stimulate students to achieve better results and foster greater interest in learning. These study results are consistent with previous research by Ramli *et al*. [33] at Tadulako University and Taheri *et al*. [34] at Guilan University of Medical Science, which underscores the significant impact of socio-cultural factors, particularly the university academic environment, on achievement motivation. Another relevant study, conducted by Mustafa and Zalim [35], highlights the influence of situational factors such as family, teacher, and curriculum on student interest.

3.4.2. The influence of external factors on self-directed learning readiness

The t-statistic value for the impact of EF on SDL readiness is 26.466 (Table 4). This suggests that EF has a notable effect on students' readiness for SDL. EF exerts an indirect positive influence on SDL readiness of 0.392 through IF. This finding indicates that IF acts as a mediator for the influence of EF on SDL readiness. The total influence of EF on SDL readiness is 0.577. Among the external factors, the factor related to lecturers (EF.6) has the greatest impact on students' SDL readiness (Table 5) followed by three factors (EF.1, EF.3, EF.4). In other words, maintaining an optimal learning environment and the influence of lecturers should aim to enhance students' autonomy and self-regulation in learning (IF), which is likely to yield better results than directly attempting to enhance SDL.

The study findings corroborated the outcomes of research conducted by Muawiyah *et al.* [19], indicating that for undergraduate science students, this approach offers innovative learning experiences, adaptable scheduling for in-depth courses, and involvement in substantial, project-based assignments. Another study on SDL readiness in Asia, particularly Indonesia, was conducted by Leatemia *et al.* [36], sampled students from five medical faculties, each representing universities in five major islands of Indonesia: Sumatra, Java, Kalimantan, Sulawesi, and Bali. The study results revealed that the academic environment, including learning facilities and academic atmosphere, influenced students' SDL readiness levels. Further research on the impact of the academic environment on students' SDL readiness was conducted by Huang [37], demonstrating that students' perceptions of a supportive learning environment significantly affected their SDL readiness. Syam *et al.* [38] elucidated that the efficacy of English as a foreign language (EFL) online instruction in Indonesian higher education is notably influenced by lecturers' proficiency and preparedness for the transition to online teaching, their preferences for media in project-based learning, comprehensive B-learning strategies, and institutional support during the adaptation phase. The findings suggest a moderate level of preparedness among educators, with prominent competencies in digital literacy and environmental management surpassing pedagogical skills, curriculum development, and learning assessment. Chen [39] also highlighted that the availability of resources, management strategies, and robust technological infrastructure were identified as significant contributors to the successful implementation of B-learning.

3.4.3. The influence of internal factors on self-directed learning readiness

In addition to finding that EF positively contributes to students' SDL readiness through IF, the study also reveals that IF directly and significantly impacts SDL readiness. According to the research findings, the t-statistic value for the influence of IF on SDL readiness was 12.481, with a loading factor of 0.472 (Table 4). This suggests that IF has a significant direct positive effect on SDL readiness. IF, characterized by variables such as achievement motivation, interest in learning, and academic self-concept, positively influences SDL readiness by 0.472. This implies that an increase in students' IF leads to an enhancement in their SDL readiness, indicating that students with high levels of achievement motivation, interest, and academic self-concept also exhibit high levels of SDL readiness.

Among the IF influencing SDL, the factor that significantly determines students' SDL readiness is the ability to connect learned knowledge to solve practical problems (Table 6). This factor helps students realize the significance of learning, serving as a motivation for them to engage in learning and be prepared for SDL. These results are consistent with the findings of Suriagiri *et al.* [16]. Their research explored the influence of intrinsic motivational factors—such as interest, perceived competence, autonomy, and sense of belonging—on students' digital engagement and satisfaction with online classes compared to their psychological engagement and satisfaction in physical classroom settings.

The internal factors and drive of students play a crucial role in their readiness for SDL readiness [40]. Students with high levels of achievement motivation, learning interest, and academic self-concept are inclined to effectively manage their study time and autonomously seek academic information from diverse sources. Tokareva *et al.* [17] demonstrated that the integration of ICTs in higher education underscores blended learning approaches, which harness online technologies.

3.4.4. The influence of characteristic factors on self-directed learning readiness

The results of analyzing the influence of major factors show that students majoring in natural sciences have the lowest average SDL readiness score, while students majoring in social sciences have the

highest average SDL readiness score. This difference is statistically significant at the 95% confidence level. This result can be attributed to the tendency of social sciences students to be more diligent and to take greater advantage of support resources from teachers.

The results of analyzing the influence of academic year factors show that first-year students have the lowest average SDL readiness score, particularly in the factor groups SDL3, SDL4, and SDL5. This difference is consistent with the teaching process, as first-year students are exposed to SDL methods at an earlier stage. The results also show no significant difference in SDL readiness scores among groups from the second year to the fourth year. This finding supports the effectiveness of HNUE's implementation of the B-learning model teaching method in common subjects to enhance students' SDL readiness.

3.4.5. Suggestions for enhancing students' SDL in a B-learning model

The results highlight the avenues through which students' SDL readiness can be enhanced through external factors. First is teacher encouragement. Numerous studies underscore the significant impact of teacher acknowledgment and praise on learners. In the context of B-learning, instructors can bolster students' SDL readiness by implementing various strategies to encourage SDL. Examples include regularly tracking student completion of SDL tasks, publicly acknowledging task completion, commending and exemplifying students who excel in SDL tasks, praising students' achievements and efforts, and offering timely guidance and support when students encounter learning challenges. Instructor encouragement enhances students' confidence in their abilities. Second, suitability of school computer and network systems for SDL on learning management systems. Adequate computer and internet facilities within educational institutions are essential for facilitating SDL according to the B-learning model. Schools should provide access to computer-equipped libraries and internet services, with additional consideration for open spaces with internet access to enable students to engage in regular SDL using personal electronic devices.

The third, double the time allocated for online SDL compared to in-class study. Allocating sufficient time for SDL is crucial for fostering a habit of SDL while ensuring students have the groundwork to participate in class discussions effectively. Fourth, peers' diligence in SDL; the commitment of peers to SDL influences and motivates students' engagement in SDL activities. Therefore, mechanisms should be in place for students to observe their peers' dedication to SDL. Public recognition of SDL task completion or praise, as mentioned in the teacher encouragement factor, serves as a means to showcase students' diligence and motivate others to engage in SDL. Fifth, teachers should design SDL tasks with practical content tailored to students' needs. Lastly, the institution should augment ICT skills training courses for students.

4. CONCLUSION

This study employed scientific and reliable methods to develop a tool suitable for measuring learners' readiness for SDL in B-learning environments. A standardized questionnaire was constructed based on recognized theories, including Knowles' SDL theory, Guglemino's SDL readiness scale, and Meyer and MacBeath's theory of influencing factors. A large and representative sample of students across various subject groups in a B-learning environment was surveyed, providing comprehensive data on both internal and external factors influencing SDL readiness.

The study revealed that EF, such as the academic environment, particularly the roles of lecturers and peer interactions, significantly influence IF like achievement motivation, learning interest, and learning self-concept. These IF, in turn, significantly impact students' readiness for SDL in a B-learning environment. The findings indicated that EF directly and indirectly affect SDL readiness, with IF serving as mediator. Specifically, EF accounted for 68.7% of the variance in IF and 41.6% of the variance in SDL readiness. These results contribute to the understanding of SDL in B-learning models, providing a foundation for enhancing teaching strategies at institutions like HNUE. Additionally, the study opens new research directions, such as examining how specific factors affect SDL in diverse educational contexts or exploring additional variables like cultural context, learning style, learner experience, and family support.

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