

Preliminary Needs Assessment for the Development of An Effective Drill-Based Deep Learning Textbook for University Students

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Abstract- This study aims to analyze students' needs regarding the development of an Islamic Religious Education (PAI) textbook designed based on deep learning and drill strategies. The background of this research is rooted in the importance of instructional materials that can promote deep understanding, critical thinking, and problem-solving skills through structured exercises. This study employs a quantitative descriptive approach using a survey technique involving 45 student respondents. Data were gathered through a 4 point Likert scale questionnaire comprising 10 items and analyzed through descriptive statistical methods. The findings indicate that students' highest needs relate to textbooks that can guide them from basic concepts to solving complex problems (mean score: 3.44), as well as the inclusion of open-ended questions that stimulate critical thinking (mean score: 3.42). On the other hand, aspects such as the weaknesses of current textbooks and the one-way lecture method received lower average scores. Overall, students expressed a strong need for textbooks that are systematic, reflective, and contextual. Therefore, the results of this study recommend the development of a PAI textbook based on deep learning and drill as an innovative solution to improve the quality of Islamic Religious Education learning in higher education.

Keywords: Needs analysis; Textbook; Deep learning; Drill

I. INTRODUCTION

Twenty-first century education emphasizes the importance of higher-order thinking skills, including the ability to analyze, reflect critically, and solve complex problems. In this context, the deep learning approach becomes highly relevant to be implemented in the learning process, as it encourages learners to develop deep understanding rather than merely memorizing information (Sakman et al., 2024). This is consistent with the views expressed by (Córdova-Esparza et al., 2024) that deep learning has the advantage of encouraging students to understand the material meaningfully rather than merely

memorizing it. This approach helps students develop critical, analytical, and reflective thinking skills, and encourages them to actively construct knowledge through experience and connections between concepts.

In addition, deep learning strengthens learner autonomy, problem-solving ability, and the application of knowledge in real-life situations, making it more relevant to the demands of 21st-century learning.

The deep learning approach is a learning strategy that encourages students to understand material in a meaningful way, connect new knowledge with prior experiences, and apply concepts in real-world contexts rather than simply memorizing them (Weng et al., 2023)

However, the achievement of deep learning is often hindered by the lack of instructional materials that can systematically and gradually guide students toward deep understanding. This is evident at STKIP Taman Siswa Bima, where the teaching materials developed by lecturers are still far from being contextual and effective in directing students toward meaningful comprehension—particularly in the Islamic Religious Education (PAI) course.

Another issue identified in the learning process is the lack of activities that train students through repeated practice in solving problems.

Based on these challenges, one method that has proven effective in strengthening the foundation of conceptual understanding is the drill method, which involves structured exercises designed to reinforce and internalize basic cognitive skills through repetition (Sudirman & Zain, 2023). Drill is not merely a mechanical exercise; when properly designed, it can serve as a bridge toward meaningful and deep learning. (Jenny Obligado Duppins, 2023), In practice, many textbooks tend to focus solely on the presentation of theoretical content, without providing adequate and systematic practice opportunities, resulting in weak learning retention.

Therefore, the development of a drill based deep learning textbook has become an urgent need. Such a textbook not only presents essential concepts but is also equipped with gradual exercises that encourage students to think reflectively, synthesize information, and internalize concepts through repeated practice.

However, to date, there are still very few textbooks that explicitly and comprehensively integrate deep learning principles with the drill approach, particularly within the context of higher education in Indonesia.

Most previous studies have focused on only one aspect either the development of textbooks based on deep learning principles *or* the application of drill techniques without exploring their combined implementation in an integrated instructional design (Wang, 2023) or the effectiveness of drill exercises for mastering basic skills (Dewi et al., 2020), research on the effectiveness of deep learning (Naseer et al., 2024), (Sun et al., 2023), (X.

Zhang & Cao, 2021), (Prihantini et al., 2025). Research related to development is limited to the development of deep learning teaching materials. (Rosyidah et al., 2025), (Bagus et al., 2025) and other research (Chen & Singh, 2024), (Y. Zhang & Qiu, 2024), (Tian et al., 2023). Of all the research that has been conducted, none has combined the two into a single, comprehensive and systematic teaching medium. Furthermore, most textbook development is conducted without prior needs analysis involving students and lecturers as direct users. Yet, the needs analysis stage is a crucial part of the research and development model, which aims to ensure the resulting product is appropriate and relevant to the user's context. (Branch, 2017).

This research possesses scientific novelty, which lies in three main aspects: 2) The integration of a deep learning approach with a drill strategy in a single textbook, systematically and contextually structured. 2) The conduct of a front-end needs analysis prior to the development process, as a basis for designing the textbook's content and format to meet student needs. 3) The evaluation focuses on the impact on deep learning indicators, such as analytical, reflective, and synthetic skills, which are rarely addressed in similar research. With this approach, the developed textbook is expected to bridge the gap between theory and practice and support students in achieving in-depth, structured, and applicable learning.

II. METHODS

1. Types and Approaches of Research

This research is a descriptive qualitative-quantitative (mixed methods) study using a survey approach. This approach was chosen to explore the needs of users, specifically students and lecturers, regarding the development of a deep learning-based textbook with a drill strategy. This research is the initial stage of the research and development process, namely the needs analysis stage.

2. Research Subjects and Locations

The subjects of this study were second-semester students of the Elementary School Teacher Education (PGSD) program who were teaching Islamic Religious Education (PAI) and three lecturers, totaling 45 students. This study was conducted at STKIP Taman Siswa Bima during the even semester of the 2025/2026

academic year.

3. Data collection technique

Data collection was conducted using:

- Semi-structured interviews. Conducted with several lecturers as key informants to obtain more in-depth and contextual data.
- Documentation study. Reviewing lesson plans (RPS) and textbooks currently used in Islamic Religious Education courses to identify the limitations of existing teaching materials.
- Questionnaire. The instrument was designed on a Likert scale to explore students' perceptions regarding the need for textbook development.

6	Deep Learning Strategies	Students prefer an active and reflective approach
7	Critical Thinking	Need open-ended questions that challenge reasoning
8	Textbook Structure	Material is arranged from easy to complex
9	Effectiveness of Problem-Based Textbooks	Books can develop critical thinking
10	Evaluation of Current Methods	Lectures do not support active understanding and communication

4. Research Instruments

This study used two instruments to collect data. The first instrument was a questionnaire aimed at students to explore their needs regarding the development of relevant, structured, and contextual Islamic Religious Education (PAI) textbooks. The second instrument was an interview guide used to obtain information from PAI lecturers, with the aim of understanding their views, experiences, and expectations regarding the development of textbooks that meet the learning needs of higher education institutions.

Tabel 1. Questionnaire Instrument Grid

No.	Measured Aspects	Indicators
1	Weaknesses of Current Textbooks	Material does not support in-depth understanding
2	Content Needs	Need contextual problems, not memorization
3	Learning Strategies	Students are helped by a case-based approach
4	Weaknesses of Current Textbooks	Material does not challenge critical thinking
5	Drill Practice	Need questions with a gradual level of difficulty

Tabel 2. Interview Instrument Grid

Aspects Explored	Indicators
Learning Objectives	Clarity of critical and reflective learning direction
Depth & Contextuality of the Material	Relationship of material to real life and depth of discussion
Question Quality	HOTS questions, openness of questions, case studies
Exercise Structure (Drill)	Gradual and systematic practice
Active Learning Activities	Student involvement in collaborative and reflective activities

Instrument validation was conducted through expert judgment by three experts, and content validity analysis used the Gregory formula. Reliability was tested using Cronbach's Alpha, and the results were declared reliable if $\alpha > 0.7$. The result of the Cronbach's Alpha analysis using SPSS was 0.9, indicating that the instrument is reliable

5. Data Analysis Techniques

Quantitative data from the questionnaire were analyzed descriptively using statistics, including the average value, frequency, and percentage of each aspect.

$$\text{percentage} = \frac{\text{score obtained}}{\text{Total Score}} \times 100\%$$

Interpretation of needs using the following criteria.

Table 3. Interpretation of Needs

Average Score	Interpretation of Needs
4,20 – 5,00	Highly needed
3,40 – 4,19	Needed
2,60 – 3,39	Moderately needed
1,80 – 2,59	Less needed
1,00 – 1,79	Not needed

Qualitative data from interviews were analyzed using thematic analysis techniques (Miles & Huberman, 1994) through data reduction, data presentation, and conclusion drawing. The results of this analysis served as the basis for designing the initial specifications for the drill-based deep learning textbook.

III. RESULT AND DISCUSSION

The data from the questionnaire filled out by students relates to students' needs for the development of PAI textbooks based on problem solving.

Table 4. Description of Questionnaire Results

Description	Score
Number of respondents	45 students
Total score of all respondents	1.338
Highest score	34
Lowest score	26
Ideal maximum score (45×40)	1.8
Average score	29.73
Score range	8 (34 – 26)
Median score	30
Mode	31
Need category	Sufficiently Needed

Based on the summary of the questionnaire completed by 45 students, a general overview reveals that the need for the development of Islamic Religious Education (PAI) textbooks based on deep learning and

drill strategies is quite high. The 10-item questionnaire yielded a total score of 1,338, out of an ideal maximum score of 1,800. Students' scores ranged from 26 to 34, with an average score of 29.73. Converted to a 4-point scale, the average score per student was 2.97, which falls into the "fairly needed" category based on the interpretation of the score range. The median score was 30, indicating that half of the students scored above or equal to that score, while the mode (the most frequently occurring score) was 31.

These data indicate that, in general, students believe that existing PAI textbooks do not fully meet their needs for gradual and in-depth learning. While not indicating an extremely high need, the distribution of scores indicates a positive trend, indicating that the majority of students support the development of more contextual, reflective, and structured textbooks. The highest score of 34 also confirms that some students strongly desire changes to the textbook that can guide them from basic material to complex problem-solving questions. Meanwhile, the lowest score remains at a score indicating moderate need, meaning there is no significant resistance to the idea of developing a new textbook. Thus, these results can provide a strong basis for designing Islamic Religious Education textbooks that are more relevant to student needs and in line with 21st-century learning approaches that emphasize critical, collaborative, and reflective thinking. The following is the analysis data per statement item.

Table 5. Results of the analysis of each statement item

Item	Total Score	Average	Needs Category
P1	97	2,16	Simply Needed
P2	151	3,36	Simply Needed
P3	152	3,38	Simply Needed
P4	104	2,31	Simply Needed
P5	146	3,24	Simply Needed
P6	148	3,29	Simply Needed
P7	154	3,42	Needed
P8	155	3,44	Needed
P9	152	3,38	Simply Needed

P10	79	1,76	Not Needed
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Based on the summary of questionnaires administered to 45 students, we obtained a picture of their needs for the development of Islamic Religious Education (PAI) textbooks designed to support deep learning and drill-based learning. Of the ten items analyzed, the average scores ranged from 1.76 to 3.44. This indicates variation in the level of student need for each aspect measured.

The item with the highest average score was statement 8 ("I want a book that guides me from simple examples to more complex problem-solving problems"), with an average score of 3.44, which falls into the needed category. This indicates that students strongly desire a systematic and gradual textbook structure, in line with the drill principle in learning. Statement 7 ("I like being given open-ended questions that encourage deeper thinking") also received a high average score of 3.42, reflecting the importance of providing reflective and challenging reasoning questions in textbooks.

Most of the other statements, such as statements 2, 3, 5, 6, and 9, ranged from 3.24 to 3.38 on average, categorizing them as moderately needed. This indicates that although students recognized the importance of problem-solving questions, tiered exercises, case-based approaches, and context-based textbooks, they had not explicitly stated a pressing need for them.

Meanwhile, the first and fourth statements, highlighting the weaknesses of current textbooks, only received average scores of 2.16 and 2.31, respectively, indicating that students tended to be neutral, not overly critical of the available materials, but remained open to improvements. The lowest-scoring statement was statement 10 ("I find it difficult if learning is only one-way lectures"), with an average score of 1.76, categorized as unnecessary. This could be interpreted as meaning that some students are still comfortable or accustomed to conventional learning models such as lectures.

Overall, these findings indicate that students support the development of textbooks that are structured, step-by-step, include open-ended questions, and can guide them in deep thinking. Therefore, textbooks that integrate deep learning and drill approaches are seen as a real need to encourage more meaningful, systematic,

and contextual Islamic Religious Education learning.

A summary of the questionnaire administered to 45 students revealed varying levels of need for the development of Islamic Religious Education (PAI) textbooks based on deep learning and drill strategies. Of the ten items analyzed, the average score ranged from 1.76 to 3.44. This indicates that, despite differences in individual needs, students generally expressed interest and need for textbooks designed to be more interactive, step-by-step, and promote in-depth thinking.

Statement 8, "I want a book that guides me from simple examples to more complex problem-solving problems," received the highest average score (3.44) and falls into the "need" category. This indicates that students strongly desire textbooks that are structured in a step-by-step and systematic manner, in accordance with the principles of drill practice—that is, presenting questions and material from basic to complex levels. This type of practice aligns with the findings of the study (Lehtinen et al., 2017) which emphasizes that drill and deliberate practice can increase mastery of concepts gradually and in depth if arranged correctly.

Statement 7 also received a high average score (3.42), reflecting that students need open-ended questions that challenge critical thinking. This aligns with the deep learning approach, which emphasizes reflective, participatory, and meaningful learning activities (Adhantoro et al., 2025). Open exercises like this can foster analytical and evaluation skills in Islamic Religious Education concepts, enabling students to connect the material not simply by memorizing but by connecting it to real-life situations.

Meanwhile, several statements, such as numbers 2, 3, 5, 6, and 9, fell into the "quite needed" category, indicating that although students recognize the importance of problem-solving questions, tiered exercises, and case-based approaches, they have not yet explicitly identified them as urgent needs. This finding indicates room to improve students' understanding of the benefits of deep learning and drill strategies in their learning process.

Statements 1 and 4, which highlight the weaknesses of current textbooks, received average scores of 2.16 and 2.31 (quite needed). This indicates that students tend to be neutral or

reluctant to criticize existing textbooks, but remain open to innovation and the development of better textbooks. Statement 10 ("I have difficulty if learning is only one-way lectures") received the lowest average score (1.76) and was categorized as "not needed," suggesting that some students are still accustomed to or comfortable with traditional learning methods such as lectures. However, these results are also an important indicator for developers not to completely abandon conventional approaches, but to align them with active and reflective learning methods.

In general, these findings support the results of previous research which stated that the combination of a gradual learning structure (drill) and activities that require critical thinking (deep learning) is able to create learning that is not only meaningful, but also sustainable. (Freeman et al., 2014), (Jenny Obligado Duppins, 2023). Therefore, the Islamic Religious Education textbooks developed should address students' actual needs and be designed to reinforce the following elements: a gradual material structure, open-ended reflective questions, an applicative context, and a discussion space. Such textbooks are believed to be able to support the achievement of essential competencies in Islamic Religious Education in a deep and contextual manner.

Based on the results of interviews and open-ended questionnaires analyzed qualitatively, it can be concluded that the current Islamic Religious Education (PAI) textbooks still have several limitations in supporting learning that emphasizes the development of critical and reflective thinking. Most respondents stated that the textbooks do not explicitly state learning objectives that lead to the development of students' reasoning and reflection, and are still dominated by lectures and memorization. This indicates that the deep learning approach has not been fully internalized in the design and structure of the textbooks used. Although some material is considered contextual and relevant to real life, the presentation is not in-depth enough to arouse curiosity or foster critical dialogue in the classroom.

Furthermore, the questions provided in the PAI textbooks are deemed inadequate in supporting higher-order thinking skills. HOTS questions, case studies, and open-ended questions

appear only sporadically and have not yet become a primary component of learning evaluations. Respondents also stated that the textbooks do not provide systematic practice questions from easy to difficult levels (drills), which are crucial for developing conceptual understanding gradually. Activities such as discussions, projects, and reflections that should support an active and collaborative approach are still rarely found in the textbooks used.

Furthermore, most respondents stated that the available textbooks do not provide evaluation space that assesses students' thinking processes. Evaluations are more focused on the final outcome, rather than on how students develop ideas or solve problems. However, assessments that emphasize the thinking process are crucial for developing a deep understanding and contextual application of Islamic values. Interestingly, most lecturers stated that they have attempted to implement a problem-solving approach in Islamic Religious Education (PAI) learning because it is considered relevant to students' lives and encourages critical thinking. However, these efforts are not fully supported by the available textbooks.

The main challenges faced in encouraging students to think deeply are low motivation, rote-oriented study habits, and the lack of a supportive learning environment for exploring ideas. In this context, respondents suggested that newly developed Islamic Religious Education (PAI) textbooks incorporate important features such as collaborative activities, reflective questions, case study scenarios, and structured drill exercises from basic to complex. Thus, textbooks would not only serve as sources of information but also as pedagogical tools capable of fostering critical thinking, applicable Islamic values, and active student participation in the learning process.

The results of this study indicate that current Islamic Religious Education (PAI) textbooks do not fully support the development of students' critical and reflective thinking skills. This is evident from the finding that most textbooks still focus on conveying normative concepts, memorizing religious texts, and laws without explicitly stating learning objectives that lead to the development of higher-order thinking skills. These findings align with the opinion of Brookhart (2010) which emphasizes that to foster critical thinking skills, teaching materials must be designed to

include clear, challenging learning objectives and encourage analysis, evaluation, and reflection.

Although some lecturers stated that the material in textbooks was sufficiently contextual, the presentation tended to be descriptive and did not delve into in-depth understanding. In the context of 21st-century learning, teaching materials are not only required to be relevant but also to encourage students to build connections between religious concepts and their social realities. This aligns with the principle of deep learning, which, according to (Adhantoro et al., 2025) which prioritizes a meaningful, reflective learning process rooted in students' real-life experiences.

Furthermore, research reveals that most Islamic Education textbooks do not systematically include HOTS (Higher Order Thinking Skills) questions, case studies, or open-ended questions. Yet, these types of questions are crucial for fostering critical thinking and problem-solving skills. Brookhart (2010) states that HOTS questions are a crucial component of assessments aimed at developing students' analytical and evaluative skills. The lack of these types of questions in textbooks indicates that the learning approach still predominantly focuses on lower cognitive levels, namely remembering and understanding.

Other findings indicate that the exercise structure in the textbook does not yet take the form of gradual drills from easy to difficult. However, according to (Lehtinen et al., 2017), model *drill and deliberate practice* very effective. In developing conceptual skills and improving learning performance sustainably, they can be structured systematically. This lack of structure makes textbook exercises ineffective in fostering progressive student thinking. Furthermore, the lack of active learning activities such as discussions, projects, and reflection in textbooks is also a major obstacle hindering the achievement of meaningful learning.

From an evaluation perspective, lecturers believe that textbooks don't provide enough space to assess students' thinking processes. The evaluations used are still focused on final results and don't address process aspects such as analytical skills, argumentation, and reflection. (Wiggins & McTighe, 2006) emphasizes the importance of authentic assessment, which

evaluates not only what students know but also how they construct knowledge and make decisions based on the values they learn. Therefore, textbooks ideally provide an evaluation format that not only tests memorization but also facilitates the exploration of in-depth understanding.

Interestingly, most lecturers stated that they have implemented a problem-solving approach in Islamic Religious Education (PAI) learning because they believe it connects the teaching material to the realities of students' lives. This presents a strategic opportunity to design textbooks that support this approach, particularly through the provision of real-life cases, open-ended questions, and reflective activities. The challenges lecturers face in guiding students to think deeply are largely related to learning habits that are still oriented toward memorization and low student motivation. Therefore, the textbooks to be developed must be able to act as facilitators that encourage active student engagement, not simply as presenters of material.

Overall, the results of this study confirm the importance of developing Islamic Religious Education textbooks based on deep learning and practice drills to address the challenges of modern learning. Such textbooks are expected to not only convey religious material normatively but also encourage students to think reflectively, solve problems, and internalize Islamic values contextually.

IV. CONCLUSION

The questionnaire results indicated that students need Islamic Religious Education textbooks that are structured, contextual, and encourage critical thinking. They desire books that include drill exercises, open-ended questions, and problem-solving. While not critical of the existing textbooks, students support the development of deep learning-based drill textbooks as a more meaningful and relevant learning tool for today's needs.

Based on the interviews, it can be concluded that the current Islamic Religious Education textbooks do not fully support learning that encourages critical, reflective, and contextual thinking. The material remains normative, HOTS questions and step-by-step exercises are not systematically presented, and discussion and reflection activities are minimal. Evaluations in the

textbooks also fail to assess students' thinking processes. Lecturers welcomed the development of deep learning-based and drill textbooks as a solution to improve the quality of Islamic Religious Education learning, making it more meaningful and applicable.

REFERENCES

- Adhantoro, L. M. A. M. S., Purnomo, E., Kurniaji, & Tribuana, G. (2025). Implementation of Deep Learning in Education: Towards Meaningful and Joyful Learning Experiences. *Journal of Deep Learning*, 1(1), 47–56.
- Bagus, I., Arjaya, A., Hermawan, I. M. S., Putu, S., Surata, K., Sintya, K., Sari, P., Ulan, K., Wati, P., & Dema, K. (2025). *Optimalisasi Pengembangan Bahan Ajar Berbasis Deep Learning dan Artificial Intelligence dalam Pendidikan Vokasi*. 3(4), 1730–1740.
- Branch, R. M. (2017). Cultural-Based Physical Education: The Impact of Traditional Sports on Students' Physical Fitness and Cultural Identity. *International Journal of Sports Science*, 8(4), 145–155. <https://scihub.st/https://link.springer.com/book/10.1007/978-0-387-09506-6>
- Chen, J., & Singh, C. K. S. (2024). A Systematic Review on Deep Learning in Education: Concepts, Factors, Models and Measurements. *Journal of Education and Educational Research*, 7(1), 125–129. <https://doi.org/10.54097/gzk2yd38>
- Córdova-Esparza, D. M., Romero-González, J. A., Córdova-Esparza, K. E., Terven, J., & López-Martínez, R. E. (2024). Active Learning Strategies in Computer Science Education: A Systematic Review. *Multimodal Technologies and Interaction*, 8(6). <https://doi.org/10.3390/mti8060050>
- Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, 111(23), 8410–8415. <https://doi.org/10.1073/pnas.1319030111>
- Jenny Obligado Duppins, M. (2023). Effect of D.E.S.I.R.E. (Drill Exercises Towards Students' Increased Responsive Engagement) on the Improvement of Higher Math Skills. *American Journal of Educational Research*, 11(5), 279–286. <https://doi.org/10.12691/education-11-5-5>
- Lehtinen, E., Hannula-Sormunen, M., McMullen, J., & Gruber, H. (2017). Cultivating mathematical skills: from drill-and-practice to deliberate practice. *ZDM - Mathematics Education*, 49(4), 625–636. <https://doi.org/10.1007/s11858-017-0856-6>
- Naseer, F., Khan, M. N., Tahir, M., Addas, A., & Aeja, S. M. H. (2024). Integrating deep learning techniques for personalized learning pathways in higher education. *Heliyon*, 10(11), e32628. <https://doi.org/10.1016/j.heliyon.2024.e32628>
- Prihantini, P., Sutarto, S., Apriliyani, E. S., Stavinibelia, S., Arsyad, M., & Mukhtar, D. (2025). Deep Learning Approaches in Education: A Literature Review on Their Role in Addressing Future Challenge. *TOFEDU: The Future of Education Journal*, 4(5), 1213–1220. <https://doi.org/10.61445/tofedu.v4i5.532>
- Rosyidah, W. M., Suprayitno, E., & Na'fan, M. (2025). Pengembangan Modul Ajar Materi Peradaban Pra Islam dengan Pendekatan Deep Learning. *Advanced Journal of Education and Religion*, 2(2), 18–25.
- Sakman, Abdulkarim, A., Komalasari, K., & Masyitoh, I. S. (2024). Unveiling the Merdeka Curriculum: A Review of Local Wisdom Integration in Civic Education for Junior High Schools. *KnE Social Sciences*, 2024, 200–208. <https://doi.org/10.18502/kss.v9i19.16496>
- Sudirman, S., & Zain, M. I. (2023). Application of The Drill Method to Improving Science Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 9(4), 1886–1891. <https://doi.org/10.29303/jppipa.v9i4.3649>
- Sun, L., Wang, J., Gong, & Jiang, N. (2023). The Effectiveness of Implementing Deep Learning Activities in a Blended Learning Perspective Based on Big Data Analysis. In *Proceedings of the 2022 International Conference on Educational Innovation and Multimedia Technology (EIMT 2022)*. Atlantis Press International BV. <https://doi.org/10.2991/978-94-6463-012-1>
- Tian, X., Park, K. H., & Liu, Q. (2023). Deep Learning Influences on Higher Education Students' Digital Literacy: The Mediating Role of Higher-order Thinking. *International Journal of Engineering Pedagogy*, 13(6), 33–49. <https://doi.org/10.3991/ijep.v13i6.38177>
- Wang, L. (2023). On the Current Situation of the Selection of PEP Junior English Textbook Illustrations. *OALib*, 10(10), 1–10. <https://doi.org/10.4236/oalib.1110740>

- Weng, C., Chen, C., & Ai, X. (2023). A pedagogical study on promoting students' deep learning through design-based learning. *International Journal of Technology and Design Education*, 33(4), 1653–1674. <https://doi.org/10.1007/s10798-022-09789-4>
- Wiggins, G., & McTighe, J. (2006). Understanding by Design (2nd ed.). Association for Supervision and Curriculum Development (ASCD). *Understanding by Design*, 1956, 1–18.
- Zhang, X., & Cao, Z. (2021). A Framework of an Intelligent Education System for Higher Education Based on Deep Learning. *International Journal of Emerging Technologies in Learning*, 16(7), 233–248. <https://doi.org/10.3991/ijet.v16i07.22123>
- Zhang, Y., & Qiu, X. (2024). Exploration of Teaching Mode Combining Theory and Practice in Deep Learning Courses. *Journal of Education and Educational Research*, 10(2), 26–29. <https://doi.org/10.54097/cv4n9484>