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How to Evaluate Learning Object?

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Abstract

The development of digital technology has significantly influenced education, with e-learning systems becoming essential tools for teaching and learning. A fundamental component of these systems is learning objects—the smallest units of knowledge—whose validity and usability are increasingly scrutinized due to the rapid growth of available educational materials. This research aims to develop a tool for evaluating learning objects using the Delphi method, which can function independently or as part of an e-learning system. Previous studies have identified two main categories of assessment: teacher-conducted assessments, often based on experience, and computerized assessments, which typically rely on specific evaluation criteria. In this study, the Delphi method was employed to develop a learning object assessment tool, involving multiple rounds of expert evaluation to reach a consensus. The primary evaluation criteria were derived from Bloom's taxonomy of learning objectives, the VAK (Visual/Aural/Kinesthetic) model of learning styles, and Biggs' cognitive deep/surface learning framework. The results indicated a high level of agreement among respondents with the proposed statements, confirming the validity and reliability of the developed instrument. Additionally, the calculation of Cronbach's alpha coefficient (0.9165) demonstrated high instrument reliability, supporting its implementation in e-learning systems for personalized education.

Keywords: Learning Object (LO), e-learning, evaluation, Delphi method, assessments

1. Introduction

With the advancement and widespread availability of digital technology in all areas of human activity, its role in education requires special attention. Today, it is difficult to imagine education without digital technologies and e-learning applications. The smallest unit of knowledge used in the learning process is the learning object. Thanks to the flexibility of digital technologies, learning objects can take various forms, such as individual lessons, videos, and other multimedia materials. As the number of learning objects used in teaching and learning continues to grow rapidly, an important question arises: how can we efficiently and accurately assess their validity and determine their usability based on specific parameters?

The need for a general model for evaluating learning objects is becoming increasingly pronounced, making it the focus of this research. Learning object evaluation is often aimed at

determining their quality. Başaran (2016) identifies several key criteria used by teachers for evaluation, including content quality, granularity (size of learning objects), reusability (the possibility of integrating them into different learning and teaching contexts), controllability, the ability to penalize incorrect answers, compatibility across various platforms and learning management systems, accessibility and efficiency, technological stability, and interoperability with different browsers and course management systems.

As technology advances, the number of learning objects continues to grow, along with repositories for their storage. Learning objects are therefore mainly associated with digital technology. Today, especially with virtual reality and virtual learning objects. The authors Bareišytė et al. (2024) have investigated this area by analyzing questionnaires in published articles. They identified parameters that are specific to virtual reality such as user experience, presence, realism of the simulator, immersion, motion sickness, embodiment but insufficiently focused on pedagogical parameters that are important for learning objects. While the authors Romero et al. (2021) include the existing learning object quality assessment tool LORI (Learning Object Review Instrument) in addition to the parameters that characterize virtual reality object quality assessment. However, the temporal assessment becomes extremely complex and less acceptable for use over time.

The need for a standardized evaluation model is becoming more urgent. However, Chawla et al. (2012) highlight that theorists and researchers propose various evaluation studies focusing on reuse, standardization, design, application, and learning outcomes. In line with this, Chawla et al. (2012) and Cotić Poturić et al. (2024) suggest a learning object evaluation framework based on three key metrics: a quality metric related to learning object metadata, a reuse metric (which is crucial given the large volume of educational materials used across different digital environments and learning scenarios), and a ranking metric based on current relevance, personal significance, and contextual applicability.

Recently, there has been a growing trend toward adapting existing quality monitoring frameworks, such as ISO 9001 and the European Foundation for Quality Management (EFQM), rather than developing entirely new evaluation instruments (Dandan et al., 2025). Considering all these factors, we have chosen to develop our own evaluation instrument using the Delphi method.

2. Materials and Methods

2.1 Delphi Method – Theoretical Framework

The Delphi method is a qualitative research technique that facilitates structured group communication among experts in a particular field using a scientific approach. It employs data processing techniques that involve the application of descriptive statistical measures. While sample size is not a strict requirement for implementing the Delphi method, there is some debate regarding the optimal number of participants. The number of team members should align with the research objectives; for heterogeneous groups, having more than 12 participants is recommended (Van der Schaaf & Stokking, 2011). Participants can be selected using two approaches: systematic selection or the chain referral method (snowball sampling). The Delphi method allows for a combination of open-ended and closed-ended questions, including those with predefined answer options. When using rating scales to assess significance, the 5- or 7-point Likert scale is generally preferred. “By using statistical programs to process collected data, it has become common practice to determine reliability by calculating the Cronbach’s alpha coefficient.” Visković (2016)

The foundation of the Delphi method lies in the knowledge and expertise of scientists and professionals whose research topics align with their professional interests. Furthermore, the anonymity of participants in the group discussion helps mitigate the effects of group influence and resistance to authority, ensuring a more objective and unbiased consensus.

2.2 Development of an Instrument for Evaluating Learning Objects

For the purposes of this research, an instrument was developed to evaluate learning objects. This instrument can be used either within e-learning systems or independently as an auxiliary tool for quickly assessing the suitability of learning objects in the educational process. The fundamental measurement characteristics of any instrument are validity and reliability. Validity determines whether and to what extent the instrument measures exactly what it is intended to measure. The reliability assessment process involves calculating the Cronbach's alpha coefficient when the instrument utilizes a Likert scale (Cronbach, 1951; Cronbach & Warrington, 1951). The process of developing a learning object evaluation instrument using the Delphi method is presented below.

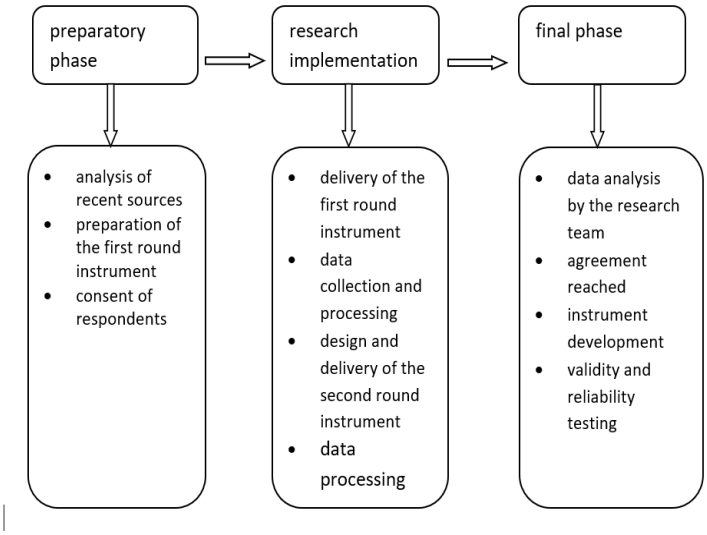

Figure 1. The process of creating an instrument using the Delphi Method in individual phases

Source: Author

In the preparatory phase of developing the instrument based on previous research related to the selection of criteria for adapting learning content in the educational process (Gligora Marković et al., 2018), the following criteria were selected for the assessment of learning objects: learning objectives according to the revised Bloom's Taxonomy (Krathwohl, 2002), learning style according to the VAK division (Chislett & Chapman, 2005), cognitive style Deep/Surface according to the Biggs (2001). Based on the selected criteria, the preparation of the first round of the instrument for assessing learning objects was initiated in such a way that for each individual criterion, statements or questions were proposed that would assess the extent to which the learning object satisfies a particular criterion. Thus, the following method of testing was envisaged to assess the extent to which the learning object satisfies a particular level of Bloom's Taxonomy learning objectives: initially, based on the literature studied (Anderson & Krathwohl, 2001; Krathwohl, 2002), a certain number of verbs were selected for each level, the importance of which was assessed by members of the expert team.

The examination of learning style according to the VAK division was carried out in such a way that for each manifestation of VAK statement was proposed about the level of use of a

particular form in the learning object. The suggested levels are from 1 to 5, where 1 indicates not represented at all, 2 is represented to a lesser extent, 3 is equal to other forms of content presentation, 4 is represented to a greater extent, and 5 is fully represented in this form of content presentation.

To examine the extent to which the learning object influences each category of Depp/Surface cognitive style, statements were formulated according to the original questionnaire, but only for the strategy category. The experts evaluated the proposed statements in relation to the original ones from the questionnaire for examining cognitive style in students (Biggs, 2001) and stated the extent to which they agreed with the proposed statements. They expressed their opinion on a scale from 1 to 5, where 1 represents completely disagree and 5 represents completely agree. All questions in the instrument also included space for additional comments and suggestions.

In addition to the groups of questions related to the development of the instrument, the online survey questionnaire also contained demographic questions for the experts who had expressed their consent to participate in the research in advance.

The selection of respondents was in accordance with the theoretical knowledge of the Delphi method, a systematic selection of experts was used, and 25 of them agreed to participate in the research, the number of which was appropriate for the implementation of this method, and 21 of them actually responded to the research in all rounds of the Delphi method. All experts are from universities and polytechnics of the Republic of Croatia.

During the research implementation phase, a link to the online questionnaire with instructions on conducting the research and the planned deadlines was sent by e-mail. After the planned time expired, access to the online questionnaire was disabled and the collected data was processed. Data processing techniques in research in which the Delphi method is applied primarily involve the application of descriptive statistics, namely measures of central values such as mode and arithmetic mean (Hsu, Sandford, 2007), if they are suitable for assessing the content validity of the instrument.

3. Results with Discussion

The following are the results of the research after the first round, related to the development of an instrument for assessing learning objects.

The first group of questions was related to giving a rating of the importance of verbs for each level of Bloom's taxonomy. Respondents rated the importance of each verb using a Likert scale from 1 to 5, where 1 indicated completely unimportant and 5 extremely important.

Verbs of the first level of Bloom's taxonomy were mostly rated with an average rating higher than 3.19, as can be seen from Figure 2. In addition to the arithmetic mean of the importance ratings of each verb, the value of the most frequent occurrence of each importance rating (mode) was calculated.

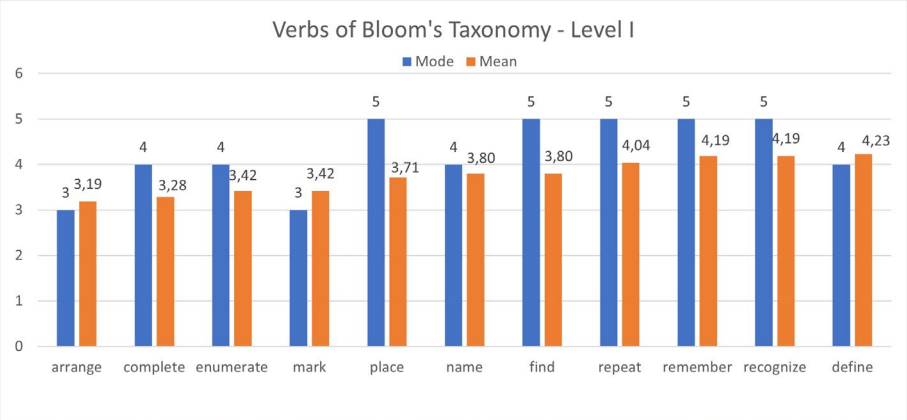

Figure 2. Verbs of first level of Bloom's Taxonomy

Source: Author

The average importance ratings of the verbs of the first level of Bloom's taxonomy range from 3.19 to 4.23, which means that the respondents rated the importance of the listed verbs in the range from neutral (neither is nor is it important) to important.

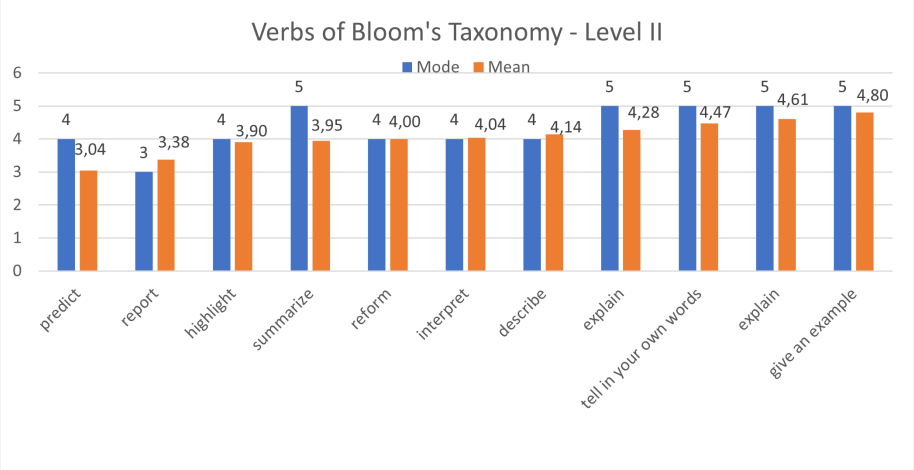

Figure 3. Verbs of second level of Bloom's Taxonomy

Source: Author

When assessing the importance of the verbs of the second level, we can also see that the most frequent rating for the verb predict is 4, which means that the respondents most often consider the observed verb to be important, although its average rating is 3.04, which tells us that some of the ratings of the participants in the study are extremely low or high, because we know that the mean measure is very sensitive to final ratings. (See Figure 3)

Verbs at the third level of Bloom's taxonomy were also mostly rated with an average score higher than 3.5, namely 9 of the 11 verbs offered. The arithmetic mean values, and the most frequent values (mode) for verbs at the third level of Bloom's taxonomy, are shown in Figure 4.

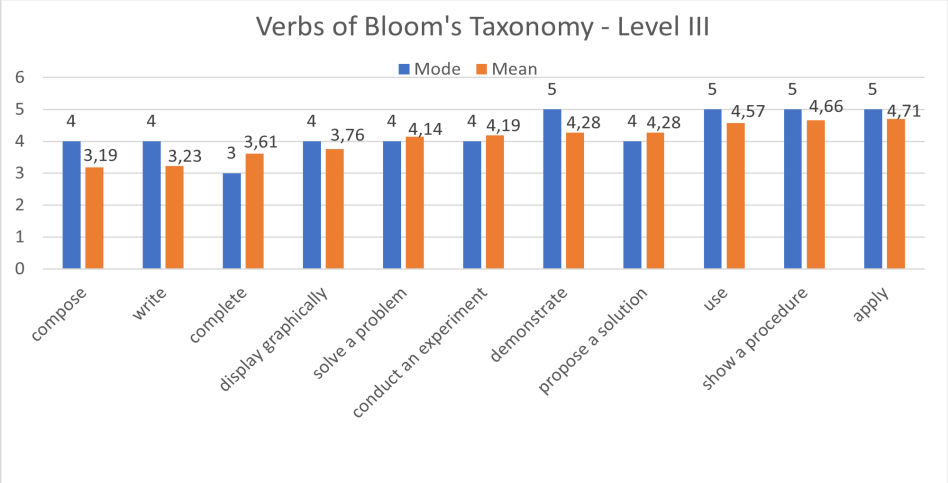

Figure 4. Verbs of third level of Bloom's Taxonomy

Source: Author

The respondents rated the verb compose with the most frequent score of 4, i.e. important, while the average score of importance was 3.19. The other verbs are in line with the most frequent score and the corresponding average score.

Figure 5 shows the values of the arithmetic mean and mode for each individual verb of the fourth level of Bloom's taxonomy.

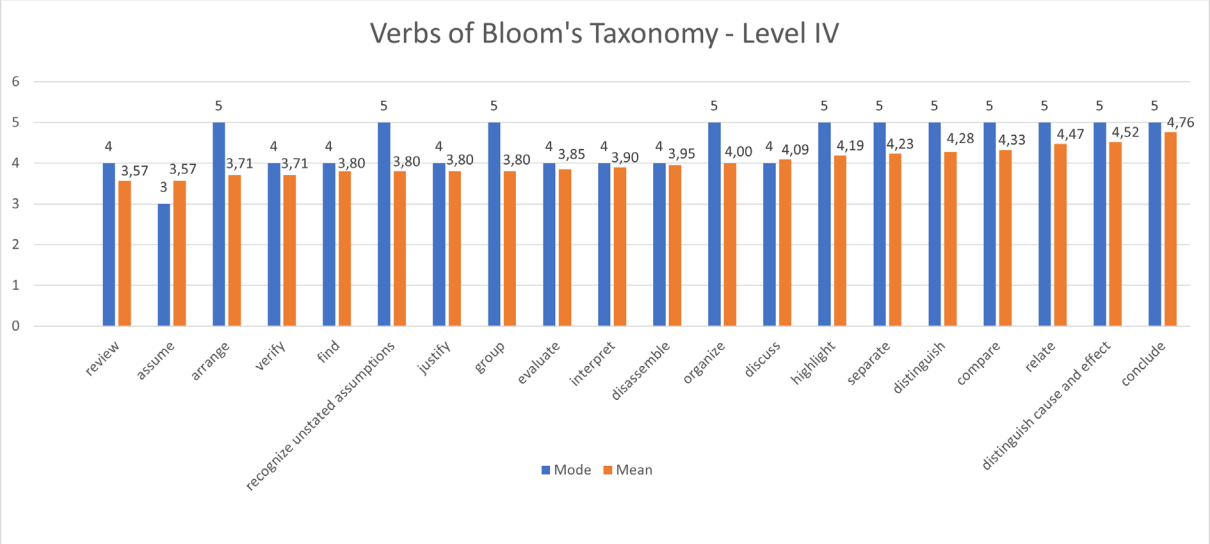

Figure 5. Verbs of fourth level of Bloom's Taxonomy

Source: Author

The most common importance rating for the verb assume is 3, i.e. neither is nor is it important. The average rating for this verb is 3.57. Only this verb has the most common rating of neither is nor is it important, while all other verbs are rated as important or extremely important. This is expected because these are verbs at level IV of Bloom's taxonomy, which are an integral part of the learning outcomes of higher education. The verb conclude has the most common rating of 5 and the highest average rating of 4.76.

Verbs at level V of Bloom's taxonomy are also all rated with an average rating higher than 3.5, as can be seen in the table, i.e. most have an average rating higher than 3.8, as shown in Figure 6.

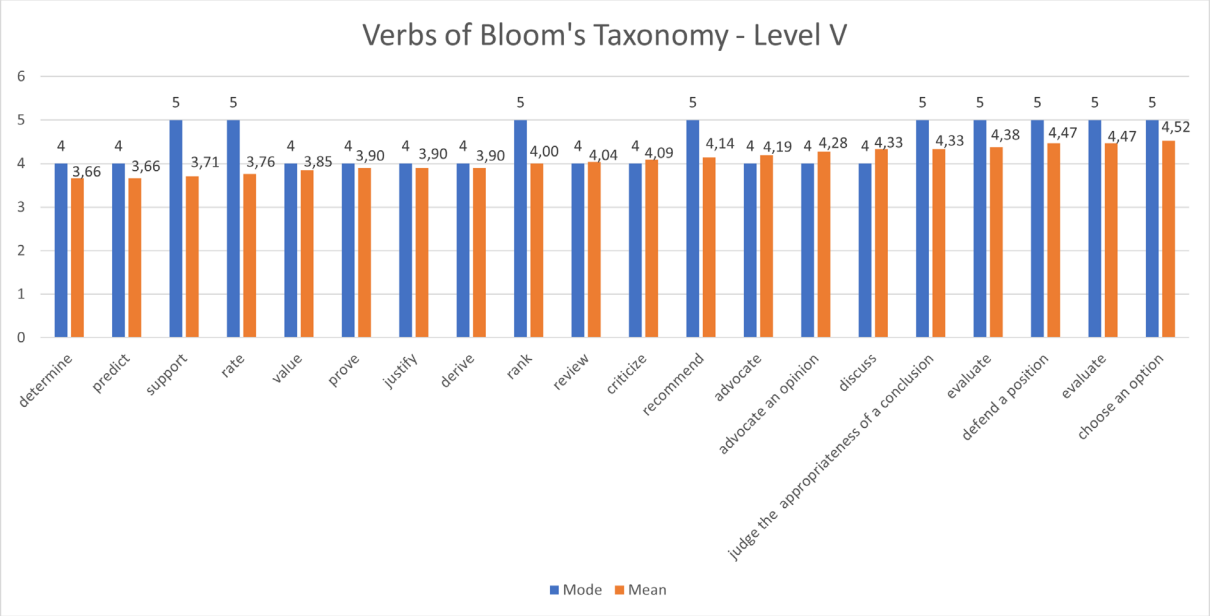

Figure 6. Verbs of fifth level of Bloom's Taxonomy

Source: Author

All verbs at this level have a rating of important or extremely important. With high most frequent ratings and average ratings. The average importance rating of verbs ranges from 3.66 to 4.52.

Figure 7 shows the values of the most frequent importance rating (mode) and the average importance rating (arithmetic mean) for verbs at level VI of Bloom's taxonomy.

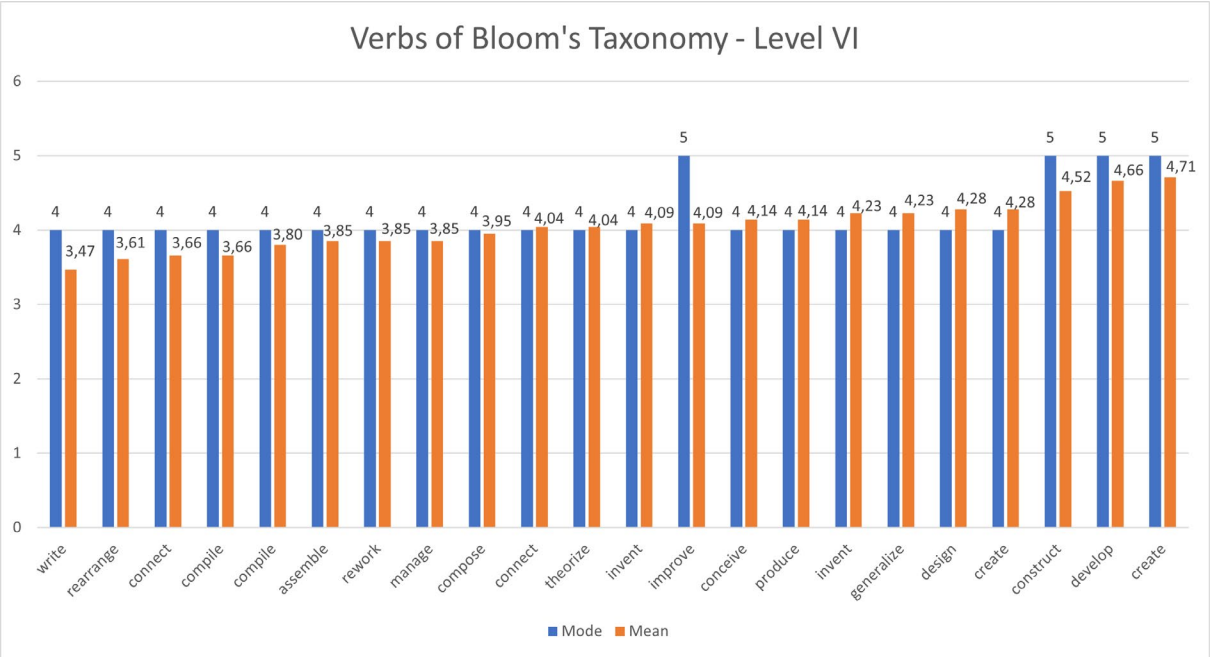

Figure 7. Verbs of sixth level of Bloom's Taxonomy

Source: Author

The verb write was most often rated 4, meaning important as the verb with the lowest rating in the group. While the verb create was rated as extremely important with an average rating of

4.71. In addition to the verb create, the verbs develop and construct also stand out with high average importance ratings.

In this group of questions, in addition to each question related to a particular level of Bloom's taxonomy verb there was also an area intended for giving comments. However, there were none in this round.

If we compare the results obtained for verbs of all levels, we can see that the higher the level of Bloom's taxonomy, the higher the importance ratings of the verb.

The second group of questions was related to the proposed statements that will assess how well an individual learning object corresponds to the VAK learning style. Statements were offered for each individual form of the VAK learning style and possible answers in the instrument (not represented at all, represented to a lesser extent, equal to other forms of content presentation, represented to a greater extent, this form of content presentation is fully represented). The experts expressed their agreement with scores from 1 to 5, where 1 meant completely disagree and 5 meant completely agree. They had the opportunity to comment on each question. However, no additional suggestions for changes were made to any of the statements. Which is also evident from the average scores on their agreement with the proposed statements as well as the frequencies of individual levels of agreement. Table 1 shows the proposed statements for each learning style and their average agreement scores of the expert team members.

Table 1. Proposed statements of the VAK learning style assessment instrument

Proposed statements of each VAK learning style	**Frequencies of levels of agreement for the statements offered**		**Percentage of agreement**
How much are drawings, pictures, tables, graphs and text represented in the learning object? (Visual/Read)	Strongly disagree	0	-
	Disagree	0	-
	Neither agree nor disagree	0	-
	Agree	7	33%
	Strongly agree	14	67%
How much is the audio recording represented in the presentation of content? (Aural)	Strongly disagree	0	-
	Disagree	0	-
	Neither agree nor disagree	0	-
	Agree	8	38%
	Strongly agree	13	62%
How prevalent are practical examples of content application in the learning object? (Kinesthetic)	Strongly disagree	0	-
	Disagree	1	4.76%
	Neither agree nor disagree	1	4.76%
	Agree	4	19.05%
	Strongly agree	15	71.43%

Source: Author

For the proposed question assessing the presence of the Visual learning style in the learning object, all respondents agreed with the statement, 14 of them completely agreed, while 7 agreed.

Regarding the question examining the presence of the Aural learning style, 13 respondents completely agreed, and 8 agreed with the statement.

The final question on learning styles assessed the representation of the Kinesthetic learning style. One respondent disagreed with the proposed statement, one was neutral (neither agreed nor disagreed), four agreed, and the remaining 15 completely agreed. Although two

respondents disagreed, they did not provide any comments or suggest an alternative wording for the question.

These results indicate a high level of agreement among respondents across all categories. The findings suggest that experts largely support the proposed statements, particularly as no additional comments or suggestions for revisions were provided.

Overall, the percentage of agreement far exceeds 70%, which is considered the threshold for high agreement in the Delphi method (De Loe, 1995).

The third group of questions focused on cognitive style, specifically the learning approach strategy. This section contained ten statements adapted for the assessment of learning objects, based on the original questionnaire for evaluating students' cognitive styles by Biggs (2001). Table 2 presents the proposed statements along with the most common agreement ratings.

Table 2. Proposed statements for the assessment of the object of learning according to the original Biggs questionnaire (2001)

No	Statement	Mode	Mean	SD
1	The time spent studying using this learning object will give the student a feeling of deep satisfaction.	4	4,09	0,68
2	By using this learning object, the student will pass the course with minimal effort. and that is his goal.	4	3,90	0,86
3	By using this learning object, the student will become more familiar with the topic and it will be more interesting to him.	5	4,23	0,92
4	By using this learning object, the student will keep his engagement to a minimum.	4	3,80	1,00
5	The experience of using this learning object for the student is the same as watching a good movie or reading a good novel.	4	3,76	1,01
6	Using this learning object, the student will be able to remember key parts without understanding.	5	3,90	1,15
7	The student will work hard on the course because the content of the learning object is interesting.	4	4,04	0,94
8	Using this learning object is not useful for studying the topic in depth and may cause the student to feel confused and waste time.	5	3,71	1,11
9	Using the learning object will encourage the student to ask questions in class that they want to get answers to.	5	4,23	0,92
10	The content of this learning object will probably not be on the exam and is not important to the student.	4	3,28	1,27

Source: Author

The respondents generally agree with the proposed statements, as evidenced by the most frequent occurrence of agreement level 4 (I agree) for 6 statements, or level 5, I completely agree. The comments given by the respondents in this round of research are presented below, and new propositions for the statements were formed based on them. It is the respondents' comments that are considered one of the most important contributions to research conducted using the Delphi method.

Statement 1. The time spent learning using this learning object will give the student a feeling of deep satisfaction.

Comments and suggestions:

1. "It is too strong for me to describe it as deep satisfaction through learning...deep satisfaction occurs when the subject is very well known and higher levels of Bloom's taxonomy are reached. Suggestion: The student felt satisfaction after learning with this learning object."
2. "Perhaps instead of deep. use the word great satisfaction / exceptional satisfaction."

By analyzing the comments. this statement was reshaped into the following:

The student will feel exceptional satisfaction after learning using this learning object.

Statement 2. By using this learning object the student will pass the course with minimal effort, which is his goal.

Comments and suggestions:

1. This is somehow contradictory to me. I didn't really understand it. Namely. it is possible for a student to pass the course with minimal effort (because unfortunately it sometimes happens that the effort invested by the teacher and the student is inversely proportional). but somehow I do not believe that this is the goal of any teacher. Now only after reading the comment below is it clearer to me! :-) Maybe rephrase the question to: "Using this learning object. it is possible for students to pass the course with minimal effort. if that is their goal."
2. Maybe instead of passing the course - pass the exam in the course?

Given the very detailed comments, the new proposal for this claim reads:

By using this learning facility, it is possible for students to pass the exam with minimal effort, if that is their goal.

Statement 3. By using this learning object, the student will become more familiar with the topic and will find it more interesting.

Comments and suggestions:

1. This question is also "strange" to me. Namely. we can judge based on what we have seen whether a student will get to know a topic more than expected or not. but they should not judge based on the content alone whether that topic will be more interesting for them or not. only they can do that. It is possible that the opposite is true. that a topic is even more repulsive or boring to him if he gets to know it better. because we are all different with a diverse spectrum of interests.

The analysis of this comment determined that the proposed statement will not be changed, since the comment is not focused on the form of the claim itself and its clarity, but on the content that will be referred to when it is applied.

Statement 4. By using this learning object, the student will keep his engagement to a minimum,

Comments and suggestions:

1. "This seems quite similar to: By using this learning object. the student will pass the course with minimal effort. and that is its goal...if we are talking about minimal effort...then it is evident that the goal is to pass...perhaps make one parameter of both...

Analysis of the comments has transformed the proposed statement into the following:

By using this learning object, the student will not be engaged more than the minimum.

Statement 5. The experience of using this learning object for the student is the same as watching a good movie or reading a good novel.

Comments and suggestions:

1. Is a comparison with a good movie or reading a good novel necessary. or can it be with some other activity that is closer to today's students. e.g. playing their favorite online games?

2. I would also connect this criterion with the first one about satisfaction...namely. satisfaction is a unique feeling and if someone says that they watched a "good" movie. it automatically means that they were satisfied during that process...

The proposed statement was transformed into the following based on the conducted analysis and the suggestions given by the respondents:

The experience of using this learning object for the student is the same as playing a favorite computer game.

Statement 6. Using this learning object, students are able to memorize key parts without understanding.

Comments and suggestions: no comments or suggestions

Since there were no comments for this statement, it was not reformulated.

Statement 7. The student will work hard on the course because the content of the learning object is interesting.

Comments and suggestions:

1. Similar to one of the previous comments. You should not comment on the interestingness of the course on behalf of another person. What is interesting and stimulating to us may not be to someone else. I am clearly bothered by these questions that we shift from the first person to the third person. A more realistic question might be: "I find the content of the object interesting and I think students will be happy to use it".

This statement was reformulated completely according to the comments and suggestions of the respondents into the following statement:

The content of the learning object is interesting and students will be happy to use it.

Statement 8. Using this learning object is not useful for studying the topic in depth and can cause students to feel confused and waste time.

Comments and suggestions:

1. If the goal was to study the topic in depth. then first the student chose some learning objects to get acquainted with the material. so if he wanted to get to know the topic more deeply. perhaps a better adjective than confusion is dissatisfaction due to unfulfilled desires and needs.
2. This question is logically formulated completely correctly. Although one should be careful when drawing conclusions because the answers to this question cannot be interpreted in light of the original question because they are fundamentally different.

The reformulated statement based on the respondents' comments and suggestions is the following:

Using this learning object is not useful for studying the topic in depth. so it can cause the student to feel dissatisfied due to unfulfilled needs.

Statement 9. Using a learning object will encourage the student to ask questions in class for which they want to get answers.

Comments and suggestions:

1. I suggest: instead of asking questions in class, a more proactive approach to studying the topic. In this way, additional activities are included that encourage the student to study the topic in depth in addition to asking questions.

2. This question is logically formulated completely correctly. Although one should be careful when drawing conclusions because the answers to this question cannot be interpreted in light of the original question because they are fundamentally different.

Since the goal is to create an instrument for assessing learning objects regardless of the teaching method and the application of technologies. The following statement was formulated by analyzing the comments:

Using a learning object will encourage students to take a more proactive approach to studying the topic.

Statement 10. The content of this learning object will probably not be on the exam. So, it is not important for the student.

Comments and suggestions:

1. The content of this learning object may not be necessary for passing the exam. but it gives the student additional knowledge in the field.
2. This original question makes sense when asked to a student because many of them calculate... However, I believe that no teacher will assess the importance of the material based on its appearance in the exam, and in this sense it is completely unnecessary. Perhaps the content of the material can be commented on in terms of whether it is more adapted to regular content or some additional content.

By analysing the respondents' comments, the statement was reshaped into the following:

The content of this learning object provides the student with additional knowledge from a wider field of learning content, although they will not be examined.

According to the experts' comments, the statements were reformulated in a new proposal for the instrument for the next round of Delphi research.

After the analysis of the responses to the questionnaire received, verbs of individual levels that achieved an average importance rating of 4.00 and higher were taken into account for the next round of research, as this means that these verbs were mostly rated as important and extremely important.

Questions related to the examination of learning style according to the VAK division were not further examined, since the agreement regarding these statements was extremely high, from 90.47% to 100%, therefore, this part was adopted as such by the analysis and was not included in further research. The respondents were familiar with the results of the conducted research round.

The statements related to the examination of cognitive style according to Biggs (2001) were included in their new form according to the comments and suggestions of the respondents of the previous research round.

Based on the processed data, an instrument for the next round was created, which was also in the form of an online questionnaire, delivered via e-mail to the members of the expert team.

The planned data collection time for this round was two weeks, with the same response rate as the previous round, N=21.

The results of the data collected after this round of the Delphi method are shown below.

The first group of questions was related to the assessment of the importance of individual verbs at all six levels of Bloom's taxonomy.

Figure 8 shows the values of the most frequent importance rating (mode) for the verbs at the first level of Bloom's taxonomy (2nd round).

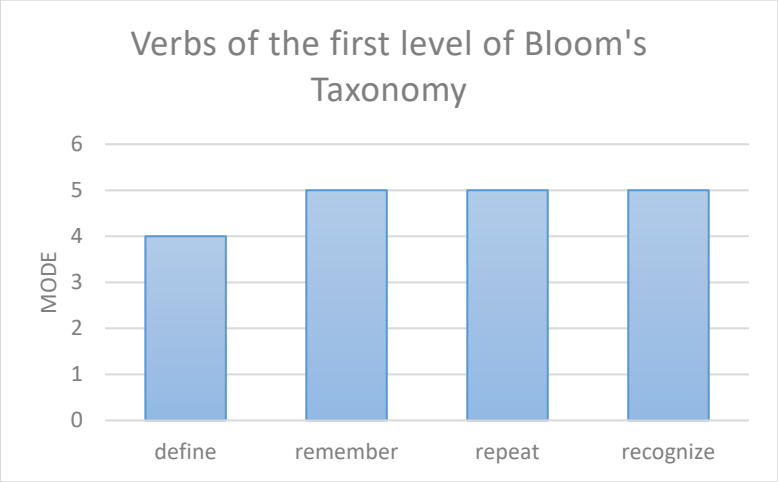

Figure 8. Mode of first-level verbs according to Bloom's Taxonomy

Source: Author

The verb define was most frequently rated 4, meaning important. The respondents rated the verbs remember, repeat and recognize most frequently with a score of 5, meaning extremely important. We can observe small deviations from the group's rating.

Figure 9 shows the values of the most frequent importance ratings for verbs at the second level of Bloom's taxonomy.

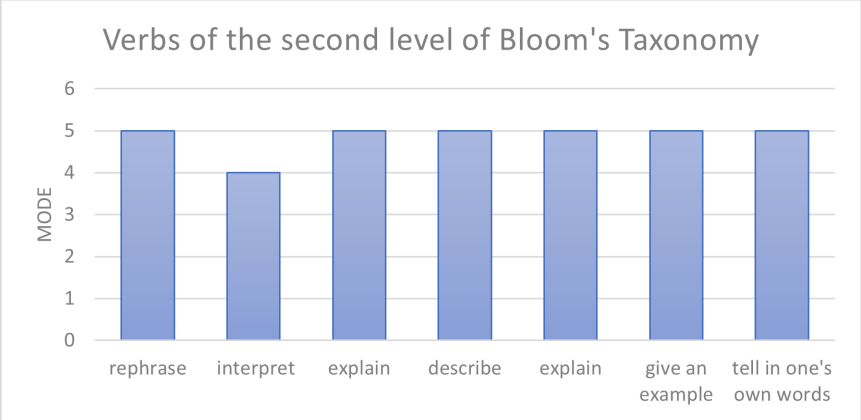

Figure 9. Mode of second-level verbs according to Bloom's Taxonomy

Source: Author

The most frequent score for the verbs to explain, describe, explain, give an example, tell in your own words is 5, or extremely important. Only verb interpret has the most frequent importance rating of 4, or important.

Figure 10 shows the most frequent importance scores for verbs at the third level of Bloom's taxonomy.

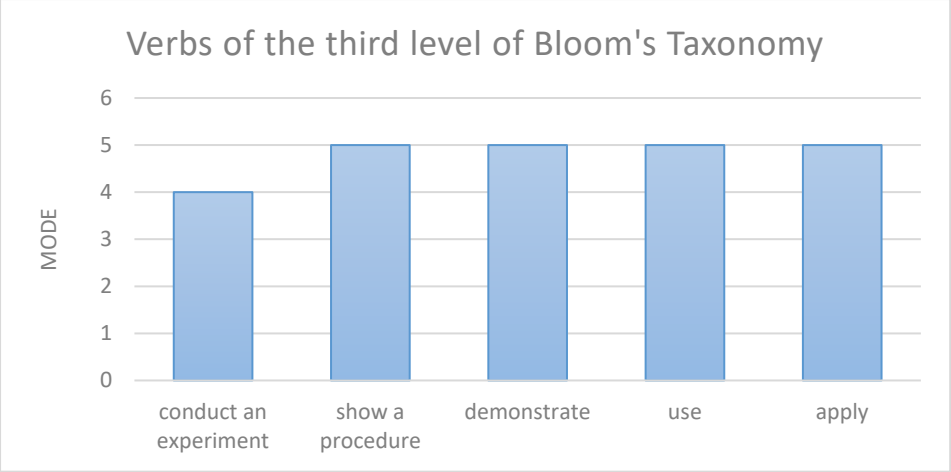

Figure 10. Mode of third-level verbs according to Bloom's Taxonomy

Source: Author

The verb to conduct an experiment is most often rated 4, or important. While the most common ratings for the verbs to show a procedure, demonstrate, use, apply are 5, or extremely important.

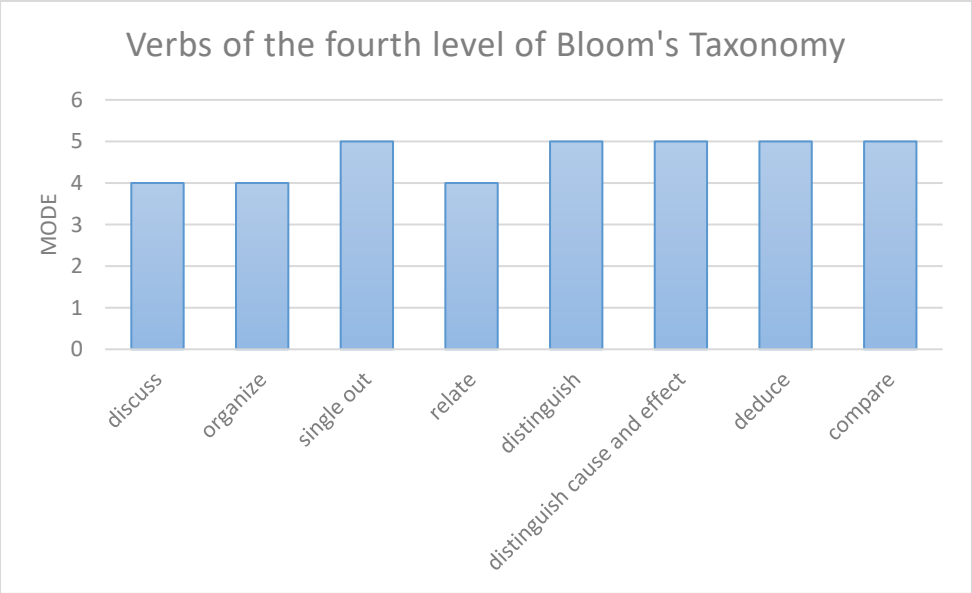

Figure 11. Mode of fourth-level verbs according to Bloom's Taxonomy

Source: Author

Figure 11 shows the values of the importance ratings for verbs of the fourth level of Bloom's taxonomy.

The verbs discuss, organize and relate were most frequently rated by the respondents with a score of 4, meaning important. While the verbs to separate, highlight, distinguish, distinguish cause and effect, conclude, compare were rated with a score of 5, meaning extremely important.

Figure 12 shows the most frequent importance ratings for verbs at the fifth level of Bloom's taxonomy.

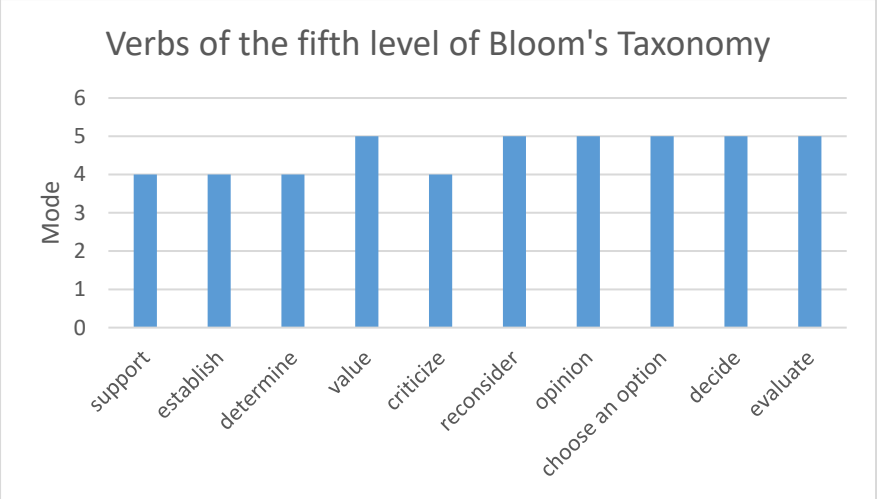

Figure 12. Mode of fifth-level verbs according to Bloom's Taxonomy

Source: Author

The verbs support, determine, criticize, establish were most often rated with a score of 4, i.e. important. The respondents rated the verbs to choose an option, to value, to reconsider, to choose an option, to decide, to evaluate with a score of 5, i.e. extremely important.

Figure 13 shows the values of the average importance score and the most frequent importance scores of the verbs of the sixth level of Bloom's taxonomy.

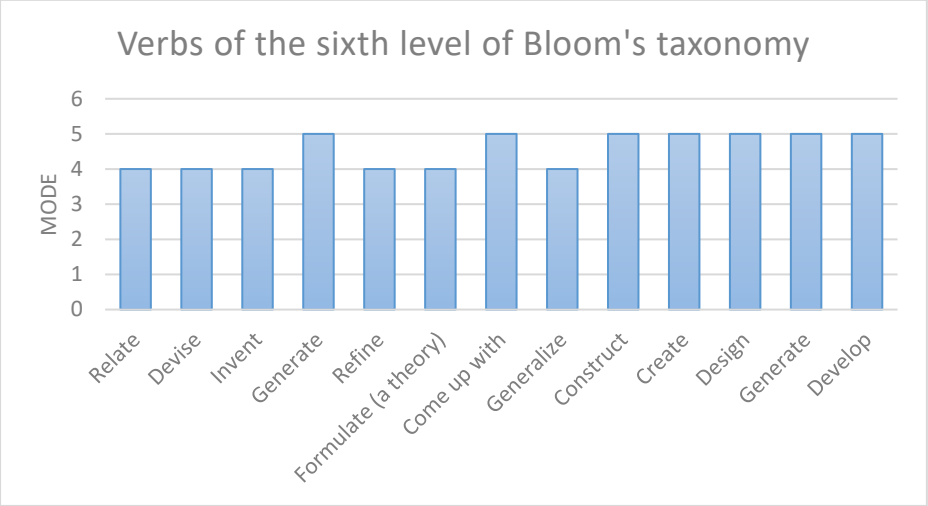

Figure 13. Mode of sixth-level verbs according to Bloom's Taxonomy

Source: Author

The respondents most often rated the verbs connect, invent, invent, improve, set up a theory, generalize with a score of 4, i.e. important.

The respondents most often rated the verbs produce, devise, construct, create, design, create, develop with a score of 5, i.e. extremely important.

Table 3 shows the statements related to the examination of cognitive learning style with the corresponding average scores of agreement of the proposed statements.

Table 3. Values of the average score of agreement and the mode of the proposed statements in the second round of the Delphi method.

No.	Statement	Mode	Mean	SD
1	The student will feel immense satisfaction after learning with this learning object.	4	3.71	0.54
2	Using this learning object. students can pass the exam with minimal effort if that is their goal.	4	3.85	0.98
3	By using this learning object. the student will become more familiar with the topic. making it more interesting.	4	3.71	0.98
4	Using this learning object. the student will not engage more than the minimum required.	4	3.76	0.42
5	The experience of using this learning object is the same as playing a favorite computer game.	4	3.90	0.30
6	Using this learning object leads to memorization of key parts without understanding.	4	4.00	0.81
7	The content of the learning object is engaging. and students will enjoy using it.	4	4.09	0.81
8	Using this learning object is not useful for in-depth study of the topic. which may cause the student to feel dissatisfied due to unmet learning needs.	4	4.00	0.61
9	The use of this learning object will encourage the student to take a more proactive approach to studying the topic.	4	4.33	0.56
10	The content of this learning object provides students with additional knowledge from a broader field of study. even though it will not be tested.	4	4.04	0.78

Source: Author

There were no more textual comments on the statements made in this round.

4. Conclusion

The result of the Delphi method implemented in this research is an instrument for evaluating learning objects as a support for individually personalized teaching regardless of the form in which it is implemented. The validity of the instrument was confirmed by the high degree of agreement of the respondents with the proposed statements and ratings. While the reliability of the instrument was tested by calculating the Cronbach alpha coefficient which is 0.9165 for the entire instrument.

The instrument consists of three parts. The first part refers to the teacher's assessment of how much the learning object will successfully contribute to the achievement of a particular level of learning objectives according to Bloom's taxonomy. In such a way that each level is represented by the three verbs that received the highest importance ratings in the second round of the Delphi method. In this way, the verbs selected for the first level of learning objectives were: remember, repeat and recognize. The verbs of the second level of Bloom's taxonomy included in the instrument are: tell in your own words, give an example and explain. When choosing verbs of the third level, the verbs that received the highest importance ratings were: demonstrate, use and apply. The fourth level of Bloom's taxonomy is represented by the verbs to distinguish cause and effect, conclude, compare. The verbs of the fifth level of Bloom's taxonomy included in the instrument are: evaluate, decide, choose an option. The verbs of the sixth level of Bloom's taxonomy in the instrument are: design, create, develop. These verbs received the highest average importance ratings, and the most common importance rating is extremely important. The second part of the instrument contains statements that evaluate the learning object in relation to the learning style according to the VAK method. The statements offered assess the extent to which a particular form of learning content presented by one of the

styles (Visual/Aural/ Kinesthetic) predominates in the learning object. For Visual, the following statement was created: How prevalent are drawings, pictures, tables, graphs and text in the learning object? For Aural, the following statement was created: How prevalent are audio recordings in the presentation of content? While the statement for Kinesthetic is as follows: How prevalent are practical examples of content application in the learning object? The third part of the instrument contains proposed statements that assess the extent to which a particular learning object satisfies the Deep/Surface cognitive learning style (approach to learning strategy) according to author Biggs (2001). The statements are designed in such a way that respondents who evaluate the learning object express their level of agreement on how much the learning object satisfies each statement. The scale has five levels. The statements are presented in Table 3.

The plan for future research includes the application of an instrument for assessing the quality of learning objects used in teaching subjects in the field of biomedical informatics in the Merlin/Moodle e-learning system. The researchers also intend to include AI agents available in the Moodle LMS for faster and better validation of learning objects by use this instrument.

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