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Teachers' Efforts in Integrating Deep Learning-Based Instruction in the Curriculum at SMKS Informatika Ciputat

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Abstract

Abstract:
This study aims to comprehensively describe teachers' efforts in integrating deep learning-based instruction into the *Merdeka Curriculum* at SMK Informatika Ciputat. The deep learning approach in education emphasizes deep conceptual understanding, critical thinking, reflection, and the ability to apply knowledge in real-world contexts. In the context of vocational education, the integration of this approach is essential to ensure that students not only master technical skills but also develop analytical, creative, and adaptive abilities in response to technological advancements. This research employs a descriptive qualitative approach to provide a comprehensive depiction of the phenomenon, particularly regarding teachers' strategies in implementing deep learning in the classroom. Data were collected through in-depth interviews, participatory observation, and documentation studies involving productive subject teachers, the school principal, and students from the Software Engineering (RPL) program. Data analysis was conducted interactively using the Miles, Huberman, and Saldana model, which includes data reduction, data display, and conclusion drawing. The findings are expected to reveal teachers' understanding of the deep learning concept, the instructional strategies applied, and the supporting as well as inhibiting factors in its implementation. This study is expected to contribute theoretically to the development of reflective and contextual 21st-century learning models and to provide practical benefits for schools in designing policies and teacher training programs to strengthen meaningful learning in the digital era.

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INTRODUCTION

The transformation of education in the 21st century has significantly shifted the focus of learning from knowledge acquisition to the development of higher-order thinking skills. In the digital era, learners are expected not only to master content knowledge but also to demonstrate competencies such as critical thinking, creativity,

collaboration, and communication (4C skills). These competencies are essential for addressing complex global challenges and adapting to rapid technological changes. Consequently, educational systems are required to adopt innovative pedagogical approaches that foster meaningful, reflective, and student-centered learning environments.

One of the approaches that has gained increasing attention is deep learning in education. Deep learning refers to a learning process in which students actively construct meaning, connect new knowledge with prior understanding, and apply concepts in real-world contexts (Fullan, Quinn, & McEachen, 2018). This approach contrasts with surface learning, which emphasizes memorization and short-term retention. Deep learning encourages learners to engage in analysis, reflection, and problem-solving, leading to more sustainable and transferable knowledge (Biggs & Tang, 2011). Furthermore, deep learning is closely related to constructivist learning theory, which posits that knowledge is actively constructed by learners through interaction and experience. According to Hattie (2009), learning approaches that emphasize deep understanding have a stronger impact on student achievement compared to traditional teaching methods. In addition, research by Freeman et al. (2014) demonstrates that active and student-centered learning approaches significantly improve student performance in comparison to conventional lecture-based instruction.

In the Indonesian context, the implementation of the *Merdeka Curriculum* provides a strong foundation for integrating deep learning into classroom practices. The curriculum emphasizes flexibility, student-centered learning, and the development of competencies aligned with the Profile of Pancasila Students. It encourages the use of project-based learning, inquiry-based learning, and reflective practices, all of which are essential components of deep learning (Kemendikbudristek, 2022).

In vocational education, particularly in vocational high schools (SMK), the application of deep learning is highly relevant. Vocational students are required not only to master technical skills but also to develop problem-solving abilities, adaptability, and innovation. According to Lucas, Spencer, and Claxton (2012), vocational education should integrate both technical competence and thinking skills to prepare students for the demands of the workforce. Therefore, deep learning becomes a strategic approach to enhance both hard skills and soft skills in vocational education.

Despite its theoretical importance, the implementation of deep learning in educational practice remains limited and inconsistent. One of the primary challenges is the lack of a clear and shared understanding of deep learning among educators. The concept is often interpreted differently, leading to variations in its application in classroom settings (Hattie & Donoghue, 2016). Another significant challenge lies in teacher readiness and pedagogical competence. Many teachers still rely on traditional, teacher-centered approaches that focus on content delivery and examination outcomes rather than meaningful learning processes. Research indicates that teacher beliefs and instructional practices play a crucial role in determining the success of innovative learning approaches (Ertmer & Ottenbreit-Leftwich, 2010). Without adequate professional development, teachers may find it difficult to implement deep learning effectively.

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In addition, institutional and infrastructural factors also influence the implementation of deep learning. The integration of deep learning requires access to digital technologies, interactive learning media, and supportive learning environments. However, disparities in resources and infrastructure remain a major barrier, particularly in developing countries (OECD, 2019).

A review of previous studies reveals that most research on deep learning focuses on its impact on student outcomes, such as critical thinking, engagement, and academic performance. For example, studies have shown that deep learning approaches significantly improve students' higher-order thinking skills and learning motivation (Freeman et al., 2014). However, there is still limited research that examines how teachers actually implement deep learning in classroom practice, particularly in vocational education contexts. Moreover, studies that explore the integration of deep learning within specific curriculum frameworks, such as the *Merdeka Curriculum*, are still scarce. This indicates a research gap in understanding how teachers interpret, adapt, and implement deep learning in real educational settings, especially in vocational schools with unique characteristics and challenges.

In response to the identified research gap, this study aims to explore teachers' efforts in integrating deep learning-based instruction into the curriculum at SMK Informatika Ciputat. Specifically, this study focuses on three main aspects: (1) teachers' understanding of deep learning, (2) the strategies they employ in integrating deep learning into classroom practices, and (3) the supporting and inhibiting factors influencing its implementation. This study is expected to provide both theoretical and practical contributions. Theoretically, it contributes to the development of knowledge on deep learning implementation in vocational education, particularly within the framework of the *Merdeka Curriculum*. It also offers insights into the relationship between pedagogy, curriculum, and 21st-century competencies.

Practically, this study provides valuable recommendations for teachers, school leaders, and policymakers. It offers guidance on how to design and implement deep learning strategies that promote meaningful learning experiences. Furthermore, it supports the development of teacher professional training programs and institutional policies aimed at improving the quality of education in the digital era. By examining teachers' real experiences in a vocational school context, this study provides a contextualized understanding of deep learning implementation and contributes to the development of more adaptive, reflective, and innovative instructional practices.

METHODS

This study uses a *mixed methods* approach with a simple parallel model (concurrent design), where the qualitative approach is dominant, while the quantitative element is used simply to strengthen the research results (Creswell & Plano Clark, 2023). A qualitative approach was used to explore in depth the strategies and experiences of teachers in integrating deep learning-based learning at SMK Informatika Ciputat.

Meanwhile, a simple quantitative approach is used to obtain supporting data in the form of students' perception and level of understanding of learning. According to Moleong (2019), the qualitative approach aims to understand phenomena in depth

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through the interpretation of the meaning of human behavior in certain contexts. Meanwhile, Sugiyono (2023) explained that simple quantitative elements are useful for showing the general tendency of a phenomenon in the form of descriptive numbers, so that the results can strengthen qualitative findings.

This research was carried out at SMK Informatika Ciputat, a vocational education institution that focuses on the field of information and communication technology in South Tangerang City, Banten. This school was chosen because it has implemented the Independent Curriculum, which is conceptually in line with deep learning-based learning principles such as reflection, problem-solving, and contextual learning (Ministry of Education and Culture, 2022).

The research period was carried out for 10 months, from October 2025 to July 2026, including preliminary observation, main data collection, and data analysis. The school's technology facilities and the support of productive teachers make this location relevant to explore how teachers seek to integrate deep learning into the vocational curriculum. The research subjects consist of:

1. 4 Productive teachers in the field of information technology at SMK Informatika Ciputat, who are the direct implementers of learning with the Independent Curriculum approach.
2. Principals and curriculum representatives, who provide policies and supervision related to the implementation of Deep Learning-based learning.
3. 30 students of grade XI of the RPL (Software Engineering) expertise program as supporting informants to see the impact of learning from the perspective of students.

The selection of subjects was carried out by purposive sampling for teachers and principals, because they had direct experience in applying deep learning, as well as total sampling for grade XI RPL students who participated in learning with the teacher (Lincoln & Guba, 1985).

Data and Data Sources

The data sources in this study consist of two types, namely qualitative data and quantitative data.

a. Qualitative data was obtained through in-depth interviews, class observations, and documentation studies (lesson plans, teaching modules, school activity reports).
b. Simple quantitative data was obtained through the dissemination of Likert scale questionnaires (1–5) to measure students' perception and understanding of the application of *deep learning*.

The primary data sources are teachers, principals, and students, while secondary data sources are in the form of school documents and learning policies.

Data Collection Techniques and Instruments

According to Miles, Huberman, and Saldaña (2014), data collection is carried out repeatedly and interrelated between observations, interviews, and documentation. In this study, four main techniques were used:

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Table 3.1 Data Collection Techniques

Data Type	Technique	Purpose	Instruments
Qualitative	In-depth interviews	Exploring teachers' strategies, reflections, and constraints in applying *deep learning*	Semi-structured interview guide
Qualitative	Participatory observation	Observe the implementation of learning and student engagement	Observation sheet
Qualitative	Documentation	Gather supporting evidence for implementation	lesson plans, teaching modules, activity reports
Quantitative	Simple questionnaire	Measure students' perception and level of understanding	Likert scale questionnaire (1–5)

Questionnaires were given to students in grade XI RPL, while interviews were conducted with teachers and principals. Documentation is used to strengthen evidence of triangulation between quantitative and qualitative data.

Data Validity

The main instrument of this research is the researcher himself (human instrument), as explained by Lincoln & Guba (1985), namely as a planner, data collector, analyst, and interpreter of the meaning of research results. In addition, auxiliary instruments are used in the form of:

a. Interview guide, which contains open-ended questions around understanding, learning strategies, supporting factors, and inhibitions of *deep learning implementation* (Creswell & Poth, 2023).
b. Observation sheets, to observe the behavior of teachers and students during the learning process.
c. A simple questionnaire, which contains four indicators:
   1) Understanding of *deep learning* concepts;
   2) Strategies for application in learning;
   3) Supporting factors (facilities, training, technology);
   4) Inhibiting factors (time, workload, understanding).

The questionnaire instrument was validated in terms of content validity through expert judgment and tested for reliability with Cronbach's Alpha using a limit of ≥0.70 (Hair et al., 2022).

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Data Analysis Techniques

Quantitative data was analyzed using descriptive statistics by calculating frequency, percentage, and mean values. According to Sugiyono (2023), descriptive analysis is used to describe phenomena without conducting hypothesis tests, making them suitable for exploratory research.

The results of the analysis are displayed in the form of tables and diagrams to show:

a. The percentage of students who understand *deep learning*;
b. The level of implementation of *deep learning* in the classroom;
c. Supporting factors and perceived obstacles.

Qualitative Data Analysis

The qualitative analysis used the Miles, Huberman, and Saldaña (2014) model which includes:

a. Data reduction: sorting and grouping the results of interviews, observations, and documentation based on the research theme;
b. Data presentation: displaying the results of the analysis in the form of narratives and matrices;
c. Drawing conclusions: interpreting the meaning of the data and finding patterns of teachers' strategies in the application of *deep learning*.

The results of quantitative and qualitative analysis are then triangulated to ensure the validity and consistency of the data (Creswell & Plano Clark, 2023).

Data Validity

To ensure the validity of the research results, four validity tests were used according to Lincoln and Guba (1985), namely:

a. Credibility through triangulation of sources, techniques, and time.
b. Transferability describes the context of the research in detail so that the results can be applied in other schools.
c. Dependability maintains the consistency of the data collection and analysis process.
d. Confirmability maintains objectivity through *member checks* and trail audits.

For quantitative data, validity and reliability were tested simply using SPSS or Excel, adjusting to the level of complexity of the study (Hair et al., 2022).

Table 3.2 Research Stages and Achievement Indicators

Stages	Activities	Moon	Exterior	Achievement Indicators
A. Preparation	Literature study and instrument preparation	9–10	Draft research instruments	Validation by experts completed
	Research coordination and permits	10	Research license	School approved

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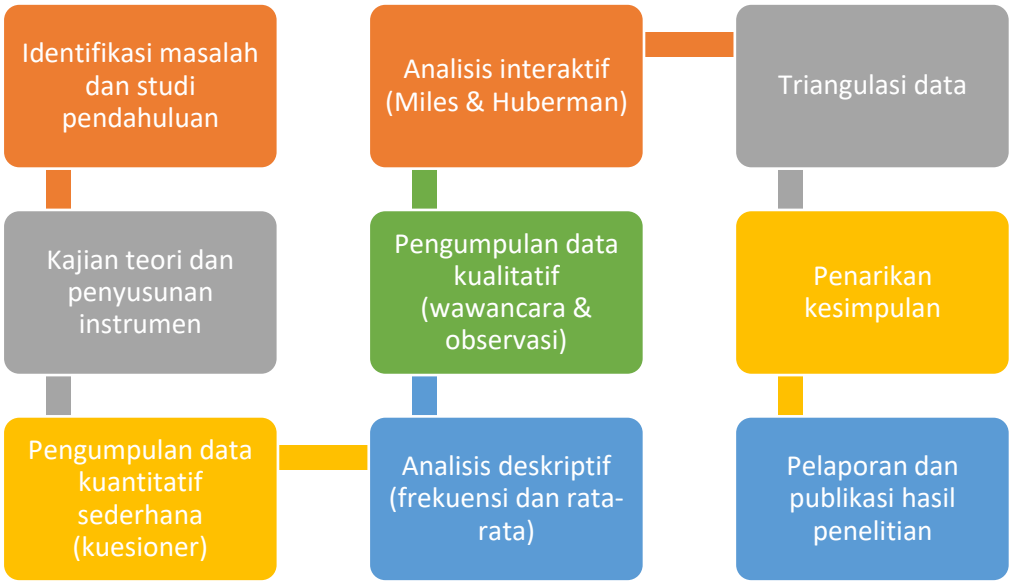
B. Data Collection	Simple questionnaire deployment	10–11	Student perception data	80% of student respondents
	Interviews and observations	11–12	Transcripts and observation notes	Complete field data
C. Data Analysis	Descriptive (quantitative) and thematic (qualitative) analysis	1–2	Integrated analysis results	Preliminary findings are structured
D. Triangulation & Conclusion	Triangulation and validation of results	2–3	Verified data	Consistent results
E. Reporting & Publication	Preparation of scientific reports and articles	3–4	Final report & journal manuscript	Articles ready to ship

Research Flow Diagram

The following is a research flow chart that describes the stages and data flows in its entirety:

Figure 2 Research Flow Diagram



RESULT AND DISCUSSION

This study aims to comprehensively describe teachers' efforts in integrating deep learning-based learning in the implementation of the Independent Curriculum at Ciputat Informatics Vocational School. The *deep learning* approach in the context of education

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is interpreted as a learning process that emphasizes deep conceptual understanding, critical thinking skills, reflection, and the application of knowledge in real situations. In the context of vocational schools, this approach is important because students are not only required to master technical skills, but also analytical skills, problem-solving, and adaptation to very fast technological developments.

This study uses **a mixed methods** approach that combines quantitative and qualitative methods to obtain a more comprehensive picture of the phenomenon being studied. This approach was chosen because it is able to provide a deeper understanding through the integration of numerical data and contextual interpretation of the experiences of the study participants. Quantitative data is used to determine students' perceptions of the implementation of *deep* learning-based learning, while qualitative data is used to delve deeper into the experiences, strategies, and challenges faced by teachers in integrating these approaches in the learning process.

Quantitative data was obtained through the distribution of questionnaires to **30 students in grade XI of the Software Engineering (RPL) expertise program** at SMK Informatika Ciputat. The questionnaire instrument was compiled using a Likert scale with a value range of 1 to 5 which represents the level of approval of the respondents to the statement submitted. The questionnaire is designed to measure several key indicators, namely students' understanding of *deep* learning-based learning, learning strategies implemented by teachers, and factors that support and hinder the learning process. The results of the questionnaire were then analyzed using descriptive statistics in the form of frequency, percentage, and mean to obtain an overview of students' perceptions of the implementation of *deep learning* in the classroom.

Meanwhile, qualitative data was obtained through several data collection techniques, namely in-depth interviews, learning observations, and documentation studies. Interviews were conducted with four productive teachers in the field of information technology as well as principals or vice principals in the field of curriculum. This interview aims to explore information about teachers' understanding of the concept *of deep learning*, the strategies used in the learning process, and the obstacles faced in its implementation. In addition, the interview also provides an overview of how teachers adjust the learning approach to the characteristics of students in vocational schools.

Learning observation is carried out to see firsthand how the learning process takes place in the classroom, especially in productive subjects in the field of information technology. Through this observation, researchers can observe the interaction between teachers and students, the learning methods used, and the level of student involvement in the learning process. Observations also help researchers understand how *deep learning* principles are applied in learning activities such as group discussions, problem-based projects, and the use of digital learning media.

In addition to interviews and observations, the researcher also conducted a documentation study on various learning tools used by teachers, such as teaching modules, lesson plans (RPP), presentation materials, and reports on learning activities. The analysis of these documents provides an overview of how teachers design learning that is in line with the principles of *deep learning* and the Independent Curriculum. This

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documentation also serves as supporting data to strengthen the results of interviews and observations.

Data processing in this study is carried out in stages. Quantitative data were analyzed using descriptive statistics to determine the general tendency of students' perceptions towards deep learning-based learning. Meanwhile, qualitative data was analyzed using an interactive analysis model proposed by Miles, Huberman, and Saldaña which included the process of data reduction, data presentation, and conclusion drawn. This analysis process is carried out repeatedly to ensure that the research results truly reflect the conditions that occur in the field.

Through the combination of quantitative and qualitative data, this study is expected to be able to provide a more comprehensive picture of the practice of implementing deep learning-based learning at SMK Informatika Ciputat. The description of the research results presented in this chapter not only displays data in the form of numbers and tables, but also contextually explains the experiences of teachers and students in the learning process. Thus, the results of this study can provide a deeper understanding of teacher strategies, supporting and inhibiting factors, and the implications of the application of *deep learning* in improving the quality of learning in vocational schools.

Quantitative data analysis was carried out with descriptive statistics using the calculation of frequency, percentage, and mean values. The calculation of the mean is carried out using the formula:

$$\text{Mean} = \Sigma X / N$$

Remarks:ΣX = total respondent scoreN = number of respondents

Table 4.1 Interpretation of average values using the following categories:

Interval	Categories
4.21 – 5.00	Excellent
3.41 – 4.20	Good
2.61 – 3.40	Enough
1.81 – 2.60	Less
1.00 – 1.80	Very Less

Meanwhile, qualitative data was analyzed using **the Miles, Huberman, and Saldana** models, namely data reduction, data presentation, and conclusion drawn.

Quantitative Data Results

The first questionnaire aims to find out the extent to which students understand deep learning-based learning applied by teachers.

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Table 4.2
Students' Understanding of Deep Learning

No	Statement	Red	Percentage
1	I understand the material deeply	4.1	82%
2	Teachers encourage students to think critically	4.3	86%
3	Learning helps to understand concepts	4.2	84%

Overall average = **4.2,** Average score of **4.2** indicates a good to **very good** category. This shows that students feel that the learning process carried out by teachers is able to help them understand the material more deeply, not just memorize concepts. The second questionnaire aims to find out the learning strategies used by teachers in implementing deep learning.

Table 4.3Deep Learning Strategies

No	Indicator	Red	Percentage
1	Project-based learning	4.4	88%
2	Discussion and collaboration	4.2	84%
3	Utilization of learning technology	4.3	86%

Average = **4.3,** The score belongs to the **excellent** category, which indicates that teachers have used a variety of active learning strategies that encourage student engagement. When visualized in a bar graph, the results show that **project-based learning has the highest scores**, which means this method is most benefited by students.

Table 4.4Supporting Factors for Deep Learning Implementation

No	Indicator	Red	Percentage
1	Computer laboratory facilities	4.5	90%
2	School internet access	4.2	84%
3	Digital learning media	4.1	82%

Average = **4.26,** This value shows that the supporting factors of deep learning are in the very **good category**. This shows that the learning environment at SMK Informatika Ciputat is quite supportive of the implementation of technology-based learning.

Table 4.5Factors Inhibiting Deep Learning

No	Indicator	Red	Percentage
1	Limited learning time	3.8	76%
2	Differences in students' abilities	3.9	78%

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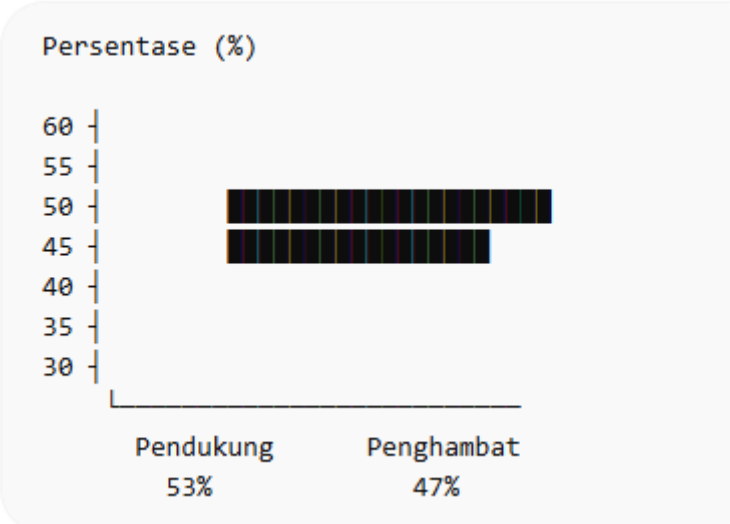
3	Complexity of the material	3.7	74%

Average = **3.8,** This value is in **the category of adequate**, which means that there are still some obstacles in the implementation of deep learning. Graphs that can be used:

Graphic. 2 Pie Diagram of Supporting and Inhibiting Factors



Supporters: 53%
Inhibition: 47%

The graph shows that despite the obstacles, the supporting factors are still more dominant. Based on the results of the questionnaire data analysis, information was obtained that the supporting factors for the implementation of deep learning-based learning had a percentage of **53%,** while the inhibiting factors had a percentage of **47%.** The graph shows that supporting factors are slightly more dominant than inhibiting factors in the implementation process of deep learning at SMK Informatika Ciputat. The main supporting factors that affect the implementation of deep learning-based learning include the availability of learning technology facilities such as computer laboratories, school internet access, and the use of digital learning media. The facility provides opportunities for teachers to implement various innovative learning strategies such as project-based learning, collaborative discussions, and the use of technology in the teaching and learning process.

However, there are still several factors that are obstacles to the implementation of deep learning. Some of the obstacles found include limited learning time, differences in students' academic abilities, and the complexity of learning materials that must be delivered in a relatively limited time. This condition shows that even though the learning environment is quite supportive, a more effective learning management strategy is still needed so that the implementation of *deep learning* can run optimally. A relatively balanced comparison between supporting and inhibiting factors shows that the success of

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the implementation of deep learning-based learning is highly dependent on the teacher's ability to utilize existing supporting factors and overcome various obstacles that arise during the learning process.

The results of qualitative data in this study were obtained through several data collection techniques, namely in-depth interviews, observation of the learning process, and documentation studies of learning tools. This technique is used to gain a deeper understanding of how teachers at SMK Informatika Ciputat integrate deep learning-based learning approaches in the classroom learning process. This qualitative data also serves to complement and strengthen the results of quantitative data analysis obtained through student questionnaires.

Based on the results of interviews with several productive teachers in the field of information technology, information was obtained that the concept of deep learning-based learning has begun to be applied in daily learning activities. Teachers realize that learning in vocational schools does not only focus on delivering material theoretically, but must also emphasize a deep understanding of concepts as well as students' ability to apply that knowledge in real practice.

The teacher explained that the learning approach currently used emphasizes more on practical activities, exploration, and problem-solving related to the world of information technology. In programming subjects, for example, teachers not only explain basic programming concepts theoretically, but also assign tasks to students to develop simple projects related to the material being studied. One of the teachers stated:

> "*In programming learning, students not only learn theory, but directly create projects like simple applications so that they understand concepts in more depth."*

The statement shows that teachers are trying to create a more contextual and meaningful learning experience for students. Through the project activities, students not only understand the concept of programming theoretically, but also learn how to apply the concept in real practice. This approach is in line with the principles of deep learning-based learning which emphasizes deep understanding, active student involvement, and critical thinking skills in solving problems.

In addition, the results of the interviews also show that teachers play a role as facilitators in the learning process. Teachers are no longer the only source of information, but rather play a role in guiding and directing students to find solutions to the problems given. In this process, students are encouraged to discuss, ask questions, and develop creative ideas in completing the assigned tasks.

The results of observations made during the learning process show that the implementation of the deep learning approach has begun to be seen in classroom learning activities. Teachers often assign project-based assignments that require students to work collaboratively in groups. Through these activities, students not only learn individually, but also learn to work together, share ideas, and solve problems together.

During the learning activities, students were seen to be more active in following the learning process. They were involved in group discussions, exchanging opinions about the solutions that would be used in the project, and trying various alternatives in solving

the problems given by the teachers. This condition shows that learning is no longer one-way, but more interactive and participatory. Observations also show that teachers provide opportunities for students to present the results of the projects they have worked on. This presentation activity not only serves as a form of evaluation of learning outcomes, but also as a means for students to practice communication and critical thinking skills. Through the presentation, students can explain the process of working on the project, the obstacles faced, and the solutions they used to solve the problem.

In addition, teachers also provide feedback on the results of students' work. This feedback is given in the form of class discussions and direct comments on the results of the project that have been made by the students. With this feedback, students can understand the strengths and weaknesses of their work and improve learning outcomes in the next activity.

In addition to interviews and observations, this study also uses documentation techniques to obtain supporting data regarding the implementation of deep learning-based learning. The documentation analyzed includes teaching modules, learning tools, and various teaching materials used by teachers in the learning process. The results of the document analysis show that teachers have developed teaching modules that integrate various active learning approaches such as project-based learning, group discussions, and learning reflection. The teaching module is designed to provide opportunities for students to explore concepts in more depth through practical activities and problem-solving. In addition, the learning tools used by teachers also show that there are efforts to integrate digital technology in the learning process. Teachers use various digital learning media such as online learning platforms, learning videos, and interactive applications to help students understand the subject matter.

The use of technology allows students to access various learning resources independently and deepen their understanding of the material studied. This is in line with the principles of deep learning-based learning that emphasizes learning that is exploratory, reflective, and student-centered.

Overall, the results of qualitative data analysis show that teachers at SMK Informatika Ciputat have tried to integrate a deep learning-based learning approach in the learning process. These efforts can be seen through the use of various innovative learning strategies such as project-based learning, collaborative discussions, and the use of digital technology in the learning process. This approach not only increases student engagement in the learning process, but also helps students understand learning concepts more deeply. Thus, the implementation of deep learning at SMK Informatika Ciputat can be said to be running, although it still needs to be strengthened in several aspects such as learning time management and the development of more systematic learning strategies.

The discussion in this study is prepared based on the formulation of the research problem that has been determined in Chapter I. This discussion aims to interpret the research results obtained through quantitative and qualitative data analysis and relate it to previous theories and research on the implementation of deep learning-based learning in the context of vocational education.

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Teachers' Understanding of Deep Learning-Based Learning

Based on the results of research obtained through interviews with productive teachers in the field of information technology, it is known that teachers at SMK Informatika Ciputat generally have a basic understanding of the concept of deep learning-based learning. Teachers understand that deep learning does not only focus on delivering material theoretically, but also emphasizes understanding concepts, critical thinking skills, and the application of knowledge in real contexts.

This understanding is reflected in the way teachers design learning activities that actively involve students in the learning process. Teachers not only provide explanations of the material in class, but also encourage students to explore concepts through practical activities, discussions, and problem solving related to the field of information technology. This shows that teachers are starting to adopt a *student-centered learning approach*, where students are the main subjects in the learning process. These findings are also supported by the results of the questionnaire given to students. Quantitative data showed that students' perception of concept understanding in learning obtained an average score of 4.2, which was included in the good category. This shows that students feel that the learning done by the teacher helps them understand the material more deeply.

Theoretically, deep learning-based learning emphasizes the importance of students' active involvement in the learning process as well as their ability to connect new knowledge with previous learning experiences. According to Suryana (2023), deep learning allows students to build a more comprehensive understanding of the concepts learned so that they can apply them in a variety of different situations. In addition, the results of this study are also in line with Hidayat's (2023) research which states that teachers who have a good understanding of the concept of *deep learning* tend to be better able to create a learning environment that encourages critical and reflective thinking in students. Thus, teachers' understanding of the concept of deep learning is an important factor in the successful implementation of this approach in schools.

However, the results of the interviews also show that teachers' understanding of the concept *of deep learning* is still practical and has not been fully supported by a deep theoretical understanding. Some teachers still associate deep learning only with practical activities or projects, without comprehensively understanding the aspects of reflection, metacognition, and the interconnectedness between concepts that are the main characteristics of *deep learning*. Therefore, efforts are needed to strengthen teachers' pedagogic competence through continuous training and professional development.

Teachers' Efforts in Integrating Deep Learning into the Curriculum

Based on the results of the research, teachers' efforts to integrate deep learning-based learning in the Independent Curriculum at SMK Informatika Ciputat are carried out through various innovative learning strategies. One of the most dominant strategies is the implementation of *project-based learning*. In project-based learning, students are given the task of developing a product or solution to a problem related to the subject matter. In the context of programming subjects, for example, students are required to create simple applications or web-based information systems. Through these activities,

students not only learn programming theory, but also understand how the concepts are applied in real practice.

The results of the questionnaire showed that the learning strategy indicator obtained an average score of 4.3, which is included in the very good category. This shows that students feel that the learning methods used by teachers are able to increase their involvement in the learning process.

In addition to project-based learning, teachers also utilize various digital technologies in the learning process. The technology is used as a learning medium that helps students understand abstract concepts. Teachers utilize online learning platforms, interactive quiz applications, and various digital learning resources to support the learning process. The use of digital technology also allows students to learn more independently and flexibly. Students can access the learning materials at any time as well as explore various sources of information relevant to the topic being studied. This condition is in line with the characteristics of 21st century learning that emphasizes digital literacy and independent learning skills. In addition, teachers also implement group discussion and learning reflection activities. After completing a specific project or assignment, students are asked to present their work in front of the class. This activity not only serves as a form of learning evaluation, but also as a means to develop communication, collaboration, and critical thinking skills.

The findings of this study are in line with the research of Lestari and Nugraha (2022) which states that project-based learning in the Independent Curriculum can improve students' analytical and problem-solving skills. Thus, the integration of *deep learning* approaches in vocational school curricula can make a significant contribution to the development of 21st century competencies in students

Supporting and Inhibiting Factors for the Implementation of Deep Learning

The results of the study show that the implementation of deep learning-based learning at SMK Informatika Ciputat is influenced by various factors, both supportive and obstacles in the learning process.

Based on the results of quantitative data analysis, the supporting factors for learning implementation obtained an average score of 4.26, which is included in the very good category. The main supporting factor found in this study is the availability of adequate learning technology facilities. The school has computer laboratories, internet access, and various technology devices that can be used to support digital-based learning activities.

In addition to technology facilities, school policy support is also an important factor in the implementation of deep learning-based learning. The implementation of the Independent Curriculum provides flexibility for teachers to develop more innovative and contextual learning strategies. Teachers have the freedom to design teaching modules, choose learning methods that suit the characteristics of students, and integrate various learning activities that encourage deep understanding.

On the other hand, this study also found several factors that are obstacles in the implementation of deep learning-based learning. The results of the data analysis showed

that the inhibiting factors obtained an average score of **3.8**, which shows that these obstacles are still quite felt by teachers in the learning process.

One of the main obstacles is the limitation of learning time. Teachers often have to adjust learning activities to a fairly dense curriculum target, so not all project-based learning activities can be carried out optimally. In addition, the difference in students' academic abilities is also a challenge for teachers in designing learning that can reach all students effectively. Another obstacle is the high administrative burden that teachers must meet. Administrative tasks often reduce teachers' time to design innovative and reflective learning. This condition is in line with the findings of research by Fitriani and Marlina (2021) who stated that administrative burden and time constraints are one of the main obstacles in the implementation of deep learning in schools. Furthermore, international studies also highlight similar issues, such as a report by UNESCO (2020) which emphasizes that excessive workload and limited instructional time hinder teachers' ability to implement student-centered learning effectively. In this context, institutional support is crucial to help teachers manage both instructional and administrative responsibilities more efficiently.

However, in general, the implementation of deep learning-based learning at SMK Informatika Ciputat has shown positive developments. This can be seen from the various efforts made by teachers to create more active, contextual, and meaningful learning for students.

CONCLUSION

Based on the research findings, it can be concluded that teachers at SMK Informatika Ciputat have a basic understanding of deep learning-based instruction, which emphasizes conceptual understanding, critical thinking, and real-world application. However, this understanding still needs to be strengthened to ensure more systematic implementation. In practice, teachers have made efforts to integrate deep learning through innovative strategies such as project-based learning, group discussions, and the use of digital technology. These approaches encourage student engagement and foster critical and creative thinking skills in line with 21st-century learning principles. The implementation of deep learning is supported by the availability of technological facilities and flexible school policies, but it also faces challenges such as limited instructional time, differences in students' abilities, and teachers' administrative workload. Overall, the implementation of deep learning shows positive progress.

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