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8.1. Concept Map

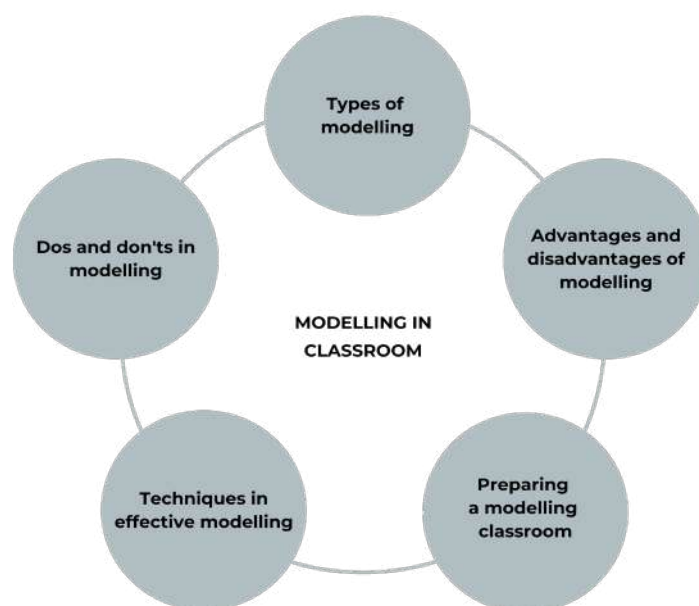


Figure 8.1. Modelling in classroom

8.2. Learning Outcomes

By the end of this chapter readers should be able to:

- Define modelling.
- Explain types of modelling in the classroom
- Discuss the advantages and disadvantages of modelling in classrooms
- Prepare a modelling classroom
- Apply effective modelling strategies in teaching-learning situations.

8.3. Clarification of key terms

Modelling: This refers to a pedagogical method or teaching strategy that involves delivering lessons by using real objects or materials as instructional media relevant to the subject matter in a sequence of activities (Ramadan & Surya, 2017). This definition aligns with that provided by Chingombe (2013), who states that modelling involves the teacher performing a task while learners observe, and later, they will be asked to imitate the skill or behaviour.

Teaching strategy: This is a well-designed plan for delivering a lesson, which includes topics, instructional objectives, and an outline of teacher and learner activities implemented in class, ensuring that learners acquire worthwhile knowledge and skills for lifelong learning.

Procedure: This term is used synonymously with “technique,” signifying a series of steps or phases that a teacher employs when modelling or delivering content knowledge to learners in the classroom or during outdoor learning activities.

8.4. Reflective questions

1. What is modelling in the classroom?
2. Compare and contrast step-by-step and whole process modelling in the classroom.
3. Assess the advantages and disadvantages of modelling in the classroom.
4. Explain the steps and precautions you would take when preparing a modelling classroom.
5. Identify effective modelling techniques and explain how you would apply them in teaching-learning situations.

8.5. Introduction to modelling as a teaching strategy

Modelling in the classroom encompasses a set of strategies and techniques that teachers employ to create a conducive learning environment that supports learners’ academic, social, and emotional growth. This can involve using real objects, demonstrating how something works, or engaging in role play to act out social situations.

Modelling is also referred to as the demonstration method, where the teaching-learning process is systematically carried out, initially by the teacher and subsequently by the learners, whether in a classroom or during outdoor activities. In this learning situation, learners observe the instructor performing a teaching-learning task and then imitate and replicate the technique. This chapter discusses three main types of modelling by execution: step-by-step modelling, whole process modelling, and on-the-spot modelling. It also provides an overview of the advantages and disadvantages of modelling in the classroom, along with acceptable and unacceptable practices. A case study is included for readers to reflect on and evaluate against the effective modelling techniques recommended in this chapter.

8.6. Modelling in classrooms

The main purpose of modelling in the classroom is to simplify the understanding of concepts and to help learners develop systematic procedural proficiencies or competencies. A teacher models by systematically performing a specific learning activity or illustrating a concept that he or she wants learners to understand and replicate. Effective modelling in classrooms requires the teacher to understand the audience, their background knowledge, and the modelling environment. Teachers should know why, when, how, and what teaching materials to use when modelling in the classroom.

A teacher should engage in modelling under the following circumstances: when introducing a new topic to learners; when learners face difficulties in connecting theories to practical applications; when the teacher wants to explain and illustrate the connection between difficult or abstract concepts and the lived realities of the learners; and when revising a test that learners performed poorly on. The main purpose of modelling in classrooms is to demonstrate the occurrence of an event or the stages in processes that take place within a phenomenon, thereby facilitating an easier understanding of the subject matter for learners. In other words, the teacher models factual and conceptual knowledge as well as procedural problem-solving skills. Figure 8.2 below shows the key steps in classroom modelling.

Steps in modelling in the classroom

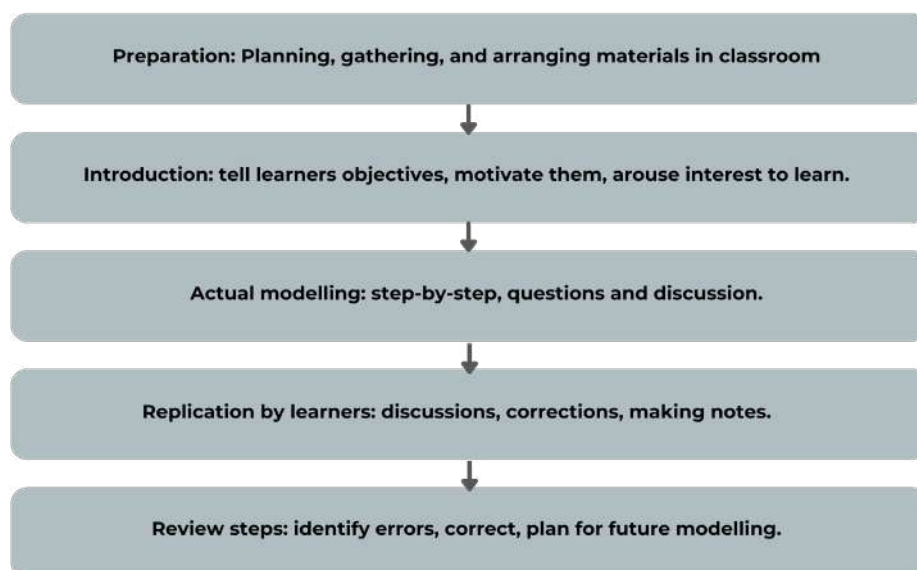


Figure 8.2. Steps in modelling in class.

Chingombe (2013) classifies types of modelling based on their execution methods: step-by-step, continuous modelling, and spot modelling. Similarly, Basheer et al. (2017) identify three types of modelling used in classrooms: visual, analogical, and experimental modelling. This chapter merges these classifications according to their execution in the classroom to minimise confusion for practitioners. The following section discusses types of modelling by execution.

8.6.1. Step-by-step modelling in the classroom

Step-by-step modelling involves the teacher executing the modelling process before the class and explaining each phase to ensure that learners master the key skills, knowledge, and precautions (especially when dangerous tools and substances are used) before moving on to the next phase. The teacher displays objects, substances, and visual aids to help learners visualise functions and processes at each stage. Teachers can utilise films, projectors, computers, experiments, and other information and communication tools to illustrate concepts or demonstrate functional inter-relationships in space. At the end of each phase, the teacher asks comprehension questions, facilitates brainstorming, entertains questions from learners, and may ask learners to replicate each step to identify and eradicate mistakes before proceeding to the next phase. This type of modelling allows learners to observe detailed procedures, hear the accompanying explanations of activities from the teacher, and participate through replication. The advantage of step-by-step modelling is that it caters to all learners with diverse learning needs and abilities. Chingombe (2013) noted that the use of visual teaching aids is particularly suitable for learners with hearing impairments. Visual modelling is crucial in reducing verbose lectures and saves time in covering a given topic of study. According to Basheer et al. (2017), visual modelling benefits learners with high visual and spatial intelligence but limited cognitive abilities.

8.6.2. Whole process modelling in the classroom

Whole process modelling is the second type of modelling, representing a real experiment in a science laboratory. Experiments are common forms of modelling in science classrooms and other practical subjects, where a teacher demonstrates practical skills covering all pertinent stages that he or she wants the learners to master in the processes.

In this type of modelling, the teacher demonstrates the entire process from beginning to end without interruptions from the learners. The purpose is to enable the learners to see the whole process and then allow them to replicate the modelling while the ideas are still fresh. This continuous modelling process is particularly appropriate when substances, chemicals, and catalysts with timed reactions are used, as any interruption may distort the experimental results.

8.6.3. On spot modelling in the classroom

Execution of spot modelling in the classroom usually occurs when the teacher follows up on learners' attempts to replicate modelling done through step-by-step or whole-process modelling. At this point, the teacher takes corrective steps in response to the learners' replication of prior modelling. Spot modelling is carried out when the teacher identifies a problem or mistake in the learners' modelling performance. In this case, the teacher halts the learners' activities to prevent the issue from worsening. The teacher then redemonstrates or repeats the important modelling activity that the learners failed to execute adequately. The teacher explains complications, errors, and the significance of precision at each step. This phase involves particular attention to each learner's conceptual understanding and skills proficiency development. The teacher engages the learners by asking questions about concepts, procedures, precautions, and the importance of each step towards content mastery. Analogical modelling is implemented when a teacher chooses a phenomenon exhibiting relevant similarities to the concept or aspect of a process the learners need to understand. This method can be applied in any of the three types of modelling discussed above.

Teachers should recognise that modelling in the classroom is influenced by the nature of the learners, class sizes, lesson time distribution, and the availability and allocation of learning resources. Teachers must first identify the learning needs and interests of their learners before selecting and employing modelling methods. In this regard, education systems should consider incorporating rigorous training in modelling and appropriate language use as examinable components in teacher training programmes.

When modelling in classrooms, teachers should utilise instructional media related to the subject content intended for mastery by the learners. The use of indigenous knowledge, tools, concepts, and practices should be prioritised during modelling, ensuring that knowledge is built from the known to the unknown, and from simple to complex, while bearing in mind the principles of assimilation and accommodation of new knowledge. Step-by-step modelling facilitates the creation of cognitive links between new and previously learned knowledge.

While modelling in classrooms is often perceived as more suitable for science, mathematics, agriculture, technical subjects, and information and communication technology studies, proficient teachers in the social sciences can effectively model historical events, rules, stories, and religious and cultural practices, thereby connecting abstract concepts to the lived realities of learners. In science subjects, modelling serves as a pedagogical strategy aimed at illustrating a specific scientific concept (Basheer et al., 2017).

Teachers should be aware that learning becomes more motivating, interesting, and impactful when learners are directly and actively engaged with the subject matter through effective discipline and quality modelling. Learners should be tasked to replicate the modelling after the teacher assesses their procedural and conceptual knowledge development. Modelling can be complemented by employing Socratic dialectics (the question-and-answer method) to evaluate the advancement of critical problem-solving thinking skills in learners. Improvement in efficiency and academic achievement largely results from well-planned and diligently executed modelling in class.

8.7. Advantages and disadvantages of modelling in teaching

There are advantages and disadvantages of modelling that a professional education practitioner should understand.

8.7.1. Advantages of modelling in teaching

The modelling method is an excellent way to actively engage learners in classroom participation, involving the use of concrete objects and various senses for lifelong learning. Consequently, learners will develop a deeper perceptual and conceptual understanding and internalisation of the content knowledge gained through the modelling method, which becomes permanently remembered.

Modelling arouses and increases learners' interest, curiosity, motivation, and satisfaction. The quality of the teacher's modelling processes, along with allowing learners to demonstrate their mastery of skills, inspires them with the spirit of discovering new knowledge. Thus, modelling becomes the key ingredient in boosting learners' reasoning capacities, problem-solving success, and academic achievement.

Modelling is a practical pedagogy that enhances the understanding of complex or difficult topics, enabling teachers to explain concepts easily using a variety of learning materials. More importantly, modelling accelerates learners' cognitive development and improves their reasoning capacities and problem-solving abilities. Consequently, there is a significant improvement in their overall performance compared to the conventional lecture method. Basheer et al. (2017) found that learners exposed to modelling exhibited increased interaction and became more active in academic discussions than the control group that was not exposed to it. Modelling in the classroom dramatically improves learners' behaviour.

Modelling motivates learners to undertake serious original individual inquiry and to gain the necessary psychomotor skills and empowerment objectives. Additionally, modelling saves time because learners can visualise the modelling process live, which helps them understand the practical application of the theoretical knowledge acquired. Modelling enhances the translation of theory into practical application, the development of creativity and innovation skills, and the understanding of scientific concepts by learners. This method can also trigger and encourage post-modelling group discussions and cooperative learning, providing learners with opportunities to reflect on what they have learned during the modelling session. Modelling is the most suitable learner-centred pedagogical method for teaching students of all age groups, from kindergarten learners in the psychomotor stage, through primary school learners in their pre-operational and concrete operational stages, to higher levels of education. Figure 8.2 below summarises the advantages of modelling in the classroom.

Advantages of Modelling (summary)

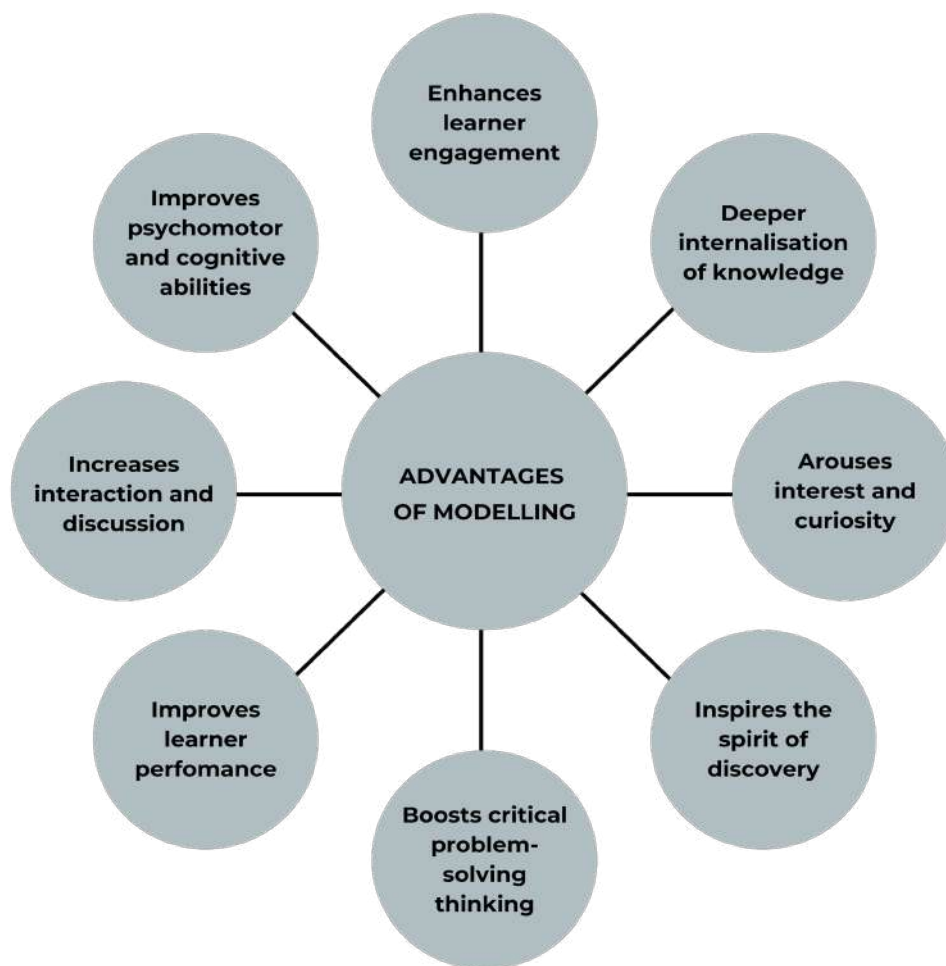


Figure 8.3. Advantages of modelling

Figure 8.2 illustrates the advantages of modelling in the classroom. The diagram can be interpreted in any direction.

8.7.2. Disadvantages of modelling in teaching

Modelling requires financial and material investment to equip teachers with communication skills and modelling proficiencies. Learners do not benefit equally due to individual differences and experiences. Modelling is costly, time-consuming, and may not be inclusive when implemented in large classes with mixed-ability learners. Not all teachers have experience in modelling, and it can be confusing if executed with limited resources and poorly prepared media. Important modelling tools can be damaged when inexperienced learners attempt to replicate the teacher's modelling, and this can result in injury if the modelling involves dangerous tools or chemicals. The teacher serves as the primary source of knowledge and controller of every activity.

8.8. Preparing a modelling classroom

The modelling environment should be neat, clean, and conducive to all learners. In preparing a modelling classroom, a teacher should revisit Bandura's theory of social learning, which posits that learners learn through imitation and emulation. The teacher must be aware that their modelling will be imitated, whether it reflects positive or negative behaviours. During the planning stage, the teacher should be diligent and thorough in designing logically sequential steps in the modelling process to prevent errors. They should also be proactive, ensuring that all essential procedures are included in the planning phase.

The teacher should consider the seating arrangement in the modelling classroom, positioning all learners so they have a clear view of the modelling processes. Additionally, teachers must prepare for the safe collection, management, and use of any necessary equipment by the learners. If the modelling involves the use of energy sources such as electricity, gas, or other fuels, the teacher should take precautions to mitigate risks to life and prevent shortages during the modelling session. Moreover, teachers should identify potential risks that may arise during the preparation and execution of the modelling, such as the use of sharp objects, harmful substances, and irritants.

8.9. Techniques in effective modelling in the classroom

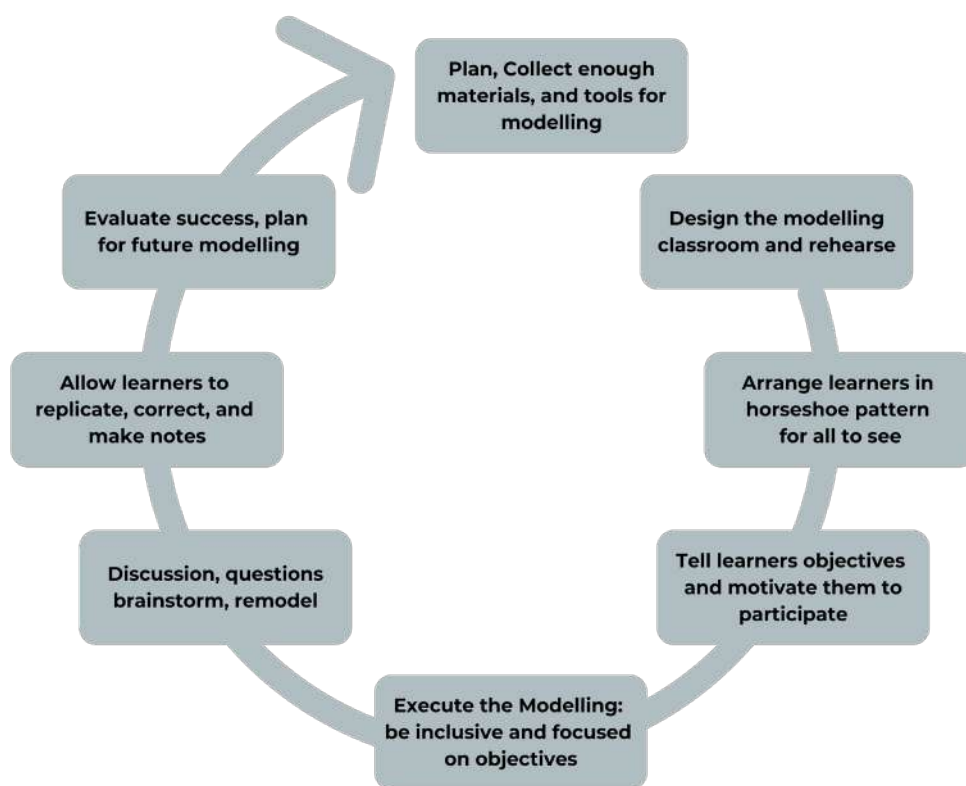


Figure 8. 4. Techniques in effective modelling in the classroom.

Figure 8.3 illustrates techniques for effective modelling in the classroom. The following section discusses these techniques in detail.

The teacher should introduce the lesson by explaining the purpose or objectives of modelling. He or she can proceed with a simple and interesting experiment, a fascinating story, or a problem that relates to the environmental experiences of the learners, as well as their differences and backgrounds. It is important to arrange learners in a horseshoe formation or create a stage or podium so that every learner is actively involved and can fully view the modelling tools and processes without difficulty. A good teacher should always begin by capturing the learners' attention, motivating and preparing them for psychological and academic readiness for the modelling session. The teacher should strive to develop pedagogical interventions that enhance learners' interests and positive attitudes towards excellent modelling performance.

During modelling, the teacher should display objects and materials that are large enough and visible to all learners. The teacher should use well-prepared teaching aids such as models, photographic media, linear or cyclical diagrams on whiteboards, graphs, and information and communication technology tools during the modelling. Field trips may be conducted if direct interaction with nature and specific concrete objects becomes necessary for the modelling, especially in science studies, agriculture, and geography. Teachers should be versatile and dynamic when modelling. This method can be complemented by discussion, brainstorming, and lecture methods when clarifying key analytic concepts. Post-modelling discussion and brainstorming are beneficial for the active, inclusive involvement of all learners. It is the teacher's responsibility to recognise the individuality of learners and ensure that everyone is benefiting from the modelling proceedings. The instructor can video record the modelling session, which can be replayed during reviews without wasting materials.

The teacher should keep in mind the principle of reflective thinking in learners, building new knowledge upon their previous knowledge. The teacher should elevate learners' attention and involvement. This can be achieved by allowing learners to define key concepts, discuss them, jot down major points, list lessons and principles learned, and explain the interrelationships discovered during the modelling session. Teachers should create a democratic and inclusive environment for learners to generate questions and provide answers during the modelling process to boost their critical thinking skills. Teachers should conduct formative and summative evaluations of the entire modelling session by reviewing the performance of learners, taking note of areas that need improvement, to make future modelling in the classroom more effective and efficient.

8.10. Dos and don'ts in modelling teaching

The teacher should be aware of what is acceptable (the dos) and what is not acceptable (the don'ts) when modelling in the classroom. The dos and don'ts of modelling are discussed below.

8.10.1. The dos in modelling teaching

To ensure that the demonstration method is a success, the following advice should be followed. Teachers should set clear, specific, measurable, achievable, realistic, and time-framed goals and objectives for the modelling. The teacher conducting the modelling should design a well-planned strategy that is simple and easy to implement. The modeller should prepare a thorough and detailed lesson plan that is well-structured and focused on the subject matter to be modelled. During the planning stage, the teacher should consider the safety of the learners and creatively gather quality materials and a complete collection of tools needed for the modelling (Damiani et al., 2018). It is essential to allow time for rehearsal before the actual modelling in class to ensure its success. When using the modelling method, teachers should use clear and simple language that promotes a better understanding of concepts and processes.

The teacher should be inclusive by paying full attention to all the learners in the class, motivating them, and providing equal opportunities to learn from the modelling. The teacher should create a democratic environment where learners are encouraged to ask questions to clarify ambiguities. Teachers should allow the answers to come from the learners themselves, giving them time to gather their thoughts and think through their responses. The teacher can provide clues or leading questions to stimulate critical thinking among learners.

8.10.2. The don'ts in modelling teaching

Do not rush when planning to model; take your time to consider the content to be modelled, the modelling tools, the sequencing of activities, the timing, and the involvement of learners. Do not omit important steps and necessary modelling procedures. Do not begin modelling until all learners understand the purpose of the modelling or the problem it is intended to solve, and until they are fully motivated. Ensure that no learner is left behind; every learner must benefit from a supportive modelling environment. Avoid careless use of objects and substances that are necessary but pose dangers to life.

8.11. Case studies in modelling teaching

A School of Agriculture advertised a vacancy to teach an elementary agriculture class. Shortlisted candidates would be required to teach, for 60 minutes, an agricultural topic of their choice using the modelling method. Thompson Sixpence applied for the post and stated in his application letter that he was skilled at modelling. He became one of the fortunate candidates to be shortlisted and was invited for an interview.

Thompson decided to model plant propagation using stem cuttings. In his lesson plan, he listed the following resource requirements: a sharp knife or scissors, a plant pot or any plant container, growing media, a pencil, a clear plastic bag, a rubber band, and a stem cutting. He collected these items in preparation for the interview. He was the first to model on the interview day. All learners were seated in their usual places, and the interview panel sat at the back of the classroom. Everyone in the modelling classroom was a stranger to one another.

Thompson placed his modelling items on the table in front of the class. He started by naming and explaining the uses of each item or medium he was going to use. He saturated the growing media with clean water. Using a knife, he cut the stock plant 5mm below the leaf joint and removed the leaves. He explained the precautions that must be taken when using sharp objects and noted that the rooting hormone can be an irritant to the skin or eyes. As a precaution, he advised the learners to use gloves and masks, although he did not have them available. Thompson used a pencil to create a hole in the growing media and placed the plant stem to prevent the displacement of the rooting hormone during planting. He inserted the cut end into the rooting hormone powder. He gently covered the cutting with the medium and placed it in a plant pot. He then covered the plant pot with a clear plastic bag and secured it with a rubber band. He explained that the plastic bag was to provide warmth and moisture for the rootless cutting.

Thompson also explained how to care for the propagated plant: it should be kept under moderate temperatures, checked weekly for moisture levels and root growth, and the plant pot size should be changed when the plant's root density increases. His modelling session took 45 minutes and concluded there.

Case study revision tasks

Imagine that you are a member of the interview panel. Write a report to the school head, explaining with reasons whether Thompson Sixpence should be offered the job or not.

Write a feedback report advising Thompson Sixpence on the strengths and weaknesses of his modelling.

Suppose you were Thompson Sixpence. Review your modelling session and suggest strategies for improvement in the future.

8.12. Conclusion

Modelling is a teaching strategy that involves executing lessons through the sequential exhibition of real objects or instructional media relevant to the subject matter. There are three types of modelling in the classroom: step-by-step, whole process, and spot modelling. The purpose of modelling is to simplify the understanding of concepts and to develop systematic procedural problem-solving skills in learners. The advantages of modelling include arousing interest and curiosity in learners, increasing reasoning, memory, and academic performance, and motivating learners to engage in individual inquiry and apply theory in practice. Teachers should engage in rigorous planning on how to actively involve learners. The modelling teacher practices inclusivity during the process. Teachers should exercise caution when using potentially harmful objects and substances in modelling. It is recommended that teachers regularly review their modelling techniques for continuous improvement.

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