05
Active learning strategy

ACTIVE LEARNING STRAGEGY 05

Case Studies

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THE STRATEGY:

CASE STUDIES

Case studies describe a sequence of events or a problem situation that asks students to analyse a problem and provide recommendations or solutions based on their experience, prior learning, course content and other resources (McKeachie, 2002; Renner, 2005). Case studies adopt a 'Problem-Based Learning' (PBL) approach whereby learning is based on real-life, authentic and complex problems. Case studies often present a multitude of solutions where the solution is not necessarily the only goal but rather the skills developed while working towards a solution, which can often be of more benefit to students.

The scenarios presented in a case study can be real-life cases from the field of study or may be carefully crafted fabrications to better illustrate a particular issue or problem. In either case, whether real-life based or carefully fabricated, case studies provide contextualised learning where the students use the material, concepts and skills from the course to enhance their ability to solve problems (McKeachie, 2002).

Case studies can be presented as a teaching strategy that brings real-life scenarios into the classroom or as a teaching strategy to deliver relevant course material, advance course concepts and develop problem-solving skills.

Image 1: A group of students participating in a Case Study

Depending on the learners' prior experience, additional scaffolding may be required to support learners, while the activity can be adapted to suit first-time students if needed. Case studies require careful analysis of the problem/issue and an appreciation that there may be many valid and viable solutions. Small group discussion can be used to share, elaborate and refine solutions while also offering opportunities for students to view the problem/issue from a range of perspectives.

Case studies have been used in medicine, business, psychology, and law programmes for many years but are becoming a ubiquitous teaching strategy in a variety of disciplines since they encourage student engagement in the subject matter (McKeachie, 2002). Regardless of context or subject discipline, instructional design such as that employed in case studies should always begin with some form of audience or learner analysis (Cranton, 2000; Morrison, Ross, Kalman, & Kemp, 2011; Reigeluth & Carr-Chellman, 2009).

RESOURCES

Selection of case studies.
A PC and projector to model the case study process.
A paper copy of a case study for each small group.

WHAT YOU CAN DO TOMORROW

A case study activity can be facilitated very easily and requires very little preparation. By simply relating a situation or story from the teacher's own experience that is relevant to the current learning, students can be tasked with problem-solving activities that require the formation of new or alternative solutions. In fact, a case study is simply a story and Renner (2005) suggests that presenting or writing a case study in the form of a story with named characters and conversations is good practice and helps to capture the student's imagination.

STEPS FOR IMPLEMENTATION

Prior to full implementation, it is important to ensure that the students have been sufficiently prepared for the activity. This may involve trial and smaller supported activities that model how the learning strategy is employed.

STEP 01

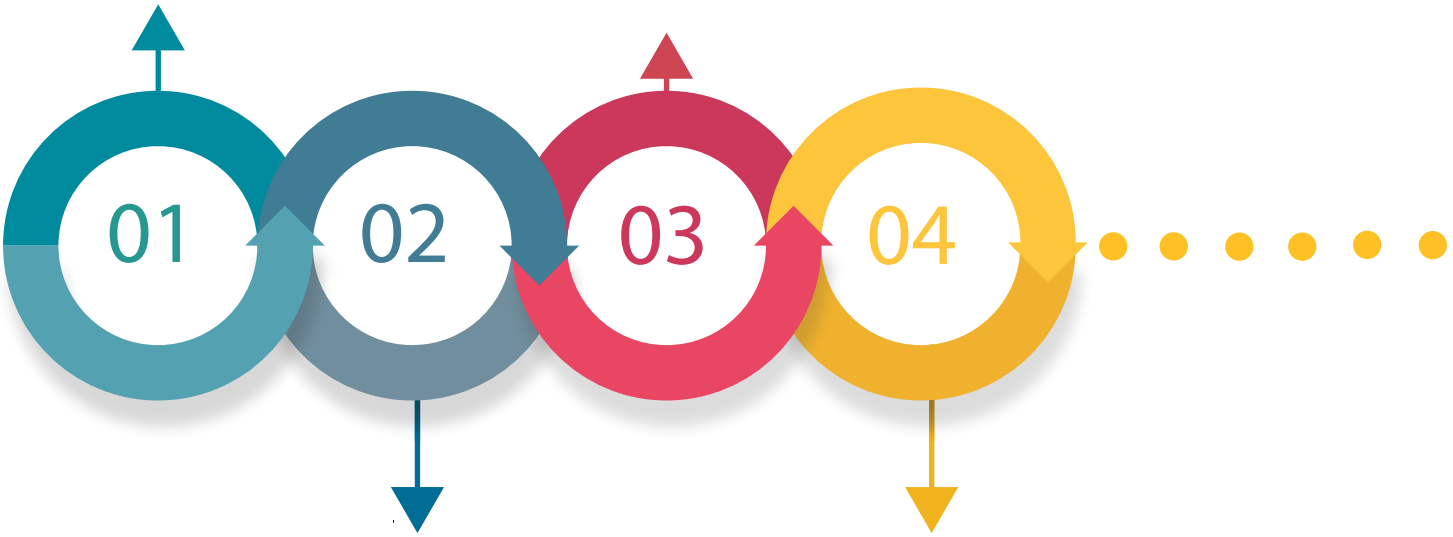
DEVELOP CASE STUDIES

Create a range of authentic case studies that relate to a particular concept that you wish the students to explore in detail, for example, belt driven power transmission fundamentals. The number of case studies required will be dependent on the class size and the variety/broadness of topic.

STEP 03

ARRANGE CLASS GROUPS

Divide the class into small groups of four. As the instructor gives each group their individual case study, they will briefly describe the case study to the class as a large group. This will prepare the students for Step 6 where all of the case studies are discussed and summarised. The classroom furniture may be rearranged to facilitate more efficient communication between students in each group.



STEP 02

PREPARE THE STUDENTS

Schedule the case study activity at a point in the course where the students have been exposed to the knowledge, concepts and skills from the course needed to engage with and solve the problem presented.

STEP 04

GROUP DISCUSSION/ PROBLEM-SOLVING

Groups discuss the merits and consequences of possible solutions presented by participants and record the outcome of their deliberations.

STEP 07

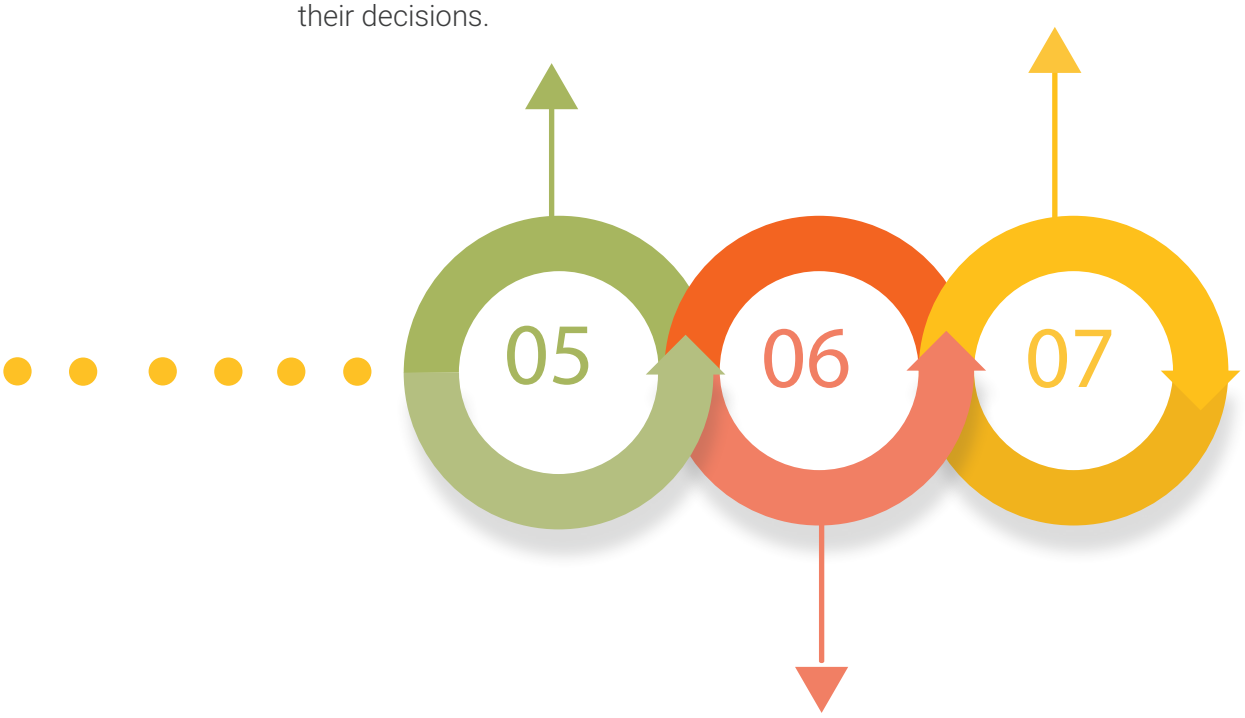
EVALUATE

Case studies that are representative of the course material, concepts and skills can be used in tests. In addition, formative or summative quizzes performed either in-class or within the Learning Management System that address the concepts targeted in the case studies can be used to provide evidence of individual learning.

STEP 05

STUDENTS PRESENT CASE STUDY SOLUTIONS

Each group is invited to describe the specific case study and outline their most preferred solution and the rationale supporting their decisions.



STEP 06

LARGE CLASS DISCUSSION

The instructor summarises the important findings from the collective case studies and initiates a larger group discussion and/or debate.

OVERCOMING PUSHBACKS

IT'S TOO SIMPLE (OR IT'S TOO HARD)

An experienced group of older apprentices would need less background and detail in a case study than, for example, a group of students just out of high school. Depending on the student level of experience, a case study presented to one cohort may be easy to solve while another may find it impossible.

Proper programme planning will ensure that the content of case studies is appropriately tailored to suit the characteristics of participating students (Cranton, 2000; Morrison et al., 2011; Reigeluth & Carr-Chellman, 2009).

I JUST WANT A LECTURE

In many cases, students can be averse to teaching and learning strategies that diverge from the 'traditional' lecture. In my experience, students prefer teaching scenarios which require little effort on their behalf other than to passively absorb information required to pass the course. Instructors can justify case studies by explaining that they simulate exposure to real-life workplace experience and that the students may face problems similar to those presented in the case studies.

Image 2: Students in a traditional lecture

CASE STUDY

OF THE CASE STUDY TEACHING STRATEGY)

The case studies employed when using this teaching strategy are based on authentic workplace scenarios which occurred during my time in industry. Describing such authentic experiences helps to connect students with real-life workplace scenarios and assure participants of the legitimacy and relevance of case studies as an effective learning strategy.

The case study described was conducted with a group of post-secondary students enrolled in the two-year Mechanical Technician and Millwright diploma in a mid-sized Ontario college in Canada. Participants had recently completed high school, were in their late teens and had no previous industry experience relating to a trade workplace environment.

In designing the case study for this student demographic, a range of factors were considered to ensure that participants could understand, relate to and engage with the content. It was important to:

- Include rich detail to compensate for a lack of industrial experience.
- Avoid making assumptions about trade knowledge and explain important details in full.
- Include an engaging storyline to enhance the real-life dimension of the case study.
- Include named characters and dialogue that is typical of the industrial and maintenance workplace.
- Describe characters that have distinct personalities and are representative of the characters that students may meet in industry.

The sample case study (Figure 1) is based on a real-life experience involved in diagnosing pump or valve-related failures in industry. There are several possible solutions or actions that may be arrived at and the outcome of which is informed by course material, suggested resources and the information contained within the case study.

The class is divided into small groups to work on their assigned case study. Upon completion, each group presents an agreed solution to the case study which feeds into a larger class discussion related to the issues identified. Students are rewarded for reasoned, informed responses..

The students' engagement with the case studies is always positive and the results are surprisingly accurate considering their level of industrial or maintenance experience. This is a good place to mention that the students gain a certain amount of experience during shop labs. These are second year students, so they have had a full year of shop classes where they disassemble, reassemble and perform basic maintenance tasks on various pieces of industrial equipment including pumps and valves.

Case Study 6 Lead Strip Rolling Mill Cooling Pump

You are a millwright in a lead-acid automotive battery factory. Lead is formed to make the plates found in the battery. Plastic is moulded to form the case and the lead plates and sulphuric acid fill the case to make an automotive battery. You have been called by Joe Forthright, the maintenance supervisor, to the Lead Strip Rolling Mill. Joe yells in the radio, as he always does when he is under pressure, "get down to the Lead Strip as soon as you can, they are moaning and groaning about the temperature again!" Joe means to say that the production operator has reported that the temperature of the finished lead strip exiting the mill is above quality standards.

Figure 1: Coolant Pump

The lead mill, is a progressive series of paired rollers, that squeeze the one-inch thick lead bar produced by the lead strip casting operation down to the prescribed thickness required for the lead-acid battery produced in the plant for this particular model. The temperature is important to the quality of the lead strip because if it is too cold it is not malleable enough for the next operation. If the strip is too hot it will break or tear in the next operation.

You arrive at the Lead Strip Rolling Mill where you find Jane Smith, the production operator who runs the rolling mill. Jane says that "The strip is way too hot and I am going to shut it down soon because the expander people are saying that the strip is breaking at the coining press." Jane also adds, and you observe, that the volume of coolant flow that washes over the lead strip between mill rollers is less than normal. This is the main problem. You need to look at the coolant pump.

You ask Jane where the coolant pump is located and she says that "It's down in the pit with the rest of this area's pumps and stuff. You will have to get security to sniff the pit because it is a confined space."

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Figure 1: Sample case Study

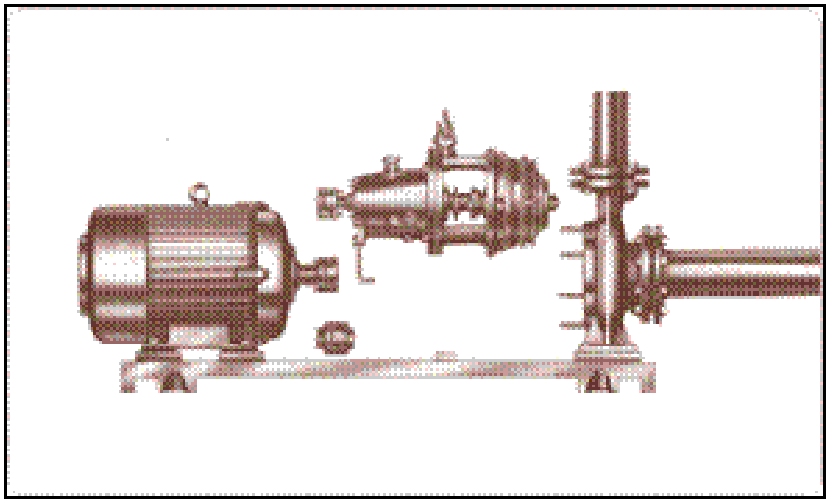

Figure 2: Back pull-out centrifugal pump design.

After security has sampled the air quality (sniffed) in the pump pit and you have followed the confined space entry procedure you enter the pit to find:

1. The pump is one of twenty other process pumps in the pit and this particular pump is a horizontal centrifugal pump with end suction. See Figure 1.
2. The pump has back pull-out (BPO) design meaning that it can be easily repaired and disassembled in place without removing a great deal of pipework. See Figure 2.
3. It has a 3" diameter discharge, 4" diameter intake and a 13" diameter closed impeller that produces 600 gallons per minute to a height of 150 feet.
4. The pump has mechanical packing that is leaking slightly. Mechanical packing has to leak to a certain degree to lubricate, seal and cool the packing rings.
5. It is an Ingersoll-Rand pump and this name brand taken in conjunction with the other features already observed indicates to you that this is a high-end, high-volume, expensive and reliable pump.
6. The coolant reservoir is located above the inlet of the pump meaning that suction is probably not a factor due to the positive inlet pressure at the pump.

Your observations and troubleshooting so far:

1. The coolant pump runs cool, quiet and smooth.
2. The mechanical packing was found to be leaking slightly but your adjustment to decrease the leak (remember that it must leak slightly!) does not increase volume of the coolant upstairs.
3. All of the auxiliary system components like inlet and outlet valves, inlet strainers and piping are operating normally and have no blockage.
4. The amperage reading for the coolant pump observed on the main Pump Control Panel indicates normal draw for this size of pump, motor and operating conditions.
5. Maintenance records indicate that the pump has been in operation fifteen years.

Use the information above, the Centrifugal Pump Troubleshooting Chart found in the Millwright Manual of Instruction and our course notes to date to diagnose and solve this problem.

Answer the questions or address the issues below as a framework to help you and your group find appropriate solutions:

1. What is the problem?

2. Develop ideas about what causes the problem.

3. What evidence supports or refutes your ideas?

4. What conclusions can be drawn?

5. What are your recommendations?

TOP TIPS FOR SUCCESS

The experience and level of knowledge within the class group should be considered in the design of the case study while Renner (2005) suggests that case studies should be presented like a story with named characters and dialogue.

Case studies should begin with rather simplistic situations with few details but progressively become more detailed and more difficult to solve. Subsequent cases can scaffold knowledge and progressively develop levels of understanding related to more complex concepts and skills.

Introduce case studies gradually by initially providing higher levels of learner support and modelling/demonstrating critical concepts when exploring the feasibility of successful outcomes.

SUMMARY

Case studies can be a very effective teaching strategy to introduce real-life issues or problems into classroom-based activities. The activity can be conducted on an individual or group basis while case studies can be fabricated or based on real-life experiences. The use of case studies in apprenticeship training provides a glimpse into the student's future workplace and helps to develop individual and team problem-solving skills required in their future careers.

FURTHER READING

Renner, P. (2005). The art of teaching adults: How to become and exceptional instructor and facilitator. Vancouver, BC: Training Associates.

McKeachie, W. J. (2002). McKeachie's teaching tips: strategies, research, and theory for college and university teachers (11th ed). Boston, MA: Houghton Mifflin Company.

TEMPLATE

Case Study Name: _____

Case Study Description: _____

Case Study Details: This section may be quite extensive and needs to include the background information relating to the situation being examined. The problem will need to be clearly stated. It is important that this section has enough detail that the students will be able to solve the problem.

Instructions: Answer the questions or address the issues below as a framework to help you and your group find appropriate solutions presented by the case study:

1. **What is the problem?**

   _____

2. **Develop ideas about what causes the problem.**

   _____

   _____

3. **What evidence supports or refutes your ideas?**

   _____

   _____

4. **What conclusions can be drawn?**

   _____

   _____

5. **What are your recommendations?**

   _____

   _____

Case Study Template