Ranking of Game Mechanics for Gamification in Mobile Payment Using AHP-TOPSIS Uses and Gratification Perspective

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Abstract*—Game mechanics are the most visible part of gamification that designed for interaction with the game state to produce an engaging experience. In a product with gamification, choosing the game mechanics has become the primary focus because it must be appropriate with the product goal. This study aims to investigate the most suitable game mechanics for gamification in mobile payment. AHP-TOPSIS methods used for the process of ranking and selecting the best game mechanics. The criteria and sub-criteria have been determined based on the Uses and Gratification perspective. Hedonic, utilitarian, and social gratification identified as criteria. While enjoyment, passing the time, ease of use, self-presentation, information quality, economic rewards, social value, and social interaction identified as sub-criteria. The questionnaire consists of pairwise comparison, and compatibility assessment of criteria and sub-criteria was conduct and distribute to collecting data from respondents. The results from the processes of AHP-TOPSIS identified feedback as the most suitable game mechanics for gamification in mobile payment. The consistency ratio from consistency checking is $C_R = 0.013514$, and this is acceptable as consistent with the value of $C_R < 0.1$.

Keywords*—gamification, game mechanics, AHP, TOPSIS, uses and gratification.

I. INTRODUCTION

Mobile payment services have recently become a trend in Indonesia payment[1] with very rapid growth. Mobile payment refers to all payments over any mobile communication device for paying a transaction like bills authorized, items in a store, or transferring money using smartphone apps. Currently, in Indonesia, there are several mobile payments brands come up like GO-PAY, OVO, DANA, Linkaja, and DOKU. The mobile payment environment is highest fiercely competitive marketplaces, so it's important to know the marketing strategies which can attract customers, increase the user base, and improve user loyalty with their mobile payment product. Many promotional activities already used as an effort to increase the active users of Mobile Payment, like improving the service quality and implementing gamification[2]. Gamification defined as applying game elements in non-game context[3] to engage and make users enjoy when using a product[4]. The use of gamification in marketing strategies must be appropriate with the product goal. The gamification elements refer to game dynamics, mechanics, and components[5], and the most visible part of the gamification elements are game mechanics, that something designed for interaction with the game state to produce an engaging experience.

Based on the results of our systematic literature review, gamification elements in mobile payment limited in the forms of game mechanics like rewards and levels, even though many game mechanics can be explored and implemented for gamification in mobile payment[6]. Based on the before studies that discussed the most suitable game mechanics for gamification is still limited. The research trends on gamification have focused on general gamification in business or gamification in education, and no research identified directly discusses the method to identify the most suitable game mechanics for gamification in mobile payment. This study will explore the alternative of game mechanics that most suitable to be implemented for gamification in mobile payment with U&G perspective using AHP-TOPSIS method. U&G perspective was used to obtain the gratification from gamification in mobile payment that can fulfill the user needs, then the result from the U&G perspective used as criteria and sub-criteria in AHP-TOPSIS method. This study conducted because there is a lack in identifying the most suitable game mechanics for gamification in mobile payment.

In the next section, this paper will explain the theoretical background and related work based on the literature with an emphasis on gamification, U&G theory, and AHP-TOPSIS. In Section 3, this paper will describe research methods, including collecting data using online questionnaires, preprocessing, and analysis. In Section 4, this paper will present the results and discussion. Then Section 5 discuss the conclusion, implication, limitations, and future research.

II. LITERATURE REVIEW

A. Gamification and Game mechanics

Gamification defined as the use of game design techniques that implemented game elements in non-game [7] to bring up the same exciting experience as a game, increase engagement and enhance positive user experience that increased user loyalty[8].

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TABLE I. GAME MECHANICS

Game Mechanics	Initial	Description
Challenge	A1	Challenges that must be solved to achieve the goal.
Competition	A2	Reach the goal by competing with other.
Feedback	A3	Feedback given to players to achieve goals. Like giving notifications, or congratulations.
Performance graphs	A4	Graph the performance of the player in achieving the goal.
Rewards	A5	prizes given to players who successfully reach the goal.
Time pressure	A6	Limited time that can be used by players to reach the destination.
Levels	A7	Levels indicates the long-term or sustained achievement of the game player.
Meaningful stories	A8	The storyline of the game that can direct the player to reach the goal.

In business practice using gamification for solving problem or marketing strategy has become a popular trend, the concept of gamification using game elements must corresponding both the requirements and product goals in designing products have potential to encourage user intention to use[9].

The game elements can be anything from game mechanics, dynamics, and aesthetics [5]. Game mechanics refers to various actions, behaviors, and control mechanisms afforded to dictate the outcome of interactions between the players and the system. The direct and concrete forms, such as points, rewards, and avatar, fall under the category of game mechanics[6], while game dynamics are the game design principles that abstract form that creates an aesthetic experience. The aesthetics are the goal of gameplay like sensation, fantasy, narrative, and expression [10]. To drive long-term behavior change, needed a specific approach to choose game elements will be used.

Both of quantitative and qualitative research already done before identifying the benefit of implemented gamification in marketing strategy such as loyalty program, gamification in the loyalty program was defined the valuable benefits in users perception and responses[5], like playful experience, enjoyment, and influence on user loyalty[11] to using the product. However, we identified previous research has that investigated the game mechanics for gamification in mobile payments still limited. This study investigates the most suitable game mechanics, such as Table 1.

B. Uses and Gratification

Uses and gratification theory (U&G) is a mass communication theory[3] used to understand and investigate how people chose specific media to satisfy their needs. This theory based on the socio-psychological approach, which is an empirical investigation using the scientific method of how people's preferences influenced by their thoughts, feelings, and behavior[12]. Different from other approaches, U&G examines how people purposely chose media based on obtained gratification[3]. This perspective provides the consumer with the power to distinguish what media they consume.

Several previous research have been applied in various types of media and identifying the gratification obtained will be different, and this influenced by the variety of media used in the research context. Previous research from[13] explored the gratification factors for which people contribute and retrieve some media like online gaming, and identified gratification factors include entertainment, relaxation, pass time, social interaction, and Achievement. Other research about gratification and mobile gaming identified different gratification factors like enjoyment, mood management, sensation seeking, and economic rewards drives user behavior change. Based on many existing studies with multiple media using U&G perspectives, this paper defines the criteria and sub-criteria based on gratification factors obtained from gamification in mobile payments to choose the most compatible game mechanics.

C. Analytical Hierarchy Process

AHP (Analytical Hierarchy Process) a method for solved complex problems in decision making developed by Thomas L Saaty[14]. The AHP method explains multi-factor problems into hierarchical forms to choose alternatives based on existing criteria and sub-criteria. This method can be applied to determine the weight of each existing criteria and sub-criteria more effectively by combining qualitative and quantitative analysis[15]. AHP method has three principles process in logically solve a problem: (1) construct the hierarchy structure model that arranged the objectives, criteria, and alternatives in a hierarchical structure. (2) Establishing priorities by a comparative judgment of criteria and alternatives using Saaty[14] scale pairwise comparisons with the value of 1 through 9. And (3) logically consistency for checking the compatibility of alternative evaluation steps by reducing bias in decision making[16].

The standard steps of AHP method[17] described as follows:

Step 1: Developed the pairwise comparison matrix.

The number of comparisons needed to form pairwise comparison matrix is:

$$K = |k_{ij}|_{n\times n} \tag{1}$$

In which. k_{ij} Denotes the importance of the criteria i is relative to the criteria j.

Step 2: Compute the eigenvectors and the eigenvalue of matrix.

$$w_i = \frac{\sum_{j=1}^{n} k_{ij}}{\sum_{p=1}^{n}\sum_{j=1}^{n} k_{pj}}; i = 1,2,..n, then, W = [w_1, w_2, .., w_n]^T \tag{2}$$

$$the\ eigenvalue: \lambda_{max} = \sum_{i=1}^{n} \frac{(KW)_i}{nw_i}$$

Step 3: Check consistency index

$$C_I = \frac{\lambda_{max} - n}{n-|1} \quad n = \text{Total of elements} \tag{3}$$

Step 4: Check consistency ratio

$$C_R = \frac{C_I}{R_I} \tag{4}$$

C_R = consistency ratio
C_I = consistency index
R_I = Index random consistency

The consistency of judgement matrix is acceptable if $C_R < 0.1$. If $C_R > 0.1$, it is considered inconsistent, the matrix judgements should be review and improved.

Step 5: Derive Criterion Weights

The final weight of each index compute by using the formula (2), the value of C_R which is known from the results of measuring the consistency ratio, and the value of consistency to the weight of acceptable criteria.

D. *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS)

TOPSIS is a method for solved multi-criteria decision-making based on the simple concept of selective alternatives [18]. TOPSIS was designed to choose the best solution from a series of alternatives with specific attributes based on the shortest distance from the positive ideal solution and the longest distance from the negative ideal solution [19]. Ideal solution refers to the best solution of related factors that must achieve the best value in an alternative candidate object. While the negative ideal solution is the worst solution with the corresponding factor value not higher than the worst value in the alternative candidate objects. [20] Because of several reasons: (1) Its suitability for problems with a large number of attributes and alternatives; (2) input subjective requirements limited; (3 its logical and programmable behavior; and (4 comparative consistency in determining alternative rankings. TOPSIS also had disadvantages like the weight of the attribute must be given before using this method.

The standard steps of TOPSIS method[21] summarized in several steps:

Step 1: Construction the normalized decision matrix

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (5)$$

Where r_{ij} and x_{ij} are the elements of normalized and original decision matrix respectively.

Step 2: Calculated the weighted normalized decision matrix

$$v_{ij} = r_{ij} * w_j \; \forall i, j \quad (6)$$

The weighted normalized value v_{ij} computed by multiplying each row (r_{ij}) with assigned attribute weight w_j.

Step 3: Ideal (A^+)and negative-ideal (A^-) solution

$$A^+ = \{(\max_j v_{ij} | i \in I), (\min_j v_{ij} | i \in I'); \forall j\} = \{v_1^+, v_2^+, \dots\}$$
$$A^- = \{(\min_j v_{ij} | i \in I), (\max_j v_{ij} | i \in I'); \forall j\} = \{v_1^-, v_2^-, \dots\} \quad (7)$$

Where I and I' are associated with benefit and cost attributes respectively.

Step 4: Separation measure calculation

$$S_i^+ = \sqrt{\sum_{i=1}^{n} (v_{ij} - v_i^+)^2} \quad \forall j$$
$$S_i^- = \sqrt{\sum_{i=1}^{n} (v_{ij} - v_i^-)^2} \quad \forall j \quad (8)$$

Step 5: Calculation of relative closeness to ideal solutions

$$C_j^+ = \frac{S_i^+}{S_i^+ + S_j^-} \quad (9)$$

Step 6: Ranking of preference order based on C_j^+ values

III. Research Methods

Given the diversity of game mechanics for gamification, This paper used a qualitative and quantitative method followed[5,6] for seeking the depth understanding from direct experiences of user and the statistical analysis for AHP-TOPSIS process.

A. *Setting*

This paper developed to identify the most suitable Game mechanics for gamification in mobile payment, the literature review conducted to discovery insight from previous research that related to U&G theory and gamification in mobile payment. Semi-structured interviews with open-ended questions technique used as an interview technique to investigation and exploration the gratification obtained from gamification in mobile payment[24]. The gratification categories identified as criteria for the quantitative approach. The quantitative approach used AHP-TOPSIS technique. The calculation using the AHP-TOPSIS contains two stages, first get the weight of criteria from the AHP method then gets ranked the best of alternative using the TOPSIS method[16].

B. *Participants and interviews*

This paper used purposive and snowball sampling for qualitative approach, then face-to-face interviews conducted with ten participants, for one week. The interview instruments consist of ten questions that generated based on the literature and several open-ended questions based on respondent answered. The average duration of the interview process was approximately 30-45 minutes and was recorded using mobile audio-recording application.

For the quantitative approach, the online questionnaire was generated using AHP-TOPSIS technique. The questionnaire consists of three sections. Section one includes the respondent's profile, i.e., educational background, experience using mobile-payment, etc. Section two containing the judgment of pairwise comparisons for criteria and sub-criteria [14]. Section three containing compatibility assessment of alternative with criteria, and sub-criteria. Four persons conducted a readability test before the questionnaire was distributed to respondents. 83 responses were collected, but 11 respondents had duplicate data, 7 respondents never used mobile payment, and 35 respondents did not complete the survey so that only 30 respondents' data could be processed.

C. *Analysis*

All interviews data from a qualitative approach using semi-structured interviews transcribed using verbatim translation technique[25]. While the data from the questionnaire analyzed with AHP-TOPSIS technique to getting the weight of criteria and sub-criteria and ranked the best alternative of game mechanics. The weight of the criteria and sub-criteria from AHP processed given as input in TOPSIS steps. The preference Ranked of alternative was identified following the steps from the TOPSIS method[21].

TABLE II. Criteria and Sub-criteria

Criteria	Initial	Sub-criteria	Initial
Hedonic	H	Enjoyment	H1
		Passing time	H2
Utilitarian	U	Ease of use	U1
		Self-presentation	U2
		Information quality	U3
		Economic rewards	U4
Social	S	Social value	S1
		Social interaction	S2

IV. Results and Discussion

In this paper, AHP-TOPSIS combined to identify the best game mechanics for gamification in mobile payment. Different alternatives have determined for each stream, as shown in Fig 1. The priority weights of all criteria and sub-criteria calculated using AHP and TOPSIS was used to obtain the most compatible alternative with the best ideal solution.

A. Get the weight using AHP method

1) Hierarchy structure model

The first step in the calculation using AHP is by arranging a hierarchy consisting of the goal, criteria, sub-criteria and alternatives. The model of hierarchy structure in this paper shown in Fig 1. The model contains three criteria, eight sub-criteria, and eight alternatives. Table II showed the criteria and sub-criteria defined based on the results of a qualitative approach using in-depth interviews and validated with the expert. While the alternatives shown in Table I determined based on literature review. The results from the questionnaire that was prepared based on the hierarchy have been processed using the AHP method and represented as a comparison matrix.

2) Pairwise Comparison Matrix

This step establish matrix of pairwise comparisons between criteria and sub-criteria using (1). The value of pairwise comparisons obtained from the questionnaire which was distributed. The diagonal value from the comparison matrix of an element between the element itself and other elements filled in with the weight from the respondent and filled with the opposite value when the condition is reliable then summed the number of each column. Table III showed the results.

3) Drive All Criteria Weights

The next step calculated each priority criterion, the calculation process used the eigenvalue (2) to attained the weight of each criterion, and enjoyment had a higher weight. Table IV showed the results from the Pairwise comparison of criteria and sub-criteria.

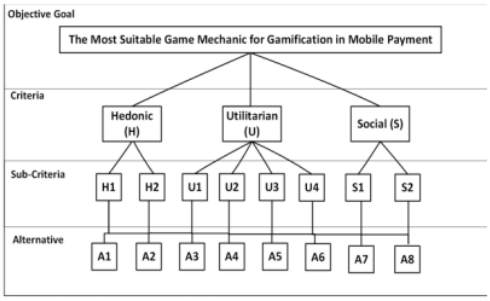

Fig 1 Hierarchy structure for the AHP

TABLE III. Criteria Pairwise Comparison Matrix

Criteria	Hedonic	Utilitarian	Social
Hedonic	1	0.66469	1.837448
Utilitarian	1.50446	1	2.568339
Social	0.544233	0.389357	1

TABLE IV. Weight of Criteria and Sub-criteria

Criteria	Weight of criterion	Sub-criteria	Weight
H	0.330	H1	0.682
		H2	0.318
U	0.485	U1	0.257
		U2	0.143
		U3	0.256
		U4	0.343
S	0.184	S1	0.66
		S2	0.34

TABLE V. The Overall Weight

Criteria	Sub-criteria	Weight	Rank
H	H1	0.2255	1
	H2	0.1050	6
U	U1	0.1249	3
	U2	0.0695	7
	U3	0.1243	4
	U4	0.1664	2
S	S1	0.1216	5
	S2	0.0627	8

4) Check Consistency

After the weight for each criterion is obtained, the value of C_R compared with the saaty [14] consistency value. The calculated consistency value must equal to or less than 10% (consistent), if more than 10 %(inconsistent) then there is an error in the assessment. Consequently, the λ_{max} must be calculated by multiplying the weight of each criterion by pairwise comparisons matrix using (3) for C_I and (4) for C_R. The results from calculated the score of C_I and C_R are =0.013514.

5) The Overall Weight of Criteria and sub-criteria

The calculation was combining the weights of the criterion and sub-criteria. This multiplication will be performed if the main criteria have sub-criteria. Table V showed the total weight of the overall criteria.

B. Alternative TOPSIS

1) Weighted Normalized Decision Matrix

The weighted normalized decision matrix were calculated using (5), which represents the results from compatibility assessment of alternative with criteria and sub-criteria by multiplying the decision matrix to the related weight using (6). Table VI showed the results.

TABLE VI. Matrix Weighted Normalization

Elements	H1	H2	U1	U2	U3	U4	S1	S2
Challenge	0.086	0.037	0.047	0.023	0.043	0.062	0.041	0.020
Competition	0.083	0.036	0.047	0.023	0.044	0.062	0.040	0.021
Feedback	0.083	0.035	0.046	0.023	0.046	0.065	0.041	0.020
Performance graphs	0.083	0.038	0.046	0.024	0.045	0.060	0.041	0.021
Rewards	0.084	0.037	0.043	0.024	0.042	0.066	0.041	0.021
Time pressure	0.078	0.039	0.045	0.025	0.046	0.063	0.042	0.019
Levels	0.086	0.038	0.042	0.023	0.043	0.061	0.044	0.021
Meaningful stories	0.086	0.038	0.043	0.023	0.045	0.059	0.042	0.023

2) Determination positive ideal solution (A^+) and negative-ideal solution (A^-)

Table VII showed the results of calculation the positive(A^+), and negative (A^-) ideal solution using (7).

3) Calculation of the Separation Measures

The next process in the AHP-TOPSIS method calculated positive S_i^+ and negative S_i^- separation measures for each alternative using the results of positive (A^+) and negative (A^-) ideal solution (8). The obtained results from this calculation showed in Table VIII.

4) Calculation of the relative closeness to the ideal solution

The best solution from a set of alternatives with specific attributes determined not only based on the shortest distance from(A^+), but also has the longest distance from(A^-). To identify the relative closeness to ideal solution the value from separation measures must be calculated using (9). The results shown in Table IX.

The results obtained from the calculation the value of ideal solutions that have relative proximity to the ideal alternative solutions, produce a ranking order for each alternative. The highest score will be the best alternative, which is the most suitable with the objective as game mechanics for gamification in mobile payments.

TABLE VII. IDEAL (A^+) AND NEGATIVE-IDEAL (A^-) SOLUTION

A^+	A^-
0.0863	0.0781
0.0347	0.0386
0.0469	0.0419
0.0248	0.0225
0.0460	0.0418
0.0663	0.0586
0.0442	0.0399
0.0191	0.0227

TABLE VIII. SEPARATION MEASURES AHP-TOPSIS

S_i^+	S_i^-
0.01057021	0.00702392
0.00856743	0.00768065
0.01119114	0.00486514
0.00724126	0.00912677
0.01004788	0.00771217
0.00793188	0.01019873
0.00960199	0.0092377
0.00841288	0.01058754

TABLE IX. RESULTS

Alternative	Calculation Ideal Solution	Rank
Challenge	0.60078042	2
Competition	0.52728889	4
Feedback	. 0.69699456	1
Performance graphs	0.44240259	7
Rewards	0.56575756	3
Time pressure	0.43748542	8
Levels	0.5096681	5
Meaningful stories	0.44277325	6

AHP-TOPSIS is combined to identify the best game mechanics for gamification in mobile payment. Followed several steps from AHP-TOPSIS method the final rank of all game mechanics alternatives were determined. The result identified the most priority sub-criteria with the highest weight values are enjoyment and rewards, that present in Table IV, Consistent with the findings [8], enjoyment and rewards have a significant impact on engaging users using gamification, users feel gratified when consumption interesting content. Then based on analysis of compatibility assessment, the most suitable game mechanics for gamification in mobile payment with U&G perspective is feedback, with the value of calculation ideal solution C_j^+= 0.69699456, that present in Table IX. Consistent with the findings of [26] feedback refers to onscreen notifications, text messages, or emails that can enhance users to continue or adjust their activities. Let the user know what users have achieved, what users should do, or the rewards information they can get, it can make user enjoying the gamification, and encourage continuous usage intention that will impact to user loyalty[9].

V. CONCLUSION

This paper used AHP-TOPSIS method to identify the most suitable game mechanics for gamification in mobile payment. This method purposed more accurate results by overcome human weakness in decision making. AHP used to identify the priority of criteria and weight for each criterion and sub-criteria. In the next steps, TOPSIS used to rank alternatives based on the shortest distance from (A^+) and the longest distance from (A^-). Feedback becomes the most suitable game mechanics that obtain the first place in the ranking of alternative game mechanics, then followed by challenge, rewards, competition, levels, meaningful stories, performance graphs, and time pressure. This model is suitable for mobile payment that wants implementation gamification to chosen game mechanics based on the U&G perspective as criteria. The results can be acceptable because the consistency ratio obtained smaller than 0.1 or less than 10% that's mean it is consistent.

From a theoretical viewpoint, the results of this paper, contributes to information system (IS) literature in several things. First, this study found the most priority factors in gamification from U&G perspective is enjoyment, and rewards, where the previous research in gamification have not to explore this. Second, this study produced knowledge about how to identify the most suitable game mechanics for gamification in mobile payment with U&G perspective using AHP-TOPSIS method, that has not been explored in prior IS

literature. Moreover, from a managerial viewpoint, this study provides new insight to practitioners in mobile payment providers who are planning or currently implementing gamification. In terms of game elements, practitioners must pay attention to a game mechanic that will be applied, this study identified the most suitable game mechanics for gamification is feedback with two priority factors are enjoyment and rewards. The practitioners must understand feedback, enjoyment, and rewards play as a primary motivation for user behavior while using the product, and this information would allow companies to improve effectiveness in implementing the gamification. Possible future research can be done by using criteria from other perspective and identified not just the most suitable game mechanics but can identify the most suitable game components.

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REFERENCES

[1] N. Agusta, Joshua Widjaja, "Mobile Payments in Indonesia: Race to Big Data Domination," Forbes Indones. March 2018 Print Ed., 2018.

[2] S. Hillman, C. Neustaedter, E. Oduor, and C. Pang, "User Challenges and Successes with Mobile Payment Services in North America," in Proceedings of the 16th International Conference on Human-computer Interaction with Mobile Devices & Services, 2014, pp. 253–262.

[3] E. Katz, J. G. Blumler, and M. Gurevitch, "The uses of mass communication: Current perspectives on gratifications research," Sociol. J. Br. Sociol. Assoc., pp. 19–32, 1974.

[4] E. Kyewski and N. C. Krämer, "To gamify or not to gamify? An experimental field study of the influence of badges on motivation, activity, and performance in an online learning course," Comput. Educ., vol. 118, pp. 25–37, 2018.

[5] C. F. Hofacker, K. de Ruyter, N. H. Lurie, P. Manchanda, and J. Donaldson, "Gamification and Mobile Marketing Effectiveness," J. Interact. Mark., vol. 34, pp. 25–36, 2016.

[6] J. Kumar, M. Herger, and R. Dam, "Introducing Game Mechanics for Gamification," Interaction Design Foundation, 2017. [Online]. Available: https://www.interaction-design.org/literature/article/introducing-game-mechanics-for-gamification.

[7] S. Deterding, M. Sicart, L. Nacke, K. O'Hara, and D. Dixon, "Gamification. Using Game-design Elements in Non-gaming Contexts," in CHI '11 Extended Abstracts on Human Factors in Computing Systems, 2011, pp. 2425–2428.

[8] J. Hwang and L. Choi, "Having fun while receiving rewards?: Exploration of gamification in loyalty programs for consumer loyalty," J. Bus. Res., no. January, pp. 1–12, 2019.

[9] C.-L. Hsu and M.-C. Chen, "How does gamification improve user experience? An empirical investigation on the antecedences and consequences of user experience and its mediating role," Technol. Forecast. Soc. Change, vol. 132, pp. 118–129, 2018.

[10] Janaki Mythily Kumar and Mario Herger, "Gamification at Work: Designing Engaging Business Software," Interaction Design Foundation, 2017. [Online]. Available: https://www.interaction-design.org/literature/book/gamification-at-work-designing-engaging-business-software/chapter-6-58-mechanics.

[11] A. C. T. Klock, A. N. Ogawa, I. Gasparini, and M. S. Pimenta, "Does gamification matter?: A systematic mapping about the evaluation of gamification in educational environments," in Proceedings of the ACM Symposium on Applied Computing, 2018, pp. 2006–2012.

[12] S. Salehi-Esfahani and J. Kang, "Why do you use Yelp? Analysis of factors influencing customers' website adoption and dining behavior," Int. J. Hosp. Manag., vol. 78, pp. 179–188, 2019.

[13] C. Chen and L. Leung, "Are you addicted to Candy Crush Saga? An exploratory study linking psychological factors to mobile social game addiction," Telemat. Informatics, vol. 33, no. 4, pp. 1155–1166, 2016.

[14] R. W. Saaty, "The analytic hierarchy process—what it is and how it is used," Math. Model., vol. 9, no. 3, pp. 161–176, 1987.

[15] Z. Yi-chuan, Q. Li-fang, C. Wei, and P. Xing-zhi, "Application of AHP-TOPSIS to the Evaluation and Classification of Provincial Landscape Construction Level of China," in 2009 International Conference on Future Computer and Communication, 2009, pp. 399–402.

[16] S. Supraja and P. Kousalya, "A comparative study by AHP and TOPSIS for the selection of all round excellence award," in 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), 2016, pp. 314–319.

[17] G. Tian, H. Zhang, M. Zhou, and Z. Li, "AHP, Gray Correlation, and TOPSIS Combined Approach to Green Performance Evaluation of Design Alternatives," IEEE Trans. Syst. Man, Cybern. Syst., vol. 48, no. 7, pp. 1093–1105, Jul. 2018.

[18] C.-L. Hwang, Y.-J. Lai, and T.-Y. Liu, "A new approach for multiple objective decision making," Comput. Oper. Res., vol. 20, no. 8, pp. 889–899, 1993.

[19] Y. Yu and Y. Bai, "Application of Interval-Valued AHP and Fuzzy TOPSIS in the Quality Classification of the Heaters," in 2010 Second International Conference on Computational Intelligence, Modelling and Simulation, 2010, pp. 273–278.

[20] V. Yadav, S. Karmakar, P. P. Kalbar, and A. K. Dikshit, "PyTOPS: A Python based tool for TOPSIS," SoftwareX, vol. 9, pp. 217–222, 2019.

[21] J. Papathanasiou, N. Ploskas, Technique of Order Preference Similarity to the Ideal Solution (TOPSIS), Multiple C. Springer International Publishing AG, part of Springer Nature 2018, 2018.

[22] D. L. Driscoll, P. Salib, and D. J. Rupert, "Merging Qualitative and Quantitative Data in Mixed Methods Research : How To and Why Not," pp. 18–28, 2007.

[23] W. Peng, S. Kanthawala, S. Yuan, and S. A. Hussain, "A qualitative study of user perceptions of mobile health apps," BMC Public Health, vol. 16, no. 1, pp. 1–11, 2016.

[24] J. Gralewski, "Teachers' beliefs about creative students' characteristics: A qualitative study," Think. Ski. Creat., vol. 31, pp. 138–155, 2019.

[25] Y. Haji and J. Tiago, "Perceived critical success factors of electronic health record system implementation in a dental clinic context : An organisational management perspective," Int. J. Med. Inform., vol. 107, no. February 2016, pp. 88–100, 2017.

[26] J. Friedrich, M. Becker, F. Kramer, M. Wirth, and M. Schneider, "Incentive design and gamification for knowledge management," *J. Bus. Res.*, 2019.

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