Published online on the journal's web page: http://jurnal.usahid.ac.id/index.php/jamr

eISSN: 2797-2917

Journal of Applied Management Research

Competitive Option Preferences of Daring and Hybrid Course Models in The Faculty of Engineering: A Game Theory Approach

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ARTICLE INFO

Received: 29 April 2024
Revised: 18 May 2024
Accepted: 30 May 2024

Keywords:

Faculty of Engineering, Game Theory, Daring-Hybrid Model, Student Preferences

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ABSTRACT

Since the COVID-19 pandemic, there has been a shift in the educational paradigm towards daring and hybrid learning models, especially at the Faculty of Engineering, Sahid University. Students are faced with the choice of daring or hybrid courses, which gives rise to differences in preferences and impacts on learning effectiveness. This research aims to identify the factors that most influence student preferences in choosing daring and hybrid study models. The research method uses a quantitative research design. An daring survey was distributed to Faculty of Engineering students with structured questions designed to identify preferences regarding lecture models. Samples were taken randomly from the student population of the Faculty of Engineering. Finally, the survey data was analyzed quantitatively using statistical methods such as logistic regression and factor analysis using a Game Theory approach. Based on the processing results using the POM-QM application, it is known that the Daring and Hybrid learning models show optimal values. The payoff value is 2.0, meaning that both learning models have their strategies for student preferences. Based on the maximin and minimax output, the respective values are -1 and 5.

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1. INTRODUCTION

In the digital era and educational transformation, higher education institutions, including the Faculty of Engineering at Sahid University, face the challenge of adapting to daring and hybrid learning models. State of the Art shows that this shift is not only driven by technological advances but also by increasingly complex student needs. Many institutions are trying to integrate these learning models, but there still needs to be clarity regarding student preferences and optimal use of educational technology.

There needs to be a significant research gap regarding understanding student preferences in choosing daring and hybrid study models. Previous studies have yet to be in-depth enough to identify the factors that influence this choice, specifically in the Faculty of Engineering. Understanding of the dynamics of student interactions and decisions in this context still needs to be improved, making this issue the centre of attention.

This research is crucial because it provides in-depth insight into the preferences of Sahid University Faculty of Engineering students regarding daring and hybrid lecture models. With better understanding, institutions can design more adaptive educational strategies, provide more effective learning experiences, and optimize the use of technology. Successful implementation of a model that suits student preferences will improve the quality of education and competitiveness of the Faculty of Engineering. According to Graham (2006),

DOI: http://dx.doi.org/10.36441/jamr

Dziuban et al. (2018), and Moore & Kearsley (2012), using a Game Theory approach can help in providing a deeper analytical perspective and description of strategic interactions in the context of student decisions regarding learning models. This study is necessary and important to support the implementation of learning models that suit student preferences and optimize the use of technology. This study hopes to contribute to the development of innovation in higher education by providing a better understanding of how educational technology can be integrated with student preferences.

The main objective of this research is to identify the factors that most influence student preferences in choosing daring and hybrid study models at the Faculty of Engineering. The final aim of this research is not only to meet academic needs but also to contribute directly to the development of better educational policies and practices at the Faculty of Engineering, Sahid University.

2. LITERATURE REVIEW

It is important to understand the theoretical framework that is the basis of this research. Game theory is a relevant framework because it describes strategic interactions between players in decision-making. Game theory is a branch of mathematics that models competitive and cooperative human interactions. A game consists of a group of players, a set of strategies available to each player, and a set of rewards for each player at the end of the game.

In the context of student preferences regarding college models, game theory can help identify strategies that students and institutions may adopt. According to Von Neumann and Morgenstern in their book entitled "Theory of Games and Economic Behavior" in 1944, Game Theory is the study of decision models and conflicts between players who have conflicting interests. In the context of this research, Game Theory will be applied to analyze the dynamics of interactions between students and daring and hybrid study options. By understanding the rational decisions and strategies that students might take, deep insight into their preferences can be generated.

During the ongoing pandemic, there was a change in the learning process pattern; namely, face-to-face lectures were changed to daring and hybrid lectures. These changes ultimately give rise to differences in students' perceptions and preferences. Researchers often use game theory to understand how people make decisions, to try to predict the outcomes of those decisions and to measure how good or bad these decisions impact other people. We can also use game theory to identify incentives that align what is best for the individual and what is best for the system as a whole. In this way, decentralized systems may behave as if they were managed centrally.

2.1. Differences between Daring and Hybrid Lecture Models

Various studies have outlined the differences between daring and hybrid lecture models, which are focused on the context of student preferences.

1) Daring Lecture Model: According to Moore and Kearsley (2012), the daring lecture model includes completely daring learning without physical presence on campus. Curriculum, learning materials, and interactions between students and teachers occur through daring platforms. Advantages include flexibility of time and location, but they can present disadvantages in social interaction and direct supervision.
2) Hybrid Lecture Model: The hybrid lecture model, often called blended learning, is a combination of daring and face-to-face learning. Graham (2006) states that this model utilizes the advantages of both methods by combining physical presence in the classroom with the use of technology to facilitate daring learning. Hybrid provides a balance between flexibility and social interaction but can pose logistical challenges.
3) Differences in Student Preferences: According to research related to student preferences (Dziuban et al., 2018), factors such as learning style, personal preferences, and time requirements influence the choice between daring and hybrid lectures. Students tend to have varying preferences based on personal experiences, learning preferences, and individual challenges faced.

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2.2. Related Previous Research

A number of studies have been conducted regarding student preferences for daring and hybrid lecture models.

1) A study by Smith et al. (2020) identified that students prefer the hybrid lecture model because it provides a combination of social interaction and daring flexibility. However, this research needs to analyze the factors that influence these preferences in more depth.
2) Research by Johnson (2019) highlights the tendency of students to choose daring lecture models because of convenience and flexibility. Still, it places less emphasis on aspects of strategic interaction analysis in the context of game theory.

2.3. Synergy of Game Theory and Student Preferences

In the context of this research, the synergy between game theory and student preferences becomes the centre of attention. By applying Game Theory concepts, such as Nash equilibrium, this research will deepen understanding of how students' decisions in choosing college models can be understood as the result of strategic interactions. It provides a deeper analytical dimension to understanding student preferences at Sahid University's Faculty of Engineering.

This research fills knowledge gaps by summarizing information from trusted sources, explaining the definition of Game Theory, the differences between daring and hybrid lecture models, and identifying research gaps in the study of student preferences. With a Game Theory approach, this research seeks to provide a more comprehensive and analytical insight into the dynamics of interaction in the context of student decisions regarding learning models, which is expected to contribute to the development of more adaptive and responsive educational policies.

3. RESEARCH METHOD

3.1. Place and Time of Research

The research was conducted at the Faculty of Engineering, Sahid University, Jakarta, considering that it is one of the faculties that accommodates students from regular class groups and employee classes. The time for the process of collecting and collecting data and information is from February to April 2024.

3.2. Method of Collecting Data

Data collection was carried out through an daring survey via Google form involving students from the Faculty of Engineering, Sahid University. This survey will be designed with structured questions covering aspects such as college model preferences and factors influencing student decisions. This survey will be uploaded to an daring platform for easy access and student participation. Sample selection will be done randomly, ensuring a balanced representation from various study programs and semester levels. The questionnaire is considered valid when all statements are answered by respondents who match the characteristics. Collecting student preference data according to level of interest using a questionnaire. Determining the level of importance of each variable is presented on a Likert Summated Rating (LSR) scale, namely 1=Very Not Important, 2=Not Important, 3=Quite Important, 4=Important, and 5=Very Important.

3.3. Data Processing and Analysis Methods

The collected data will be processed using QM for Windows analysis software. Descriptive analysis will be used to describe sample characteristics and identify general trends. Next, factor analysis will be used to determine the main factors that influence student preferences for daring and hybrid lecture models. To determine the results of the respondent's preference level of importance for each attribute answered, it is necessary to calculate the answer score using the Likert scale multiplication formula, namely: T x Pn. Where T is the total number of respondents, and Pn is the choice of Likert score numbers. If the respondent answers important or very important, the highest score is obtained, whereas if the respondent answers not

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important or very unimportant, it means the lowest score (Sedarmayanti & Hidayat, 2011; Sukwika, 2023a; 2023b).

3.4. Game Theory Formulation Rules

A Game Theory approach will be applied to analyze the dynamics of strategic interactions between students and the lecture model. In this context, student strategy is their choice between daring and hybrid lectures, while faculty strategy is the formulation of educational policies that take into account student preferences. Some Game Theory concepts and formulas that may be applied include (Creswell, 2015; Creswell et al., 2017; Miles et al., 2014; Patton, 2015):

1) Player: (a) Player 1 (Student-1): Students choose between two options, daring or hybrid lectures, based on individual preferences and factors. (b)
2) Player 2 (Student-2): Students choose an education policy that includes the proportion of daring and hybrid lectures based on institutional needs and strategies.
3) Strategy: (a) Student Strategy-1: Choose between daring or hybrid courses based on individual preferences and criteria. (b) Student Strategy-2: Accept the proportion and policy of daring and hybrid courses that will be offered.
4) Payoff (Benefits): (a) Student Payoff-1: Based on learning experience, flexibility and personal needs. (b) Student Payoff-2: Based on teaching effectiveness, student engagement, and compliance with institutional policies.
5) Nash Equilibrium: (a) Nash Equilibrium: The point at which student and faculty strategies maximize their profits, and neither party can gain additional profits by changing their strategies.

The application of this formulation rule will provide a deeper understanding of the dynamics of interaction between students and faculty in the context of lecture model preferences. The analysis will include determining optimal strategies for both parties and potential Nash equilibria that reflect situations in which student decisions and faculty policies support each other.

By combining quantitative data collection methods with a Game Theory approach, this research is expected to provide a deeper understanding of student preferences for daring and hybrid lecture models at the Faculty of Engineering, Sahid University. This approach not only provides a descriptive view but also analyzes the dynamics of strategic interactions between students and faculty, contributing to the development of more effective and adaptive educational policies.

4. RESULTS AND DISCUSSIONS

Based on Likert Scale calculations, it is known that the proportion distribution of student preferences is quite diverse, and the average value is above 80 per cent. Table 1 presents the results of calculating the total score of respondents' preference criteria for the attributes of the Daring and Hybrid lecture model options that are most important to students, with a scale value of 85.09%. A value of 81.5% means that overall the measured attributes are all included in the "Very Important" interval category. This value is a comparison between the percentage of all questions and the number of questions in the questionnaire.

On a continuum, the attributes of the Daring and Hybrid lecture model options that are important to students are in the "Very Important" category. Below, Figure 1 shows the position of the category of importance of the attribute being measured.

Calculations using the game theory method in this research were made by filling in the questionnaire and comparing each existing attribute. The variables used by each player are the same, namely: 3) Interaction with lecturers and students, (4) Flexibility of time, (5) Learning experience, (6) Health and safety conditions, (7) Cost and availability of facilities, (8) Personal learning style, (9) Quality and educational technology, and (10) Availability of campus facilities.

DOI: http://dx.doi.org/10.36441/jamr

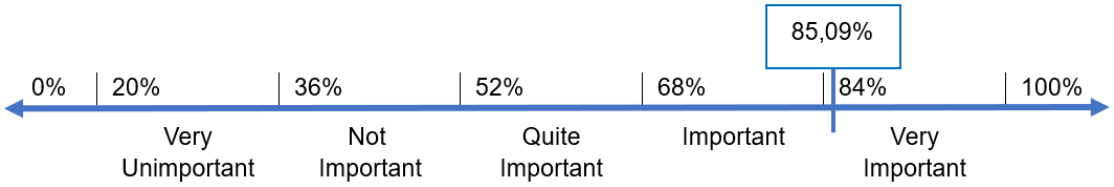

Fig 1. Continuum Scale of Importance Level Categories

Table 1. Student Preferences on Questionnaire Questions Related to Lecture Model Attributes

No	Important Attributes According to Student Preferences	Respondent Preferences					Score Total	Score Ideal	%
		5	4	3	2	1			
1	The speed and availability of internet access can influence student preferences for daring lecture models.	29	22	4	0	0	245	275	89,09%
2	The quality of daring learning materials, such as recorded lectures, e-books, and digital resources, can influence student preferences.	32	19	4	0	0	248	275	90,18%
3	Students may prefer a hybrid lecture model if they value direct interaction with lecturers and fellow students.	17	9	24	2	3	200	275	72,73%
4	Students who have busy schedules or need time flexibility may prefer the daring lecture model.	43	8	4	0	0	259	275	94,18%
5	Previous positive or negative experiences with daring or hybrid learning models can influence student preferences.	16	28	11	0	0	225	275	81,82%
6	Health factors, such as the pandemic or personal health conditions, may influence student preferences for hybrid or daring study models.	21	23	9	0	2	226	275	82,18%
7	Cost factors, including the cost of transportation, accommodation, or special equipment for daring lectures, may influence student preferences.	23	19	11	2	0	228	275	82,91%
8	Preference for learning style, whether you prefer independent learning or direct interaction, can play a role in choosing a lecture model.	17	24	11	2	1	219	275	79,64%
9	The availability of advanced educational technology and the quality of daring learning platforms can influence student preferences.	22	26	9	1	2	245	275	89,09%
10	The availability of facilities on campus, such as laboratories, libraries and discussion rooms, can influence preferences for the hybrid lecture model.	22	26	9	1	2	245	275	89,09%
	Average								**85,09%**

The following Figure 2 shows student preferences for 10 attributes of daring and hybrid lecture models, all of which are in the "Very Important" category. In the pie chart, it is known that, on average, respondents gave attribute scores according to the issues asked in the questionnaire between 72.73% - 94.18% or in the category "Important" to "Very Important".

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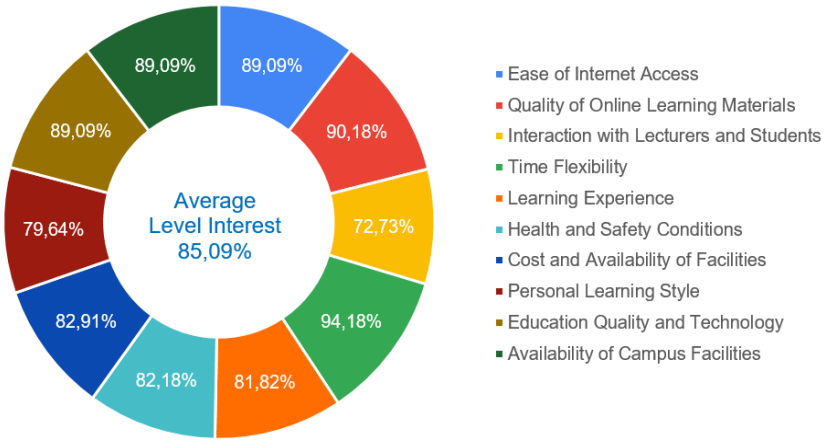


Fig 2. Game Theory Variables Used from the Hybrid Daring Lecture Model Attributes

Based on the attributes that have been assessed, attribute scores for competing options for the hybrid daring lecture model are obtained. These values can underlie the formation of competitive values between daring and hybrid lecture models that are "Student-important". The following detailed measurement data is presented in Table 2.

Table 2. Competing Option Attribute Values in the Hybrid-Daring Lecture Model

Competitive strategy	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}
X_1	35	34	31	33	30	29	25	33	33	28
	20	21	24	22	25	26	30	22	22	27
X_2	25	28	30	27	26	33	27	34	28	29
	30	27	25	28	29	33	28	21	30	26
X_3	27	28	35	26	25	31	28	25	27	24
	28	27	20	29	30	24	27	30	28	31
X_4	28	30	29	29	27	30	32	29	29	28
	27	25	26	26	28	25	23	26	26	27
X_5	26	27	23	27	28	26	22	21	26	26
	29	28	32	28	27	29	33	34	29	29
X_6	30	27	25	27	30	32	25	23	31	30
	25	28	30	28	25	23	30	32	24	25
X_7	26	26	30	26	25	31	29	24	26	26
	29	29	25	29	30	24	26	31	29	29
X_8	21	29	26	26	27	30	29	23	30	34
	34	26	29	29	28	25	26	32	25	21
X_9	22	26	30	25	25	30	27	24	29	33
	33	29	25	30	30	25	28	31	26	22
X_{10}	32	28	27	26	29	24	26	25	26	27
	23	27	28	29	26	31	29	30	29	28

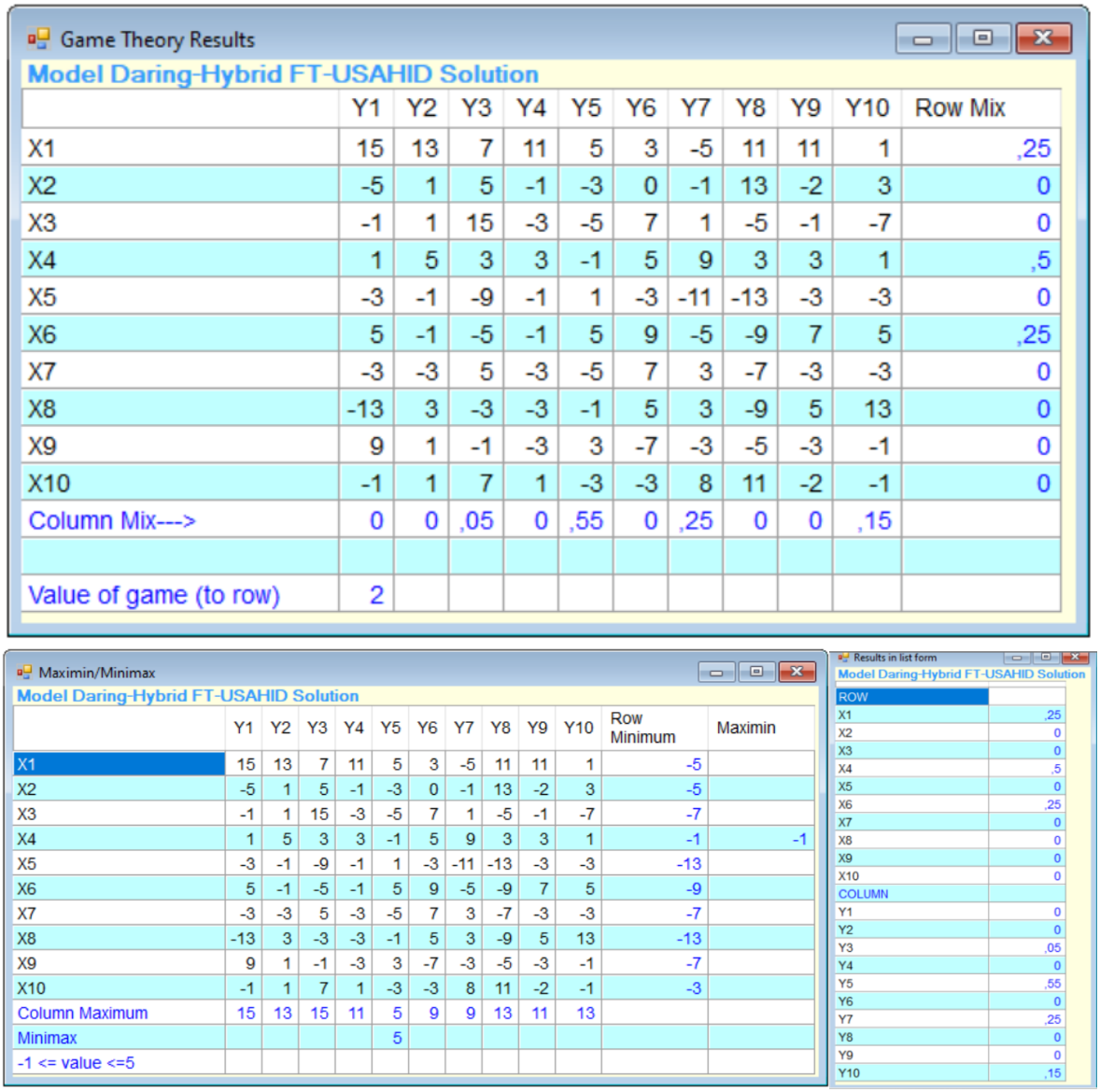
Remark: n = X or Y
(n1) Ease of internet access, (n2) Quality of daring learning materials, (n3) Interaction with lecturers and students, (n4) Time flexibility, (n5) Learning experience, (n6) Health and safety conditions, (n7) Cost and availability facilities, (n8) Personal learning style, (n9) Educational quality and technology, and (n10) Availability of campus facilities.

Mixed strategy software processing is used to find the payoff value of both daring transportation services. The payoff is the final result that occurs at the end of the game regarding this reward; this game considers every profit as a positive number and every loss as a negative number. Competition in Game Theory is the interaction of the number of row players (Xn) with the number of column players (Yn). Where the score

DOI: http://dx.doi.org/10.36441/jamr

obtained in the Daring and Hybrid lecture model games is the difference in score between the Daring and Hybrid scores. The complete results of this competition are presented in Figure 3: Pay off Matrix for Daring and Hybrid Lecture Models.

From the results of obtaining the POM-QM application software, two outputs were obtained from the mixed strategy, namely game theory and maximin and minimax. Based on the output of game theory results, a payoff value of 2.0 is obtained. This value shows that if both learning models use strategies: ease of internet access, quality of daring learning materials, interaction with lecturers and students, time flexibility, learning experience, health and safety conditions, cost and availability of facilities, personal learning style, educational quality and technology, and the availability of campus facilities, then the minimum loss obtained by Daring is 2.0 and the maximum profit obtained by Hybrid is 2.0, based on the maximin and minimax output, the maximum value obtained is -1 and the minimum value is 5.



Game Theory Results

Model Daring-Hybrid FT-USAHID Solution

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Row Mix
X1	15	13	7	11	5	3	-5	11	11	1	,25
X2	-5	1	5	-1	-3	0	-1	13	-2	3	0
X3	-1	1	15	-3	-5	7	1	-5	-1	-7	0
X4	1	5	3	3	-1	5	9	3	3	1	,5
X5	-3	-1	-9	-1	1	-3	-11	-13	-3	-3	0
X6	5	-1	-5	-1	5	9	-5	-9	7	5	,25
X7	-3	-3	5	-3	-5	7	3	-7	-3	-3	0
X8	-13	3	-3	-3	-1	5	3	-9	5	13	0
X9	9	1	-1	-3	3	-7	-3	-5	-3	-1	0
X10	-1	1	7	1	-3	-3	8	11	-2	-1	0
Column Mix--->	0	0	,05	0	,55	0	,25	0	0	,15	
Value of game (to row)	2										

Maximin/Minimax

Model Daring-Hybrid FT-USAHID Solution

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Row Minimum	Maximin
X1	15	13	7	11	5	3	-5	11	11	1	-5	
X2	-5	1	5	-1	-3	0	-1	13	-2	3	-5	
X3	-1	1	15	-3	-5	7	1	-5	-1	-7	-7	
X4	1	5	3	3	-1	5	9	3	3	1	-1	-1
X5	-3	-1	-9	-1	1	-3	-11	-13	-3	-3	-13	
X6	5	-1	-5	-1	5	9	-5	-9	7	5	-9	
X7	-3	-3	5	-3	-5	7	3	-7	-3	-3	-7	
X8	-13	3	-3	-3	-1	5	3	-9	5	13	-13	
X9	9	1	-1	-3	3	-7	-3	-5	-3	-1	-7	
X10	-1	1	7	1	-3	-3	8	11	-2	-1	-3	
Column Maximum	15	13	15	11	5	9	9	13	11	13		
Minimax					5							
-1 <= value <=5												

Results in list form

Model Daring-Hybrid FT-USAHID Solution

ROW	
X1	,25
X2	0
X3	0
X4	,5
X5	0
X6	,25
X7	0
X8	0
X9	0
X10	0
COLUMN	
Y1	0
Y2	0
Y3	,05
Y4	0
Y5	,55
Y6	0
Y7	,25
Y8	0
Y9	0
Y10	,15

Remark: 1=Very Unimportant, 2=Not Important, 3=Quite Important, 4=Important, 5=Very Important

Fig 3. Pay off Matrix for Daring and Hybrid Lecture Models

Referring to Figure 3, it is known that Daring is superior in ease of internet access (X1) with a value of 0.25 and health and safety conditions (X6) 0.25. At the same time, the Hybrid Model excels in the learning experience strategy (Y5) with a score of 0.55 and cost and availability of facilities (Y7), which is 0.25. The

DOI: http://dx.doi.org/10.36441/jamr

Ease of Internet Access Strategy is a strategy that concerns the ease of students using the learning model, namely the Daring Model, which is superior to the Hybrid Model. Strategy Health and safety conditions regarding the security obtained by students both in terms of the threat of COVID-19 transmission data as well as COVID-19 mitigation and control services around the campus environment during the pandemic as well as the availability of reliable human resources (Agustina & Sukwika, 2021). Ease of internet access is a determining factor in both learning models. For students who have a preference for the Daring Model, this strategy scores superior to the Hybrid Model. The hybrid model is superior in terms of the learning experience strategy, costs, and availability of facilities.

Studies conducted by Lim & Morris (2009) and Johnson (2019) show that daring learning provides advantages in ease of internet access because of its flexibility, which allows access from anywhere with an internet connection. Daring learning can also provide a safe and controlled learning environment, which supports students' health and safety conditions, especially in the context of a pandemic like the one we are currently experiencing. The demand for daring learning models supported by easy internet access has encouraged increased development and availability of various teaching materials, learning media, learning models, applications, and creative and innovative digital platforms to support the learning process (Thohir et al., 2021). In contrast to Surbakti and Pamungkas (2021), they found obstacles during the daring learning process, such as frequent miscommunication and misunderstanding, limited mastery of internet technology for both lecturers and students, lack of interaction between lecturers and students, limited internet signal, and changes in students cognitively and emotionally. , feelings, and behaviour during daring learning.

In the Hybrid model, the relationship between the Learning Experience as well as the Cost and Availability of Facilities is confirmed in the results of research written by Picciano (2009) and Smith et al. (2020) that the hybrid model, which combines daring learning with face-to-face learning, can provide a more varied and interesting learning experience for students. Apart from that, the hybrid model can also reduce learning costs and improve the availability of necessary learning facilities, such as classrooms and learning equipment. Harlanu et al. (2023) stated that the factors that have a positive influence on student learning outcomes through the hybrid learning model are that the hybrid learning model can maintain the chemistry of the campus environment, learning motivation, and student learning outcomes.

5. CONCLUSION

The conclusion of this research confirms that various factors influence preferences for daring and hybrid learning models in the Faculty of Engineering. The daring learning model is considered superior in terms of ease of internet access and health and safety conditions. In contrast, the hybrid learning model is preferred in terms of learning experience strategy, cost, and facility availability. Policy recommendations that can be proposed based on the findings of this research are: (1) Increasing Learning Effectiveness: The Faculty of Engineering can further strengthen infrastructure and technological support to increase the effectiveness of daring learning. It could include investment in learning software, training for staff and students in the use of technology, and improving internet accessibility and speed on campus. (2) Creating a Supportive Environment: Faculty need to create a supportive learning environment for both daring and hybrid learning. It includes ensuring there is adequate technical support, providing easily accessible daring resources, and promoting health and safety awareness in daring learning. (3) Fulfilling Student Preferences Holistically: The Faculty of Engineering needs to pay attention to student preferences holistically in developing learning strategies. It involves a deep understanding of student needs and preferences and providing a variety of learning options that can meet a variety of needs and learning styles.

ACKNOWLEDGEMENTS

We want to thank the management of Sahid University Jakarta and the facilitators who have helped implement PKM activities. Thank you also to LPPM Sahid University for all their support.

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