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Volodymyr Momot 

PhD in Physics & Mathematics,
ScD in Economics, Professor,
professor of the management department,
Alfred Nobel University,
Dnipro, Ukraine

vmomot@duan.edu.ua

Olena Lytvynenko 

PhD in Economics, Associate Professor,
associate professor of the management department,
Alfred Nobel University,
Dnipro, Ukraine

elena_litvinenko@duan.edu.ua

ALGORITHMIZATION OF CONTENT PREPARATION FOR A COMPILATION DISCIPLINE USING ARTIFICIAL INTELLIGENCE TOOLS

***Annotation.** Based on the experience of developing the content of the compilation discipline «Technologies of Training Delivery» at the Alfred Nobel University using the main modern AI tools (ChatGPT 4.0, Gemini and Claude), a robust algorithm is proposed. The main problems that arise when using AI tools, such as initial bias and low trust level among the teaching staff. The possibilities of joint use of AI visualization tools (DAL-E 3.0 neural network) and presentation tools commonly used in the educational process (PowerPoint and Keynote) are shown. The problems of trust that arise during the deep implementation of AI tools in the educational process are considered. Recommendations are given on the systematic use of AI tools in the preparation and improvement of educational content.*

Key words: *artificial intelligence, robustness, algorithmization, ChatGPT, Bard, Claude, DAL-E.*

Анотація. *На основі досвіду розробки контенту компілятивної навчальної дисципліни «Технології тренінгової діяльності» в Університету імені Альфреда Нобеля з використанням основних сучасних засобів ШІ (ChatGPT 4.0, Gemini та Claude) запропонований робастний алгоритм роботи. Проведений аналіз головних проблем, що виникають під час використання засобів ШІ, таких як первісна упередженість і низький рівень довіри у викладацького складу. Показані можливості сумісного використання візуалізаційних засобів ШІ (нейромережа DAL-E 3.0) та презентаційних засобів, які зазвичай використовуються у навчальному процесі (PowerPoint та Keynote). Надані рекомендації щодо системного використання засобів ШІ при підготовці та вдосконаленні навчального контенту.*

Ключові слова: *штучний інтелект, робастність, алгоритмізація, ChatGPT, Gemini, Claude, DAL-E.*

Introduction and relevance of the study. Artificial Intelligence (AI) has revolutionized the way we approach education. It has enabled educators to prepare exam questions, assignments, and model essay responses in minutes, freeing up time and energy to help students refine their analyses and recommendations. AI-supported pedagogy can help us in so many ways: to design more dynamic and interactive learning experiences, to enhance students' practical problem-solving skills [1], to create realistic business and legal scenarios that empower students to critically assess and interact with AI-generated content [2], and to foster adaptability and tech-savviness among students [3]. Particularly in the context of compilative subjects, which require the integration of knowledge from various fields, AI can play a pivotal role in enhancing the learning experience [4].

AI can also be used to create personalized learning experiences for students [5]. This can help students to learn more effectively and efficiently and can also help to reduce the workload of teachers. AI algorithms can analyze a student's performance,

identify strengths and weaknesses, and tailor content accordingly [6]. This personalized approach can be particularly beneficial for compilative subjects, where understanding often depends on grasping concepts from different areas [7].

Moreover, one could think about some additional general benefits which arise through AI tools utilization:

- AI can transform the content delivery by making it more interactive and engaging for students.
- AI can also help educators to design and implement effective and inclusive curriculum and pedagogy.

AI-powered Intelligent Tutoring Systems (ITS) can provide one-on-one tutoring, offering explanations, providing feedback, and even assessing student performance [8]. In compilative subjects, ITS can guide students through complex interdisciplinary concepts, adapting explanations based on the student's progress.

AI can also assist in generating and curating educational content. Machine learning algorithms can analyze vast amounts of information, identify relevant content, and compile it in a structured and comprehensible manner [9]. This can be invaluable in compilative subjects, where relevant information might be scattered across various sources.

AI has the potential to transform the way we approach education. By using AI to prepare educational content for compilative subjects, we can create more dynamic and interactive learning experiences, enhance students' practical problem-solving skills, and foster adaptability and tech-savviness among students. AI can also help to create personalized learning experiences for students, which can help them to learn more effectively and efficiently. As such, AI is an essential tool for educators who are looking to prepare students for the challenges of the future.

Problem statement in general form. Given the above, the objectives of this study include:

- general trends identification that arise at the starting stage of utilizing AI-tools in the teaching and scientific activity,
- a robust algorithm development, aimed on the enhancement of AI-tools utilization during the educational content compilation,

- recommendations regarding the systematic use of AI-tools in the preparation and improvement of educational content.

Research methodology. The following methods and approaches were used in the study: a survey to identify the main trends related to the AI-tools utilization in the teaching and scientific activity; comparative study and cross-tables when exploring the qualitative nature of the teachers' attitudes change towards perspectives of AI-tools in the teaching and scientific activity; structural block algorithmization when developing recommendations for the AI-tools utilization enhancement during the compilative discipline preparation.

Presentation of the main research material. Starting from the moment when one of the leading AI tools, ChatGPT by OpenAI became accessible in Ukraine in February of 2023 we at Alfred Nobel University () begun to collect and generalize the experience in using it in the teaching process. Materials collected are still "raw" because they include just primary information mostly having a form of reflections, impressions & attitudes. At the same time, it should be noted that $\approx 69\%$ of the teachers reportedly are using AI tools. Two master-classes (for PhD students and teachers respectively) were organized in April & November 2023. The cumulative number of students affected by AI tools utilization in the teaching staff preparation through 2 semesters could be estimated as being over one thousand. At the current stage of research, the students were used blindfolded so no feedback from their side was neither assumed nor received. The students' involvement will be the main distinguisher of this research next stage.

Also, the ANU teachers were interviewed to get understanding of attitudes towards AI tools utilization in their activities. The results of two consecutive surveys held in April 2023 and April 2024 are posted on Fig. 1-4. The focus group consist of 54 and 56 respectively which is absolutely representative for the ANU staff. Teachers were asked about their expectations of AI-tools utilization impact in the future (Fig. 1), then about actual impact perception during the current period (Fig. 4). Also, the assessments regarding AI-tools utilization both in the teaching and scientific work were surveyed in 2023 and 2024 (Fig. 2-3).

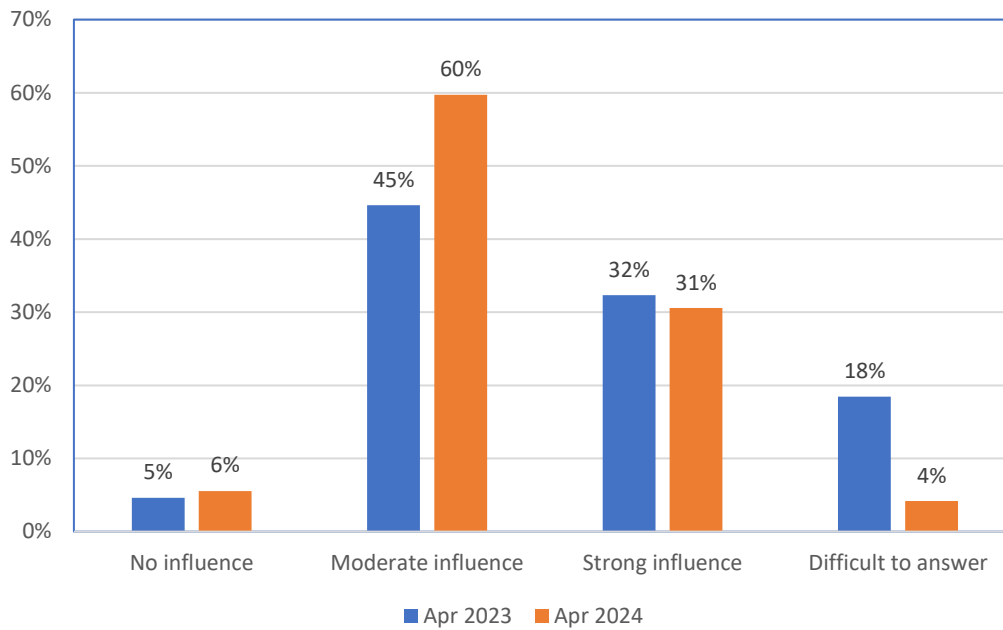


Fig. 1. Results of teachers' expectations of AI-tools utilization impact in the future

Source: data collected by the author's

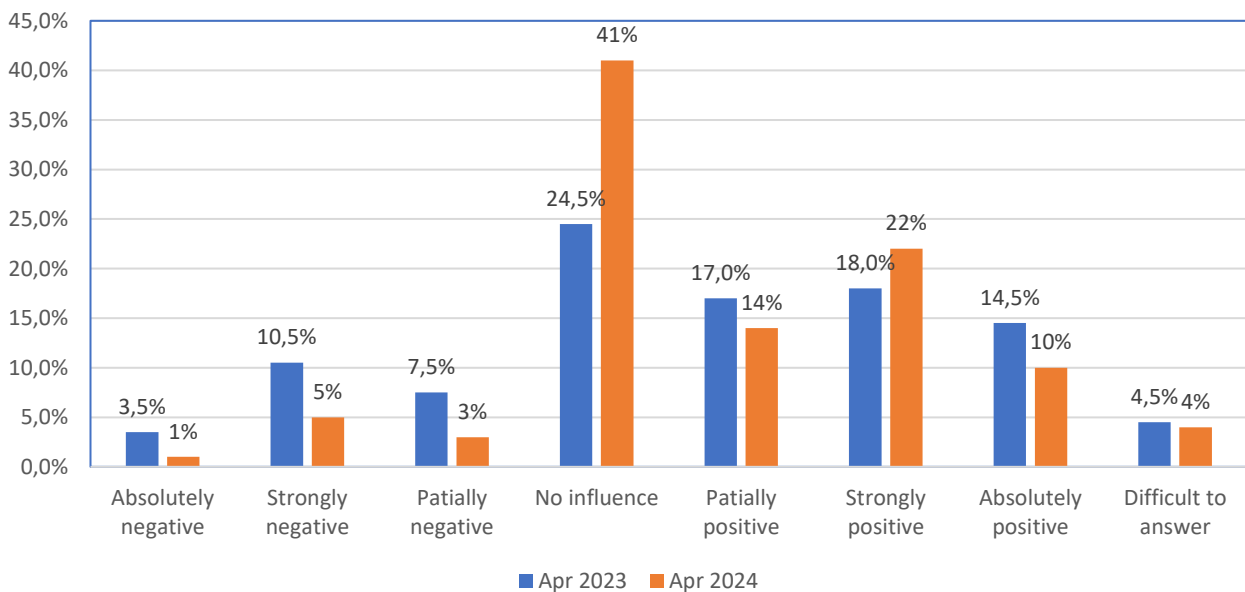


Fig. 2. Results of teachers' assessments of AI-tools utilization in the teaching activity survey

Source: data collected by the authors

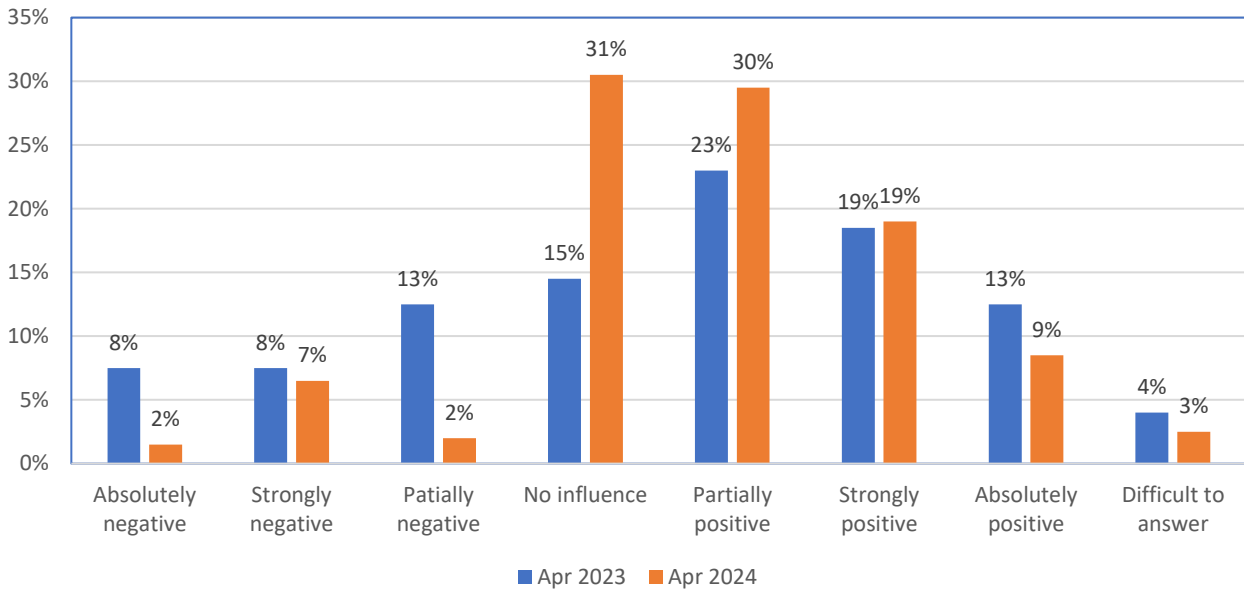


Fig. 3. Results of teachers' assessments of AI-tools utilization in the scientific activity survey

Source: data collected by the authors

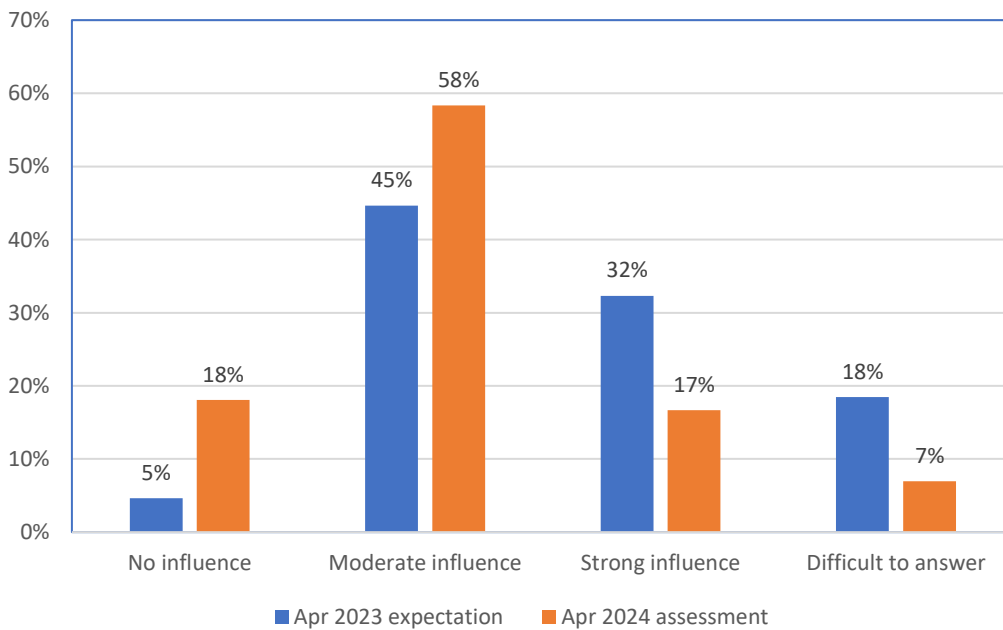


Fig. 4. Comparison of 2023's expectations and 2024's real state of art assessment teachers' attitudes towards AI-tools utilization in the scientific activity survey

Source: data collected by the authors

The main outcome of these research which will be continued during coming semesters and therefore is in active phase right now are express recommendations as to regularize and algorithmize an approach to the AI tools utilization avoiding a problems which could degrade the quality of the teaching stuff prepared in that way.

It is apparent that surveys held demonstrate visible optimism growth for the future AI-tools impact on teaching stuff activity with 15% raise between 2023 and 2024 year of those who consider it of moderate impact. Another remarkable trend is a sufficient dropdown (up to 12%) of those who could not define their attitude towards AI-tools utilization. At the same time those who percept AI-tools making no impact at their activity slightly did reduce in number by 1% which could be result of statistical error, but also could relate to better acquittance with AI and correspondent raise of skepticism. Anyhow this result indicates at the necessity of further research. Those, who consider AI-tools as strong influencer are also slightly diminished in number which could be considered as a proof of the trend that while getting deeper acquainted audience is slowly tending to be more skeptical towards AI-tools perspectives. It could be considered as kind of routinization of AI-tools implementation after being an extra-popular trend.

It hasn't much sense to ask teachers about attitudes towards AI-tools utilization back in April 2023 when their majority just took the first steps so the questioning about actual impact took place just in April of 2024 (see Fig. 4). Comparison of expectation and real state of art indicate significant jump in skepticism in current state assessment when 18% of respondents admit that AI-tool have no impact on their activities compared with just 5% of expectation. At the same time 13% more respondents confess that AI-tolls have a moderate impact.

Quite interesting are qualitative assessments of AI-tools impact on teaching staff activities. First of all, majority of teachers believe that AI-tools will have neutral or no impact on the teaching activities – 24,5% (see Fig. 2). Moreover, in April 2024 the share of such “devaluators” had been raised significantly – to 41% (see Fig. 2). At the same time the raise of those who asses the AI-tools impact as strongly positive is much less impressive – from 18 to 22% while number of absolutely positive

assessments dropping down by 4,5% from 14,5 to 10% (see Fig. 2). Assessments of the AI-tools impact on the scientific activity demonstrate a different tendency – «devaluators» being almost minority in April 2023, 15% did become a majority in April 2024, 31% (see Fig. 3). Also, there is visible raise of teaching staff quantity who at least admit positiveness of AI for the scientific activity – number of those who gave partially positive assessment had increased by 7%, from 23% to 30% (see Fig. 3 again). Number of those who gave a strongly positive mark remains almost the same, while quantity of teachers who gave the highest assessment had dropped down by 4%, as in case of questioning about scientific activity (see Fig. 3).

The trend identified analyzing qualitative assessments change between 2023 and 2024 and skepticism raise with the acquittance enhancement with AI-tools comparing 2023 expectations and 2024's real state of art assessment gave a hint to build a cross-table superposing qualitative assessment of AI-tools influence on teaching and scientific activity and perceived impact level of Apr 2024 (see Table 1). The scale ranging from was “*absolutely negative*” to “*absolutely positive*” (see axis range Fig. 2-3) was transferred into numerical one from -3 up to 3 to make a table more compact and visual.

The cross-tables built on qualitative assessment and perceived impact level of April 2024 indicate very significant differences between expected and observed counts in case of those who testified for neglectable impact of AI-tools both on teaching and scientific activity. Those who ignore the AI-tools impact by 30,5% more frequently are «zeroing» its impact on the teaching activity and by 29,95% more frequently are denying the influence on the scientific activity. It is indicative, that this disbalances almost coincide, which obviously could be just an occasionality, but at the same time to the authors' opinion in such a way a more fundamental peculiarity is displayed – kind of «unaware ignorance» / «ignorant disbelief». Individuals who did not want to get involved into the new and seemingly difficult activity (field of knowledge) quit frequently are trying to dismantle its importance, usefulness, utility *etc.* doing this mostly impulsive.

Table 1

Cross-table: qualitative assessment and perceived impact level of Apr 2024

Influence	Effect	-3	-2	-1	0	1	2	3
<i>Teaching activity</i>								
<i>No influence</i>	Count	0	1	1	10	4	2	1
	Expected Count	0,1	0,5	0,3	4,2	1,4	2,3	1,0
	% within impact level	0,00%	5,26%	5,26%	52,63%	21,05%	10,53%	5,26%
<i>Moderate influence</i>	Count	0	1	1	15	6	8	2
	Expected Count	0,3	1,7	1,0	13,6	4,7	7,3	3,3
	% within impact level	0,00%	3,03%	3,03%	45,45%	18,18%	24,24%	6,06%
<i>Strong influence</i>	Count	0	0	0	1	1	1	0
	Expected Count	0,1	0,5	0,3	3,9	1,3	2,1	1,0
	% within impact level	0,00%	0,00%	0,00%	33,33%	33,33%	33,33%	0,00%
<i>No answer</i>	Count	0	0	0	2	0	0	0
	Expected Count	0,04	0,20	0,12	1,62	0,55	0,87	0,40
	% within impact level	0,00%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%
<i>Scientific activity</i>								
<i>No influence</i>	Count	0	1	0	7	3	1	1
	Expected Count	0,2	0,7	0,2	3,1	3,0	2,0	0,9
	% within impact level	0,00%	7,69%	0,00%	53,85%	23,08%	7,69%	7,69%
<i>Moderate influence</i>	Count	0	2	1	11	10	7	3
	Expected Count	0,5	2,2	0,7	10,1	9,8	6,3	2,8
	% within impact level	0,00%	5,88%	2,94%	32,35%	29,41%	20,59%	8,82%
<i>Strong influence</i>	Count	0	1	1	3	1	1	0
	Expected Count	0,1	0,6	0,2	2,9	2,8	1,8	0,8
	% within impact level	0,00%	14,29%	14,29%	42,86%	14,29%	14,29%	0,00%
<i>No answer</i>	Count	0	0	0	2	1	0	0
	Expected Count	0,1	0,3	0,1	1,2	1,2	0,8	0,3
	% within impact level	0,00%	0,00%	0,00%	66,67%	33,33%	0,00%	0,00%

Source: the authors' calculations

It should be reminded that the number of those who assess AI-tools as being of not significant impact had raised dramatically both for the teaching and scientific

activity – possibly it is an outcome of the experience accumulated and disappointment developed. Indicative too is the fact that comparison of 2023th expectation and 2024th assessment give almost the same raise. The resulting conclusion which could be drawn from these results is formulated in the following way – majority of respondents who do not believe in the influence of AI-tools on their activity are those who assess it to be qualitatively neutral.

Therefore they are not going to pay much attention to it in the future, being passive and indifferent. Indirectly it could be testified by. To authors' opinion all that is an indication of considerable resistance to changes and inertia of thinking when teachers who are reluctant to react on undisputable changes in the educational environment are unconsciously (or even deliberately) de-valuing them.

All that could lead to the conclusion that AI-tools utilization in the teaching process gradually becoming a routine task, and correspondingly it needs to be algorithmized.

Let's consider a preliminary version of such algorithm built based on authors' experience creating the content of the subject titled «*Technologies of Training Delivery*» which was delivered to the 4th year students of specialty «Management» during spring semester 2023/24 teaching year. The workload of the discipline was 4 ECTS credits.

The algorithm of AI-based teaching material creation looks like following.:

1. Define Learning Objectives and Target Audience:

- Input: Curriculum guidelines, industry standards, student demographics, previous course feedback.
- **AI Tool**: Natural Language Processing (NLP) for analyzing curriculum documents and extracting key concepts and skills.
- Output: Clearly defined learning objectives, identified knowledge gaps, tailored content strategy for specific audience needs.

2. Content Gathering and Curation:

- Input: Learning objectives, keywords, preferred learning styles.
- **AI Tool**:

✓ *Web Scraping and Search Engines*: Automated search and retrieval of relevant articles, research papers, code examples, and multimedia resources.

✓ *Content Recommendation Systems*: Identify and suggest suitable learning materials based on user preferences and historical data.

✓ *Semantic Analysis*: Analyze content for relevance, accuracy, and complexity level.

- Output: A curated collection of diverse and engaging learning resources.

3. Content Creation and Organization:

• Input: Curated content, learning objectives, desired format (text, video, interactive exercises).

- **AI Tool:**

✓ *Automated Content Generation*: Generate summaries, quizzes, practice problems, and even code snippets based on existing materials.

✓ *Content Summarization and Paraphrasing*: Condense lengthy resources, simplify complex concepts, and create different versions for varying learning styles.

✓ *Automatic Translation*: Translate materials from/into multiple languages.

✓ *Visualization*: Create presentations with custom made slides illustrated “on-demand” by AI-tools.

• Output: Organized learning modules with diverse content formats, catering to different learning styles.

4. Personalization and Adaptive Learning:

• Input: Student performance data, learning preferences, engagement metrics.

- **AI Tool:**

✓ *Machine Learning (ML) Algorithms*: Analyze student interactions to identify areas of strength and weakness.

✓ *Adaptive Learning Platforms*: Provide personalized learning paths and recommendations based on individual progress and needs.

✓ *Personalized Feedback Generation*: Offer targeted feedback on assignments and assessments.

- Output: A personalized and adaptive learning experience that optimizes individual learning outcomes.

5. Assessment and Evaluation:

- Input: Learning objectives, student performance data, assessment criteria.

- **AI Tool:**

- ✓ *Automated Grading*: Grade objective assessments (multiple choice, fill-in-the-blanks) efficiently.

- ✓ *Plagiarism Detection*: Ensure academic integrity by identifying potential plagiarism in student submissions.

- ✓ *Performance Analytics*: Track student progress and identify areas for improvement in the curriculum.

- Output: Comprehensive evaluation of student learning and identification of areas for curriculum refinement.

The example of slide prepared in the framework of this algorithm utilizing *ChatGPT 4.0*, *Gemini 1.5 Pro* and *DAL-E* for creating the illustratives is given in Fig. 5.



ТРЕНІНГ СЕНСИТИВНОСТІ (РІЗНОВИДИ)

- **Тренінг на основі розуміння культурних різниць:** Цей тип тренінгу допомагає людям розуміти культурні різниці та поважати різні культури.
- **Тренінг на основі розуміння різниць в сприйнятті:** Цей тип тренінгу допомагає людям розуміти, що різні люди можуть мати різні сприйняття та думки про одну і ту ж ситуацію.

Fig. 5. Example of slide illustrated by *DAL-E* with content summarized and formatted by *Gemini 1.5 Pro* (in Ukrainian)

Source: teaching materials created by the authors

Benefits of using AI-tools at teaching content creation do include:

- *Efficiency:* Automate repetitive tasks and free up instructors' time for more engaging activities.
- *Personalization:* Tailor the learning experience to individual student needs and preferences.
- *Engagement:* Provide diverse and interactive learning materials that cater to different learning styles.
- *Quality:* Ensure accuracy, relevance, and up-to-date content.
- *Data-Driven Insights:* Analyze student performance data to identify areas for improvement in the curriculum.

Nevertheless, while AI offers significant potential, some important challenges still remain:

- *Data quality:* The quality of AI outputs is highly dependent on the quality of the input data.
- *Bias:* AI algorithms can perpetuate biases present in the training data.
- *Ethical implications:* The use of AI in content creation raises ethical concerns, such as copyright infringement and misinformation.
- *Human oversight:* AI should be used as a tool to augment human expertise, not replace it.

General conclusions. Thus, summarizing the general results of preliminary study of AI-tools implementation in the teaching process and algorithmizing the process of content preparation for a compilation teaching discipline using AI-tools, the following general conclusions can be drawn:

- AI-tools utilization in the teaching process is gradually becoming a routine task and therefore it needs to be algorithmized,
- at the same time first experience of AI-tools utilization testifies for the large-scale psychological inertia in the teachers' attitudes,
- by leveraging AI tools, educators can create a more efficient, personalized, and engaging learning experience for students in compilation disciplines. This

algorithmic approach ensures a dynamic and adaptive curriculum that continually evolves to meet the changing needs of the industry and the learners,

- the algorithmization of content preparation using AI tools holds immense promise for improving efficiency, accuracy, and scalability in compilation disciplines. By addressing the challenges and exploring new avenues of research, AI can become an indispensable tool for content creators, enabling them to produce high-quality content more effectively.

The directions for further research include:

- the students' involvement with AI-tools needs to be throughoutfully analyzed,
- lean and smooth integration patterns of AI with human-in-the-loop systems for the enhanced teaching content creation should be developed,
- ethical concerns of AI-tools utilization should be addressed, and AI systems fairness and unbiasedness should be ensured.

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