Analysis of the Implementation of the Independent Curriculum Through the Understanding by Design (UbD) Approach in Chemistry Lessons : Literatur Review

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ABSTRACT

Understanding by Design (UbD) is a design or framework in learning that was first introduced by Grant Wiggins and Mc Ticghe. Understanding by Design (UbD) is defined as a learning design whose goal is to focus on achieving holistic student understanding. This study aims to review the implementation of the Independent Curriculum through the Understanding by Design (UbD) approach in Chemistry subjects through literature studies. The literature study was conducted by collecting data from various articles relevant to this topic, published in the period 2013-2025. This study concludes that the application of the Understanding by Design (UbD) model has proven to be effective and efficient in improving learning achievement, 21st century skills, and students' creative thinking skills, with fun, interactive learning, and encouraging independent learning.

Keywords: *Literatur Riveiw, Understanding by Design, Kimia*

INTRODUCTION

Education is one of the most important factors in human life, because education can make it easier for humans to develop interests, talents, and personalities, as well as understand various sciences about everything related to this world. Therefore, education is a need that must be met in human life. In organizing the education process, there are components that have a strategic role, namely the curriculum. The curriculum is a learning program to achieve institutional goals in educational institutions, so the curriculum has an important role in realizing quality learning. (Amalia & Asyari, 2023).

According to Hunkins and Ornstein (2016), there are four bases for curriculum change and development, namely philosophical, psychological,

historical, and sociological bases. Indonesia has experienced many curriculum changes since 1947 until the end of 2022. The changes were 1974, 1964, 1968, 1973, 1975, 1984, 1994, 1997, 2004, 2006, and 2013. Curriculum change and development are considered to be determinants of the future of students in a nation. Therefore, the curriculum is expected to be implemented properly so that a nation can produce a bright future. Curriculum change and development must receive attention from various parties, both the government and education personnel because curriculum change and development concern the direction and goals of education, learning experiences obtained by students, and the organization of experiences (Amalia & Asyari, 2023).

The Independent Curriculum as a learning recovery option initiated by the Ministry of Education, Culture, Research, and Technology (Kemdikbudristek) has issued a policy regarding the development of the Independent Curriculum. This Independent Curriculum development policy option is given to educational units as an additional effort to recover from the learning crisis during 2022-2024 due to the COVID-19 pandemic. The Kemdikbudristek policy regarding the National Curriculum will be reviewed in 2024 based on an evaluation during the learning recovery period, referring to conditions where the COVID-19 pandemic caused significant obstacles and impacts on the learning process in educational units (Ariga, 2022). Several new things related to the Independent Curriculum, namely differentiated learning, the Pancasila student profile strengthening project (P5), schools and driving teachers, the operational curriculum of educational units (KOSP), multifaceted understanding, and the Understanding by Design (UbD) strategy (Mahdianur *et all*, 2024).

Understanding by Design (UbD) is a framework developed by McTighe and Wiggins (2005) to assist teachers in designing the teaching-learning process (G. P., Wiggins & McTighe, 2005). UbD is based on the view that "student understanding" of a particular topic can be deepened if the teaching-learning process is well designed. The term Understanding by Design (UbD) is the same as backward design. In the Understanding by Design (UbD) approach, backward design focuses more on student learning and understanding. In UbD, design begins with learning objectives, then compiles learning evaluations and then plans learning steps. Therefore, teachers are expected to plan curriculum, teaching, and assessment that focus on improving learning experiences and teaching for effective understanding of learning outcomes (Qushem et all, 2021).

According to Wiggins & McTighe (2012), there are three stages in Understanding by Design learning, namely 1). Identify Desired Result, 2). Determine Acceptable Evidence, 3). Plan Learning Experiences and Instruction. And there are six to design learning experiences and instructions as the main light. These elements are usually called WHERETO, namely: 1). W—Where and Why, 2). H—Hook and Hold, 3). E—Equip and Experience, 4). R—Rethink and Revise, 5). E—Evaluate, 6). T—To be Tailored, 7). O—To be Organized.

According to Natala (2023), the implementation of the backward design framework in Indonesia has existed since 2016. However, its implementation is still not optimal due to several factors, one of which is the lack of understanding of the majority of teachers in Indonesia about the concept of UbD and how to use it in using learning tools. So that with the gradual implementation of the independent curriculum in each school, socialization and the government that is actively raising this topic in driving teachers, driving schools and teacher profession programs (PPG), it is hoped that teachers will begin to understand and implement UbD in learning.

Understanding by Design can be applied to all subjects including chemistry. Chemistry is one of the subjects that is less popular among students, because in science, especially chemistry, abstract things are studied (Ristiyani, 2016). Although this concept is complex and abstract, chemistry is also a subject that is closely related to nature so it is very close to everyday life. Although chemistry is very close to everyday life, chemistry is still a subject that is considered difficult by many students (Herlina, 2020). The reasons why students have difficulty learning chemistry are: lack of interest and attention during the learning process, lack of readiness of students to accept new concepts, lack of emphasis on important prerequisite concepts, instilling concepts that are not deep enough, learning strategies, and lack of variety of practice questions (Yakina, 2017). Haris et al. (2019) found several factors that cause students to have difficulty learning chemistry, including teachers who do not master the material, do not use learning media, and teachers do not apply various innovative learning that requires students to be active.

To address these issues, it is important to reaffirm the role and responsibility of educators in designing structured learning through the Understanding by Design (UbD) approach, especially in the context of Chemistry learning. Therefore, teacher involvement is essential in designing learning objectives, authentic assessments, and meaningful

learning activities. To support a more effective understanding and implementation of UbD in Chemistry learning, an in-depth Literature Review is needed regarding this approach, including how UbD has been applied in the context of chemistry learning.

METHOD

This study uses the Literature Review study method as its approach. Literature study is a type of research that relies on secondary data from various relevant reference sources. Through this approach, researchers can trace, evaluate, and integrate the results of previous studies to gain a more comprehensive understanding of the topic being studied. The subjects of the study were articles taken from Google Schooler and ResearchGate.

This study presents the results of a search on Understanding By Design (UbD) in Chemistry subjects. Article searches were conducted in the Google Schooler and ResearchGate databases with the keywords "Understanding By Design (UbD) in Chemistry subjects". The inclusion criteria for the journal search carried out included: 1) Understanding by Design (UbD) articles in chemistry learning; 2) Publications between 2013-2025; 3) Full text, journal articles and open access.

FINDINGS AND DISCUSSION

Tabel 1:
Data analysis matrix on articles used in literature review

Author, Title, Journal	***Method Design***	***Result***
Nurita, T., Yuliati, L., Handayanto, S. K., Hidayat, A., & Saleah, P. (2025). Case-Based Learning for Creative Thinking Skills on the Ideal Gas Law: Application of the Understanding by Design Framework. *Jurnal Pendidikan IPA Indonesia*, *14*(1).	This study involved 115 randomly selected students, with implementation procedures including the preparation of relevant cases, the creation of tests based on success indicators (fluency, flexibility, originality, and elaboration), the implementation of learning using the CBL and UbD approaches, and the collection of quantitative data	The results of the analysis found a significant effect size of (1.029). The correlation between fluency and originality showed a relatively strong relationship with an effect size of 0.841. The correlation between fluency and elaboration with an effect size of 0.584. Flexibility and originality had the most significant effect size (1.003), Fluency and flexibility also had a significant effect size (1.029), indicating a strong relationship. The effect size

	through pre-tests, post-tests, and essay tests of creative thinking skills, as well as qualitative data through observations and interviews to understand teacher and student activities in depth.	between flexibility and elaboration was 0.856, indicating a strong and statistically significant relationship. This study revealed that CBL with the UbD framework effectively improved students' creative thinking skills, such as fluency in explaining, flexibility in interpretation and perspective, and originality in application.
Nurita, T., Yuliati, L., Handayanto, S. K., Hidayat, A., & Saleah, P. (2025). Case-Based Learning for Creative Thinking Skills on the Ideal Gas Law: Application of the Understanding by Design Framework. *Jurnal Pendidikan IPA Indonesia*, *14*(1).	This study involved 115 randomly selected students, with implementation procedures including the preparation of relevant cases, the creation of tests based on success indicators (fluency, flexibility, originality, and elaboration), the implementation of learning using the CBL and UbD approaches, and the collection of quantitative data through pre-tests, post-tests, and essay tests of creative thinking skills, as well as qualitative data through observations and interviews to understand teacher and student activities in depth.	The results of the analysis found a significant effect size of (1.029). The correlation between fluency and originality showed a relatively strong relationship with an effect size of 0.841. The correlation between fluency and elaboration with an effect size of 0.584. Flexibility and originality had the most significant effect size (1.003), Fluency and flexibility also had a significant effect size (1.029), indicating a strong relationship. The effect size between flexibility and elaboration was 0.856, indicating a strong and statistically significant relationship. This study revealed that CBL with the UbD framework effectively improved students' creative thinking skills, such as fluency in explaining, flexibility in interpretation and

		perspective, and originality in application.
Jaslin, S., & Yerimadesi, Y. (2025). Implementation of Independent Curriculum on Chemistry Learning Outcomes Phase E at Senior High School. *Jurnal Pijar Mipa*, *20*(2), 260-266.	This research method is descriptive correlational with mixed-method concurrent triangulation design. Quantitative data were obtained from questionnaires and evaluation documents, analyzed using the Spearman Rho correlation test. Qualitative data were obtained from interviews and module reviews, analyzed descriptively. This approach is to measure the relationship between the implementation of the Merdeka Curriculum and chemistry learning outcomes.	From the analysis, it shows that the chemistry teaching module created by the teacher has begun to apply the Understanding by Design (UbD) principle. However, the chemistry teaching module must be completed, especially in the assessment section. The correlation result of the implementation of the Independent Curriculum on chemistry learning outcomes is 0.339 (positive value). Meanwhile, with a p value of 0.021, the implementation of the Independent Curriculum is significantly related to the chemistry learning outcomes of phase E at SMA Negeri 2 Sungai Limau. Based on the calculation, the determination coefficient of this study is 11.5%. This means that the variable of the implementation of the Independent Curriculum (X) slightly affects the variable of chemistry learning outcomes (Y) by 11.5%. The rest (100% - 11.5% = 88.5%) is influenced by other variables not discussed in this study.
Çinkaya, Y. K., & Yurtseven, N. (2024). Anlamaya Dayalı Tasarım (UbD) Temelli Ters-Yüz Edilmiş Sınıf	This study used mixed methods with a quantitative approach through pre-test, post-test, and retention test	The results of the data analysis showed a total pre-test score of the experimental group and the control group of 13.37. Then for the post-test scores of

Modelinin Kimya Derslerinde Öğrenciler Üzerindeki Etkisi. *Türk Eğitim Bilimleri Dergisi*, *22*(2), 815-841	analyzed with ANOVA to measure learning outcomes, and a qualitative approach through student opinions and teacher observations to understand the process and response to learning. The UbD model combined with the flipped classroom was implemented for 12 weeks in grade 9 students, where students learned independently through videos outside the classroom and actively discussed in the classroom through collaborative activities.	the two groups, the total score was 86.49. And in the retention test, each group experienced a decrease in score of 79.34. From these data, it can be concluded that the application of the Understanding by Design model significantly increases students' academic scores and supports the development of more positive learning behavior. Students who take part in learning with this model show an increase in scores from pre-test to post-test and are able to maintain their knowledge on the retention test.
Tshering, S. (2022). *The Impact of Using Understanding by Design (UbD) Model on Class 10 Student's Achievement in Chemistry. IJCER (International Journal of Chemistry Education Research), 6 (April), 29–33*.	In this study, the method used is a pre-test and post-test experimental design with control and experimental groups selected purposively, then given learning using the Understanding by Design (UbD) model in the experimental group and traditional methods in the control group, with achievement data measured before and after treatment through a Chemistry	The results of the analysis show that the pre-test results of the two groups are t = -0.550593, with a significant P value of more than 0.05 (P > 0.05). This shows that there is no significant difference between the average pre-test scores of the experimental and control groups. Then the post-test results show t = 2.069897, with a P value of 0.042775. Because the P value is less than 0.05, it shows a significant difference between the results of the Chemistry Academic

	test, and analyzed using statistics to determine the influence and significant differences between the two methods.	Achievement Test (AACT) between the control group and the experimental group. This study shows that there is an increase in the average value of students' chemistry learning outcomes (increased by 3.9) between the control group and the experimental group after the intervention.

Implementation of Independent Curriculum Through Understanding by Design (UbD) Approach in Chemistry Learning

The implementation of the Independent Curriculum with the Understanding by Design (UbD) approach shows a positive impact on student learning outcomes in chemistry subjects, the use of teaching modules designed with the UbD framework is able to improve students' understanding of concepts and critical thinking skills. Nurita et all (2025), said that the implementation of case-based learning (CBL) with the UbD framework is effective in improving students' creative thinking skills, such as fluency in explaining, flexibility in interpretation and perspective, and originality in application. Although the relationship between curriculum implementation and learning outcomes shows a statistically significant influence, the influence is not too large, indicating that other factors also contribute to determining the success of learning. This emphasizes the need to strengthen and develop other aspects in the teaching and learning process so that the results obtained can be more optimal and comprehensive.

In addition, the results of the study showed that the developed teaching modules have begun to adopt the principles of UbD and are able to support the learning process in the classroom. However, there are still shortcomings, especially in the assessment section. Jaslin and Yerimadesi (2025), said that the chemistry teaching modules created by teachers have begun to apply the principles of Understanding by Design (UbD). However, the chemistry teaching modules must be completed, especially in the assessment section. With the implementation of the Independent Curriculum supported by innovative UbD-based learning strategies, it is hoped that teachers and schools can create a more creative, critical, and independent learning environment. This increase in success does not only depend on the implementation of the curriculum, but also requires support

from various other supporting aspects, such as teacher training, development of learning materials, and innovation in the assessment process and feedback for students.

Implementation of Understanding by Design (UbD) in Chemistry Learning in the International Realm

The implementation of the Understanding by Design (UbD) learning model in collaboration with the flipped classroom approach makes a strong contribution to improving student learning outcomes and knowledge retention in chemistry subjects. Cinkaya and Yurtseven (2024), said that the UbD-TYES educational model is an efficient and effective model for learning and the sustainability of academic knowledge. ongoing. This situation makes the implementation of the UbD-TYES model design in this study useful in chemistry courses. Effective applications according to current learning models to improve student academic success can be evaluated as they are. Because this model not only succeeded in significantly increasing students' academic scores from before to after learning, but also created a more active, reflective, and understanding-oriented learning environment, where students learn independently through digital materials such as videos and animations outside the classroom, then use class time to discuss, solve problems collaboratively, and relate material to their real experiences.

In line with these findings, research conducted by Tshering (2022) also shows that the application of the Understanding by Design model purely in chemistry learning has a positive impact on improving student learning outcomes. In this study, the experimental group that received learning with the UbD approach showed a deeper understanding of concepts and the ability to answer evaluation questions more accurately compared to the control group taught with conventional methods. The UbD approach, which emphasizes determining the final goal first, followed by compiling assessment evidence and designing appropriate learning activities, has been proven to be able to guide students' learning process in a more focused and meaningful way. Students not only memorize the material, but also understand the concepts conceptually and applicatively. In addition, learning designed based on UbD is able to encourage students to think critically, reflect on their learning process, and develop independent problem-solving skills, which are important skills in mastering chemistry and preparing to face the challenges of 21st-century learning.

CONCLUSION

The implementation of Understanding by Design (UbD) in chemistry learning has been proven to have a positive impact on student learning outcomes, as shown in various national (Indonesian) and international journals. Although originating from different contexts, overall findings show consistency that the implementation of UbD is able to improve the understanding of chemical concepts systematically through learning planning that begins with determining the final goal, determining evidence of achievement, and designing relevant and directed learning activities.

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