The Impact of an Intelligent Pricing System (IPS) on Business Students' Competencies and Understanding of Pricing Strategies

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ABSTRACT

The use of digital technologies for learning in universities has increased opportunities to improve students' capacity to implement theoretical knowledge in the decision-making process in business. The current research analyzes the efficiency of using an Intelligent Pricing System (IPS) for improving students' awareness and implementation of pricing strategies. A quantitative pre-test/post-test research design was used where 150 participants with previous experience of being familiarized with pricing-related concepts among business and accounting students who enrolled in The Principle of Marketing (MKT420) class were involved. The data were collected using a structured questionnaire assessing students' perceived level of understanding of pricing strategies before and after using IPS, their perception of the system, and their perceived improvement in pricing-related competencies. For analyzing data descriptive statistics, reliability analysis, and paired-samples t-test were used. It is revealed that there is a significant improvement in students' perceived level of understanding of pricing strategies when the overall mean level increased from 2.50 (before using IPS) to 4.12 (after using IPS). This improvement is statistically significant, $t(146) = 12.08$, $p < .001$ and has a high effect size (Cohen's $d = 1.57$). Additionally, the results revealed that students have positive perceptions of IPS with overall mean level of 4.06 and perceived improvement in pricing-related competencies measured with overall mean level of 4.14. Thus, IPS can serve as a good tool providing practical and interactive learning experience for students in order to learn how to apply pricing concepts in business decisions. However, in the absence of control group and using only self-reporting measures, it is impossible to state the presence of causation. Nevertheless, the results can be considered as proof of a positive relationship between using IPS and students' improvement in this area.

Keywords: Accounting Education, Business Education, Digital Learning, Experiential Learning, Intelligent Pricing System, Pricing Strategies, Student Learning

INTRODUCTION

The rapid development of the use of artificial intelligence (AI), predictive analytics, and digital technologies is bringing up new opportunities for higher education institutions to enhance the quality of teaching and learning. The increasing use of integration of AI and technology-enhanced learning in marketing education is viewed as an opportunity to improve students' analytical skills and equip them for data-driven business environments (Barger et al., 2025; Bond et al., 2024). However, the educational value of these technologies depends on their capabilities and how effectively they are integrated into the teaching and learning process.

Pricing strategy is one of the topics covered in the Principles of Marketing course (MKT420). Students enrolled in the course need to understand how businesses decide the prices of their products or services. For example, students need to consider several factors in the process to determine the price, including costs, customer value, market demand, competitors, and the intentions of the business. Therefore, learning about pricing involves more than simply identifying different pricing methods. Students also need to compare different pricing options and

understand how their decisions may affect demand, revenue, profit, and the firm's position in the market. The traditional teaching approach, which mainly uses mainly uses lectures, textbooks, and numerical exercises, may provide limited opportunities for students to understand the dynamic and interrelated nature of pricing decisions.

Simulation is an alternative approach that can improve students' active participation. For example, pricing simulations allow students to experience the interaction between pricing, demand, production, and promotional decisions rather than learn theoretically. Through simulation, students easily apply theoretical concepts, experiment with different strategies and evaluate the results. Previous study has found that simulation supports experiential learning, student engagement and higher-order thinking in marketing education (Laverie et al., 2020).

An Intelligent Pricing System (IPS) is developed to provide an interactive learning environment for marketing courses, where students can experiment with pricing decisions and analyze their potential outcomes in different market conditions. Students can apply IPS to make choices, observe the simulated outcomes, test different strategies and use computational modelling, predictive analysis and simulation to improve their pricing decisions. Therefore, the development of IPS assists in improving student learning outcomes by easily connecting the pricing concepts and developing strategic decision-making through experiential learning.

Previous studies on AI in marketing education have highlighted the need to integrate AI tools with an appropriate pedagogical approach and to explore their impact on student learning outcomes (Barger et al., 2025; Narang et al., 2025). In addition, the broader reviews of AI in higher education have called for more empirical educational outcomes, rather than only embracing technology (Bond et al., 2024). In pricing education, limited empirical evidence exists on whether changes in students' academic achievement influence an intelligent and simulation-based pricing environment. This issue is particularly important when comparing student performance across academic semesters. Differences in examination outcomes may reflect changes in students' understanding but may also be influenced by variations in cohort characteristics, assessment conditions, examination difficulty, student participation, and other contextual factors. Therefore, changes in academic performance should not automatically be interpreted as evidence of a causal effect of IPS. Instead, the systematic comparison of performance patterns can provide preliminary evidence regarding whether the introduction of a technology-enhanced learning approach coincides with observable changes in student achievement.

The primary purpose of this quantitative study is to evaluate the effectiveness of an Intelligent Pricing System (IPS) as an interactive digital technology for enhancing business education. Specifically, the study first aims to assess the change in students' perceived level of understanding regarding pricing strategies by comparing their self-reported comprehension before and after interacting with the IPS. Second, it seeks to evaluate students' overall perceptions of the IPS regarding its usability, engagement, and value as a practical learning tool. Finally, the research aims to measure the perceived improvement in students' pricing-related competencies, specifically focusing on their ability to apply theoretical concepts to real-world business decision-making processes. The study contributes to the literature on technology-enhanced marketing education by examining the application of IPS and simulation learning approach within higher education pricing context. The study provides evidence of how interactive pricing simulations can be incorporated into marketing education to strengthen the connection between theoretical knowledge, analytical reasoning, and strategic decision-making in the contemporary business environment.

LITERATURE REVIEW

Higher Education Innovation in Teaching and Learning

Innovation in higher education has changed the way teaching and learning are carried out. In the past, teaching mainly depended on lectures where students received information from the instructor. Today, higher education institutions are moving towards student-centred learning in which students are encouraged to participate actively, work with others, solve problems, conduct inquiries, and apply what they have learned in practical activities. The use of digital technologies has also contributed to this transformation of the teaching and learning process. For example, learning management systems, simulations, learning analytics, and AI provide the students with opportunities for easier access to learning materials and provide feedback based on their learning progress

However, the use of technology does not necessarily indicate that students will learn better in the learning process. The benefits of technology depend on its usage in the teaching process, the instructor's ability to use the technology, students' willingness to participate, and whether students have sufficient access to digital resources (Chan, 2023; Akintayo et al., 2024;). Therefore, technology should support the learning process rather than replace the role of the instructor. It assists students to understand concepts, think critically, solve problems, and apply their knowledge to real-life situations (Rapanta et al., 2021)

Digital Transformation of Higher Education: Asian and Malaysian Perspectives

Digital transformation is increasing significantly in higher education across Asia. Many universities have adopted the use of technologies in enhancing the teaching and learning process, such as AI, online learning platforms, and learning analytics. Countries including China, Singapore, and Korea have made significant progress in using digital education. Similarly, Malaysian universities use digital technologies in the learning process in preparing students with the skills to adapt the technology-driven workplace (Wang & Li, 2024; Martyniuk et al., 2025)

Digital technology plays an important role in business education, as students use digital technology to analyze information, consider different alternatives, and make decisions, highlighting its important role in business education. Students use digital technology to analyze information, consider different alternatives, and make decisions. But the effectiveness of technology also depends on using appropriate instructional methods. Digital transformation in higher education should not be considered as a simple application of new technologies. Instead, it should be integrated with pedagogical strategies to assist learners in creating critical thinking and professional judgement for their future jobs (Wang & Li, 2024; Martyniuk et al., 2025). Thus, an IPS can be used as interactive tools in pricing education to create interactive learning among students.

Intelligent Pricing Systems (IPS) in Pricing Strategy Education

Pricing strategy is a suitable area for the use of technology-supported learning because students need to consider many factors such as costs, demand, competition, profit margins, sales volume, and customer value. Intelligent Pricing Systems (IPS) can assist the students through pricing calculations, simulations, and different business scenarios. Students can change pricing factors, compare different options, and see how their decisions affect sales and profits. This can help them understand pricing concepts and apply them to real business situations (Onesi-Ozigagun et al., 2024)

IPS can also collect information about students' decisions and responses while they work on different pricing activities. This information can help lecturers identify areas where students have difficulties and provide more suitable feedback (Hernández-Lara et al., 2019). However, the use of IPS does not automatically mean that students will perform better. More research is needed to determine whether IPS can improve students' understanding and academic performance.

There is also a research gap in the Malaysian higher education context, especially in using IPS to teach Pricing Strategy in a Principles of Marketing course. Although previous studies have discussed AI, digital learning, simulations, and learning analytics, few studies have directly examined how IPS affects students' learning outcomes. Therefore, comparing students' academic performance across different semesters can provide initial evidence of the effectiveness of IPS. Overall, IPS may be useful because it allows students to practice pricing decisions, compare alternatives, and understand how pricing strategies work in realistic business situations.

METHODOLOGY

Research Design

A quantitative research design has been used in this research to investigate how students understand the use of pricing strategies both before and after IPS. A pretest and posttest design has been used in this research to evaluate whether the use of IPS is associated with changes in the perception of students' knowledge, confidence, and application of pricing strategies in business practice. This research not only evaluated the impact of IPS on the perception of students but also evaluated students' perception about the usefulness and usability of IPS.

This research used a questionnaire-based approach where students provided responses after the learning process about pricing strategy and IPS. There were four parts of the questionnaire including students' personal background information, perceived understanding of pricing strategies before IPS, perceived understanding after IPS, students' opinion about IPS, and perceived improvement from IPS.

Participants and Data Collection

A total of 147 responses were collected from the respondents and were included in the study. The respondents are predominantly female respondents accounting for 87.1% of the sample population while male respondents account for 12.9% of the respondents. Most of the respondents are aged 21 years (89.8%), while the rest of the respondents range from 19 to 23 years. The respondents are mostly students of business and accounting programs who enrolled in MKT420.

Regarding past experiences of pricing strategies, all the respondents stated that they have been exposed to pricing strategies in the Principles of Marketing or Entrepreneurship course. On the other hand, regarding the previous experience on digital learning applications, 80 respondents (54.8%) have such an experience while 67 respondents (45.6%) do not have such experience.

The data collection is done through a structured questionnaire distributed electronically. It is purely voluntary to take part in the survey, and the data is collected for purposes of studying students' learning experience and pricing strategies.

Research Instrument

The questionnaire had numerous sections required for assessing the students' understanding and perception of IPS. There were pre- and post-learning sections of the questionnaire each containing 10 statements that evaluated the students' perceived capacity to comprehend and implement the pricing strategies. These included, among others selection of an appropriate pricing strategy, comparison of value-based, cost-based and competitor-based pricing, identification of an appropriate selling price, effect of pricing decisions on profitability, responding to market changes and decision-making regarding pricing through simultaneous consideration of the customers, costs and competitors.

Perception of IPS was measured through eight items that dealt with ease of use, instruction clarity, exploring the pricing strategies, informativeness, simulation elements, learning engagement, practicality and general satisfaction. Additional 10 items evaluated the students' perceived improvement in competencies related to pricing, which include among others understanding of different pricing methods, comparison and selection of pricing strategies, calculation of selling price, effect of decisions on profitability, making decisions regarding pricing and application of pricing principles to real-life business scenarios. This perception and understanding items were all measured through five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Analysis

The collected data was analyzed by applying both descriptive and inferential statistical analysis methods. Descriptive statistics such as frequencies, means, and standard deviations were applied to present the demographic variables of the respondents as well as their answers to questionnaire items. For determining the changes in students' perception regarding their understanding before and after the application of IPS, mean scores for 10 pre- and 10 post-use items were calculated and compared. Paired-sample t-test was applied as pre- and post- use responses comprised of repeated measurements for the same group of respondents. Significance of the results was tested at the 0.05 significance level.

Furthermore, Cronbach's alpha coefficients were also checked for measuring the internal consistency of the questionnaire constructs. Reliability coefficients were quite high, which means that there is good internal consistency between the questionnaire items. Cronbach's alphas for pre-use understanding items were .97, for post-use understanding items – .94, for students' perception of IPS – .94, and for improvement – .95.

RESULTS AND DISCUSSION

Demographics and Profile Analysis

In terms of demographic analysis of respondents (N = 147), it can be found that most of them were female students, constituting 87.1% (n = 128), with only 12.9% (n = 19) being male students. Regarding age distribution, 88.3% (n = 132) of respondents were aged 21 years, which coincides with the normal academic age to pursue their undergraduate degree at UiTM Kelantan Branch. Mostly, the sample contains students from the Bachelor in Business Technology Management (Honours) [BA262] and Bachelor of Accountancy [AC220] programs.

Table 1 : Demographics and Profile Analysis

Demographics Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	128	87.1%
	Male	19	12.9%
Prior Digital Tool Usage	Yes	80	54.4%
	No	67	45.6%
Business Experience	Yes	87	59.2%
	No	60	40.8%

Interestingly, 59.2% of the respondents had previous experience of business or entrepreneurship, with 54.4% having already used digital learning platforms before. However, despite their knowledge background, initial assessments showed that students were facing many difficulties to incorporate several aspects of the pricing strategies together before IPS.

Students' Understanding of Pricing Strategies Before and After Using IPS

The most significant result from the study was the large growth in the students' perceived understanding of pricing strategies after the IPS exposure. Before IPS exposure, the overall mean score of the ten understanding items was 2.50 showing quite a low level of perceived preparedness. After IPS exposure, the overall mean score grew significantly to 4.12 which showed a high level of perceived understanding and confidence.

Before IPS exposure, the lowest means were shown in the ability to choose an appropriate pricing strategy for a specific business situation (M = 2.37), the ability to change product prices depending on changes in the market (M = 2.37) and the confidence in making pricing decisions (M = 2.39). The results indicated that while the students have met with pricing concepts in their courses, they felt not fully confident in translating the theoretical knowledge into practice.

The relatively higher means before IPS use were shown in the comparison of different pricing strategies (M = 2.68), determination of an appropriate selling price according to the information (M = 2.64) and consideration of the customers, costs and competitors at the same time (M = 2.61). However, the means were still lower than the neutral-to-agreement scale, thus showing the possibility of improvement in the area.

After IPS use, the means of all ten items were larger than 4.00. The highest mean score was achieved in the ability to make pricing decisions while taking into account customers, costs and competitors (M = 4.27). It was followed by the ability to make confident pricing decisions (M = 4.22). In addition, the students reported high levels of ability to determine appropriate selling prices, estimate the effect of the pricing decisions on profit and adjust prices according to changes in the market (all M = 4.12).

The significance test used to confirm whether there was a significant increase in learning outcomes through IPS was paired-sample t-test, which gave $t(146) = 12.08$, $p < .001$, and the effect size (Cohen's d) = 1.57. Thus, the results indicate a statistically significant and large effect size improvement on the part of students. It implies that there is enough evidence to show that students improved their understanding of the learning material and were more confident in their knowledge after working with IPS.

From educational point of view, the results concluded on one of the biggest issues facing management and marketing education, which is a gap between theoretical knowledge of pricing and its practical application. In the classroom setting, students can learn about different approaches to pricing such as cost-based, value-based and competitor-based pricing. However, it can be rather challenging for students to apply these concepts in practice, to decide which of these approaches would work under changing conditions.

Students' Perceptions of the Intelligent Pricing System

The attitudes towards IPS from the part of the students have been predominantly positive. The mean for all eight items of the evaluation was 4.06, which can be interpreted as a high degree of acceptance of confirmations about the system. The highest-rated item was associated with the statement about IPS helping students experiment with different pricing strategies (M = 4.12). It was followed by the belief that IPS offers a more practical way to learn about pricing strategies (M = 4.08) and the ease of comprehension of IPS instructions (M = 4.08). Students agreed that simulations helped them to understand the effects of price changes (M = 4.07).

The least satisfactory aspects included ease of use of IPS and the degree to which IPS makes learning about pricing strategies more fun (both M = 4.02). The overall satisfaction with the experience of working with IPS was also quite high (M = 4.03).

It means that the students did not perceive IPS as an additional tool to traditional learning. Instead, they realized IPS as a practical tool that would help them to learn about pricing strategies and their impact on businesses. High rating of practical learning is especially important in the case of pricing, which is a decision-making process that requires not only the knowledge of definitions of different strategies, but also an understanding of their impact on the business.

Perceived Improvement in Pricing Competencies

Findings related to improvement were similarly favorable. The mean average score in relation to all 10 improvements questions was 4.14, implying that participants generally agreed with IPS improvement of knowledge and application skills of pricing concepts.

Comparing the performance of various pricing methods (M = 4.20) and applying pricing concepts to practical cases (M = 4.20) were the most highly rated aspects of improvement among respondents. Other highly rated aspects included the evaluation of impact of pricing decisions on profit (M = 4.18) and the general improvement in understanding of pricing strategy and decision making (M = 4.18).

Understanding of value-based pricing and cost-based pricing received an average score of 4.12 while competitor-based pricing was evaluated at 4.13. Improving confidence in pricing decisions was found to be another positive aspect of simulation with the mean of 4.13.

It is interesting to note that the least positive average score of 4.02 related to the aspect of calculating the selling price correctly. While this score is also positive, it implies that quantitative aspects of pricing calculations need more attention than conceptual based ones. This finding can be particularly important for educators because it implies that while simulations can successfully improve knowledge of pricing strategies, calculation of prices still requires additional effort.

DISCUSSION

The findings indicate a significant potential of IPS in terms of its ability to be used as an experiential learning tool in the pricing strategy education. The large gap between the pre-use average score of 2.50 and post-use average of 4.12 clearly shows that the readiness of the students to participate in the pricing process improved significantly after working with the system.

From the perspective of the first principle, it can be argued that good pricing education implies that students combine several types of knowledge rather than learn a set of pricing definition. A pricing decision may include

such things as the cost, customer value, competition and expected profit at the same time. The highest score in the post-use category coincides with the combined decision-making skills (M = 4.27). This means that IPS might help students learn how to make decisions about pricing.

From a critical perspective, however, the findings should not be interpreted as definitive evidence that IPS alone caused the observed improvement. The findings should include control factors that might be caused by any number of factors such as classroom lessons and repetition of material. Moreover, all the measures were subjective. However, the magnitude of the improvement obtained offers solid grounds for further research. The effect size is very high (d = 1.57), which implies that this improvement cannot be considered a minor perceptual change in the way students see things. The internal validity of the observed pattern is also confirmed by its consistency across all ten post-use items and the reliability coefficients obtained.

From the perspective of implementation of IPS in education, this approach should prove especially helpful in combination with traditional learning rather than as a substitute for it. In other words, lecturers can cover pricing theories at their lectures, let students test different options in IPS, and then discuss in class why a certain decision on pricing led to specific consequences.

CONCLUSION AND RECOMMENDATION

This study investigated the effect of exposure to IPS on students' perceived understanding of pricing strategies and their opinions of the system as well as the impact that it had on their learning. As indicated by the 147 responses collected, the study results show considerable positive improvement in students' perceived understanding of pricing strategies.

The mean score went up from 2.50 before the use of IPS to 4.12 after the use of IPS for a total of 1.62 points mean improvement. This change was found to be statistically significant, $t(146) = 12.08$, $p < .001$, indicating a large effect size (Cohen's $d = 1.57$). In other words, this result shows that there is a very strong positive correlation between the exposure to IPS and the perceived readiness, confidence and capability of applying pricing strategies.

The results further show that the students had positive opinions of IPS, scoring an average of 4.06. The students liked in particular the way it allowed them to explore various pricing strategies and offered them a more practical way of learning. For the perceived improvement dimension, the average was 4.14 with significant improvement reported particularly in the area of comparing pricing strategies and applying pricing concepts to real-world business situations.

However, this research has a number of limitations. Firstly, the self-reported nature of some aspects of the measurement can lead to biases because of possible response biases. Secondly, the lack of control group does not allow to conclude that the positive effect is solely caused by IPS.

The findings show that IPS could be included in the syllabus for all pricing courses to serve as an alternative tool for experiential learning. The lecturers can use IPS in conjunction with theoretical teaching to allow students to apply what they have learnt in realistic situations and improve their decision-making skills. Reflection and discussion sessions could also be introduced to allow students to comprehend the implications of the pricing decisions that they have made. Numerical questions and examples should go hand in hand with IPS, especially in matters related to the computation of selling prices, costs and profitability.

Future studies should consider using larger and more varied sample sizes for enhanced generalizability of the results. Objectives pre-test and post-test sessions, as well as control groups where feasible, should also be included in the research design to provide empirical evidence on the effectiveness of IPS. Further longitudinal studies may be conducted to investigate the extent to which there are lasting effects of IPS on students' pricing knowledge and decision-making skills. Improvements in IPS through further development based on the students' feedback and complicated market conditions could be used to increase the effectiveness of IPS.

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