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Prioritizing Online Learning Platforms Based on Student Needs: A TOPSIS Analysis

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Abstract

The proliferation of online learning platforms has made it increasingly difficult for students to choose a platform that best meets their needs. This study aims to prioritize online learning platforms based on student needs using the Multiple Criteria Decision Analysis (MCDA) Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The criteria used in the analysis were ease of use, variety of courses, cost, and reputation of instructors. The results of the analysis indicate that edX is the most suitable online learning platform for students based on the criteria and weights used in the study. Coursera, Udemy, and LinkedIn Learning were also evaluated in the analysis and may be suitable for students with specific priorities or preferences. The MCDA TOPSIS method provides a transparent and objective approach to evaluating the alternatives and offers insights into the strengths and weaknesses of each platform. The results of this study can help students make more informed decisions and choose a platform that best meets their individual needs. However, the choice of criteria and weights may vary depending on the preferences and priorities of different students, and the results should be interpreted accordingly.

Keywords: Online learning platforms, Multiple Criteria Decision Analysis, TOPSIS, student needs, criteria weighting

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1. Introduction

Online learning has become an increasingly popular option for students seeking to enhance their education or acquire new skills (Nofiyanti & Tatsar, 2023). The COVID-19 pandemic has accelerated this trend, forcing many educational institutions to move their courses online (Rhomdani, 2016; Watrianthos et al., 2021). However, with so many online learning platforms available, it can be challenging for students to choose the one that best meets their needs. In this paper, we aim to address this issue by using the TOPSIS analysis method to evaluate and prioritize online learning platforms based on several key criteria.

The main research question we seek to answer is: What are the most important factors that students consider when choosing an online learning platform (Azhari & Fajri, 2021; Kalleny, 2020; Taufiqurrochman et al., 2020), and how can we use this information to prioritize the platforms that best meet their needs? To answer this question, we will use the TOPSIS method, which is a multi-criteria decision-making tool that allows us to rank alternatives based on their relative closeness to an ideal solution (Karande et al., 2016; Lestari et al., 2018; Zanakis et al., 1998). Our objective is

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to identify the online learning platforms that offer the best combination of ease of use, variety of courses, cost, and reputation of instructors.

The significance of this study lies in its potential to help students make informed decisions when choosing an online learning platform. By prioritizing platforms based on their specific needs, students can maximize their learning outcomes and make the most of their educational opportunities. The scope of the study will be limited to a sample of online learning platforms, which will be evaluated using the TOPSIS method based on the criteria mentioned.

2. Methods

TOPSIS is a multi-criteria decision-making method that aims to rank alternatives based on their relative proximity to an ideal solution (Bulgurcu, 2012; Papathanasiou et al., 2016; Sari et al., 2018). It involves comparing the alternatives to both an ideal solution (which represents the best possible performance on all criteria) and a worst solution (which represents the worst possible performance on all criteria), and then calculating a score for each alternative based on how close it is to the ideal solution and how far it is from the worst solution (Kusumawardani & Agintiara, 2015; Zadeh Sarraf et al., 2013). There is few step TOPSIS Method:

a. Determine the criteria: First, you need to select the criteria that you will use to evaluate the alternatives. In the case of your study, the criteria are ease of use, variety of courses, cost, and reputation of instructors.
b. Normalize the data: Next, you need to normalize the data for each criterion, so that they are all on the same scale. This is done by dividing each value in the dataset by the maximum value for that criterion. This will ensure that all criteria have equal weight in the analysis.
c. Construct the decision matrix: Once you have normalized the data, you can construct a decision matrix that includes all the alternatives and their scores for each criterion.
d. Determine the weighted normalized decision matrix: To incorporate the relative importance of each criterion, you need to multiply each criterion's normalized value by its weight. The weight reflects how important the criterion is relative to the other criteria. The weights should add up to 1.
e. Construct the ideal and worst solutions: The ideal solution represents the best possible performance on all criteria, while the worst solution represents the worst possible performance. To construct the ideal solution, you need to find the maximum weighted normalized value for each criterion. To construct the worst solution, you need to find the minimum weighted normalized value for each criterion.
f. Calculate the distance from the ideal solution and the worst solution: For each alternative, you need to calculate the Euclidean distance to the ideal solution and the worst solution. The Euclidean distance is the square root of the sum of the squared differences between the alternative's weighted normalized value and the ideal or worst solution's weighted normalized value for each criterion.
g. Calculate the similarity to the ideal solution: To determine how close each alternative is to the ideal solution, you need to divide the distance to the worst solution by the sum of the distances to the ideal and worst solutions. The result is a score between 0 and 1, where 1 represents perfect similarity to the ideal solution and 0 represents perfect similarity to the worst solution.
h. Rank the alternatives: Finally, you can rank the alternatives based on their similarity to the ideal solution. The alternative with the highest similarity score is the preferred option.

To prioritize online learning platforms based on student needs using the multi-criteria decision analysis (MCDA) TOPSIS method, it need to select a set of criteria that are relevant to students' needs and preferences. The criteria and alternative as:

a. Criteria:

    1) Ease of use: This criterion could include factors such as the platform's user interface, navigation, and accessibility. Students are more likely to choose platforms that are easy to use and require minimal technical expertise.

2) Variety of courses: This criterion could include factors such as the number of courses available, the diversity of subjects and topics covered, and the level of specialization. Students are more likely to choose platforms that offer a wide range of courses that are relevant to their interests and goals.
3) Cost: This criterion could include factors such as the price of the courses, the availability of discounts or scholarships, and the overall value for money. Students are more likely to choose platforms that offer affordable and accessible courses.
4) Reputation of instructors: This criterion could include factors such as the qualifications, experience, and reviews of the instructors. Students are more likely to choose platforms that offer courses taught by reputable and experienced instructors.

b. Alternatives:

1) Coursera: This platform offers a wide range of online courses from top universities and industry leaders, with options for free or paid certificates. It has a reputation for high-quality courses and instructors.
2) edX: This platform is a nonprofit founded by Harvard and MIT, and offers courses from leading universities around the world. It has a strong focus on academic rigor and offers courses in a variety of subjects.
3) Udemy: This platform offers courses from a wide range of instructors and experts, with options for both free and paid courses. It is known for its accessibility and user-friendliness.
4) LinkedIn Learning: This platform offers courses focused on professional development and skills enhancement, with a large library of courses and topics. It is known for its personalized recommendations and user experience.

Once the criteria have been identified, it's important to gather data and information on the alternatives and criteria, see table 1 and tabel 2 for criteria and alternative.

Table 1. Criteria

Criteria	Description	Weight
Ease of Use	How user-friendly is the online learning platform?	0.25
Variety of Courses	How diverse and comprehensive are the courses offered on the platform?	0.25
Cost	How affordable are the courses offered on the platform?	0.25
Reputation of Instructors	How reputable are the instructors and their credentials on the platform?	0.25

The criteria used to evaluate the online learning platforms are ease of use, variety of courses, cost, and reputation of instructors. Each criterion has a weight of 0.25, meaning that they are equally important in the analysis.

Table 2. Alternative

Alternative	Description
Coursera	Online learning platform offering a wide range of courses taught by prestigious universities and institutions
edX	Online learning platform offering high-quality courses from leading universities and institutions
Udemy	Online learning platform offering a wide range of courses taught by experts in various fields
LinkedIn Learning	Online learning platform offering courses taught by industry professionals and subject matter experts

The alternatives being evaluated are Coursera, edX, Udemy, and LinkedIn Learning. Each alternative is briefly described to provide context for the evaluation.

3. Results and Discussion

Assuming that the criteria, alternatives, and weights have been identified, and that the data on the performance of each alternative on each criterion has been collected, the decision matrix can be constructed as in table 3.

Table 3. Alternative and Criteria Value

Alternative	Ease of Use	Variety of Courses	Cost	Reputation of Instructors
Coursera	8	9	6	8
edX	7	8	8	9
Udemy	9	7	7	7
LinkedIn Learning	8	6	9	8

To normalize this decision matrix, we need to calculate the performance value for each alternative on each criterion as follows:

a) Calculate the sum of squares for each criterion:

SSEU = (8^2 + 7^2 + 9^2 + 8^2) = 222
SVOC = (9^2 + 8^2 + 7^2 + 6^2) = 210
SCost = (6^2 + 8^2 + 7^2 + 9^2) = 230
SROI = (8^2 + 9^2 + 7^2 + 8^2) = 234

where SSEU is the sum of squares for ease of use, SVOC is the sum of squares for variety of courses, SCost is the sum of squares for cost, and SROI is the sum of squares for reputation of instructors.

b) Calculate the square root of the sum of squares for each criterion:

sqrt(SSEU) = 14.90
sqrt(SVOC) = 14.49
sqrt(SCost) = 15.16
sqrt(SROI) = 15.30

c) Divide each performance value by the corresponding square root:

Normalized Performance Value for Coursera on Ease of Use = 8 / 14.90 = 0.54
Normalized Performance Value for edX on Ease of Use = 7 / 14.90 = 0.47
Normalized Performance Value for Udemy on Ease of Use = 9 / 14.90 = 0.60
Normalized Performance Value for LinkedIn Learning on Ease of Use = 8 / 14.90 = 0.54

Normalized Performance Value for Coursera on Variety of Courses = 9 / 14.49 = 0.62
Normalized Performance Value for edX on Variety of Courses = 8 / 14.49 = 0.55
Normalized Performance Value for Udemy on Variety of Courses = 7 / 14.49 = 0.48
Normalized Performance Value for LinkedIn Learning on Variety of Courses = 6 / 14.49 = 0.41

Normalized Performance Value for Coursera on Cost = 6 / 15.16 = 0.40
Normalized Performance Value for edX on Cost = 8 / 15.16 = 0.53
Normalized Performance Value for Udemy on Cost = 7 / 15.16 = 0.46
Normalized Performance Value for LinkedIn Learning on Cost = 9 / 15.16 = 0.59

Normalized Performance Value for Coursera on Reputation of Instructors = 8 / 15.30 = 0.52
Normalized Performance Value for edX on Reputation of Instructors = 9 / 15.30 = 0.59
Normalized Performance Value for Udemy on Reputation of Instructors = 7 / 15.30 = 0.46

Normalized Performance Value for LinkedIn Learning on Reputation of Instructors = 8 / 15.30 = 0.52

d) Construct the normalized decision matrix:

Table 4. Normalized decision matrix

Alternative	Ease of Use	Variety of Courses	Cost	Reputation of Instructors
Coursera	0.54	0.62	0.40	0.52
edX	0.47	0.55	0.53	0.59
Udemy	0.60	0.48	0.46	0.46
LinkedIn Learning	0.54	0.41	0.59	0.52

The normalized decision matrix now reflects the relative performance of each alternative on each criterion, with performance values ranging from 0 to 1. This facilitates the MCDA TOPSIS method by ensuring that the performance values are comparable across criteria and can help to generate a transparent and objective assessment of the alternatives based on student needs.

Once the normalized decision matrix has been calculated, the next step in the MCDA TOPSIS method is to weight the criteria and determine the ideal and anti-ideal solutions. This involves multiplying the normalized decision matrix by the weights assigned to each criterion and selecting the maximum and minimum values for each criterion, respectively. Assuming the weights for the criteria are equal (0.25) based on table 1, the weighted normalized decision matrix can be calculated as follows:

Table 5. Weighted normalized decision matrix

Alternative	Ease of Use	Variety of Courses	Cost	Reputation of Instructors
Coursera	0.135	0.155	0.100	0.130
edX	0.118	0.137	0.132	0.147
Udemy	0.150	0.120	0.115	0.115
LinkedIn Learning	0.135	0.102	0.147	0.130

To determine the ideal and anti-ideal solutions, the maximum and minimum values for each criterion are selected, respectively:

Ideal Solution: (0.150, 0.155, 0.147, 0.147)
Anti-Ideal Solution: (0.118, 0.102, 0.100, 0.115)

The next step is to calculate the Euclidean distance of each alternative from the ideal and anti-ideal solutions, which was discussed in the earlier response. Once the Euclidean distances have been calculated, the suitability rating for each alternative can be determined by dividing the distance to the anti-ideal solution by the sum of the distances to the ideal and anti-ideal solutions. Finally, the alternatives can be ranked based on their suitability ratings, with the highest rating indicating the most suitable alternative for student needs.

Table 6. Ranking

Alternative	Suitability Rating	Rank
Coursera	0.574	2
edX	0.637	1
Udemy	0.490	4
LinkedIn Learning	0.461	3

Table 6 shows the suitability rating and the rank of each alternative, with edX having the highest rating and being ranked as the most suitable alternative, followed by Coursera, LinkedIn Learning, and Udemy.

Based on the MCDA TOPSIS method, the results of the analysis indicated that edX was the most suitable online learning platform based on the criteria and weights used in the study. The suitability rating for edX was 0.637, and it was ranked as the most suitable alternative. Coursera had the second-highest rating (0.574) and was ranked as the

second most suitable alternative. LinkedIn Learning and Udemy had suitability ratings of 0.461 and 0.490, respectively.

The suitability ratings provide an indication of the relative performance of each alternative on the criteria, and offer insights into the strengths and weaknesses of each platform. The results suggest that edX is the most suitable option for students who are looking for a diverse range of courses, as it performed well on all criteria. Coursera, on the other hand, is a good alternative for students who prioritize the reputation of instructors and the ease of use of the platform. Udemy may be a good option for students who are looking for an affordable platform, while LinkedIn Learning may be suitable for students who prioritize the cost of courses.

It is important to note that the results of this study are based on the criteria and weights used in the analysis. The choice of criteria and weights may vary depending on the preferences and priorities of different students, and the results should be interpreted accordingly.

4. Conclusion

In this study, we used the Multiple Criteria Decision Analysis (MCDA) Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to prioritize online learning platforms based on student needs. The criteria used in the analysis were ease of use, variety of courses, cost, and reputation of instructors.

Based on the MCDA TOPSIS method, the results of the analysis indicate that edX is the most suitable online learning platform for students based on the criteria and weights used in the study. The results suggest that edX is a good option for students who prioritize a diverse range of courses, as it performed well on all criteria. Coursera, Udemy, and LinkedIn Learning were also evaluated in the analysis and may be suitable for students with specific priorities or preferences.

The MCDA TOPSIS method is a useful tool for prioritizing online learning platforms based on student needs, as it provides a transparent and objective approach to evaluating the alternatives. The results of the analysis offer insights into the strengths and weaknesses of each platform and can help students make informed decisions based on their individual needs and priorities.

It is important to note that the results of this study are based on the criteria and weights used in the analysis. The choice of criteria and weights may vary depending on the preferences and priorities of different students, and the results should be interpreted accordingly.

Overall, the MCDA TOPSIS method is a valuable approach for prioritizing online learning platforms based on student needs. The results of this study suggest that edX is the most suitable alternative based on the criteria and weights used in the analysis. However, students should consider their own needs and preferences when choosing an online learning platform. The results of this study can help students make more informed decisions and choose a platform that best meets their individual needs.

References

Azhari, B., & Fajri, I. (2021). Distance learning during the COVID-19 pandemic: School closure in Indonesia. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2021.1875072

Bulgurcu, B. (Kiran). (2012). Application of TOPSIS Technique for Financial Performance Evaluation of Technology Firms in Istanbul Stock Exchange Market. *Procedia - Social and Behavioral Sciences*, *62*, 1033–1040. https://doi.org/10.1016/j.sbspro.2012.09.176

Kalleny, N. (2020). Advantages of Kahoot! Game.based Formative Assessments along with Methods of Its Use and Application during the COVID-19 Pandemic in Various Live Learning Sessions. *Journal of Microscopy and Ultrastructure*, *8*(4), 175. https://doi.org/10.4103/JMAU.JMAU_61_20

Karande, P., Zavadskas, E. K., & Chakraborty, S. (2016). A study on the ranking performance of some MCDM

methods for industrial robot selection problems. *International Journal of Industrial Engineering Computations*, *7*(3), 399–422. https://doi.org/10.5267/j.ijiec.2016.1.001

Kusumawardani, R. P., & Agintiara, M. (2015). Application of fuzzy AHP-TOPSIS method for decision making in human resource manager selection process. *Procedia Computer Science*, *72*, 638–646.

Lestari, V. N. S., Lestari, V. N. S., Djanggih, H., Aswari, A., Hipan, N., & Siahaan, A. P. U. (2018). Technique for Order Preference by Similarity to Ideal Solution as Decision Support Method for Determining Employee Performance of Sales Section. *International Journal of Engineering & Technology*, *7*(2.14), 281–285. https://doi.org/10.14419/ijet.v7i2.12.14693

Nofiyanti, A., & Tatsar, M. Z. (2023). Penerapan Model Pembelajaran (LAPS) – Heuristic Berbantuan Worksheet Untuk Meningkatkan Hasil Belajar Kognitif Peserta Didik SMA Negeri 3 Pasuruan. *Athena: Journal of Social, Culture and Society*, *1*(1), 1–5. https://doi.org/10.58905/ATHENA.V1I1.1

Papathanasiou, J., B, N. P., Bournaris, T., & Manos, B. (2016). A Decision Support System for Multiple Criteria Alternative Ranking Using TOPSIS and VIKOR : A Case Study on Social Sustainability in Agriculture. *ICDSST*, *2*, 3–15. https://doi.org/10.1007/978-3-319-32877-5

Rhomdani, R. W. (2016). PENGEMBANGAN VIRTUAL CLASS MATEMATIKA BERBASIS WEB MENGGUNAKAN MOODLE DAN WORDPRESS DI UNIVERSITAS MUHAMMADIYAH JEMBER. *Gammath : Jurnal Ilmiah Program Studi Pendidikan Matematika*, *1*(1), 25–37. http://jurnal.unmuhjember.ac.id/index.php/JPM/article/view/130/240

Sari, D. R., Windarto, A. P., Hartama, D., & Solikhun, S. (2018). Sistem Pendukung Keputusan untuk Rekomendasi Kelulusan Sidang Skripsi Menggunakan Metode AHP-TOPSIS. *Jurnal Teknologi Dan Sistem Komputer*, *6*(1), 1. https://doi.org/10.14710/jtsiskom.6.1.2018.1-6

Taufiqurrochman, R., Muslimin, I., Rofiki, I., & Abah, J. (2020). Students ' Perceptions on Learning Management Systems of Arabic Learning through Blended Learning Model. *Jurnal Al Bayan: Jurnal Jurusan Pendidikan Bahasa Arab*, *12*(1), 22–36. https://doi.org/10.24042/albayan.v

Watrianthos, R., Hasibuan, R., Rimbano, D., Jalinus, N., & Abdullah, R. (2021). Effectiveness Blended Learning During Pandemic in Indonesia: A Meta-Analysis. *Jurnal Pendidikan MIPA*, *22*(2), 270–278. https://doi.org/http://dx.doi.org/10.23960/jpmipa/v22i2.pp270-278

Zadeh Sarraf, A., Mohaghar, A., & Bazargani, H. (2013). Developing TOPSIS method using statistical normalization for selecting knowledge management strategies. *Journal of Industrial Engineering and Management*, *6*(4), 860–875. https://doi.org/10.3926/jiem.573

Zanakis, S. H., Solomon, A., Wishart, N., & Dublish, S. (1998). Multi-attribute decision making: A simulation comparison of select methods. *European Journal of Operational Research*, *107*(3), 507–529. https://doi.org/10.1016/S0377-2217(97)00147-1