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# Modeling of learning motivation, satisfaction and loyalty among university students

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## Abstract

The purpose of this study is threefold: to investigate motivational factors influencing high school students' decisions to enroll in university science programs, to assess satisfaction and loyalty among undergraduate students and alumni, and to examine the relationship between undergraduate student satisfaction and loyalty. Participants comprised three groups, and data were collected via questionnaires. Structural equation modeling and logistic regression in R were employed to examine associations among latent variables and identify key predictors. Among secondary students, intentions to pursue higher education were significantly predicted by university reputation, tuition and fees, and curriculum and academics, with curriculum and academics being the most influential factor (OR = 1.478, 95% CI; 1.256–1.740). For undergraduate students, overall satisfaction was primarily determined by university reputation, and satisfaction was positively correlated with loyalty, which increased with the year of study. University reputation also influenced students' likelihood of recommending the institution to others. The importance of motivation, satisfaction, and loyalty in higher education has been demonstrated. Motivational factors influence high school students' enrollment in science programs, while satisfaction predicts student and alumni loyalty. Alumni engagement strengthens the university's reputation and fosters long-term loyalty, contributing to sustainable growth and lasting connections with graduates.

**Keywords:** Alumni, Loyalty, Motivation, Satisfaction, Structural equation modeling.

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**Transparency:** The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
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## 1. Introduction

Supporting and developing capacity in science and technology constitutes a core strategic objective for governments in developing countries, such as Thailand. Despite this, recent statistics show that enrollment in bachelor's programs in business, social sciences, administration, law, and the humanities has exceeded that in natural sciences and information and communication technologies [1]. Within the framework of the Fourth Industrial Revolution, the cultivation of skilled

technologists is indispensable for driving sustainable national development. Understanding the factors that motivate students to pursue science programs is crucial for strengthening the educational system.

Many universities now offer programs to boost enrollment and tuition revenue; however, student numbers in science programs have declined. Investigating students' perceptions and identifying associated factors are essential for 21st-century higher education to maintain future enrollment. Previous studies indicated that career (internal factors), reputation, location, promotion, and facilities (external factors), as well as some social factors (friends and parents), have statistically significant effects on students' intentions Mehboob et al. [2]. Echchabi and Al-Hajri [3], Maniu and Maniu [4] and Cortes et al. [5] examined factors influencing students' choice of university. They found that institutional reputation, cost, parental influence, program offerings, and location were the main determinants. This current study highlights the understanding of these factors influencing students' intentions to attend a university. Building upon previous research, six key dimensions were evaluated: university reputation, environment, curriculum, tuition and fees, promotion activities, and interpersonal influences.

The students' pleasure was regarded as an important surrogate for university performance in delivering high-quality education. In alignment with this notion, prior research by DeShields Jr et al. [6] has advanced a conceptual model of university students' quality of life, encompassing multiple dimensions, including academic experiences, institutional reputation, social integration, and satisfaction with facilities and services. Service quality was evaluated by Parasuraman et al. [7] and Abdullah [8] based on dimensions, namely access, academics, and reputation. Kanwar and Sanjeeva [9] identified key dimensions including teaching and learning quality, infrastructure and administrative matters, etc. Furthermore, student loyalty has been linked to university sustainability, growth, and survival Ismanova [10]. Helgesen and Nesset [11] found that service quality, facilities, student satisfaction, and institutional image were related to loyalty, with satisfaction playing a key role. Building on this literature, the present study examines the quality of educational services and how factors such as reputation, physical environment, and facilities influence student satisfaction and loyalty.

Many studies have examined the relationship between customer satisfaction and alumni. Alumni loyalty is an important concept in marketing, with positive word-of-mouth effects being significant [12]. The satisfaction of students leads to recommendations and is eventually expanded to loyalty. While prior research has explored the link between undergraduate satisfaction and loyalty, further studies are needed to understand the underlying factors influencing this relationship [13], alumni have received less attention. Considering both undergraduate students and alumni is crucial from a consumer perspective. This research examines determinants of satisfaction and loyalty within higher education, explores student–alumni interactions, and presents a case study focusing on the development and implementation of a science program in the southern region of Thailand. The conceptual framework is shown in Figure 1. The purposes of this study were to: (1) examine motivational factors in high school students that predict enrollment in university science programs, (2) assess the satisfaction and loyalty of undergraduate students and alumni, and (3) determine the relationship between undergraduate student satisfaction and loyalty.

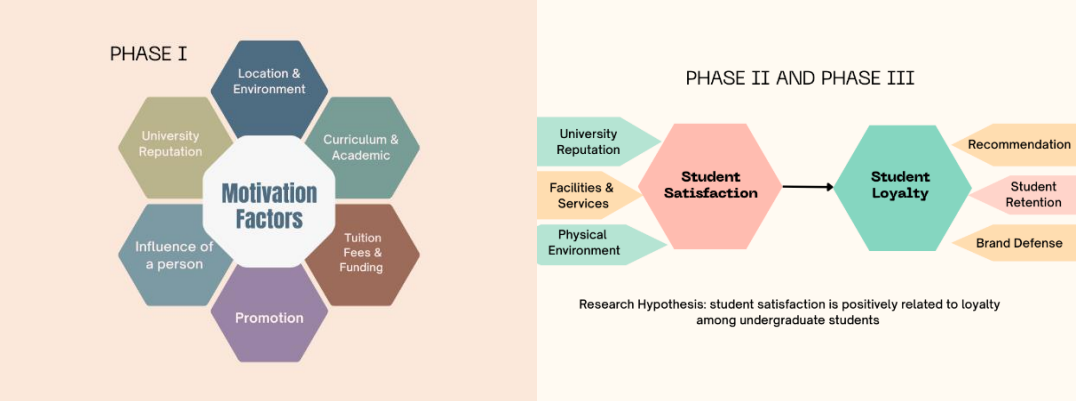


**Figure 1.**
Conceptual Framework of the Study.

*1.1. Structural Equation Modeling*

Structural equation modeling (SEM) is extensively applied in education, psychology, social, and behavioral sciences, with confirmatory factor analysis (CFA) as its most prevalent technique [14, 15]. CFA, as a component of SEM, validates the factor structure of observed variables and examines relationships among latent constructs [16]. Unlike exploratory factor analysis, CFA employs theory- or evidence-based models to assess construct validity and reliability. Structural equation modeling (SEM) provides a comprehensive multivariate framework that integrates measurement and structural models to examine complex relationships among observed and latent variables. Within this framework, the measurement model specifies how latent constructs are represented through observed indicators, while the structural model explains the interrelationships among latent constructs. Grounded in theoretical perspectives, SEM enables researchers to assess construct validity and reliability, as well as to test predictive associations between endogenous and exogenous variables, thereby offering a robust methodology [17]. The structural component of SEM can be represented by the following equation [18, 19] as

$$\eta = \beta\eta + \Gamma\xi + \zeta \quad (1)$$

where η denotes an $m \times 1$ vector of endogenous latent variables, β is an $m \times m$ coefficient matrix representing the relationships among endogenous variables, Γ is an $m \times k$ matrix of regression coefficients relating exogenous to endogenous variables, ξ is a $k \times 1$vector of exogenous latent variables, and ζ is an $m \times 1$ vector of disturbance terms (errors).

Latent variables are linked to observed indicators through measurement equations, which apply to both endogenous and exogenous constructs, and can be expressed as follows:

$y = \Lambda_y \eta + \epsilon$ (2)

- $x = \Lambda_x \xi + \delta$ (3)

where y is a vector of observed indicators for endogenous latent variables ($\eta$), with $\Lambda_y$ as the the corresponding factor loading matrix and $\epsilon$ representing measurement errors. Similarly, x is a vector of observed indicators for exogenous latent variables ($\xi$), with $\Lambda_x$as the forctor loading matrix, and δ representing measurement errors.

## 2. Literature Review

CFA and SEM methods have been widely employed in research investigating student decision-making related to university selection, as well as student satisfaction and loyalty. These methods are particularly useful for examining the relationships among multiple factors that influence decision-making, satisfaction, and loyalty across diverse educational and cultural contexts [20, 21]. For instance, Skatova and Ferguson [22] explored factors influencing undergraduate students' choice of university degree, identifying career prospects, personal interest, opportunities to help others, and ease of entry as key motivational factors. Similarly, Hidayat and Sinuhaji [23] investigated determinants of private university selection in Medan, Indonesia, considering education fees, promotion, brand image, motivation, and facilities. Using regression, factor analysis, and CFA, their study found that all observed factors significantly and positively influenced students' university choices. Qasim et al. [24] examined factors affecting student choice in the private higher education sector in Kurdistan-Iraq, with CFA results highlighting university reputation, teaching quality, employability, and facilities as the most influential factors. These findings confirm that both institutional attributes and student experiences play a critical role in shaping decisions, satisfaction, and loyalty.

Regarding student satisfaction and loyalty, numerous studies have applied SEM to examine their interrelationships. Thomas [25] found that student satisfaction significantly influences loyalty, with university reputation positively affecting loyalty through satisfaction as a mediating factor. Similarly, Leonnard et al. [26] constructed a loyalty model for private university students in London, revealing that service quality and student satisfaction significantly influenced loyalty, while satisfaction itself was shaped by service quality, university image, and price. Ng and Priyono [27] *r*eported that service quality positively affects student satisfaction, which in turn enhances loyalty in higher education institutions in Riau. Permana et al. [28] highlighted that academic service quality directly impacts satisfaction and indirectly affects loyalty through satisfaction. In Nigeria, Borishade et al. [29] confirmed a significant association between service quality and student loyalty. Collectively, these studies underscore that service quality, university image, and satisfaction are critical determinants of student loyalty in higher education. However, most existing studies have focused on individual factors in isolation, such as service quality, university image, or fees, without integrating these determinants into a comprehensive model that simultaneously considers student decision-making, satisfaction, and loyalty. In addition, prior research has largely been conducted in specific geographic or cultural contexts, leaving limited understanding of how these factors interact across diverse higher education settings. Further research is needed to develop an integrated framework that captures the combined influence of institutional, experiential, and motivational factors on student behavior, satisfaction, and loyalty.

## 3. Design/Methodology/Approach

This survey research was divided into three phases for understanding the before (pre-purchase), during (purchase), and after (post-purchase) stages of the process, in the context of marketing strategies. In this study, information was gathered from secondary school students regarding their motivation for going to the university (Phase I), university-enrolled students regarding their satisfaction (Phase II), and alumni regarding their loyalty and perceptions after leaving the university (Phase III). The subjects in Phases I, II, and III were different people.

### *3.1. Participants and Procedure*

There were three questionnaire instruments that were modified from a review of relevant studies. The instruments used in the study were validated and reviewed to confirm that all contents were appropriate by academic experts. The reliability of the instruments was assessed using Cronbach's alpha, with coefficients ranging from 0.742 to 0.951, indicating satisfactory internal consistency. All constructs exceeded the commonly accepted threshold of 0.70, confirming adequate reliability. The procedures for data collection in each phase are described below.

The first phase utilized responses from secondary education students intending to enroll in university programs, who participated in the roadshow activity through a structured questionnaire. Data were collected from September to November. The participants consisted of 1,625 students from the southern provinces of peninsular Thailand. Participants were recruited using a convenience sampling method, and participation in the study was entirely voluntary. The questions included information about the students' opinions and the factors influencing their intention to select this university. The questions "The university is well recognized" and "The price of the courses is reasonable" serve as examples. The factors influencing

students' intentions to pursue science programs were measured using 26 items on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The second phase involved current bachelor's degree university students during their studies at the university in the southern region of Thailand. A total of 221 participants provided informed consent and completed the online survey as part of the study. Data were collected from students using a structured survey questionnaire over a three-month period, from May to July. Participants were selected through a quota sampling method to ensure representation across different year levels. The questionnaire was designed to assess students' satisfaction with overall university quality, covering multiple dimensions, including satisfaction with university life as well as academic and social experiences. Sample questions included "Computer rooms or Wi-Fi are functioning, organized, and up to date" and "This curriculum has appropriate content and courses in four years." Thirty items were measured in this instrument. All items were measured using a numerical rating scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Attitudinal loyalty was assessed, including recommendation, student retention, and brand defense. The measurement of student loyalty was based on asking about behavioral intentions. Sample questions included "You are willing to attend university events" and "You would like to become a university alumnus after graduation." All items were measured using a numerical rating scale ranging from 1 (very dissatisfied) to 5 (very satisfied).

Finally, the third phase, targeting alumni, employed a five-level survey questionnaire to assess attitudinal and behavioral loyalty. Data were collected from September to December using a structured survey questionnaire. Participants were selected through purposive sampling to target specific groups relevant to the study objectives, and all respondents provided voluntary informed consent. Moreover, respondents were required to complete the Net Promoter Score (NPS) section of the questionnaire. NPS, a popular and effective tool, was employed based on the approach proposed by Reichheld and Markey [30] to assess student loyalty. NPS scoring was on a scale from 0 (Very unlikely) to 10 (Very likely) with the ultimate question: "How likely are you to recommend the university to a friend or colleague?" Responses were categorized into three groups: promoters (scores 9–10), passives (scores 7–8), and detractors (scores 0–6).

**Table 1.**
An Overview of the Research Instrument.

| | ***Phase I*** | ***Phase II*** | ***Phase III*** |
|---|---|---|---|
| *Target Group* | Secondary students, customer motivation. before (pre-purchase) | Current university students customer satisfaction during (purchase) | Alumni customer motivation Customer loyalty, after (post-purchase) |
| *Concept* | To examine motivational factors determining the decision to select further study of science programs. | To assess the satisfaction and loyalty of undergraduate students and alumni | To evaluate the attitudinal and behavioral loyalty of alumni |
| *Source* | 26 items with five-point Likert scales [3, 4] | 30 items with five-point Likert scales [7, 31] | 15 items with five-point Likert scales and Net Promoter Score [7, 12, 30] |
| *Dimensions* | University Reputation Location&Environment Curriculum&Academic Tuition Fees & Funding Promotion The influence of a person | University Reputation Physical Environment Facilities & Services Student Loyalty | Recommendation Student Retention Brand Defense |

*3.2. Data Analysis*

Descriptive statistics were employed to analyze demographic factors, student satisfaction, and student loyalty. In this study, motivation, satisfaction, and loyalty fell under the interval scale. Each item was measured using a numerical scoring scale. A higher score indicated that the students had a higher autonomous satisfaction level. The relationships among the major variables were assessed using Pearson's correlation coefficient, and the normality of the data distribution was verified through the examination of skewness and kurtosis.

Independent samples t-tests revealed statistically significant differences in group means, although the overall population mean scores remained within the standard range. An additional t-test was conducted to compare student satisfaction and loyalty between current and alumni students. A one-way analysis of variance (ANOVA) was conducted to assess differences in student satisfaction across different years of study. Moreover, logistic regression analysis was utilized to examine the factors affecting the intentions of high school students. In addition, the SEM approach was applied for measurement model validity to confirm the structure of existing hypotheses and constraints, in the R environment for computing (lavaan package). In this study, SEM was employed to analyze complex relationships among latent variables, while logistic regression was used to model binary outcome variables and identify significant predictors.

Numerous appropriate indices provided guidelines for their acceptable values as well as fit measures. The relative chi-square value of less than 5.0 is considered acceptable [32, 33]. According to Hu and Bentler [34] a comparative fit index (CFI) and Tucker–Lewis index (TLI) greater than 0.95 indicate a good model fit, whereas values greater than 0.90 indicate an acceptable fit. Similarly, a root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) less than 0.05 represent a good fit, while values less than 0.08 reflect an acceptable model fit.

## 4. Results

### *4.1. Results of Pre-Purchase from Secondary Students*

Demographic and personal characteristics are presented in Figure 2. The study sample consisted of 1,625 secondary school students, with females representing 74.01% and Nakhon Si Thammarat province accounting for 29.34%, followed by Surat Thani province at 25.99% and Phatthalung at 23.33%. The dominant grade point average segment was 2.51 – 3.00 (32.92%), followed by 3.01 – 3.50 at 30.08%. In terms of study programs, 62.26% were interested in Sciences and Mathematics, while 18.33% of the students preferred Language-Arts. Table 2 summarizes associations between personal characteristics and intentions. The results indicated that the program, province, and grade point average were associated with the students' intentions to continue their studies by attending a university ($p < 0.01$).

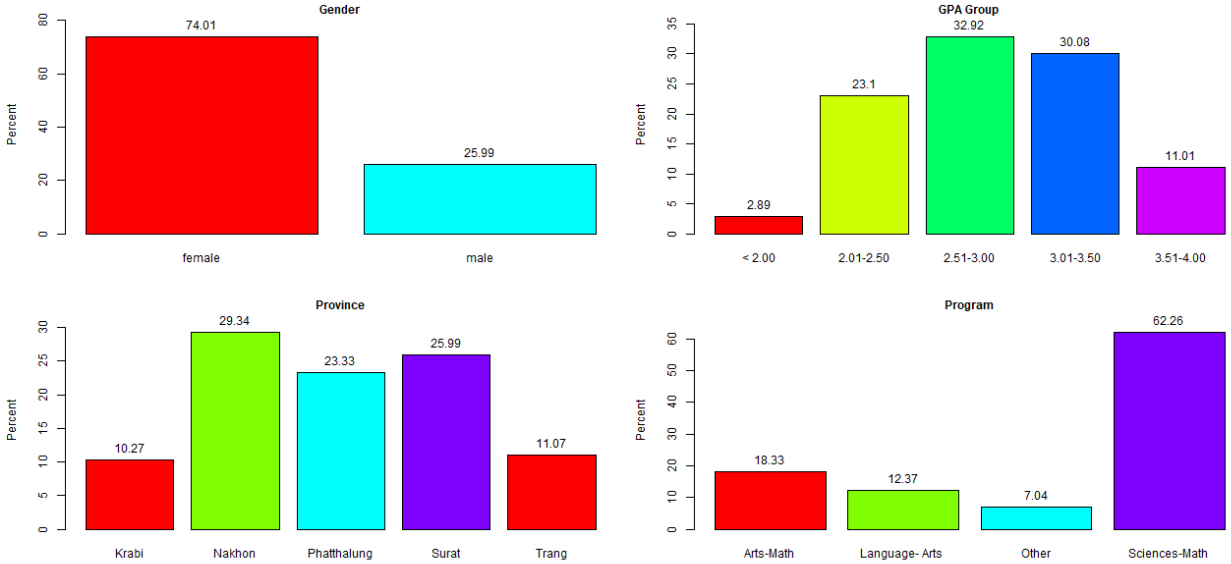


**Figure 2.**
Demographic and personal characteristics of the high school students.

**Table 2.**
Associations between personal characteristics and high school students' intentions to enroll in science programs.

| ***Variable*** | | ***Total number (percent)*** | | | | |
|---|---|---|---|---|---|---|
| | | ***n=1,625*** | ***Intention*** | ***No-intention*** | $\chi^2$ | ***p*** |
| *Gender* | Male | 419 (25.8) | 261 (16.1) | 158 (9.7) | 0.009 | 0.922 |
| | Female | 1206(74.2) | 748 (46.0) | 458 (28.2) | | |
| *Province* | Krabi | 173 (10.6) | 112 (6.9) | 61 (3.8) | 20.337** | < 0.01 |
| | Trang | 179 (11.0) | 137 (8.4) | 42 (2.6) | | |
| | Nakhon Si Thammarat | 494 (30.4) | 295 (18.2) | 199 (12.2) | | |
| | Phatthalung | 338 (20.8) | 208 (12.8) | 130 (8.0) | | |
| | Surat Thani | 441 (27.1) | 257 (15.8) | 184 (11.3) | | |
| *Grade point average* | < 2.00 | 49 (3.0) | 25 (1.5) | 24 (1.5) | 20.067** | < 0.01 |
| | 2.01 to 2.50 | 370 (22.8) | 250 (15.4) | 120 (7.4) | | |
| | 2.51 to 3.00 | 539 (33.2) | 356 (21.9) | 183 (11.3) | | |
| | 3.01 to 3.50 | 488 (30.0) | 286 (17.6) | 202 (12.4) | | |
| | 3.51 to 4.00 | 179 (11.0) | 92 (5.7) | 87 (5.4) | | |
| *Program* | Sci-Math | 1013(62.5) | 684 (42.2) | 329 (20.3) | 41.994** | < 0.01 |
| | Arts-Math | 305 (18.8) | 178 (11.0) | 127 (7.8) | | |
| | Language | 196 (12.1) | 90 (5.5) | 106 (6.5) | | |
| | Other | 108 (6.7) | 55 (3.4) | 53 (3.3) | | |

**Note:** ** $p < 0.01$.

The research continued to determine the factors affecting the intentions to study in science programs. The factors were measured as presented in Table 1. A combination of results from several subscales was considered for each factor. Data on students' intentions and non-intentions across six categories were explored as presented in Table 3.

**Table 3.**
Means and standard deviations of motivational factors influencing students' choice of a science program.

| Factor | Intention (n = 1,009) | | No-intention (n = 616) | | p |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| University Reputation | 4.2630 | 0.4921 | 4.1607 | 0.5433 | < 0.05 |
| Location& Environment | 3.9597 | 0.5719 | 3.8787 | 0.6403 | < 0.05 |
| Curriculum& Academic | 4.2450 | 0.5476 | 4.1956 | 0.6231 | < 0.05 |
| Tuition Fees & Funding | 4.1864 | 0.5780 | 4.1268 | 0.6271 | < 0.05 |
| Promotion | 4.2500 | 0.5368 | 4.1397 | 0.6030 | < 0.05 |
| Influence of a person | 3.7357 | 0.6760 | 3.4979 | 0.7903 | < 0.05 |

The factors contributing to students' decisions to choose a science program were ranked according to their mean scores, from highest to lowest: university reputation (mean score = 4.2630, sd = 0.4921), promotion (mean score = 4.2500, sd = 0.5368), curriculum & academic (mean score = 4.2450, sd = 0.5476), tuition fees & funding sources (mean score = 4.1864, sd = 0.5780), location & environment (mean score = 3.9597, sd = 0.5719), and societal factors (mean score = 3.7357, sd = 0.6760). The brand image was of vital importance to students studying at universities, while the influence of a person was the least important factor. The differences in the mean levels were examined, and statistically significant differences were noted in all motivational factors between students with and without the intention to choose the science program ($p < 0.05$).

**Table 4.**
Predictors of students' intentions to study in the science program.

| Predictor Variables | Standardized Coefficients | S.E. | Wald | Sig. | Odds Ratio (95% CI) |
|---|---|---|---|---|---|
| University reputation | 0.347 | 0.139 | 6.256 | 0.012* | 1.415 (1.078 – 1.856) |
| Curriculum & academic | 0.391 | 0.083 | 22.065 | 0.000* | 1.478 (1.256 – 1.740) |
| Tuition Fees & funding | 0.256 | 0.123 | 4.365 | 0.037* | 1.292 (1.016 – 1.644) |
| Constant | -3.447 | 0.483 | 51.005 | < 0.05* | 0.032 |

**Note:** * $p < 0.05$.

The study aimed to analyze motivational factors predicting students' decisions to pursue higher education. Since the outcome variable was categorical, distinguishing between intention and no-intention groups, logistic regression analysis was employed (Table 4). The findings demonstrated that university reputation, tuition fees and funding sources, and curriculum & academics were statistically significant factors related to student intentions. A strong determinant of curriculum and academics increased the likelihood of intending to study the science program, with an odds ratio of 1.478, followed by the university image factor and tuition fees & funding, respectively. Results from the Hosmer–Lemeshow chi-square test indicated that the model demonstrated an adequate fit to the data ($p = 0.072$). Our model correctly classified the outcomes for 66.4% of cases.

*4.2. Results of Purchase from Current Students*

The second part of the study aimed to identify the specific aspects of the university's services that contributed to student satisfaction. Data were collected from a total of 221 respondents enrolled in four-year university programs, the majority of whom were third-year students (39.37%), while senior fourth-year students accounted for 23.08%. The majority of students (50.68%) reported a grade point average (GPA) ranging from 3.01 to 3.50. Figure 3 illustrates the demographics of the students. Furthermore, a comparative study on the satisfaction level by years of study was also conducted.

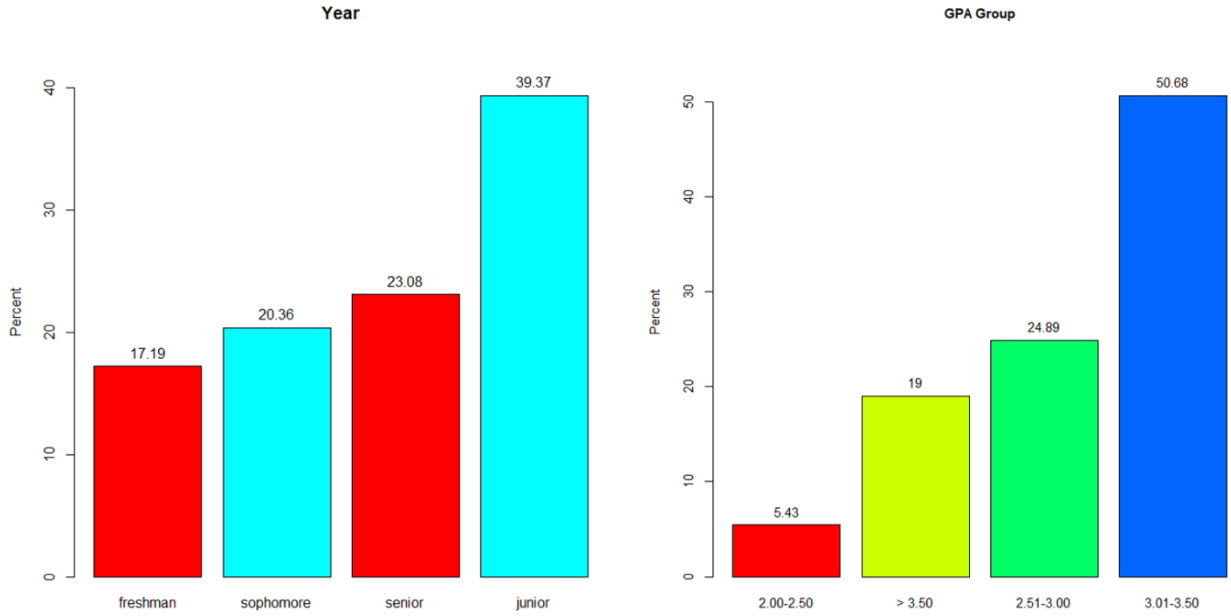


**Figure 3.**
Characteristics of current university students: year of study and grades.

The results indicate that the university's reputation exerted the strongest influence on student satisfaction, with a mean score of 4.4284. Student loyalty ranked second, with an average score of 4.3982. In contrast, the physical environment exerted the least influence on student satisfaction, with an average score of 4.0769. This included facilities such as science laboratories, computer laboratories, internet access, and the library. Based on these results, overall student satisfaction could be most effectively enhanced through improvements in service quality, particularly in facilities and infrastructure.

**Table 5.**
One-way ANOVA based on student's year of study and their satisfaction.

| Factors | Year of study | | | | Total (n=221) | F-test ANOVA | p |
|---|---|---|---|---|---|---|---|
| | 1 (n=38) | 2 (n=45) | 3 (n=87) | 4 (n=51) | | | |
| Reputation | 4.3596 ± 0.5278 | 4.3926 ± 0.4783 | 4.3985 ± 0.4898 | 4.5621 ± 0.5011 | 4.4284 ± 0.4990 | $1.657^{ns}$ | 0.177 |
| Physical Environment | 4.0877 ±0.78340 | 4.0815 ± 0.7717 | 4.0383 ±0.7628 | 4.1307 ± 0.6501 | 4.0769 ± 0.7396 | $0.170^{ns}$ | 0.916 |
| Facilities & Services | 4.3609 ± 0.5164 | 4.2952 ± 0.6961 | 4.2463 ± 0.5510 | 4.2689 ± 0.5804 | 4.2812 ± 0.58195 | $0.355^{ns}$ | 0.786 |
| Loyalty | $4.3026^{ab}$ ±0.6580 | $4.2056^{a}$ ± 0.5918 | $4.4368^{ab}$ ± 0.4959 | $4.5735^{b}$ ± 0.4881 | 4.3982 ± 0.5568 | 4.166* | 0.007 |

**Note:** ns = no significant differences; * significant at the 0.05 level; statistically significant differences within each row are indicated by different letters, based on Tukey's HSD multiple comparison test.

Further analysis across different years of study revealed that student loyalty constituted a significant factor in promoting and maintaining satisfaction with the university. Students from different years of study expressed varying opinions regarding loyalty. Notably, fourth-year students exhibited significantly higher loyalty scores compared to their counterparts in earlier years (Table 5). This was because the fourth-year students had been intimately familiar with the activities and teachers of the university for some time and tended to be loyal. Our study in its first phase indicated that the university's reputation was identified as a statistically significant motivational factor influencing students' intentions to study at the institution. This phase of the study also revealed that reputation was an important determinant of student satisfaction.

*4.3. Relationship between Student Satisfaction and Loyalty*

This section focused on assessing the relationship between student satisfaction and loyalty as shown in Table 6. The Pearson correlation analysis demonstrated a moderately positive association between the university's reputation and student loyalty, with the correlation coefficient indicating statistical significance (r=0.685, $p < 0.01$). Additionally, the relationships between facilities and physical environment had moderate positive associations with loyalty, with r = 0.633 and 0.507, respectively, at the significance level of 0.01. The interpretation of correlation coefficients was suggested by Hinkle et al. [35]. The absolute values of the correlation coefficients among the variables, ranging from 0.507 to 0.685, confirm the

absence of multicollinearity. The results demonstrate a positive relationship between student satisfaction and loyalty, aligning with the findings of previous studies [13].

**Table 6.**
Correlation of student satisfaction and loyalty

| Variable | Loyalty | | |
|---|---|---|---|
| | **Pearson Correlation coefficient (r)** | **p-value** | **meaning** |
| Reputation | 0.685** | < 0.01 | Moderately positive |
| Physical Environment | 0.507** | < 0.01 | Moderately positive |
| Facilities and Services | 0.633** | < 0.01 | Moderately positive |

**Note:** ** significant at the 0.01 level

*4.4. Structural Model and Hypothesis Testing*

Corresponding to the conceptual framework depicted in Figure 1, the research hypotheses were formulated to examine the relationships among the latent variables. Structural Equation Modeling (SEM) was employed to validate the proposed model and test the hypothesized relationships among the latent variables. Through this approach, the study measured the effects of various factors on student satisfaction and loyalty. Assessing satisfaction involved the university's reputation, facilities, and environmental factors. As for attitudinal and behavioral loyalty assessment, recommendation, student retention, and brand defense factors were taken into consideration in the analysis. In assessing the measurement model, the proposed model met the CFA criteria for reliability, convergent validity, and discriminant validity. All standardized factor loadings were statistically significant, with values ranging from 0.47 to 0.88, confirming the adequacy of the measurement model for subsequent structural analysis.

All indicators demonstrated standardized factor loadings exceeding the 0.40 threshold [36], indicating their adequacy for the measurement model. The findings revealed construct reliability (CR) values ranging from 0.79 to 0.94, exceeding the recommended threshold of 0.70 [32], thereby confirming convergent validity in this study. Discriminant validity was assessed using the average variance extracted (AVE), which should exceed 0.50 [37]. The AVE values in the current study ranged from 0.52 to 0.56; therefore, discriminant validity was acceptable. Furthermore, Cronbach's alpha (CA) was employed to assess the reliability of the constructs, with values exceeding the recommended threshold of 0.70 [38]. The results indicated that CA values ranged from 0.72 to 0.79; thus, the reliability of the model was satisfied.

The SEM analysis, conducted to evaluate the construct validity of the dimensional scale, demonstrated acceptable goodness-of-fit indicators, with suitable values for all criteria used for hypothesis testing (CFI = 0.951, TLI = 0.908, RMSEA = 0.060, SRMR = 0.053). The conceptual model of student satisfaction and loyalty is depicted in Figure 4.

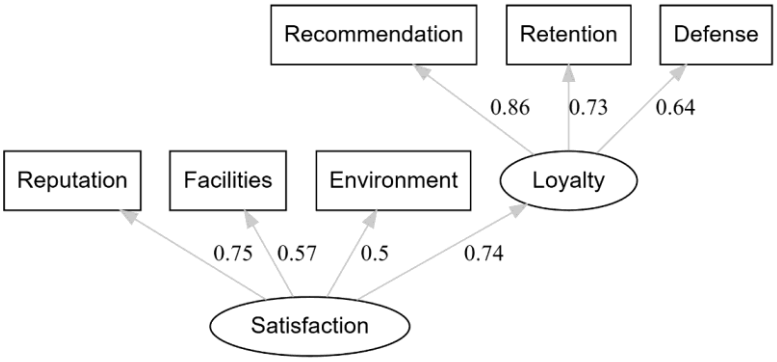


**Figure 4.**
The conceptual model of student satisfaction and loyalty.

As illustrated in Figure 4, the model results demonstrate that reputation, facilities, and environment exerted significant positive effects on students' satisfaction, with standardized path coefficients of 0.75, 0.57, and 0.50, respectively, supporting the corresponding hypotheses. Additionally, the satisfaction of undergraduate students (0.74) had a significant positive relationship with their loyalty ($p < 0.05$), which supported our hypothesis. All relationships in this empirical study were positive, coupling students' satisfaction with student loyalty. The findings suggest that the university's reputation positively influences student satisfaction, which in turn increases their intention to recommend the university to other friends.

*4.5. Results on Post-purchase from Alumni*

This study further assessed the perceptions of alumni (former students) and measured their willingness to recommend the university to others. Furthermore, a comparative analysis was conducted to investigate differences in academic quality satisfaction and loyalty between current students and alumni, as displayed in Table 7.

**Table 7.**
Comparison of opinions between current students and alumni.

| | Current students (n=221) | | Alumni (n=295) | | t-test | p |
|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | | |
| Satisfaction | 4.2962 | 0.5085 | 4.3602 | 0.5056 | -1.419$^{ns}$ | 0.156 |
| Loyalty | 4.3982 | 0.5568 | 4.4644 | 0.5930 | -1.300$^{ns}$ | 0.194 |

Although the sample results indicated that alumni exhibited higher overall loyalty (mean=4.4644, SD=0.5930) compared to current students (mean=4.3982, SD=0.5568), the difference in mean scores between the two groups was not statistically significant (Table 7).

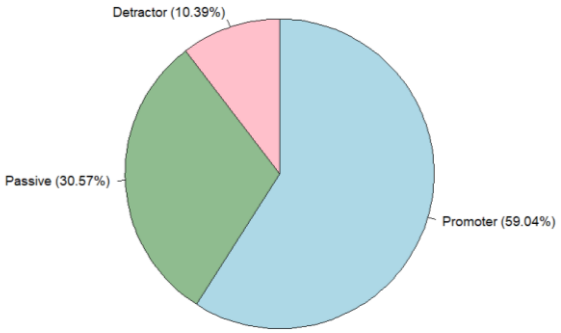


**Figure 5.**
Percentage of alumni loyalty in each category.

Figure 5 shows the results of alumni loyalty. A total of 59.04% of alumni were identified as promoters, indicating their willingness to provide positive recommendations to friends or colleagues regarding the university. Students were more inclined to remain connected and support their university if they thought it had a positive public image and an impressive track record of alumni achievement. Moreover, the alumni suggested that the practical training of research techniques or holding activities for enhancing learning experiences should be emphasized. English language and computer skills development should be added as additional areas that will benefit their careers.

## 5. Conclusion and Discussion

The logistic regression results revealed that all examined factors were associated with the students' intention to study in science programs. In terms of prioritization, the most significant factors were curriculum and academic quality, followed by the university's reputation, and tuition and fees in rank order. This conclusion is reinforced by the investigation carried out by Wallin Andreassen and Lindestad [39], which suggested that reputation demonstrated a significant association with customer satisfaction. Tuition, fees, and funding had, in the students' opinion, greater effects on purchase intentions. Similarly, recent research has revealed that university reputation, location, tuition fees, and learning environment are influential factors in students' university selection decisions [40]. The findings highlight curriculum and academics as key drivers of student motivation and engagement, emphasizing the importance of well-structured, relevant, and up-to-date programs. The university's provision of financial support for Work-Integrated Learning (WIL) further enhances students' practical experience, while sustained government investment in academic science programs is essential to ensure the long-term quality and accessibility of higher education.

The planning of marketable education services can be substantially informed by assessments of undergraduate student satisfaction. The survey findings highlighted that the university's reputation plays a key role in encouraging students to attend the university, aligning with the results reported in prior studies [41]. Attitudes in Thai society and traditional beliefs or social norms support the decision to study at a university as preferred over vocational education. Significant differences in loyalty were observed among students at different academic levels ($p < 0.05$). Additionally, SEM was performed to assess the hypothesized influence of undergraduate satisfaction on loyalty among students. This empirical study contributed valuable insights into both student loyalty and satisfaction. Regarding student loyalty, the analysis revealed that recommendation intentions had the highest standardized factor loadings, while the reputation factor comprised indicators related to current students. Our results confirm a significant positive association between undergraduate student satisfaction and loyalty, consistent with previous studies [42]. The findings further suggest that university reputation enhances student satisfaction, which in turn strengthens their intentions to recommend the university to other colleagues. The findings imply that as students become more satisfied, it increases the chances of choosing this university for studying. It is crucial to increase student happiness by upgrading the learning equipment and environment.

The analysis indicated that recommendations play a pivotal role, exerting the strongest positive effect on student loyalty, while word-of-mouth significantly influences continued enrollment and strengthens the link between the university's reputation and image [5]. By encouraging peers to pursue higher education, promoters enhance both undergraduate and alumni loyalty, with alumni further contributing through financial support, networking, and mentoring. These enduring relationships cultivate a supportive campus community, highlighting that promoting student engagement is essential not only for the university's long-term sustainability but also for its overall growth and development. A noteworthy limitation of our research is that the survey sample was only from a comparatively small university. A more comprehensive understanding of alumni loyalty in the higher education context, particularly among postgraduate students, can be obtained by examining diverse sample groups. Future studies should focus on developing support channel platforms and the refinement of marketing communication approaches. Furthermore, alternative predictive analytics tools, such as decision trees or random forests, could be applied to data on higher education. To deepen the research, conducting longitudinal studies would be highly valuable as they enable the examination of an individual's developmental trajectory over time. However, collecting this type of data is time-consuming, and maintaining contact with participants over extended periods is challenging.

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