Impact of Learning Styles on the Learning Motivation of HUST Students in the Blended-Learning Environment

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Abstract

This study explores the influence of learning styles on student motivation at Hanoi University of Science and Technology (HUST) within a Blended-Learning environment, which integrates both online and face-to-face instruction. A quantitative methodology was employed, utilizing a survey to collect data from 195 students across different academic years. The analysis involved Pearson's correlation and multiple linear regression in investigating the relationships between six distinct learning styles (Visual, Auditory, Kinesthetic, Tactile, Group, and Individual) and three types of motivation (intrinsic, extrinsic, and amotivation). The results revealed that while Visual and Group learning styles are the most prevalent among the students, Tactile and Kinesthetic styles have a more significant impact on both intrinsic and extrinsic motivation. Students who prefer hands-on activities and physical engagement displayed higher motivation levels, whereas those with an Individual learning style showed decreased motivation in the Blended-Learning environment. These findings highlight the importance of incorporating practical and collaborative elements into Blended-Learning courses to enhance student motivation. Educators are advised to adjust their teaching strategies to accommodate diverse learning styles better, thereby fostering greater student engagement and motivation.

Keywords: Learning Style, Learning Motivation, Blended-Learning

1. Introduction

In modern higher education, the adoption of Blended-Learning has become a significant global trend. By integrating traditional classroom instruction with electronic learning, this model offers a flexible and dynamic learning experience that enhances student learning outcomes, improves teaching effectiveness for instructors, and reduces costs for educational institutions (Efthymiou, 2024). Although Blended-Learning has been widely implemented and popularized in many educational settings, the impact of learning styles (LS) on learners' motivation (LM) within this model remains under-explored. Recent studies on the interplay between learning styles and motivation have primarily focused on their influence on final academic performance and outcomes (Diana, 2024) (Vito, 2023) (Suciani, 2022) (Sinaga, 2022) or within specific subjects, courses without addressing the integration of technology, distance learning, and blended learning environments (Muzafar, 2022) (Maming, 2023).

As a multidisciplinary university, with a leading position in engineering and technology nationwide, Hanoi University of Science and Technology (HUST) has consistently committed to updating and innovating its teaching methods. In 2010, after receiving funding from the Korean International Cooperation Agency (KOICA) under the "Establishment of ASEAN-Korea University Network" (ACU) project, HUST developed and implemented online courses using the Blended-Learning model (Nguyen, 2016). Since 2019, more than 100 courses have been delivered through Blended-Learning, with approximately 230 classes per semester (excluding summer semesters). However, there has been no research to evaluate the impact of students' LS on their LM in this model.

Therefore, the focus of this study is on HUST students, to answer the following research questions:

1) How do learning styles affect the learning motivation of HUST students in a Blended-Learning environment?
2) Are there any differences in learning motivation between groups of HUST students with different learning styles when studying in a Blended-Learning environment?
3) How do HUST students with different learning styles have different learning motivations?

To respond to the above research questions, the following tasks are set to be conducted:

1) To synthesize the theoretical foundation of Learning Styles, Learning Motivation, and Blended-Learning.

2) To identify groups of Learning Styles and groups of Learning Motivations among students.

3) To construct a research model on the impact of Learning Styles on Learning Motivation in Blended-Learning environments.

4) To apply the research model to analyze and measure the impact of learning styles on the learning motivation of students in Blended-Learning environments.

2. Literature review

2.1. Theoretical foundation

2.1.1. Blended-Learning

Blended-Learning is a widely used term in the global education landscape. The definition of Blended-Learning has evolved and there is no universally agreed-upon definition (Sarah Carroll, 2024). Currently, Blended-Learning is understood as leveraging the advantages of both face-to-face and online learning in instruction to achieve outcomes aligned with specific goals and contexts (Bambang Ismaya, 2022). The most widely accepted and used definition of Blended-Learning is provided by Graham: "The combination of face-to-face learning with learning via computer" (Graham, 2006). However, this definition still has some limitations. As Graham himself noted, Blended-Learning is an overly broad concept, and it is difficult to find any form of 21st-century learning that does not fall under the Blended-Learning umbrella.

A more recent definition, proposed in 2023, states: "Blended-Learning involves the careful and continuous development of curriculum to maximize the effectiveness of teachers in guiding learning and enabling students to learn where, when, and how they learn best". This definition highlights a greater focus on learning theories and models, in addition to defining the implementation modalities of Blended- Learning (Shaun McCarthy, 2023).

According to Cronje (2020), Blended-Learning is defined as the judicious integration of learning theories, teaching methods, and technology to optimize learning within a specific context. While one study suggested that the medium of instruction has a negligible impact on learning outcomes, this definition could be further enriched by incorporating elements of learning theories, teaching methods, and learning context (Clark, 1994). This report approaches Blended- Learning as a pedagogical approach where learning activities are flexibly organized, combining face-to-face and online learning, with a particular focus on teaching methods within the higher education context.

2.1.2. Learning styles

The concept of learning styles was first introduced in the research of American scholars (Thelen, 1954) in his book *Dynamics of Groups at Work*, Thelen argued that learning activities are highly complex, involving thought, emotion, action, and need, thus requiring educators to organize various activities corresponding to learning activities. Subsequently, the concept of personalized learning styles gained prominence in the 1970s (Frank Coffield, 2004).

Based on the experiential learning theory, Kolb and his associates conducted in-depth studies on learning styles and determined that: "Differences in learning styles are due to a preference for certain learning behaviors over others" (David A. Kolb, 1975) or "Learning style is an individual's dynamic approach to learning based on their preference for the four stages of the experiential learning cycle: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation" (David A. Kolb A. Y., 2013).

Numerous studies have been conducted, resulting in various learning style models. According to (Frank Coffield, 2004) 71 models have been identified. However, four models are more prevalent: VARK, Felder-Silverman’s, Kolb's, Peter Honey and Alan Mumford's.

In the VARK learning style model, learners are categorized into four main groups based on their preferred learning methods: visual, auditory, read/write, and kinesthetic. Some learners feel they acquire knowledge more effectively when they can learn using two or more preferred learning styles, such as visual combined with read/write, auditory combined with kinesthetic, etc. (N. D. Fleming, 1992) (N. D. Fleming D. B., 2006).

The Felder-Silverman Learning Style Model (FSLSM) emphasizes the individual learner's approach to the learning process. The model comprises four dimensions: perception (active-reflective), input (sensing-intuitive), processing (visual-verbal), and understanding (sequential-global). Each dimension represents two polar ends that define a learner's preferred learning style (R. M. Felder and L. K. Silverman, 1998). This classification of learning styles is commonly found in learning environments involving technology and instructional media (which is particularly relevant in E-Learning contexts) (M. T. Alshammari and A. Qtaish, 2019) (S. M. Nafea, 2019) (I. Karagiannis and M. Satratzemi, 2020).

Kolb's Learning Style Inventory (LSI), created this model in 1971 based on his previously developed learning theory model with two main dimensions: horizontal action and vertical knowledge. The vertical knowledge includes four interdependent structures: Reflective Observation (RO), Abstract Conceptualization (AC), Active Experimentation (AE), and Concrete Experience (CE) (D. A. Kolb, 2006). LSI is used to assess individuals and results show four different types of learners. They are categorized as concrete experience and RO, assimilating: AC and RO; converging: AC and AE; and accommodating: concrete experience and AE.

This study utilizes Joy M. Reid's (1987) framework to explore learning styles. Her Perceptual Learning Style Preference Questionnaire (PLSPQ) identifies preferences across two dimensions: sensory (visual, auditory, tactile, kinesthetic) and social (individual, group) (Reid J. M., 1987).

In essence, the PLSPQ rests on three core principles. First, learning styles combine perceptual and social aspects. Second, students exhibit varying degrees of preference for specific sensory modalities and learning environments. Finally, aligning teaching methods with students' preferred styles (Matching Hypothesis) can lead to improved performance (Reid J. M., 1987).

2.1.3. Learning motivation

According to (Koenka, 2020), motivation is considered one of the most extensively studied psychological constructs in educational psychology. Motivation is also believed to be "related to the amount of mental energy typically invested in learning activities and this leads to the belief that motivation can be considered a relatively stable personality trait, on a par with personality" (Filgona, 2020). Motivation is the driving force that fosters persistence, directs behavior, and helps achieve goals and complete tasks. It can be either Intrinsic (guided by one's internal beliefs and choices, the significant pleasure and satisfaction a person derives from performing a task) or Extrinsic (driven by goals) (Christopher P. Cerasoli, 2014). Learning motivation is the specific application of motivation theory to the learning process in schools (Slavin, 2005). How to stimulate, transform, and sustain students' learning motivation is a significant topic in motivation research. Although previous studies have explored learning motivation in school contexts, most of these studies have focused on traditional learning environments.

Learning motivation is the specific application of motivation theory to the learning process in schools (Slavin, 2005). How to stimulate, transform, and sustain students' learning motivation is a significant topic in motivation research. Although previous studies have explored learning motivation in school contexts, most of these studies have focused on traditional learning environments.

The paper uses the Academic Motivation Scale (AMS-C 28) college version questionnaire from this foundation. The original Academic Motivation Scale (AMS) was created in Canada by Vallerand et al (Vallerand, 1992). The Academic Motivation Scale (AMS) is a commonly employed instrument for assessing students' motivation for studying. *Échelle de Motivation en Éducation* (EME), the original title, was provided in French. The EME is based on the principles of self-determination theory (STD) (Deci, 1991).

2.2. Current situation of Blended-Learning in HUST

Since 2017, Hanoi University of Science and Technology has officially implemented a blended learning model with a 50% in-person and 50% online ratio. In blended learning courses, students participate in (1) face-to-face learning in classrooms and (2) online learning on the Learning Management System (LMS). These two modalities are interspersed throughout the semester. Initially, blended learning was applied to supplementary courses and technical subjects such as soft skills, applied psychology, engineering mechanics, etc. By February 2020, due to the impact of the COVID-19 pandemic, Hanoi University of Science and Technology had deployed 40 blended learning courses on the LMS with the participation of over 8,300 students in 78 classes (Student Affairs Board - Hanoi University of Science and Technology). Currently, with investments in infrastructure, lecturers from all faculties/schools have participated in implementing blended learning courses, ranging from foundational courses to core courses.

3. Research Methodology

3.1. Research Model

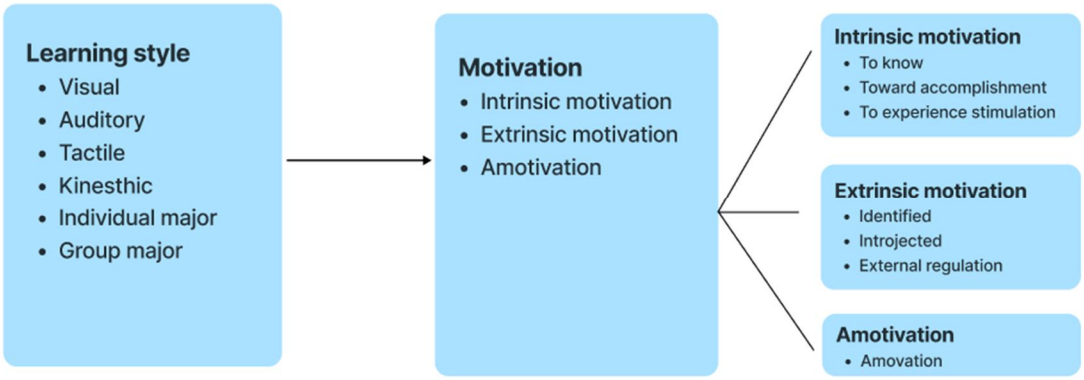

Fig. 1. Research model

This research model focuses on the impact of learning styles on the motivation of HUST students in a Blended-Learning environment. In this model, the independent variables are learning styles, which include: Visual, Auditory, Tactile, Kinesthetic, Individual major, and Group major. These learning styles are measured by Reid's Perceptual Learning Style Preference Questionnaire (PLSPQ) - 1984.

The dependent variable in this model is learning motivation, which is divided into three main types: Intrinsic motivation, Extrinsic motivation, and Amotivation. Intrinsic motivation includes factors such as to know, toward accomplishments, and experience stimulation (Reid J. M., 1987). Extrinsic motivation includes factors such as identified, introjected, and external regulation. These factors are measured using the Academic Motivation Scale (AMS-C 28) College Version.

This model illustrates the relationship between different learning styles and students' levels of motivation to learn. It helps identify which learning style has the greatest impact on motivation in a Blended-Learning environment. Understanding this relationship can help educators design appropriate teaching methods, optimize the learning experience, and enhance students' motivation to learn.

3.2. Respondents

The study was conducted using a quantitative method through a survey questionnaire regarding the motivation and learning styles of students. This study involved 195 students from Hanoi University of Science and Technology (HUST), including 147 males and 48 females, representing various academic years and majors, primarily focusing on students from the first to third years. These students were selected through the convenience sampling method because the study was conducted during the summer semester at Hanoi University of Science and Technology.

3.3. Measurement

Our literature review identified four prominent scales for measuring student motivation and five for assessing learning styles. Aligning with our research objectives and questions, we chose the Academic Motivation Scale (AMS-C 28) College Version to gauge student motivation and the Perceptual Learning Style Preference Questionnaire (PLSPQ) by Reid (1987) to assess learning styles.

The AMS-C 28 College Version is specifically designed to measure learning motivation in college students. It effectively assesses a broad spectrum of motivations, encompassing both intrinsic (Intrinsic motivation - to know; Intrinsic motivation - toward accomplishment; Intrinsic motivation - to experience stimulation) and extrinsic (Extrinsic motivation - identified; Extrinsic motivation - introjected; Extrinsic motivation – external regulation) drives. In a Blended-Learning environment, students need to be highly self-directed and motivated to complete online and face-to-face learning tasks. The AMS-C 28 helps to accurately assess this level of motivation (Nguyen Thanh Tung, 2021)

The PLSPQ (Perceptual Learning Style Preference Questionnaire) focuses on two key dimensions of learning styles: sense and social. The sense dimension explores preferred information reception methods (visual, auditory, tactile, and kinesthetic). The social dimension examines preferences for individual or group majors. This is important in Blended-

Learning, where the combination of online and face-to-face learning requires flexibility in teaching methods to meet the needs of individual learners. By understanding students' learning styles, teachers can design appropriate learning activities, thereby improving learning effectiveness.

We employed Pearson correlation analysis to investigate the relationships between each type of motivation and the six learning styles, aiming to understand how learning styles influence motivation. Subsequently, multiple linear regression analysis will be conducted, with each of the seven identified motivational types serving as the dependent variable.

3.3.1 Academic Motivation Scale (AMS-C 18)

There are three types of motivation: intrinsic, extrinsic, and amotivated (Deci, 1991). The instrument has a total of 28 questions, using the 5-point Likert scale, the minimum score for each question is 1 point and the maximum score is 5 points (1= Does not correspond at all to 5 = Corresponds exactly). The 28 items can be grouped into 7 dimensions: Intrinsic motivation - to know; Intrinsic motivation - toward accomplishment; Intrinsic motivation - to experience stimulation; Extrinsic motivation - identified; Extrinsic motivation - introjected; Extrinsic motivation – external regulation and Amotivation.

The AMS instrument's overall score is termed a Self Determination Index (SDI) (Yingjie Zeng, 2023). The range on the SDI is from -12 to +12. Ranging from -12 to +12, the SDI offers a nuanced understanding of how individuals perceive their autonomy, competence, and relatedness.

3.3.2 Perceptual Learning Style Preference Questionnaire (PLSPQ)

The PLSPQ, created by Reid J. M. in 1987, is a self-report tool designed to assess individual learning preferences across different styles. It contains 30 items, each rated on a 5-point Likert scale. Respondents are asked to indicate their level of agreement with each statement, where 1 represents 'strongly disagree' and 5 represents 'strongly agree.' Each of the six learning styles is measured by five specific questions. This scale allows for a nuanced understanding of how strongly participants align with different learning styles. These learning styles are divided into two main categories: Sensory, which includes Visual, Auditory, Tactile, and Kinesthetic styles, and Social, which includes both Individual and Group learning preferences.

By Reid's description (1995: 205-207) of the individuals who have each of these styles as preferential:

Visual style: Visual learners prefer reading over listening. They understand and remember information better when they see it written down. They may struggle with verbal explanations and often rely solely on written materials.

Auditory style: Auditory learners learn best by listening. They can remember information better by reading aloud or talking to themselves and benefit from listening to spoken words like lectures and discussions.

Kinesthetic style: Kinesthetic Learners learn best by doing. Engaging in activities, field excursions, and role-playing games helps them retain material better.

Individual style: You learn best on your own. Working alone helps you learn a new subject more effectively, retain it, and advance more quickly.

Group style: Group learners learn better by working collaboratively with others and benefit from the stimulation of group interaction.

Tactile style: Tactile learners learn best by doing practical activities and benefit from hands-on experiences like experiments and building models

4. Results

4.1. Descriptive statistics

After collecting 300 online survey responses via Microsoft Forms, the research team conducted a thorough data-cleaning process. A predetermined threshold was applied to the Likert scale responses across all 60 items related to Learning Styles. Specifically, responses where the majority of answers clustered around a single point on the scale (e.g., consistently selecting 'neutral' or 'strongly agree') were flagged as unreliable and removed from the dataset. This filtering process aimed to eliminate response sets that lacked variability or showed potential response bias. After applying this criterion, 195 valid survey responses remained for further analysis.

This resulted in a refined sample of 195 valid responses, with a predominant focus on students from the first to third years (Cohorts K66, K67, K68) (see Fig. 2).

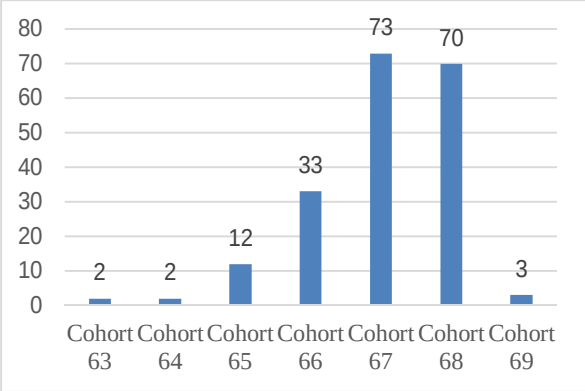

Fig. 2. The number of students per course

The results showed that among the six learning styles presented, the Visual learning style had the highest number of students (N=152), while the Individual learning style had the fewest (N=102) in Table 1.

Table 1. Number of respondents' choices of each learning style

	Visual	Auditory	Kine-sthetic	Group	Individual	Tactile
Number of choices	152	116	118	141	102	127

The six student motivation groups achieved strong average scores overall. Notably, the group that includes extrinsic motivation identified, extrinsic motivation to know, and extrinsic regulation had the highest average scores, ranging from 3.9 to 3.93. On the other hand, the amotivation group had a relatively low average score (M=2.8321) (Figure 3).

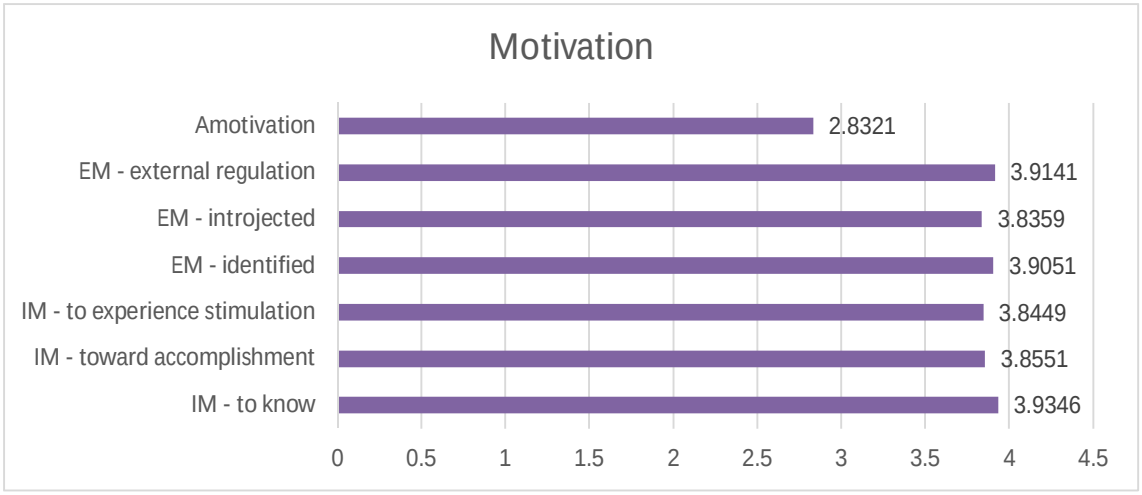

Fig. 3. Level of learning motivation

4.2. Self-Determination Index (SDI)

The SDI (Self-Determination Index) is used to assess the level of self-determination and intrinsic motivation of students. With a 1-5 Likert scale, the SDI can achieve a minimum value of -12 and a maximum value of 12.

-12 ≤ SDI ≤ -7.2 (No motivation);
-7.19 ≤ SDI ≤ -2.4 (Few motivation);
-2.39 ≤ SDI ≤2 .4 (With motivation);
2.41 ≤ SDI ≤ 7.2 (Many motivations); 7.21 ≤ SDI ≤ 12 (So many motivations);

Table 2. Self-Determination Index

	N	Min	Max	Mean	Std. Deviation
SDI	195	-2.63	8.00	2.1224	2.35234
Valid N	195				

Through the survey results, the SDI index of HUST students studying in a Blended-Learning environment is at a motivated level - SDI = 2.1224 in Table 1, which falls into the group “With motivation”.

4.3. Pearson correlation test

The Pearson correlation test was performed to assess the linear relationship between learning motivation and six independent variables, which are the different learning styles.

The study employs the following formula to calculate the Pearson correlation coefficient between different types of motivation and each learning style:

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n.\sum x_i^2 - (\sum x_i)^2}\sqrt{n.\sum y_i^2 - (\sum y_i)^2}}$$

- *n* represents the sample size (*n* = 195).
- *x* represents each type of motivation (7 types).
- *y* represents each learning style (6 groups)

Each type of motivation is correlated with six learning styles, resulting in a total of seven sets of correlation calculations corresponding to the seven types of motivation. These calculations are conducted using SPSS software, and the results are presented in Table 3.

The results show that, except for the amotivation factor, all other aspects of learning motivation exhibit a positive correlation with each of the learning styles (Table 3). Amotivation has a statistically significant positive correlation solely with the learning styles of individuals (r= 0.170, n= 195, p= 0.018).

Table 3. Pearson correlation test

		Visual	Auditory	Kinesthetic	Group	Individual	Tactile
Intrinsic motivation - to know	Pearson Correlation	.368**	.424**	.519**	.482**	.208**	.505**
	Sig. (2-tailed)	.000	.000	.000	.000	.004	.000
	N	195	195	195	195	195	195
Intrinsic motivation - toward accomplishment	Pearson Correlation	.294**	.399**	.480**	.423**	.253**	.477**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	195	195	195	195	195	195
Intrinsic motivation - to experience stimulation	Pearson Correlation	.334**	.367**	.474**	.444**	.224**	.433**
	Sig. (2-tailed)	.000	.000	.000	.000	.002	.000
	N	195	195	195	195	195	195
Extrinsic motivation - identified	Pearson Correlation	.346**	.388**	.472**	.427**	.191**	.504**
	Sig. (2-tailed)	.000	.000	.000	.000	.007	.000
	N	195	195	195	195	195	195
Extrinsic motivation - introjected	Pearson Correlation	.328**	.398**	.458**	.400**	.187**	.386**
	Sig. (2-tailed)	.000	.000	.000	.000	.009	.000
	N	195	195	195	195	195	195
Extrinsic motivation - external regulation	Pearson Correlation	.288**	.335**	.388**	.400**	.162*	.419**
	Sig. (2-tailed)	.000	.000	.000	.000	.024	.000
	N	195	195	195	195	195	195
Amotivation	Pearson Correlation	-.037	.074	.008	-.036	.170*	-.061
	Sig. (2-tailed)	.607	.304	.910	.616	.018	.399
	N	195	195	195	195	195	195

4.4. Linear regression analysis

Performing linear regression with data from 195 HUST students, the learning styles that have a statistically significant impact are presented in Table 11 Linear Regression Analysis.

Among the six learning styles presented, Visual and Auditory are two groups of learning styles that do not affect students' motivation to learn. HUST means statistics.

List of Abbreviations

IM: Intrinsic motivation
EM: Extrinsic motivation
VS: Visual
AU: Auditory
Kin: Kinesthetic
Gr: Group
Indiv: Individual
Tac : Tactile

Linear regression equation of each type of motivation:

IM - to know = 0.275*Tac + 0.206*Kin + 0.148*Gr

Table 4. IM - to know Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.647[a]	.419	.401	.45106	2.006

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: IM - to know

IM - toward accomplishment = 0.287*Tac + 0.180*Kin + 0.130* Indiv

Table 5. IM- toward accomplishment Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.604[a]	.364	.344	.47846	1.961

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: IM - toward accomplishment

IM - to experience stimulation = 0.210*Tac + 0.202*Kin + 0.160*Gr

Table 6. IM - to experience stimulation Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.582[a]	.339	.318	.51679	2.180

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: IM - to experience stimulation

EM - identified = 0.315*Tac + 0.182*Kin

Table 7. EM-identified Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.610[a]	.372	.352	.50323	1.994

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: EM - identified

EM - introjected = 0.206*Kin + 0.171*Tac

Table 8. EM-introjected Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.549[a]	.302	.280	.58769	1.897

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: EM - introjected

EM - external regulation = 0.244*Tac

Table 9. EM - external regulation Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.519[a]	.270	.246	.54557	2.217

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: EM - external regulation

Amotivation = 0.179* Indiv

Table 10. Amotivation Model Summary[b]

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.219[a]	.048	.017	.99171	2.082

a. Predictors: (Constant), Tactile, Individual, Visual, Kinesthetic, Group, Auditory

b. Dependent Variable: Amotivation

Table 11. Linear Regression Analysis

	Visual		Auditory		Kinesthetic		Group		Individual		Tactile	
Standardized Coefficients	**Beta**	**Sig.**	**Beta**	**Sig.**	**Beta**	**Sig.**	**Beta**	**Sig.**	**Beta**	**Sig.**	**Beta**	**Sig.**
IM - to know	-	-	-	-	0.206	0.010	0.148	0.046	-	-	0.275	0.000
IM - toward accomplishment	-	-	-	-	0.180	0.031	-	-	0.130	0.037	0.287	0.000
IM - to experience stimulation	-	-	-	-	0.202	0.018	0.160	0.044	-	-	0.210	0.003
EM – identified	-	-	-	-	0.182	.028	-	-	-	-	0.315	.000
EM - introjected	-	-	-	-	0.206	.018	-	-	-	-	0.171	.018
EM - external regulation	-	-	-	-	-	-	-	-	-	-	0.244	.001
Amotivation	-	-	-	-	-	-	-	-	0.179	.019	-	-

Conversely, the other four learning styles have a significant impact on students' motivation to learn, specifically: The Tactile learning style has a positive influence on all types of intrinsic and extrinsic motivation. Learning style Kinesthetic also affects most types of motivation except for extrinsic motivation - external regulation and amotivation.

Learning style group influences two types of motivation within intrinsic motivation: Intrinsic motivation - to know and Intrinsic motivation - to experience stimulation. As for the Individual learning style, it has a positive impact on Intrinsic motivation - toward accomplishment and is the only style that affects amotivation in a positive direction.

5. Discussion

From the above findings, it is observed that among the six learning styles, four - Kinesthetic, Group major, Individual major, and Tactile - impact on the learning motivation of HUST students in Blended -Learning environment. Of these, the Tactile style has the most positive impact on both intrinsic and extrinsic learning motivation. The Kinesthetic learning style also positively influences various types of motivation among students, indicating that those who learn through actions and experiments often have more motivation in Blended-Learning courses (Fig.4).

On the other hand, students with a Group learning style only exhibit an impact on intrinsic motivation. Notably, students with an Individual learning style have shown a decrease in motivation in a Blended- Learning environment. This suggests that students with a preference for individual learning are struggling to maintain their motivation when participating in Blended-Learning courses.

This result is consistent with the study by Keshavarz, M., & Hulus, A. (2019), which indicates that individuals with a social learning style are more motivated and enjoy collaborative learning, as they often prefer working in groups. In contrast, those with an individual learning style are more motivated in traditional classrooms with instructor-led teaching. However, the difference for HUST students is that visual and auditory learning styles do not affect motivation in a Blended-Learning environment.

For HUST students, Tactile and Kinesthetic learning styles play a crucial role in boosting motivation to learn. The opportunity to practice, experiment, and create tangible products not only satisfies their natural desire for movement and exploration but also significantly deepens their knowledge. The Tactile learning style, in particular, aligns well with the characteristics of engineering fields, where applying theory to practice is of utmost importance.

In addition, the Kinesthetic learning style also significantly contributes to students' motivation to learn. Physical activities in the classroom, such as participating in group exercises, discussions, and practical tasks, enhance interaction and create a dynamic learning environment. This approach not only helps students understand the material more deeply but also fosters excitement and a desire to explore further.

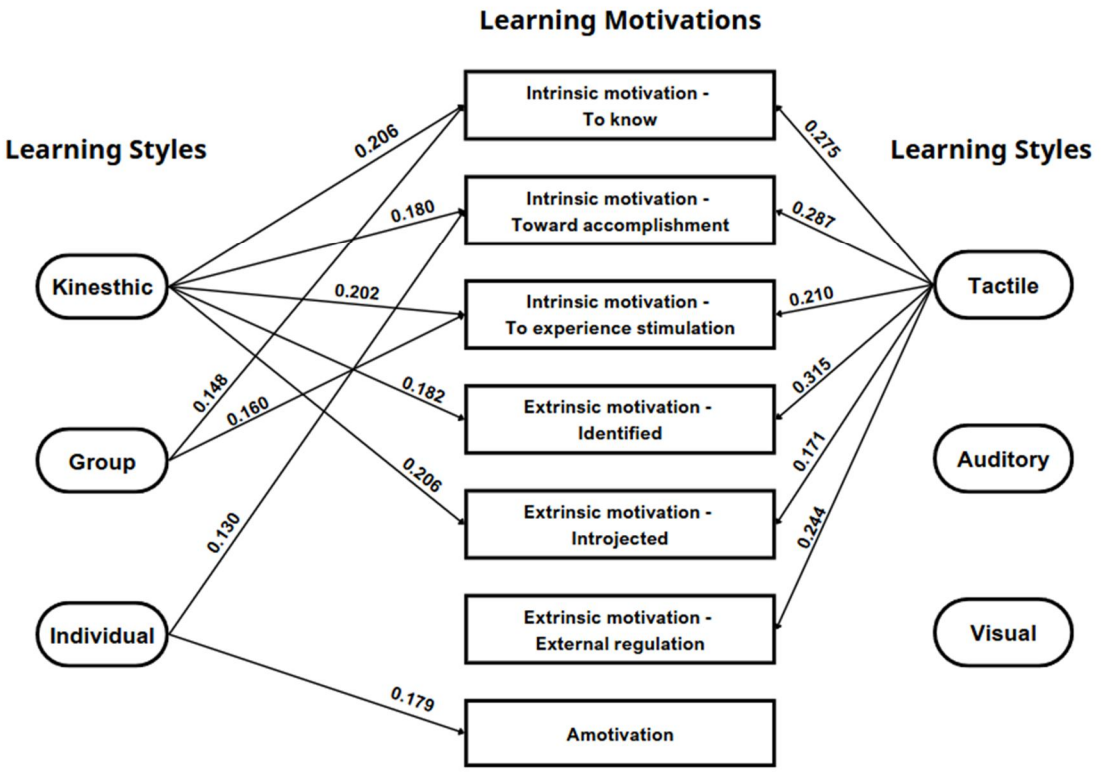

Fig. 4. Linear Regression Analysis: Impact of Learning Style on Motivation

From the above analysis, it is evident that incorporating practical and physical activities into the learning process not only helps HUST students grasp specialized knowledge but also creates a positive learning environment that encourages creativity and independent thinking. This, in turn, enhances the quality of the school's education and helps students feel more confident in applying their knowledge to real-life situations.

Correlation analysis shows a positive relationship between visual and auditory learning styles and students' motivation to learn. However, the results of the statistical analysis indicate that this relationship is not strong enough to assert a significant influence of these factors on learning motivation. While a positive correlation exists, the statistical results are not sufficient to definitively conclude that learning styles are the primary cause of differences in motivation. Other factors, such as the learning environment, teaching methods, and personal characteristics, may also significantly impact students' motivation to learn.

Students with an Individual learning style may experience a decrease in motivation and less interest in blended learning classes. They might face difficulties in this learning format because they prefer to work alone, while blended learning often involves interactive activities and group work. This can pose a challenge during the blended learning process. However, since students typically have more than one learning style, they should consider adjusting their learning approach to better fit the blended learning model.

6. Conclusion and recommendations

This study indicates that in the Blended-Learning environment at HUST, the most common learning styles are Visual and Group. However, Tactile and Kinesthetic learning styles tend to provide students with higher motivation during their learning process, while the Individual learning style tends to decrease student motivation.

Based on these findings, instructors should design teaching materials and strategies that incorporate practical activities, group work, or experiments where students can create products or achieve practical outcomes. These approaches will enhance students' motivation and improve their learning performance. Conversely, individual learning activities may reduce students' motivation in a blended learning environment.

A robust and user-friendly Learning Management System (LMS) is essential for ensuring smooth online interaction and accessibility. The current LMS should be upgraded to facilitate better communication between students

and instructors, offer more interactive tools like simulations and virtual labs, and ensure stable performance during peak usage times.

Due to time constraints, this study has several limitations. The data was collected only from HUST's Blended-Learning courses during the summer term, making the sample size and composition difficult to control as desired. The distribution of students across different academic years was unbalanced, with most first- and second-year students (73.3%) and very few final-year students in the sample.

Future research will explore in more depth why these learning styles have varying effects on student motivation at HUST in a Blended-Learning environment. Data will be collected during regular semesters, with an effort to balance the number of students across academic years to better align with the research objectives, providing more accurate recommendations based on the study's results.

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