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An Activity-Based Constructivist Approach to Teaching Core Scientific Concepts

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Abstract. Background: Science education at the middle-school level often becomes abstract when taught only through definitions and formulas. Topics such as "Force and Pressure" remain difficult for learners unless they are connected with real-life contexts and supported by hands-on activities. Objectives: This study aims to design and evaluate an activity-based constructivist lesson plan to improve conceptual understanding, engagement, and questioning skills of Class VIII students in learning the concepts of Force and Pressure. Methods: A constructivist framework was applied in preparing a lesson plan aligned with NCERT curriculum guidelines. The teaching involved real-life demonstrations (e.g., knives, balloons, magnets, water bottles), experiments with everyday objects, mind mapping, guided practice, and collaborative activities. Data on student learning were gathered through pre/post evaluations, classroom participation, and observation of skill development. Results: Students taught through the constructivist activity-based approach demonstrated stronger conceptual clarity about types of forces, pressure as force per unit area, and its real-life applications. They also showed improved participation, curiosity, and the ability to link classroom learning with daily experiences (e.g., why sharp knives cut better or how porters reduce pressure using turbans). Conclusions: The findings highlight that activity-based constructivist pedagogy enhances both conceptual understanding and critical thinking. Such approaches make science learning more meaningful, relatable, and engaging, supporting the objectives of competency-based education recommended by NEP 2020 and NCF 2005.

Keywords: Force, Pressure, Motion, Physical Science, Constructivist Learning, Activity-Based Teaching, Science Pedagogy.

I. Introduction

Science is all around us, from the daily life of opening a door to how a balloon inflates or a ball changes direction when kicked. Simple but powerful scientific principles rule these everyday actions. "Force and Pressure" is one such topic that helps junior students understand the physical world. It also introduces students to the concept of pressure, explaining how force acts over an area and why this is relevant in real-life situations, such as using sharp knives or carrying heavy loads.

What makes this plan effective is its focus on hands-on learning. Students aren't just reading definitions; they're engaging in activities, performing simple experiments, and discussing what they observe. Whether it's pressing a balloon, using magnets, or exploring how liquids exert pressure, the goal is to make science visible, tangible, and

fun. Throughout the lesson, students will develop not only their knowledge but also important skills: thinking critically, asking questions, working in teams, and drawing conclusions based on observation.

The plan follows NCERT guidelines and uses real-life examples, diagrams, and practical demonstrations to keep learning grounded and relatable. It is aligned with the pedagogical recommendations of the National Curriculum Framework (NCF), 2005 and the National Education Policy (NEP), 2020, which emphasize learner-centered, experiential, and competency-based education (NCERT, 2005; Ministry of Education, 2020). By the end of the lesson, students will not just understand what force and pressure are; they will start noticing them everywhere, from a football field to the kitchen, and even in the surrounding air.

Recent scholarship in the Asian Review of Social Sciences has also highlighted the importance of activity-based, constructivist, and technology-supported approaches in enhancing student learning outcomes across varied educational contexts (Peter, Orubebe, & Oladokun, 2024; Sain, Ikhwan, & Serban, 2024; Doloi, Timung, & Bordoloi, 2024). These studies confirm that meaningful engagement and interactive teaching strategies foster deeper conceptual understanding, echoing the aims of the present lesson plan.

II. Background of the Lesson Plan

Science becomes truly meaningful when students can connect what they learn in the classroom with what they see and experience in their everyday lives. Concepts like force and pressure are all around us whether it's kicking a ball, riding a bicycle, cutting vegetables, or noticing how water flows from a tap. Despite this, these topics can often feel abstract to students if taught only through definitions and formulas.

This lesson plan was created to make the topic of "Force and Pressure" more engaging, relatable, and understandable for Class VIII students. It is based on the NCERT curriculum and uses a mix of real-life examples, classroom demonstrations, and interactive activities to help students explore the subject in a hands-on way.

The idea behind this plan is to move away from rote learning and encourage a more inquiry-based and experiential approach. Students have opportunities to observe, question, experiment, and discuss, which leads to a deeper and more lasting understanding of the concepts. By blending concept clarity with practical application, the lesson supports different learning styles and keeps students actively involved.

These pedagogical principles resonate with global findings that emphasize early constructivist foundations (Kaur & Kauts, 2019) and address broader challenges in school education systems (Akhter & Mahor, 2019). Together, these ARSS contributions provide evidence that activity-based and learner-centered strategies are central to improving science education at all levels.

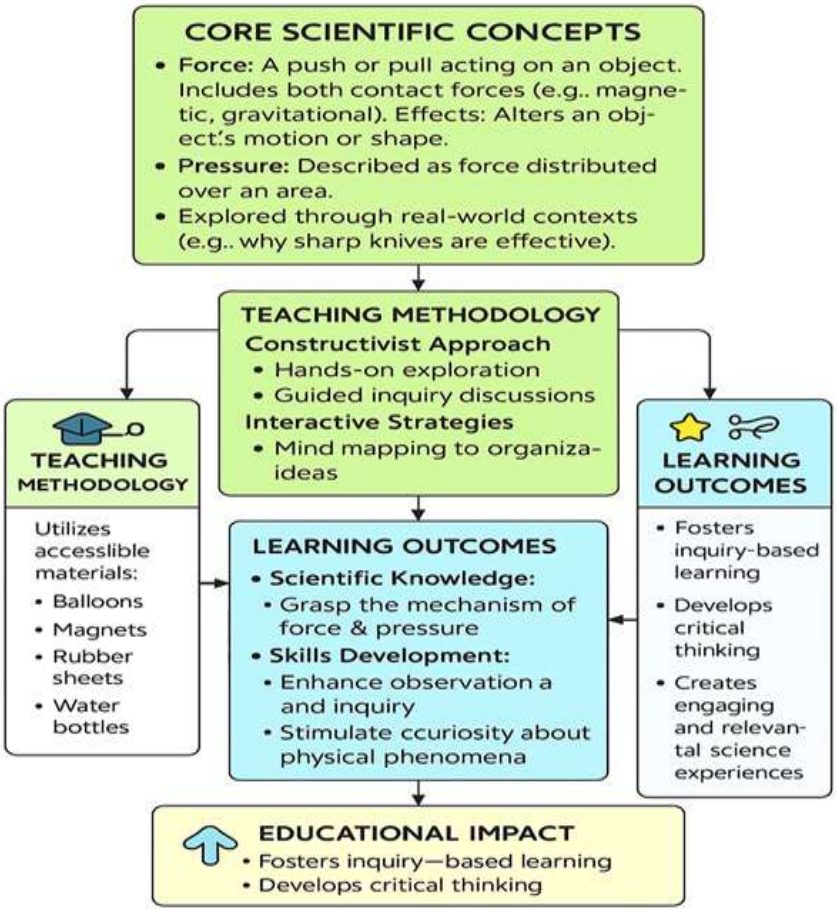
Objective

The study aims to design and evaluate an activity-based constructivist lesson plan to improve conceptual understanding, engagement, and questioning skills of Class VIII students in learning the concepts of Force and Pressure.

Methods

A constructivist framework was applied in preparing a lesson plan aligned with NCERT curriculum guidelines. The teaching involved real-life demonstrations (e.g., knives, balloons, magnets, water bottles), experiments with everyday objects, mind mapping, guided practice, and collaborative activities. Data on student learning were gathered through pre/post evaluations, classroom participation, and observation of skill development.

Systematic flow diagram of core scientific concepts



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LESSON PLAN NO.				
Date:11-06-2025	Class: VIII	SUBJECT: Physical Science	Period :3rd	Time :35 min.
TOPIC: Force and Pressure		SUB TOPIC: Types of Forces, Effects of Force, Pressure, Contact and Non-contact Forces		
Reference Materials: NCERT Science Textbook (Class 8), charts, diagrams, physical models, digital tools (animations/videos), blackboard, chalk, and classroom experiments.				
Instructional Objectives				
Students will be able to				
Cognitive:	• Define and identify force, pressure, types of forces (contact, non-contact). • Differentiate between contact and non-contact forces with examples. • explain the effect of balanced and unbalanced forces. • Apply the formula Pressure = Force / Area to explain real-life situations.			
Affective:	• Appreciate the role of force and pressure in everyday life (e.g., walking, using a bag, inflating a balloon). • Develop curiosity and a scientific attitude toward exploring physical phenomena.			
Psychomotor:	• Handle basic science materials like magnets, bottles, balloons, and rubber sheets safely and effectively. • Perform simple experiments demonstrating push, pull, and pressure (e.g., pushing a ball, pressing a balloon).			

Figure 1. Systematic flow diagram of core scientific concepts

1. Introduction

Focus and association

Steps	Pupil Teacher's Activity	Students' Activity	Teaching support Material	Evaluation
Focus the learner's attention	How do you play football or cricket?" What do you do to make the ball move or stop?" How do you try to replace a heavy table or a stuck drawer?	We kick the ball to move it." To make a ball move, apply a force for example push, pull, or kick it. To make a ball stop, apply a force in the opposite direction I pull it to open the drawer. I also pull the table to replace it in another place.	Chalk, duster, Real objects like book, Door, Bag   	What is a push? What is a pull?

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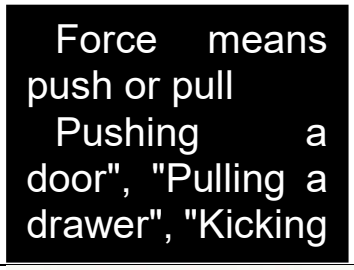
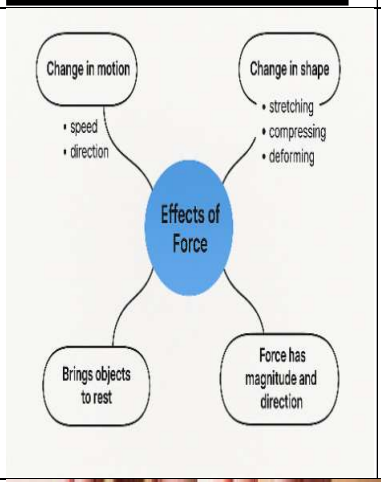
Steps	Pupil Teacher's Activity	Students' Activity	Teaching support Material	Evaluation
Diagnose pre requisite learning	How does an object move, or does something make it move?" What happens when we stop pedaling a bicycle—why does it stop?	we need to push or pull to make things move. The bicycle stops because something slows it down.		Can an object move on its own? Why does a cycle stop moving?
Relate previous learning to new learning	you learned about motion and how objects move. Can an object start moving or stop on its own without any external influence? You've seen a ball slowing down or changing direction after hitting something — what do you think causes these changes?	No, something must push or pull it. A force must be acting on it — like a hand, wall, or air resistance.	 	What are we going to learn today?
Declaration of the topic	Today we will start a new and exciting chapter in Science 'Force and Pressure.' We will learn what force really is, what types it has, how it can change the motion or shape of things, and how even air and water exert pressure around us.			

6. Mind Mapping				
Steps	Pupil Teacher's Activity	Students' Activity	Teaching support Material	Evaluation
Explore	What comes to your mind when you hear the word Force? Can you give some examples where you applied force recently in daily life?	Force means push or pull Pushing a door", "Pulling a drawer", "Kicking a football", "Lifting a bag	Charts, globe, diagram, Black Board etc. 	
Enrich	Can force only move objects, or can it do something else too? What happens to a rubber ball when you press it? Can force change the shape too? Does it matter how hard we push something, or in which direction we push it?	Force can change direction and speed. Yes, pressing a balloon or dough changes its shape. Yes, harder push moves things faster. Direction also matters.		expand their understanding of force from just "push/pull" to its measurable effects and characteristics.
Excel	We learned that force is applied on an area. What happens when the area is small? Is there a term related to this? When you use a sharp knife vs. a blunt knife, which one cuts better? Why? What makes liquids or gases push against the container walls?	"Pressure!" Sharp knife cuts better because the area is smaller. Water or air pushes against walls pressure is exerted.		help students extend their thinking by connecting force to pressure, and understand its practical implications in daily life.

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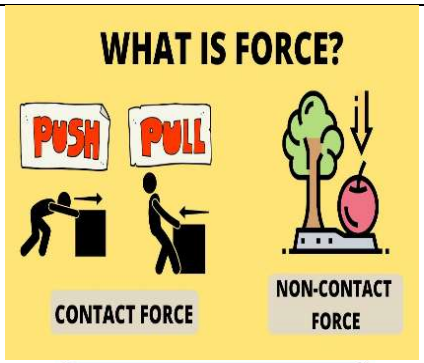
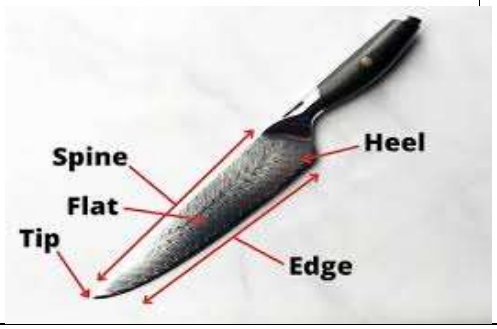
Practice				
Steps	Pupil Teacher's Activity	Students' Activity	Teaching support Material	Evaluation
Guided Practice	Fill in the blanks: 1. Force is a _____ or a _____. 2.Pressure is defined as _____ divided by _____. 3.Magnetic force is a type of _____ force. 4. A balloon changes shape when _____ is applied. Multiple Choice Questions: Which of the following is a non-contact force? a) Friction b) Muscular force c) Magnetic force d) Push Which factor increases pressure? a) Larger area b) Lesser force c) Smaller area d) Equal force and area True/False: Force can only change the speed of an object. Atmospheric pressure acts only in one direction. Pressure = Force / Area.	Fill in the blanks: Force is a push or a pull. Pressure is defined as force divided by area. Magnetic force is a type of non-contact force. A balloon changes shape when force is applied. Multiple Choice c) Magnetic force c) Smaller area True/False: False False True		
Independent Practice	Short Answer Type Questions: What are the effects of force on an object? (List any 3) Define pressure and write its SI unit.	Force can change the speed of an object. Force can change the direction of a moving object. Force can change the shape or size of an object. Pressure is the force applied per unit area of a surface. Formula: Pressure = Force / Area SI Unit: Pascal (Pa) Contact Forces:	Force can change the **speed, direction, shape** or size of an object. **Pressure** is the force applied **per unit area** of a surface. **Formula:** Pressure = Force / Area **SI Unit: Pascal (Pa)**	What are the effects of force on an object? Define pressure and write its SI unit.

	Give two examples of contact forces and non-contact forces. **Numerical Problem:** A force of 50 N is applied on an area of 5 m². What is the pressure applied? *(Answer: Pressure = 50/5 = 10 N/m²)* **Application Question:** Why are sharp knives more effective than blunt ones? Why do porters use turbans or pads while carrying loads on their heads?	Muscular Force (e.g., lifting a bucket) Frictional Force (e.g., sliding a box on the floor) Non-contact Forces: Magnetic Force (e.g., magnet attracting iron nail) Gravitational Force (e.g., apple falling from tree) Formula: Pressure = Force / Area Calculation: Pressure = 50 N / 5 m² = 10 N/m² 10 Newton per square meter (N/m²) Sharp knives have a smaller surface area at the edge, so for the same force, they apply greater pressure, making it easier to cut objects. Turbans or pads increase the surface area, which reduces the pressure on the head. This helps in spreading the weight and prevents injury or discomfort.	  Pressure = Force / Area Pressure = 50 N / 5 m² = 10 N/m² 	Give two examples of forces. What is the formula of pressure?

Discussion and Evaluation

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Steps	Pupil Teacher's Activity	Students' Activity	Teaching support Material	Evaluation
	Engages students in class discussion by asking real-life examples of force and pressure. force, types, and effects. Uses think-pair-share technique. Conducts a 5-minute oral or board quiz based on lesson. Concludes with a reflective question: "How is force related to pressure in daily life?"	Share experiences like kicking a ball, carrying a school bag, or using a sharp object. Think, discuss with peers, and respond in class. Answer quiz questions aloud or write on mini whiteboards. Respond based on what they've learned in the lesson.	Everyday objects, classroom items  Chalkboard or flashcards Board, verbal discussion	Where do you apply force in your daily life? What are the different types of forces? Can force change the shape of an object? What is pressure? What is the SI unit of pressure? Explain one situation where force leads to pressure being exerted.
Recapitulation	Asks rapid-fire questions to recall key points from the lesson. Summarizes the lesson: Force (push/pull), Types of Forces, Effects, Pressure concept. Conducts a quick group quiz (e.g., 'Pass the Ball' or 'Pick a Slip' with force facts). Asks students to write one thing they learned and one question they still have.	Respond actively to recall-based questions. Listen and note down important points. Participate and answer the question they receive. Write and submit their responses before leaving the class.	Board, flashcards Paper slips with questions Small papers or exit slips	What is force? Name one contact and one non-contact force. How is pressure related to area and force? Can force change the direction of an object? Give an example. What did you learn today about pressure or force that surprised you?

Summarization and closure

Teacher: Statement:Today, we explored the concepts of Force and Pressure. You learned that force is a push or a pull which can change the motion, direction, or shape of an object. We also discussed different types of forces contact like muscular and frictional and non-contact like magnetic and gravitational. We saw how force not only moves objects but can also bring them to rest or deform them.

You also understood pressure as the force applied per unit area, and how it plays a role in our daily lives from using sharp knives to porters carrying loads on their heads. We discussed how liquids and gases exert pressure and why atmospheric pressure doesn't crush us.

TeacherAsks:

Before we close, who can summarize in one sentence what force and pressure are?

Student Activity: Students respond with a summary statement. Force is a push or pull that can change an object's motion or shape, and pressure is the force applied on a unit area.

Closure Statement: Excellent! So, always remember whenever something moves, changes shape, or feels heavy in a small area force and pressure are at work. You'll see these concepts all around you in nature, machines, sports, and even in your body.

Result

Students taught through the constructivist activity-based approach demonstrated stronger conceptual clarity about types of forces, pressure as force per unit area, and its real-life applications. They also showed improved participation, curiosity, and the ability to link classroom learning with daily experiences (e.g., why sharp knives cut better or how porters reduce pressure using turbans).

Conclusion

Teaching the topic "Force and Pressure" to Class 8 students is not just about helping them understand a few definitions or solve formula-based problems it's about helping them see science in action all around them. This lesson plan was created with that idea in mind. Through simple experiments, relatable examples, and interactive discussions, students explored how force can move objects, stop them, change their direction, or even change their shape. They also learned what pressure means, why sharp knives work better, and how air and water exert pressure things they see and feel every day but may not have thought about scientifically.

The activities and questions encouraged students to observe, think, and ask why, rather than just memorize facts. They were given the space to experiment, talk with their peers, and connect classroom learning to real-world situations. By the end of the lesson, students didn't just understand force and pressure—they could see it working in their daily lives. And that's what meaningful science education is all about: making students curious, confident, and connected to the world they live in.

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