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Learning designs for work and power materials using didactical situation analysis approach

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ABSTRACT

Junior high school students often find learning obstacles in thinking critically and systematically in solving problems in natural science subjects, particularly for work and power materials. This is caused by the sequence and/or stages of curriculum presentation. Efforts to improve the sequence and/or stages of curriculum presentation have been made by examining various alternatives in accordance with students' previous learning experiences as well as their capacity and potential through didactical situation analysis. This study aims to improve students' ability to think critically and systematically in finding solutions to problems given through learning design and developing teachers' pedagogical skills. This qualitative study used a didactical design research design. Data were collected by interviewing students and teachers regarding the delivery of work and power materials. Besides, data collection also involved a documentation study of the modules and teaching materials, including the textbooks. Data were analyzed using an interactive model covering 1) data reduction; 2) data presentation; and 3) Conclusion. The result of the study was in the form of learning designs that consider learning obstacles by predicting students' answers and teacher anticipation before, during, and after learning. Students were also given sharing tasks for the application of the material in daily life.

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ABSTRAK

Kesulitan belajar yang sering dialami peserta didik sekolah menengah pertama pada mata pelajaran IPA materi daya dan usaha adalah kemampuan berpikir secara kritis dan sistematis dalam mengatasi masalah yang diberikan. Munculnya masalah tersebut kemungkinan disebabkan oleh urutan dan atau tahapan sajian kurikulum. Upaya yang dilakukan untuk memperbaiki urutan dan atau tahapan sajian kurikulum, dengan mengkaji berbagai alternatif yang sesuai pengalaman belajar peserta didik sebelumnya, serta kapasitas dan potensinya melalui analisis situasi didaktis. Penelitian bertujuan meningkatkan kemampuan peserta didik berpikir kritis dan sistematis dalam menemukan solusi terhadap masalah yang diberikan melalui desain pembelajaran serta mengembangkan kemampuan pedagogik guru. Penelitian menggunakan metode kualitatif dengan desain Didactical Design Research. Pengumpulan data dilakukan dengan wawancara terhadap peserta didik dan guru terkait cara penyampaian materi daya dan usaha. Teknik lainnya adalah studi dokumentasi terhadap modul dan bahan ajar yang digunakan serta pengkajian berbagai textbook. Teknik analisis data yang digunakan adalah analisis data model interaktif yang mencakup 1) Reduksi data; 2) Penyajian secara naratif; dam 3) Penarikan kesimpulan. Hasil yang diperoleh berupa desain pembelajaran yang memperhatikan hambatan belajar dengan memprediksikan jawaban peserta didik dan antisipasi guru pada sebelum, saat dan setelah pembelajaran. Selain itu peserta didik diberikan sharing task yang merupakan aplikasi materi dalam kehidupan sehari-hari.

Keywords: *daya; desain pembelajaran; situasi didaktis; usaha*

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INTRODUCTION

The Merdeka curriculum emphasizes core material that allows students to have more time to explore the competencies they need. The learning process in the Merdeka curriculum is designed to be simpler, more enjoyable, meaningful, free, and flexible. Teachers can carry out the learning process according to the development of students' abilities and potential (Lestari, 2023). However, junior high school students sometimes encounter obstacles in analyzing a problem given by the teacher, obstacles in communicating, and low collaborative skills in solving problems, especially in science learning (Inganah et al., 2023). Students' understanding of science subjects is the basis for taking real action to make a positive contribution to the development of themselves and their environment. One of the characteristics of science subject learning is inquiry-based which has an important role in science education (Safkolam et al., 2024). Students need to have at least six inquiries in science learning, namely observing, asking and predicting, planning and investigating, processing, evaluating and reflecting, and communicating results (Takda et al., 2022).

Based on the results of observations, junior high school students found obstacles in learning work material and power material in science learning. They can indeed provide solutions based on the problems given, but they are less able to think critically and systematically in the planning process to find these solutions (Ermawan & Fauziah, 2023). Learning obstacles in science subjects can be caused by the sequence and/or stages of curriculum presentation. These obstacles need to be anticipated by changing learning methods (Halim et al., 2022). Teachers usually use the lecture method in learning activities. In addition, in designing learning, they do not consider the characteristics of each student, do not predict how students will react to each activity in the learning process, and do not conduct discussions and reflections at the end of learning (Syawalia et al., 2023).

The results of the initial documentation study of the learning modules used by teachers showed that the modules did not contain predictions of student responses and teacher anticipation of predictions of student responses. The design of the module has not considered the analysis of didactic situations. Based on the results of the interview, teachers only use the lecture method and practice questions. As a result, this learning is centered on the teacher rather than the student so that students have low problem-solving skills. In addition, students find it difficult to connect previous knowledge with other materials and find it difficult to understand the application of the material in the context of everyday life.

Problems in the learning process occur due to low teacher competence. Based on the Kemendikbud website (https://npd.kemdikbud.go.id/?appid=ukg), the results of the Teacher Competency Test (Uji Kompetensi Guru or UKG) show that the pedagogical competence of teachers in Bandung City only reached 58.79% which is lower than the professional competence of 65.97%. The average value is below 70 out of 100 until 2023. This shows that teacher competence is still low. Low teacher pedagogical competence will affect student learning outcomes. The higher the teacher's pedagogical competence, the higher the learning achievement, and vice versa (Sudargini & Purwanto, 2020). Teachers' pedagogical competence needs to be continuously developed along with changes in the curriculum in order to improve learning outcomes. Other factors that cause low teacher pedagogical competence are low motivation in developing themselves and lack of enthusiasm in implementing quality education that is oriented towards the future of students (Ali et al., 2023).

In addition, problems in the learning process can occur because the stages of learning activities do not match the characteristics of the students. Efforts to improve the sequence and/or stages of curriculum presentation can be carried out by examining various possible alternatives according to the students' previous learning experiences and their capacities and potentials through didactic situation analysis.

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Didactics is defined as the art of teaching. As inspired by Socrates' educational practices, didactics means efforts to make students independent in producing new knowledge. As a direct result of the meaning of didactics, Didactic Design Research (DDR) can be defined as a research design based on the nature of didactics as art, science, and epistemology in the context of knowledge diffusion and acquisition to empower students in producing new knowledge as justified true beliefs. This didactic situation analysis effectively helps teachers develop their basic competencies to support the learning process (Verawati et al., 2020).

This didactic situation analysis helps in understanding students' characters and improving students' critical thinking skills. The didactic model in the learning process can improve students' critical thinking skills. This model integrates the principles of psychology, cognitive modification, and neuroscience, and adopts a socio-constructivist and connectivity approach in learning (Ishbayeva, 2024; Sandoval et al., 2022; Ruli et al., 2022; Sari et al., 2023). This model focuses on problem-solving scenarios and cognitive routines to integrate critical thinking skills into all aspects of education confirming the effectiveness of experimental didactic strategies in environmental education, especially in increasing awareness and pro-environmental behavior among junior high school students (Ummah & Yuliati, 2020). Previous studies have discussed the development of learning devices for science materials, but not based on didactic situation analysis (Asmar & Suryadarma, 2021; Putri et al., 2021). This study focuses on the development of learning designs for work and power materials using didactic situation analysis. This study aims to improve students' critical and systematic thinking skills to find solutions to the problems given. In addition, it is expected to improve teachers' pedagogical competence.

LITERATURE REVIEW

Didactical Situation Analysis

Teacher's actions in the learning process create situations that can be the starting point for the learning process called the scaffolding technique (Nguyen et al., 2022). The learning process can occur because new situations will emerge as a result of students' responses to previous situations. The new situation can be single or varied depending on the learning environment or setting designed by the teacher. When the new situations are more diverse, the didactic situation will also become more complex. Therefore, creating good interactions between individuals in an environment requires collaborative learning. Didactic situations are developed to design material and social interaction conditions that are expected to emerge from students' perspectives. Teachers need to recontextualize and re-personalize knowledge by looking at situations that can give meaning to the knowledge to be taught to students (Fauzi & Suryadi, 2020).

Didactics is defined as the art of teaching. Inspired by Socrates' educational practices, didactics means an effort to make students independent in producing new knowledge (Verawati et al., 2020). Didactics as a teacher's actions in the learning process that creates a situation that can be the starting point for a learning process (Ikawati, 2020). Didactical situation analysis is designed based on analysis of learning barriers and prediction of teacher responses (Fauzi & Suryadi, 2020). Two fundamental aspects in the learning process need to be considered, namely the student-material relationship and the teacher-student relationship, which can create both didactical and pedagogical situations. The didactic triangle describes the didactic relationship (HD) between students and material, while the pedagogical relationship (HP) is between the teacher and students and to develop the didactic triangle by adding the relationship between the teacher and the material as a pedagogical didactic anticipation (ADP) (Verawati et al., 2020).

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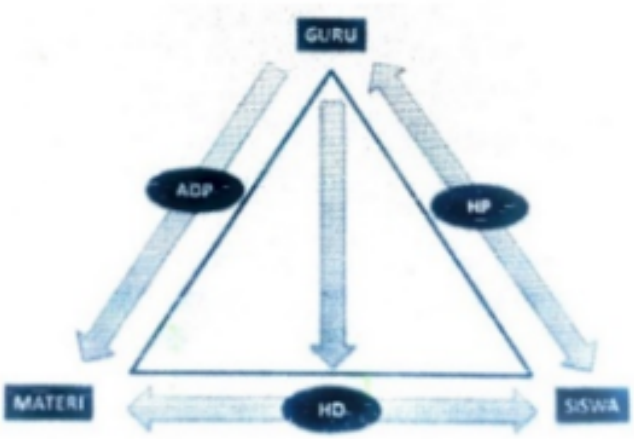

Figure 1. Modified Didactical Triangle
Source: (Verawati et al., 2020)

Teachers play the most important function in a didactic triangle (in **Figure 1**) by creating a didactic situation to make the learning process run well. Teachers have to understand the teaching material, have other knowledge related to students, and be able to create didactic situations that can encourage optimal learning processes (relationship between students and material). Teachers need to consider some factors in creating didactic situations such as 1) The clarity of the problem seen from the model of presentation and its relationship to the concept taught; 2) The prediction of students' responses to each problem presented; 3) The relationship between the didactic situations created in each different problem presentation; and 4) The development of intuition (a form of reasoning due to interaction with the environment). The developed pedagogical situation needs to pay attention to some elements, namely 1) a U-shaped classroom setting with students sitting in groups (four or three people); 2) Learning activities in various ways including individual or group interactions, inter-group interactions, and class activities; and 3) Teacher concern for students (Verawati et al., 2020).

Creating an appropriate didactical and pedagogical situation requires a learning plan that views the learning situation as a whole as an object. Possible student responses require didactic or pedagogical action so it is important to anticipate them in such a way in order to create a dynamic change in didactic and pedagogical situations that suits the capacity, needs, and acceleration of the student's learning process (Fauzi & Suryadi, 2020). The abilities that need to be possessed are called metapedidactics, the teacher's ability to 1) View the components of the modified didactic triangle, namely ADP, HD, and HP as a unity; 2) Develop actions to create didactic and pedagogical situations that suit students' needs; 3) Identify appropriate didactical and pedagogical situations resulting from the didactic and pedagogical actions done; 4) Carry out further didactic and pedagogical actions based on the results of analyzing student responses towards achieving learning targets (Verawati et al., 2020).

Metapedidactics includes three components. First, the unity is related to the teacher's ability to view the sides of the modified didactic triangle as something whole and closely related to each other. The most important thing, in this case, is the prediction of students' responses as didactic or pedagogical actions that will be done and anticipation regarding future possibilities, what if the students' responses match the teacher's predictions, and what if some or even none appear at all. Teachers need to predict them all before learning occurs. Second, the flexibility component means that students' responses do not always match the teacher's predictions so prepared anticipations need to be modified during the learning process. Third, the components of coherence in the learning process must be interrelated as many different didactic situations will arise during the learning process so the environment formed will vary but must be related to each other (Verawati et al., 2020).

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The study of didactic situation theory includes various didactical situations, learning obstacles, learning trajectories, and didactic contracts. That learning begins with action. This situation will be used by children to use previous experience and knowledge so that perception of the environment and action on the environment occur. If the new mental object is formed, it can be described as a formulation situation which in abstraction is the result of the actions (Stern et al., 2023). The process of interaction between students and between teachers and students allows for arguments, statements, or representations that encourage the validation process to develop. The development of teaching modules using didactical situation analysis consists of two important stages, namely Pre-learning analysis (hypothesis didactic design) and Metapedadidactic analysis (Lestari, 2023).

Pre-learning analysis (hypothesis didactic design), a didactical situation analysis is carried out by identifying obstacles in the learning process. Teachers need to predict possible learning obstacles, create student responses that arise during the learning process, and prepare teacher anticipation in responding to students. Metapedadidactic analysis as the teacher's ability to 1) View the modified didactic triangle components, namely ADP, HD and HP as a whole unit; 2) Develop actions so that didactical and pedagogical situations are created that suit students' needs; 3) Identify appropriate didactical and pedagogical situations due to the didactical and pedagogical actions taken; and 4) Carry out further didactical and pedagogical actions based on the results of the analysis of student responses towards achieving learning targets (Sari et al., 2023).

The teacher designs a teaching module based on a hypothetical learning trajectory (HLT) model consisting of learning flow and objectives, stages of learning activities to be implemented, learning process hypotheses that predict student responses, and pedagogical didactical anticipations (Putri et al., 2021). The learning scheme needs to describe the learning sequence of contextual problems, learning experiences obtained by students in the learning process (Experience-based activities), relationship patterns between contextual problems and experience-based activities, and formal activities or learning process hypotheses (Putri et al., 2021). Based on the HLT learning scheme, predictions of student responses and didactical anticipations at each learning step are presented in a table.

Sharing Task

Sharing tasks is a type of learning activity to establish cooperation between groups so that they understand learning topics that contain material concerning learning objectives (Rudi et al., 2020). Sharing task design builds a learning environment that respects differences and exchanges opinions (Verawati et al., 2020). Sharing tasks are carried out to facilitate students to collaborate with each other so those who can understand the material quickly can help others who have not understood the material (Susetyarini et al., 2022).

Work and Power

Work as effort made by an object by applying force and the distance an object will travel (Indrawati & Darmadi, 2021). Meanwhile, power is the amount of work that has been done per unit of time (Harefa, 2020). Therefore, effort is strongly influenced by distance and force without regard to time, while power considers effort and time without regard to distance. Can be seen from the effort and power formulas in **Table 1.**

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Table 1. Formula for Work and Power

Work	Power
W = force x distance	P = work/time

Source: (Indrawati & Darmadi, 2021)

The effort exerted by a constant force on an object as the product of the magnitude of the displacement (d) and the component of the force parallel to the displacement (F). A person makes an effort when he or she exerts a force that can cause displacement. for example when someone moves goods, pushes a car and pedals a bicycle. Power is concerned with time and effort. An example is the existence of a lighting lamp that describes how quickly the lamp uses electrical energy to produce light, the fan works by converting electrical energy into kinetic energy to produce wind and the washing machine uses power to rotate the drum and move water to wash clothes (Niyanti et al., 2022).

METHODS

This qualitative study used Didactical Design Research (DDR). A qualitative study produces findings that do not need to be obtained statistically or quantitatively. A qualitative study usually discusses community life, history, behavior, organizational functionalization, social activities, and so on. Data obtained from interviews with three students and two teachers concerning the work and power materials. Besides, a documentation study by examining modules, teaching materials, and textbooks used by teachers with predetermined criteria. Then, data were presented narratively in paragraphs. Besides, additional data for designing learning were obtained from the analysis of various textbooks and observations. Then, the researcher developed the learning design that contains predictions of student responses and trigger questions according to the class setting.

In this research, there are several stages, namely 1) Analysis of the didactic situation before learning; 2) Analysis of didactic situations during learning; 3) Analysis of the didactic situation after learning. Data analysis uses an interactive data analysis model consisting of 1) Data reduction to determine data that are relevant, meaningful, and important, in this case referring to needs analysis; 2) Data presentation in the form of narrative descriptions; and 3) Drawing conclusions. Data verification was carried out by triangulating data sources and methods. Triangulation of data sources means that information is obtained from one source and cross-checked with other data sources. Data triangulation is carried out by collecting data using several methods, namely through documentation studies and interviews. The researcher used the results of the interview as the basis for the learning design that will be developed.

RESULTS AND DISCUSSION

Analysis of the Results of Interviews with Teachers and Students

The interviews with two of the Natural Sciences (IPA) teachers at State Junior High School in Bandung showed that the learning of work and power materials was carried out well. The teacher tried to actively involve students in the learning process, but they faced some obstacles such as difficulty in understanding the concepts of questions related to work and power materials. Practices were only done if there was sufficient time. This is confirmed by a science teacher's statement:

> "*Menjelaskan teori menggunakan media seperti PPT atau melalui sumber belajar yaitu buku, kalau ada waktu dilakukan praktikum. Tapi dilihat dulu dasar teori siswa nya sudah mampu atau belum, ini juga untuk melihat perkembangan peserta didik" (N, 27 Sept 2024).*

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Students have difficulty understanding basic concepts or work and power, especially when working on questions. This is confirmed by the results of an interview with a teacher:

> ”U*ntuk peserta didik perempuan sulit ketika mengerjakan soal hitungan. Sedangkan untuk peserta didik laki-laki sulit memahami konsep sehingga menghambat ketika diberi soal yang ada hubungan antara konsep dengan soal hitungan"* (W, 27 Sept 2024).

Thus, students' understanding of the concept of the material needs to be improved. Besides, teachers need to allocate time for practice to help students explore more of their knowledge and skills. This is confirmed by the results of an interview with one teacher:

> *“Peserta didik harus sering berlatih dan diadakan refleksi. Selain itu peserta didik yang sudah paham dijadikan tutor sebaya agar belajar lebih enjoy, jadi peserta didik saling berbagi. Untuk kelompok dibatasi jumlahnya agar efektif. Selain itu peserta didik diperbolehkan untuk mencari sumber referensi lainnya yang bisa menunjang pembelajaran*" (N, 27 Sept 2024).

Meanwhile, based on the results of interviews with three students who have studied the work and power materials, they faced obstacles in understanding learning concepts where most of them did not understand the theory comprehensively so it is difficult to make connections between one concept and another. This is confirmed by the results of an interview with a student:

> *"Untuk yang usaha mudah, tapi kalau dihubungkan antara materi usaha dengan daya bingung*" (S, 27 Sept 2024).

Some students also do not connect the existing material with everyday life. This is confirmed by the results of an interview with a student who expressed that they had difficulty understanding the application of the material in everyday life:

> "*Saya cuma ingetnya, usaha itu jumlah energi untuk memindahkan, daya itu energi untuk memindahkan kalau ga salah itu. Salah satu contohnya yang dorong kursi itu bukan ya bu? Ga inget contoh yang lainnya*" *(N, 27 Sept 2024)*.

Meanwhile, when students have difficulty understanding the material, most of them ask the teacher. There was a lack of collaboration between one student and another. This can be confirmed based on the results of an interview with a student:

> "*Kalau aku bingung bertanya ke guru, belajar dari sumber-sumber yang ada di internet, tanya orang tua, dan coba mengerjakan soal-soal lain*" *(B, 27 Sept 2024)*.

It is important to help students understand the concepts, context, and their relationship to everyday life through practice. Moreover, the material should be linked to everyday life and the environment. The interaction between students and teachers and between students and other students also needs to be improved to realize collaborative learning.

Analysis of the Teaching Modules and Materials

The teaching and learning modules used by teachers were assessed. The assessment criteria are related to the relationship between each component in the teaching module consisting of learning achievements, learning objectives, steps in core activities, teaching materials, learning strategies, learning evaluations, and anticipation or prediction of student responses. Analysis of the teaching modules used by teachers showed relevance between learning outcomes and learning objectives, between learning objectives and the steps in core activities, between learning objectives and teaching material, between core activities and learning strategies used by teachers, between learning objectives and evaluation used by teachers as well

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as student-centered learning. However, the module did not contain predictions of student responses and the teacher's anticipation of predicted student responses.

Figure 1. Natural Sciences Textbook for Grade VIII
Source: Author Documentation 2024

Further assessments were carried out on the teaching materials, namely the Natural Sciences Textbook for Grade VIII (in **Figure 1**). The teaching materials contained the concepts of understanding work, work formulas, power, and power formulas. However, they did not include the concept of the relationship between work and weight, the difference between work and power, the relationship between work and power, and the application of work and power in daily life.

Discussion

Learning Design for Work and Power Materials

Based on interviews and analysis of teaching modules and materials, a learning design for work and power materials was created using a didactical situation analysis approach by considering predictions of student responses and teacher anticipation, as well as sharing tasks. The developed learning design emphasizes the class settings or milieu in order to increase student understanding and connect learning materials with everyday life context (Syawalia et al., 2023). Integrated learning designs positively influence students' critical thinking skills and improve learning outcomes (Ramdani et al., 2021). When building a class setting, teachers have to understand and consider the characteristics of each student through diagnostic assessments. This aims to determine the initial ability (pre-learning experience) to build new understanding through the learning process. In building this new experience, teachers can use didactical situation analysis to help students construct new understanding based on initial information conveyed by the teacher in accordance with the created class setting (Prabowo & Juandi, 2020).

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The developed learning design in this research was in the form of Didactical Design Research (DDR). This is a series of relationships between students and material that describes the didactical relationship (HD), the pedagogical relationship between students (HP) and the teacher, and the relationship between the teacher and the material which is referred to as didactic and pedagogical anticipation (ADP) as developed (Verawati et al., 2020). Learning designs using didactic situation analysis and task sharing prioritize collaboration between students. The developed learning design is considered feasible and effective in increasing the student's active role and collaboration in learning. Contextual collaborative learning has a positive effect on improving students' conceptual understanding skills. Besides, the collaborative-contextual method can also increase student learning activities (Dewi et al., 2021). Collaborative learning results in collaborative skills between students such as asking friends/teachers when they do not understand, speaking or arguing, appreciating and respecting other people's opinions, working together to solve problems, sharing tasks well among group members, showing concern for friends, and guiding others to achieve goals (Verawati et al., 2020).

The problem-solving learning model can encourage students to be more active in learning. This model allows students to build their cooperation and critical thinking skills to solve problems in order to understand the material better. Problem-based learning (PBL) models teach students to think critically, solve problems, be intellectual, and work together. This model also improves students' collaboration skills and suitable to the conditions and needs of Indonesian education today (Anwar, 2022; Pertiwi et al., 2023). In this study, the developed learning design consists of three stages. The first stage is the analysis before learning to build initial understanding based on students' acquired knowledge to be elaborated with new material. The second stage is the analysis during learning based on the syntax of the learning model to create a new experience related to the new material. The third stage is the analysis after learning to reflect on the student's understanding (Rahmadita, 2021). The learning design for work and power materials consisted of three stages, namely preliminary activities, core activities, and closing activities. The description of each stage of activities is as follows.

Preliminary Activities

The preliminary activities are the first part of the learning design related to apperception and motivation. Apperception was in the form of asking trigger questions related to differences in distance and movement. Learning process needs to include apperception based on students' learning difficulties in order to find out students' readiness to learn. The apperception activity conditions students to focus on the material (Saidah et al., 2021).

Table 2. Preliminary Activities

Syntax	Situations/issues/problems	Student Response Prediction	Student Anticipation/Response
Preliminary	Explain the difference between distance and displacement If I walk from point A to point B for 5 meters, then return to point A. How far have I traveled?; Do I make a displacement?	The distance is far, if the displacement is close. The distance is 5 meters mam, there is no displacement	When you were in 7th grade, you discussed distance and displacement. Now, try to explain the difference between distance and displacement! If you travel from school to home, for example, 5 meters, then return home. Approximately how far is the distance? The teacher reminds the difference between distance and displacement.

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Syntax	Situations/issues/problems	Student Response Prediction	Student Anticipation/Response
Motivation	 Source: sumateranews.co.id What happened to the stalled car after the police pushed it?	The car is moving Because the car is moving from one place to another The car will move furth	What causes the car to move? If the force the police exert to push the car is greater what will happen?

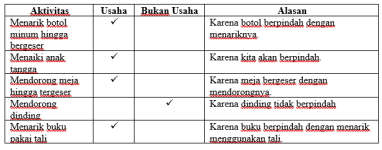
Source: Research, 2024

Table 2 showed at the motivation stage, the teacher provided a picture of a broken car being pushed to construct student knowledge regarding the application of work in everyday life. Learning needs to be connected to everyday life (contextual learning), because learning will be more meaningful if students experience what they are learning themselves, not just knowing (Syawalia et al., 2023).

Core Activities

The learning model used Problem Based Learning (PBL) with a syntax consisting of problem orientation, organizing, investigating, developing, and presenting results as well as analyzing and evaluating problems.

Table 3. Core Activities

Syntax	Situations/issues/problems	Student Response Prediction	Student Anticipation/Response
Orientation problem	***Sharing Task 1*** Business is closely related to various activities in everyday life. To find out the application of work in everyday life, watch the following video: https://www.youtube.com/watch?v=C9XwXatEgtE Based on the video you have watched earlier, now please group which are work and non-work activities in the table in the LKPD by giving a check mark. 	OK, mam OK, mam 	The teacher asks students to watch videos related to various activities in everyday life to find out the application of work in everyday life. The teacher asks students to group various work and non-work activities The teacher reminds students to answer the reasons why the activity is a business or non-business activities.

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Syntax	Situations/issues/problems	Student Response Prediction	Student Anticipation/Response
Organization	After being able to distinguish between work and non-work activities. What are the aspects that can influence the size of a work?	Power and displacement	A pull or push on an object that can change the speed and shape of the object. How far an object moves
		Work: an attempt to move an object/load a certain distance Yes	True, work is affected by the power given and the displacement. So the definition of work is? Work to move an object at a certain distance, mathematically can be written as follows: F x s, where F is the symbol for power (Newton) and s is the symbol for displacement (m)
		Power	If the speed to do work is increased, will it affect the displacement of an object? Then what is the correct term to define the speed to do work? work? Power is also called work per unit of time, mathematically it can be written as follows: P = W/t
Investigation	***Sharing Task 2*** Is there a relationship between work and power?	confused mam	Based on the aspects that affect the magnitude of the work, in your opinion, what is the relationship between work and power?
		moving mam	Imagine when you push a car, what will happen to the car?
		because it gets power	Why can the car move?
		power	What is the power used to make the car move?

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Syntax	Situations/issues/problems	Student Response Prediction	Student Anticipation/Response
	Sharing Task 3 Alif pushes the shopping cart with a force of 250 N so that the shopping cart moves forward 50 m. Alif needs 50 seconds to push the shopping cart. Questions: e. The amount of work done by Alif to push the shopping cart. f. The power used by Alif to push the shopping cart.	Information: F = 250 N Δs = 50 m t = 50 seconds Question: a. W..? b. P..? Answer: a. W = F x Δs = 250 N x 50 m = 12500 Nm or 12500 Joule. b. P = W/t = 12500 J / 50 s = 250 J/s or 250 Watt	To test your deep understanding regarding work and power, please discuss the practice questions in the LKPD.

Source: Research, 2024

Table 3 showed at first in the problem orientation step, students were given sharing task 1 by watching videos on the application of work in daily life and classifying what is work and what is not work on the Student Worksheet (LKPD). Second, in the organizing step, students were asked questions related to what influences the amount of work so that they could differentiate between work and power. In the investigation step, students were given sharing task 2 to answer the question on the LKPD about the relationship between work and power. Then, they were given sharing task 3 to complete calculation practice questions. In the developing and presenting result step, students were asked to present the results of the discussion and provide critical suggestions and input to each group. The last, in analyzing and evaluating the problem, students made conclusions regarding the relationship between power and work. In the core activities, the teacher uses a problem-solving model through the videos in order to attract students' attention in the learning process. Students are able to concentrate and better understand the orientation of the problem given and then discuss to find answers to the orientation of the problem (Kurniawan et al., 2020).

Closing Activities

This discussion process is in accordance with the concept of pedagogical nature as proposed covering 1) U-shaped class setting with students sitting in groups (four or three people); 2) varied learning activities, including individual, group interaction, interaction between groups and class activities; and 3) teacher concern for students that the teacher needs to act as a facilitator so when students have difficulties, they will be assisted according to the teacher's anticipation (Sari et al., 2023).

Table 4. Closing Activities

Syntax	Situations/issues/ problems	Student Response Prediction
Developing and Presenting Results	Present the results of your discussion, provide criticism, suggestions and input on the results of other groups.	Students present the results of their discussions on work and power.

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Syntax	Situations/issues/ problems	Student Response Prediction
Analyzing and Evaluating Problems	Based on the discussion, make a conclusion about the relationship between the concepts of work and power.	Work is an effort to move an object/load at a certain distance. While power is a pull or push on an object that can change the speed and shape of the object. The relationship between work and power is that the power value is determined by the value of the work produced, where the greater the work produced, the greater the power produced.

Source: Research, 2024

Table 4 showed students were asked to read the conclusions they had made regarding the relationship between work and power, then the teacher reconfirmed the material.

CONCLUSION

Junior High School students' understanding of Natural Sciences (IPA) can be increased using a learning design based on didactical situation analysis approaches and sharing tasks. The learning design is developed based on students' learning obstacles which predict the didactic situation in the environment along with the teacher's anticipation. This learning design is prepared with the application of the material to everyday life as in the preliminary activities. Students are given an illustration of a broken car pushed by the police to construct their knowledge regarding the application of work in everyday life. Meanwhile, in the core activities using the PBL learning model, at the problem orientation stage, students are given sharing task 1 to watch videos on the application of work in daily life and classify what is work and non-work on the Student Worksheet (LKPD). Then, in the organizing step, students are asked questions related to the influencing factors of the amount of work so that they can differentiate between work and power. In the investigation step, students are given sharing task 2 to answer the question on the LKPD concerning the relationship between work and power. Then, they are given sharing task 3 to complete calculation practice questions. In the developing and presenting result step, students present the results of the discussion and provide critical suggestions and input to each group. The last, in analyzing and evaluating the problem, students make conclusions regarding the relationship between power and work. However, in the closing stage, the teacher reconfirms the students' understanding of the work and power materials. Future studies can implement the learning design that has been designed to check the effectiveness of the design.

AUTHOR'S NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The author confirms that the data and content of the article are free from plagiarism.

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