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MODELING THE CHOICE OF AN ONLINE COURSE FOR INFORMATION HYGIENE SKILLS USING THE SAATY METHOD

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Abstract. *The development of IT has led to the emergence of digital educational platforms that offer a variety of training courses. Among such courses are information hygiene courses relevant for Ukrainian citizens (the hybrid war causes demand to counteract information influences). The problem becomes the choice of such a course that would best meet the needs of the consumers of the course. The task of choosing a course is unstructured and multicritorial. Therefore, to solve it, it seems reasonable to use the Saaty (hierarchy analysis) method to solve problems of choosing the best alternative among the proposed ones. The authors substantiate the feasibility of using the Saaty method to select an online course and build a model of the educational task for choosing an online course according to the selected criteria. The model is based on five criteria and three alternatives (three various courses, A1–A3). Expert assessment from three experts is presented. The results of the pedagogical experiment are given (data from three student groups). The Saaty method has proven effective in solving choice tasks in the educational process. Therefore, mastering the method is recommended for the teacher, the mentor, or the facilitator.*

Keywords: Saaty method, hierarchy analysis method, information hygiene skills, online course, information hygiene skills formation, education

MODELOWANIE WYBORU KURSU ONLINE DLA UMIEJĘTNOŚCI HIGIENY INFORMACJI METODĄ SAATY

Streszczenie. *Rozwój informatyki doprowadził do powstania cyfrowych platform edukacyjnych, które oferują różnorodne szkolenia. Wśród takich kursów znajdują się kursy z zakresu higieny informacji istotne dla obywateli Ukrainy (wojna hybrydowa powoduje zapotrzebowanie na przeciwdziałanie wpływom informacyjnym). Problemem staje się wybór takiego kursu, który najlepiej odpowiadałby potrzebom konsumentów. Zadanie wyboru kursu jest nieustrukturyzowane i wielowątkowe. Dlatego, aby go rozwiązać, rozsądne wydaje się zastosowanie metody Saaty (analiza hierarchiczna do rozwiązywania problemów wyboru najlepszego rozwiązania spośród proponowanych. Autorzy uzasadniają możliwość wykorzystania metody Saaty do wyboru kursu online i budują model zadania edukacyjnego dla takiego wyboru według wybranych kryteriów. Model opiera się na pięciu kryteriach i trzech alternatywach (trzy różne kursy, A1–A3). Przedstawiono ekspertyzę trzech ekspertów. Podano wyniki eksperymentu pedagogicznego (dane z trzech grup uczniów). Metoda Saaty okazała się skuteczna w rozwiązywaniu zadań związanych z wyborem w procesie edukacyjnym. Dlatego opanowanie metody jest zalecane dla nauczyciela, mentora lub moderatora.*

Słowa kluczowe: metoda Saaty, metoda analizy hierarchicznej, umiejętności higieny informacji, kurs online, kształtowanie umiejętności higieny informacji, edukacja

Introduction

Today, Ukrainian education faces challenging conditions due to military aggression, which restricts offline and online learning opportunities. Educational programs are predominantly studied by students independently or in asynchronous modes. It becomes crucial for instructors to engage various auxiliary resources and tools to ensure successful mastery of different learning topics. On the other hand, hybrid warfare has necessitated the need for youth to adhere to information hygiene, which is now synonymous with media literacy. Information hygiene, as a field of knowledge, explores the impact of informational content on individuals' mental and physical health and is concerned with developing skills to counter the negative influences of such content on individuals and society as a whole. These skills are not considered "classical" in the academic sense and are not developed within the framework of conventional established courses. Their deliberate formation is also not envisioned by the developers of educational programs in educational institutions. They can be indirectly developed through the cultivation of critical thinking (analysis, comparison, analogy, questioning, and evaluation) within other academic courses. However, an analysis of the informational content of social media in the context of hybrid warfare has revealed that Ukrainian youth have insufficiently developed information hygiene skills, which require additional efforts from both students and instructors for their formation. Currently, numerous educational materials of different content, orientation, and format have been developed. These include video clips on YouTube channels, educational portals with graphical materials, grant project websites, free digital platforms, and more [19, 24]. The wide variety of available resources often becomes an obstacle when choosing the most effective resource for developing information hygiene skills and raises the issue of making the best choice among them.

The internet hosts various courses aimed at developing information hygiene skills, many of which are targeted at Ukrainian youth. These courses include:

- Information Hygiene: How to Recognize Lies on Social Media, the Internet, and Television (https://cutt.ly/13qCt1H),
- Information Hygiene during War (https://cutt.ly/a3qCids),
- Information Warfare (https://cutt.ly/O3qX46l),
- News Literacy (https://cutt.ly/8WMkOXh),
- Internet Verification (https://cutt.ly/mWMkSaE),
- Understanding Social Networks (https://cutt.ly/JWMkFsq),
- Very Verified (https://verified.ed-era.com/ua),
- Media Literacy for Educators (http://surl.li/afnug),
- Science of Everyday Thinking (http://surl.li/mgol),
- Critical Thinking in the Ukrainian Context (https://cutt.ly/q3qZ0U4),
- Critical Thinking (https://courses.prometheus.org.ua),
- Media Literacy: How to Avoid Manipulation (https://cutt.ly/i3qZHNE),
- Media Literacy – Practical Skills (https://cutt.ly/i3qZBqm),
- Media Literacy for Citizens (http://surl.li/afnuj),
- Media Literacy Course for Parents (https://cutt.ly/zWMkHjc),
- Introduction to Critical Thinking (https://vumonline.ua/course/critical-thinking/).

A significant number of projects initiated by national organizations, such as "Filter: National Media Literacy Project" (https://filter.mkip.gov.ua/test/), and international organizations, like "Study and Differentiate: Info Media Literacy" (https://www.aup.com.ua/onlayn-prezentaciya-mediagramotnis/), aim to develop the ability of youth to recognize information attacks, understand their objectives, and behave safely in the information space. Researchers [7, 11] have characterized qualitative characteristics of individuals that enable them to adhere to information hygiene.

Among these are:

Understanding. This includes understanding media's increasing influence on society, the structure of media, and the processes and methods of media reality manipulation. It refers to passive comprehension of how the media operates.

Utilization involves actively utilizing equipment, and software applications, and navigating media environments. It encompasses actively using media tools and resources.

Communication. This entails searching for and processing information, creating content, and participating in social media. It encompasses engaging in information retrieval, content creation, and active involvement in social media platforms.

Interaction with others through media. This refers to engaging with others through various media channels and platforms, fostering social connections, and participating in online communities.

Strategy. This involves reflecting on one's media usage and employing media to achieve specific goals. It includes self-reflection on media consumption habits and utilizing media strategically to accomplish objectives.

These qualitative characteristics contribute to individuals' ability to navigate and engage with media in a responsible and informed manner, thereby maintaining information hygiene.

Summarizing the results of the conducted analysis, we can conclude that educators face the problem of choosing a course that would best meet the educational needs of learners and align with their demands for developing information hygiene skills. The problem is further complicated by the fact that online courses, as a rule, have qualitative characteristics, making it difficult to subject them to quantitative analysis when selecting the most effective one. There is a need for the development of a course selection model that would address these issues and be universal, convenient, and reliable. Since the described problem is unstructured and has multi-criteria, it is appropriate to utilize the Analytic Hierarchy Process method (Saaty method) as a solution for choosing the best alternative among the proposed ones. The method of structured organization and analysis for complex decision-making was developed by Thomas Saaty in the 1970s and gained wide popularity in solving problems of optimal choice in conditions of uncertainty. Its foundation lies in the modeling of a hierarchical composition of tasks and the subsequent ranking of alternative solutions through pairwise comparisons. According to the constructed hierarchy, the more important criterion is determined for each criterion pair defined for the goal, and the more important alternative is determined for each alternative pair based on the criterion. The mathematical implementation of the method is thoroughly described in the scientific work [18].

Our problem was related to selecting the most effective course offered on digital educational platforms. There are numerous courses aimed at developing information hygiene skills, making the choice difficult for the average student. Therefore, the teachers faced the challenge of selecting the most effective course.

Research objectives:

1. to demonstrate the possibility of modeling an educational task using the Saaty method, using the example of selecting an online course for developing information hygiene skills,
2. to justify the relevance of using the Saaty method for selecting an online course.

1. Material and methods

The first objective involved modeling the educational task, which required refining the criteria and alternatives. Refining the criteria and alternatives was based on the analysis of scientific publications by researchers regarding the interpretation of the concepts of "media literacy" and "information hygiene", as well as content analysis of websites presenting the results of media literacy grant projects.

The second objective aimed to validate the effectiveness of the Saaty method for selecting an online course by comparing expert opinions on one hand and students' learning outcomes on the other. To achieve this, we used the expertise method (expert assessment of alternative courses using the Saaty method) and conducted a pedagogical experiment.

Saati's Analytic Hierarchy Process is a mathematical decision-making method based on mathematics and psychology. The method allows you to choose the optimal solution option from many offered depending on the defined criteria and alternatives. The method's main idea is to break down a complex solution into simpler components (hierarchy levels) and make comparisons during decision-making at each hierarchy’s level.

The main stages of the Saati hierarchy method:

1. Development of a complex solution based on a hierarchy of criteria, sub-criteria and alternatives.
2. Carrying out a pairwise comparative analysis (comparing each pair of elements at each level of the hierarchy)
3. Determining the weight of each element at each level of the hierarchy.
4. Checking the consistency of benchmarks to determine their stability and correctness.
5. Total weights Calculation for obtaining final results and making a decision [18].

For organizing and conducting the expertise, we utilized the MS Excel spreadsheet, which was programmed to perform all the mathematical calculations of the Saaty method [18]. This simplified the analysis of values in the respective matrices. An expert could be an IT course instructor with at least ten years of experience specializing in media education issues. The expert needed to be familiar with all the alternatives (A1–A3), meaning they had completed all three courses. After completing the courses, the expert was required to fill in the corresponding matrices of pairwise comparisons. To enhance the objectivity of the course evaluation, we involved three experts. The objective of the expertise was to determine, according to the experts' opinions, which course (alternative) was most productive for developing information hygiene skills.

For organizing the pedagogical experiment, three groups of students from different educational institutions were involved: Sumy State Pedagogical University named after A. S. Makarenko, and Sumy National Agrarian University. The students agreed to take the alternative courses as elective subjects within their selective course block. EG1 (28 students) took course A1, EG2 (26 students) took course A2, and EG3 (23 students) took course A3. To determine the results of course mastery, we developed a questionnaire in which each correct answer was scored as one point, with a maximum score of 12 (table 1). Participation in the experiment was voluntary and anonymous (students filled out the questionnaire under specific numbers).

For the pedagogical experiment to yield reliable results, we needed to form statistically equivalent samples for the initial stage of the experiment. Based on the results of the first survey, we excluded those participants whose scores significantly influenced the average score in each group. We also excluded the results of students who initially scored 8 or higher. These students' results were not taken into account during the second survey. We aimed to make the groups gender-balanced (approximately an equal number of girls and boys). For this purpose, we kept 20 participants in each experimental group, ensuring that these groups had statistically equivalent average scores at the beginning of the experiment (before the alternative course).

After studying the alternative course, a second survey was conducted using identical questions and answers. To evaluate the before-and-after averages, we utilized statistical analysis of means (Student's t-test) within the groups of 20 individuals. The statistical difference in means serves as evidence of the effectiveness of a particular alternative course in developing information hygiene skills.

If, after the experiment, the highest average score is found in the same group that studied the course recommended by the experts, then the application of the Saaty method should be considered effective for determining the most efficient course among the given alternatives.

Table 1. Questionnaire for students

Indicator		*Task*	*Answer options**
Critical thinking	1	"The well-known fact that the quality of automotive service has decreased over the past 2 years." What's wrong with this headline?	• There is no link to the source of the information • There is a lack of facts, figures, and reasoned details • **Both options are correct** • Both answers are wrong
	2	How to understand that an expert is competent enough to comment on certain issues?	• The person has experience in the field related to the question • The organization represented by the expert is recognized by the professional community and has a good reputation. • Both options are correct • Neither option is correct
Fact-checking	3	Confirm or deny the information presented on YouTube by link https://youtu.be/k-W2Bkz_Rno?t=55	• Fake • **Truth** Attach a file with evidence of your conclusion
	4	Confirm or deny the information in the photo with the call for youth to join the territorial defense	• **Fake** • Truth Attach a file with evidence of your conclusion
Media understanding	5	The standard of the balance of opinion in a media message means that:	• The position of the party that is right is reflected in detail • **Coverage in the news of the positions of all sides of the situation in the same volume and tone** • Both options are incorrect
	6	How can you understand that media news is "jeans", that is, paid news without the "advertisement" mark?	• Google a lot of identical news with the same headlines • Experts give one-sided feedback about a person (batch, product) • Similar information is posted several times in the same media • **All the specified options are features of jeans**
Social behavior	7	You see the following headline: "The shocking truth about the pollution level of the Psel River "What is your reaction?	• We need to spread this information - it looks too serious, and everyone should know the truth. • **Looks like manipulation** • This could be expected, so I will like the material
	8	What should you do if you come across information that you have doubts about?	• Try to find the source of the information • Do a quick internet search to see if other reliable sources of information are reporting the same thing. • Check whether the authors of this material are known. Can they be trusted? • **All of the above weaves are signs of jeans**
Emotional and psychological stability	9	How to recognize emotional manipulation in the news?	• The source of the news is the press office of a political party you do not support • Information causes indignation, fear, anger, or other strong (even positive) emotion • The journalist deliberately chooses a hot topic for his material
	10	Which of the following headlines does NOT manipulate emotions?	• The famous liar came to power again • It broke the web: the whole truth about the new vaccines was revealed • **Clubhouse abandoned the invitation system** • SHOCK! See how prices have changed over the last quarter

* Additional point if the student attaches a file with evidence for tasks 3 and 4.

2. Results of research

Objective 1: Modeling an educational task using the Saaty method in the context of choosing an online course for developing information hygiene skills.

Modeling an educational task using the Saaty method in the context of choosing an online course for developing information hygiene skills requires specifying the criteria by which the course and its alternatives will be selected.

The following learning outcome criteria were important for instructors:

- Ability to distinguish between facts and judgments, evaluate and interpret events, and analyze premises and causes (*C1 – critical thinking*).
- Ability to detect and identify fake information, including finding primary sources and utilizing services for analyzing the authenticity of video and photo content (*C2 – fact-checking*).
- Awareness and understanding of media functioning, and knowledge of journalistic standards (*C3 – media literacy*).
- Ability to communicate ethically, identify the imposition of stereotypes, and effectively counteract discrimination (*C4 – social behavior*).
- Ability to recognize manipulations, hostile language, propaganda techniques, and emotional influences (*C5 – emotional-psychological resilience*).

Among the courses that could meet the specified criteria, the following were chosen:

- Course "Media Literacy. Practical Skills" (https://courses.prometheus.org.ua) on the "Prometheus" online platform (*alternative A1*).
- Course "Very Verified: Online Course on Media Literacy" (https://verified.ed-era.com/ua) as a result of the IREX project "Study and Differentiate Info-Media Literacy" (*alternative A2*).
- Course "English for Media Literacy" (http://bit.ly/2yPRkon) on the educational platform Coursera (*alternative A3*).

The model of the educational task is presented in figure 1.

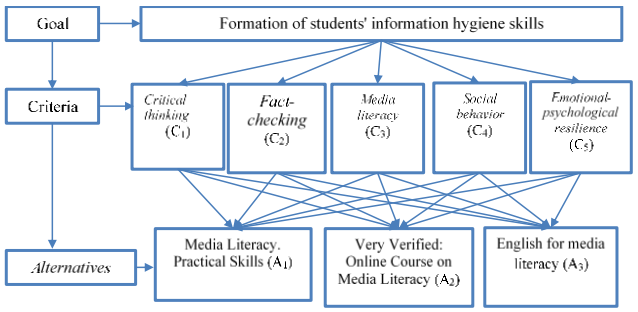

Fig. 1. Hierarchy model for online course selection

Therefore, we have constructed a model of the educational task for choosing an online course based on the selected criteria.

Objective 2: Justification of the appropriateness of using the Saaty method for selecting an online course.

Justifying the appropriateness of using the Saaty method for selecting an online course involved engaging experts and conducting a pedagogical experiment.

Let's provide matrices with the influence ratings from three experts (all calculations were performed in MS Excel). The results of the priority calculation (W) for the criteria for choosing alternative courses are demonstrated in table 2.

Let's briefly comment on the table filling. Our goal is to develop information hygiene skills that correspond to the selected criteria (i.e., to develop skills K1–K5). The first expert believes that the development of students' critical thinking (K1) is more significant than fact-checking (K2).

*Table 2. Matrix of pairwise comparisons and vector of priorities for criteria from the first expert**

Criteria	K1	K2	K3	K4	K5	**W**
K1	1	2	3	2	4	**0.38**
K2	1/2	1	3	1/2	1/2	**0.14**
K3	1/3	1/3	1	1/3	1/4	**0.07**
K4	1/2	2	3	1	1	**0.22**
K5	1/4	2	4	1	1	**0.20**

*Here and further, the relative consistency of the expert's judgments does not exceed 10%

Therefore, the pairwise comparison of criteria K1 and K2 has a ratio of 2 to ½ (table 1). The importance of the criteria "Social Behavior" and "Emotional-Psychological Resilience" is equal for the first expert, so the ratio of criteria K4 and K5 is 1. For the given matrix, the consistency index is 0.026, and the relative consistency index is 0.08. Since the relative consistency index does not exceed 10%, the pairwise comparison matrix is considered fully consistent (constructed correctly).

The analysis of priorities among the proposed alternative courses for each criterion is presented in table 3. The first expert determines the priority of alternatives and evaluates the consistency for each criterion. The alternative with the highest priority vector value is considered the best.

Table 3. Results of calculations for the course priorities based on the first expert's criteria

	K1	K2	K3	K4	K5	W
K1	1	5	3	4	7	0.528
K2	1/5	1	2	1/2	1/3	0.092
K3	1/3	1/2	1	1	2	0.127
K4	1/4	2	1	1	1	0.137
K5	1/7	3	1/2	1	1	0.116
K1	A1	A2	A3	W		
A1	1	2	4	0.316		
A2	1/2	3	3	0.261		
A3	1	1/3	1	0.109		
K2	A1	A2	A3	W		
A1	1	7	3	0.435		
A2	1/7	1	6	0.150		
A3	1	1/6	1	0.087		
K3	A1	A2	A3	W		
A1	1	3	6	0.414		
A2	1/3	1	7	0.209		
A3	1	1/7	1	0.082		
K4	A1	A2	A3	W		
A1	1	2	9	0.414		
A2	1/2	1	3	0.181		
A3	1	1/3	1	0.109		
K5	A1	A2	A3	W		
A1	1	1/9	3	0.109		
A2	9	1	8	0.656		
A3	1	1/8	1	0.079		
	K1	K2	K3	K4	K5	Vector of global priorities
W	0.528	0.092	0.127	0.137	0.116	
A1	0.316	0.435	0.414	0.414	0.109	0.724
A2	0.261	0.150	0.209	0.181	0.656	0.415
A3	0.109	0.087	0.082	0.109	0.079	0.179
	0.316	0.435	0.414	0.414	0.656	0.724

Table 3 demonstrates that when comparing alternatives A1, A2, and A3 based on criterion K1 "Critical Thinking," the highest priority is given to alternative 1 (course "Media Literacy: Practical Skills") with a priority vector value of W = 0.57. In the lower part of the table (highlighted in pink), the calculation of global priority vectors for each course based on the ratings from the second expert is presented. The alternative with the highest priority value has the greatest advantage. In the calculations, this is alternative A1 (course "Media Literacy: Practical Skills"). This course has the maximum priority vector values for criteria K1, K2, and K4, K5.

The grouping of the evaluation results using the Saaty method from the three experts shows a consensus in the conclusion: the experts prioritize the first alternative (table 4).

Let's move on to describing the results of the pedagogical experiment. As a reminder, EG1 chose the first alternative, EG2 chose the second alternative, and EG3 chose the third alternative. The survey results (before and after the experiment) are presented in table 5.

To compare the educational results accurately, the experiment aimed to identify statistically equivalent groups. Therefore, the responses of individual students outside the blue contour were excluded according to the constraints described in the methodology. For all comparison cases, the null hypothesis of statistical equality of means and the alternative hypothesis of their significant (statistically significant) difference were used. The results of applying the Student's t-test for mean comparison are presented in table 6.

The pink cells in Table 6 represent data that support the null hypothesis, while the green cells represent the alternative hypothesis. Based on the data in table 7, we have grounds to conclude the statistical similarity of groups EG1, EG2, and EG3 at the beginning of the experiment. After the pedagogical experiment, we have evidence supporting the alternative hypothesis when comparing the results between "EG1 and EG2" and "EG1 and EG3" pairs. The data indicate a significant development of information hygiene skills for group EG1 both compared to the beginning of the experiment and about groups EG2 and EG3. It is worth noting that groups EG2 and EG3 showed significant individual development compared to the beginning of the experiment but not between each other – according to the analysis, their means are statistically similar.

Therefore, Alternative 1 proved to be the most effective in developing information hygiene skills among the youth. This aligns with the conclusion of the experts regarding the potential effectiveness of the courses, where Alternative 1 was also recommended. Thus, there are grounds to assert that modeling educational tasks using the Saaty method is appropriate and effective.

Table 4. Consolidated Opinion of Experts

	EXPERT 1	EXPERT 2	EXPERT 3
A1	**1.143**	**0.724**	**0.687**
A2	0.346	0.415	0.661
A3	0.089	0.179	0.129

Table 5. Survey Results in Three Groups

No	EG1 (before)	EG1 (after)	EG2 (before)	EG2 (after)	EG3 (before)	EG3 (after)
1	2	7	9	9	9	8
2	4	7	5	7	4	6
3	8	8	2	6	9	9
4	6	9	3	6	2	7
5	3	6	2	9	5	8
6	3	6	6	5	3	6
7	4	9	6	6	4	9
8	4	8	5	5	2	5
9	5	6	4	7	4	7
10	6	8	5	8	5	9
11	2	8	5	9	3	7
12	3	6	6	7	6	7
13	2	9	5	5	6	8
14	4	8	4	9	3	8
15	4	8	5	5	4	7
16	5	9	2	5	3	5
17	5	10	4	5	4	9
18	4	9	6	6	6	7
19	4	7	3	5	5	5
20	4	8	3	9	3	5
21	5	7	3	9	5	7
22	3	8	2	8	4	6
23	6	11	2	6	4	7
24	6	7	8	11		
25	10	10	2	5		
26	6	9	8	10		
27	9	7				
28	8	9				

Table 6. Results of Student's t-test analysis

Before the experiment	EG1	EG2	EG1	EG3	EG2	EG3
Average	4.1	4.05	4.1	4.05	4.05	4.05
Dispersion	1.463	2.682	1.463	1.524	2.682	1.524
Number	20	20	20	20	20	20
The difference of averages for H_0	0		0		0	
t-empirical	0.110		0.129		0.001	
t-critical	2.030		2.024		2.030	
After the experiment	EG1	EG2	EG1	EG3	EG2	EG3
Average	8.0	6.7	8.0	7.0	6.7	7.0
Dispersion	1.895	2.747	1.895	1.734	2.747	1.734
Number	20	20	20	20	20	20
The difference of averages for H_0	0		0		0	
t-empirical	2.698		2.465		-0.528	
t-critical	2.026		2.024		2.028	
Before and after the experiment	EG1 (before)	EG1 (after)	EG2 (before)	EG2 (after)	EG3 (before)	EG3 (after)
Average	4.1	8.0	4.05	6.7	4.05	7.0
Dispersion	1.463	1.895	2.155	2.747	1.524	1.734
Number	20	20	20	20	20	20
The difference of averages for H_0	0		0		0	
t-empirical	-9.518		-5.352		-7.185	
t-critical	2.026		2.026		2.024	

3. Discussion

The presented material is a continuation of the research on the issue of developing media literacy among youth, which is presented in the work [17]. The research follows the idea of developing information hygiene skills within formal education (higher education) and aligns with the laws of media and information literacy (MIL) [22]. In particular, the third and fifth laws, which appeal to the ability to resist information influences and develop this ability over a prolonged period through personal dynamic experience, are noted. These laws are interpreted as a societal need to develop information hygiene skills during youth education, involving educational online platforms as auxiliary means for such development.

The conducted research corresponds to the demands of Ukrainian society for victory in information warfare [9]. In the conditions of aggression by the Russian Federation, attention is focused on the importance of developing critical thinking for every member of society to ensure their information security [14]. The analysis of resources aimed at developing information hygiene skills emphasizes the importance of combating misinformation in the media [13, 23], and social media [10]. Researchers emphasize the need to develop critical thinking skills in youth, which has become the most important criterion in the problem we have posed.

Due to the escalation, there is a need to develop information hygiene skills among Ukrainian students. Three online courses on non-formal education platforms have been offered to higher education instructors for selection. The choice of the three courses involved in the experiment is justified based on their popularity and content. The selection criteria were made based on the analysis of the concepts of "media literacy", "info-media literacy", and "information hygiene" [7], as well as the results of content analysis of internet sources related to the identification of various types of fakes [5, 20]. The selection criteria were considered at three levels: individual, societal, and governmental. At the individual level, information hygiene skills address the issue of mental health prevention. At the societal level, information hygiene skills contribute to the development of information culture in society and its media (perception, analysis, interpretation, critical evaluation, dissemination, etc.). At the governmental level, information hygiene skills determine a balanced information policy to preserve the health of the nation.

We have used the Saaty hierarchy method to decide on the selection of the optimal course. The practical application of the method has been demonstrated in various fields, including economics and business [21], construction management [6], advertising [8], and the social sphere [2].

Modifications of the hierarchy method and its application have been the subject of research by T. Baker, D. Bridges, and R. Hunter, who analyzed general approaches and described algorithms for solving stochastic problems under uncertainty [4].

In [12], the solution of tasks related to the application of mathematical modeling tools for educational multi-criteria problems with hierarchical structures is presented. The authors of these studies, like us, acknowledge the universality of the method, the convenience, and the simplicity of the mathematical tools.

Despite the obvious advantages of the hierarchy method and its active use in the fields of economics, construction, and finance, it should be noted that in educational tasks, this method is only used fragmentarily. However, in the case of formalizing an educational task and constructing its model with alternative solutions, the use of the method can provide quick results, as confirmed by our research.

It should also be noted that by the state policy of Ukraine, the problem we have discussed aligns with the increase in educational courses on digital platforms such as Ed-Era (https://www.ed-era.com/), Vumonline (https://vumonline.ua/), Media-IQ (http://media-iq.tilda.ws/medialiteracy), and others. However, despite the high quality, such courses often have drawbacks that are inherent to online education as a whole, such as a lack of interactive communication, insufficient motivation and self-organizational skills of course consumers, and a low level of self-directed learning skills. Such shortcomings and their possible solutions are discussed in the study [1]. The authors explore models for improving online learning and emphasize the importance of feedback: timely task reviews and timely notifications contribute to improved learning outcomes. Therefore, online courses that provide feedback (and these are Alternatives 1 and 2) will undoubtedly be more effective. A similar conclusion is given by the authors of the study [15]. They emphasize the importance of such a factor as "discussion areas frequently accessed and participated", which characterizes alternative A1 in our research.

Distance and mixed learning has become a reality not only for Ukrainian students [3]. Therefore, looking for the best opportunities to ensure quality education for the young generation is necessary. The way we have chosen (using educational online platforms) is possible and potentially effective [16].

4. Conclusions

Today, among educational tasks, there is a need to choose the most suitable solution from a set of available options. The development of digital educational platforms has led to a wide variety of courses in different fields. Navigating through them requires knowing how to solve the problem of choice. The Analytic Hierarchy Process method or Saaty method, developed by T. Saaty, allowed us to compare online courses based on criteria and select the one that different experts deemed optimal. The method provided the opportunity to analyze criteria, alternative courses, and their functional interactions, and determine the priority of their impact on the development of information hygiene skills.

The use of this approach in course selection ensures a rational choice or provides recommendations when designing individual learning trajectories. However, it is important to have a clear understanding of the criteria that courses should meet before applying the Saaty method. Therefore, it is crucial to model the educational task, identifying the relevant criteria and available alternatives. The developer of the method recommends limiting the number of criteria and alternatives to 5–7.

The Saaty method has proven its effectiveness in addressing educational tasks. Therefore, mastering the Saaty method is considered relevant for average teachers as well as mentors or facilitators. This means that studying the Saaty Analytic Hierarchy Process should be included in relevant educational programs for training professionals in the field of education, including teachers. Mastery of the method is seen as a direction for enhancing the qualifications of educators.

The prospects for further research involve exploring other types of educational tasks that can be addressed using the Saaty method, promoting its use among instructors, and developing training programs for mastering and implementing it in education.

References

[1] Ahuja S., Kaur P., Panda S. N.: Identification of Influencing Factors for Enhancing Online Learning Usage Model: Evidence from an Indian University. International Journal of Education and Management Engineering (IJEME) 9(2), 2019, 15–24 [https://doi.org/10.5815/ijeme.2019.02.02].
[2] Aliluyko A., Mykolyuk S., Stefurak N.: Application of the analytic hierarchy process in the management of social child placement. Innovative Economy, 2019, 53–59.
[3] Asarta C. J., Schmidt J. R.: Comparing student performance in blended and traditional courses: Does prior academic achievement matter? The Internet and Higher Education 32, 2017, 29–38.
[4] Baker T. et al.: Guidebook to Decision Making Methods. 2001, WSRC-IM-2002-00002.
[5] Chetty-Mhlanga Sh., Fuhrimann S., Eeftens M.: Different aspects of electronic media use, symptoms and neurocognitive outcomes of children and adolescents in the rural Western Cape region of South Africa. Environmental Research 184, 2020, 109315 [https://doi.org/10.1016/j.envres.2020.109315].
[6] Darko A. et al.: Review of application of analytic hierarchy process (AHP) in construction. International Journal of Construction Management 19(5), 2019, 436–452 [https://doi.org/10.1080/15623599.2018.1452098].
[7] Drushlyak M. et al.: Typology of internet resources for the development of youth's infomedia literacy. Information Technologies and Learning Tools 88(2), 2022, 1–22 [https://doi.org/10.33407/itlt.v88i2.4786].
[8] Dubrovin V. I., Kruglikova V. V., Fandeeva K. O.: The use of an analytic hierarchy process in improving the effectiveness of advertising campaigns. State and Regions 4, 2011, 87–91.
[9] Gorban Y. O.: Information warfare against Ukraine and means of its conduct. Herald of the National Academy of Public Administration under the President of Ukraine 1, 2015, 136–141.
[10] Grimes D. R.: Health disinformation & social media: The crucial role of information hygiene in mitigating conspiracy theory and infodemics. Embo Reports 21(11), 2020, 5181 [https://doi.org/10.15252/embr.202051819].
[11] Ilchenko O.: Media literacy in the educational and professional training program for students of higher education. Current issues of the humanities 28(2), 2020, 113–119 [https://doi.org/10.24919/2308-4863.2/28.208652].
[12] Klochko O. V.: Mathematical modeling of systems and processes in education/pedagogy: A training manual. Vinnytsia 2019.
[13] Loukas G., Murugesan S., Andriole S. J.: Information Hygiene: The Fight Against the Misinformation 'Infodemic'. IT Professional 24(2), 2022, 16–18.
[14] Melnychuk V., Horokhova L.: Critical thinking as a component of information security. Herald of Lviv University: Philosophical Sciences 29, 2022, 7–13.
[15] Nandi D., Hamilton M., Harland J.: What Factors Impact Student – Content Interaction in Fully Online Courses. International Journal of Modern Education and Computer Science (IJMECS) 7(7), 2015, 28–35.
[16] Richardson J. C. et al.: Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. Computers in Human Behavior 71, 2017, 402–417.
[17] Rudenko Y. O. et al.: Development Of Students' Ability To Resist Information Influences. Information Technologies and Learning Tools 94(2), 2023, 54–71.
[18] Saaty T. L.: The Analytic Hierarchy Process: A New Approach to Deal with Fuzziness in Architecture. Architectural Science Review 25(3), 1982, 64–69.
[19] Semenikhina O. V. et al.: Open Educational Resources as a Trend of Modern Education. Proceedings of 42 International convention on information and communication technology, electronics and microelectronics "MIPRO 2019", Opatija (Croatia), 2019, 779–782.
[20] Semenog O. et al.: Formation of Media Educational Skills of a Future Teacher in the Professional Training. Revista Romaneasca Pentru Educatie Multidimensionala 12(3), 2020, 219–245.
[21] Sinenko M. A.: The Saaty method in managerial decision-making: A case study of a small business enterprise. Intellect XXI 1, 2018, 235–238.
[22] Valenza J.: UNESCO Launches Five Laws of Media and Information Literacy (MIL), 2017 [https://blogs.slj.com/neverendingsearch/2017/02/20/unesco-launches-five-laws-of-media-and-information-literacy-mil/].
[23] Varynskyi V. et al.: Information security and information hygiene on internet media. Nexo Revista Cientifica 34(01), 2021, 120–128.
[24] Yurchenko A. et al.: Using online IT-industry courses in the computer sciences specialists' training. International J. of Computer Science and Network Security 21(11), 2021, 97–104 [https://doi.org/10.22937/IJCSNS.2021.21.11.13].

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