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19.1. Concept Map

This chapter delves into the powerful imagery tool for visualised learning and its potential to enhance learners' experiences in both classrooms and online settings. By harnessing the cognitive benefits of visualisation, educators can create more engaging and effective learning environments that cater to diverse learning preferences, promoting active learning and deeper understanding. Furthermore, it appeals to the current generation of learners, who are attracted to visual messaging through social media platforms such as TikTok and Instagram. The chapter explores various aspects of imagery and visualised learning, including theoretical foundations, practical implementation strategies, and potential outcomes for learning.

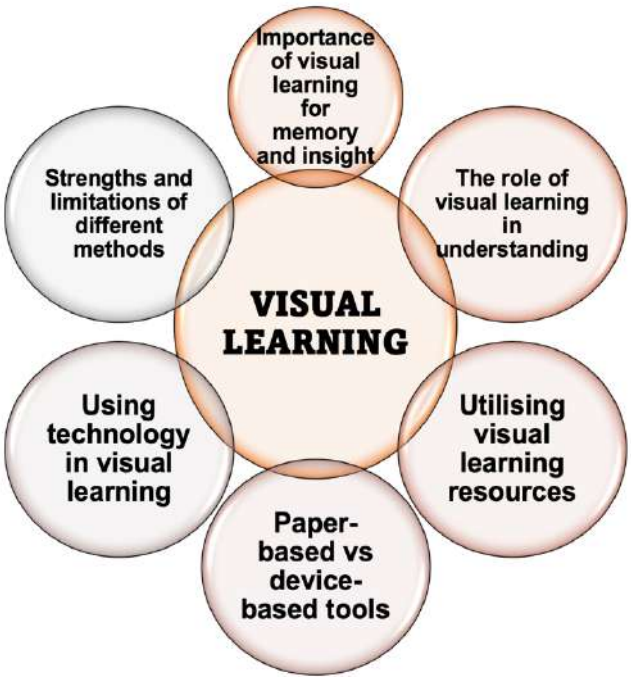


Figure 19.1: Concept Map of Chapter Outline (Source: https://flic.kr/p/2qg6tYR)

Figure 19.1 illustrates the relationship between visual learning and active participation, emphasising the crucial role of engagement in memory retention. To ensure effective and impactful learning in the context of current technological advancements, educators must prepare learners for a digitally integrated world that increasingly incorporates technology-driven visual learning methods.

19.2 Learning Outcomes

- After reading this chapter, the reader should be able to:
- Understand the impact of imagery and visual tools on engagement, comprehension, and critical thinking.
- Identify and apply visual learning techniques to enhance instruction.
- Analyse the cognitive benefits of visual aids for diverse learning preferences.
- Effectively integrate visual learning activities into lesson plans.
- Evaluate the effectiveness of visual learning across different educational contexts.
- Design visual learning strategies based on successful case studies for improved outcomes.

19.3 Clarification of Key Terms

Cognitive strategy instruction: Teaching specific strategies like summarising and questioning to improve comprehension and retention.
Cycle: A series of stages forming a loop, illustrating a continuous process.
Frayer model: A four-square graphic organiser to help understand vocabulary.
Imagery in learning: Using imagery to enhance understanding and retention.
Infographics: An image that combines text and images to present complex data.
Think boards: Classroom visual tools that encourage critical and creative thinking, often used for brainstorming and reflection.
Timeline: A linear visual representation of events in chronological order.
Visual learning: A learning preference where information is processed through visual aids like diagrams and charts to simplify complex concepts.

19.4 Introduction to Imagery and Visualised Learning Strategies

Extensive research highlights the benefits of imagery and visual learning, supported by dual coding theory (Paivio, 2014) and constructivism, accommodating various learning preferences—including visual, kinaesthetic, and auditory. Cognitive strategy instruction enables learners to simplify complex information and link it to prior knowledge. Social constructivist pedagogies emphasise the role of social interaction and collaboration in constructing knowledge (Figure 19.2). The use of smartphones and QR codes has enhanced visual learning by providing quick access to resources, emphasising the importance of adapting teaching methods to diverse learner needs. Imagery and visual learning improve comprehension, retention, and engagement by forming mental pictures that aid understanding and recall. Visual learning involves using aids like diagrams, charts, and videos to organise information; for instance, a timeline of Nelson Mandela's life can visually represent key events. Visual learning has been shown to improve higher-order thinking skills (Raiyn, 2016), allowing learners to develop schemas and organise knowledge within existing frameworks (Cochrane & Bateman, 2010; Retorta & Cristovão, 2017).

Understanding how factual, declarative, and procedural knowledge work together is crucial, with structural knowledge bridging basic knowledge to practical application. Visual aids enhance active learning by engaging learners in discussions and critical thinking, particularly in real-world contexts. Learning preferences, styles, and strategies often overlap and may need clarification. Learning preferences refer to how individuals approach learning tasks; teaching preferences relate to methods that support these preferred approaches; and strategies are the approaches educators select to enhance learning. Jawed et al. (2019) indicated that approximately 65% of learners are visual learners. Visual strategies enhance engagement and accelerate comprehension by catering to these visual learners.

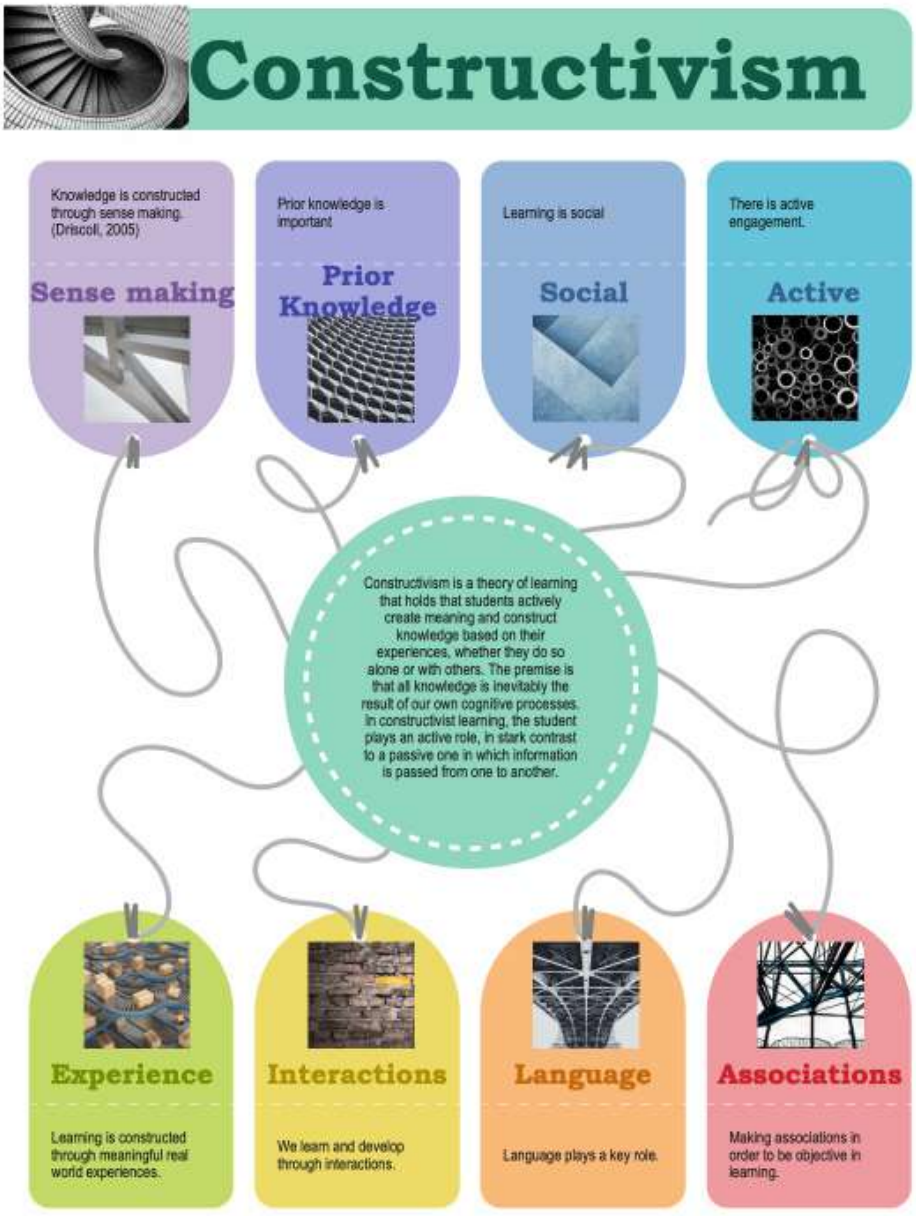


Figure 19.2: Infographic on Constructivism (Source: https://flic.kr/p/2qevDKQ)

- **Summarisation:** Distilling key points to reinforce understanding and focus.
- **Active engagement:** Interacting with material meaningfully, often using visual aids to enhance memory.
- **Spelling and pronunciation:** Focusing on how words are spelt and pronounced to improve recall by connecting sounds and meanings.
- **Personalisation:** Linking new information to personal experiences or prior knowledge to aid memory retention.

The more personally relevant something is, the more likely you will remember it.

19.5 Preparing Productive Imagery and Visualised Learning

Learning through visualisation, planning, self-regulation, memorisation, analysis, prediction, establishing associations, utilising signals, and metacognition (thinking about thinking) are some tactics to help learners achieve various educational goals. By exposing learners to multiple approaches, we aim to refocus our efforts on teaching them how to learn, rather than merely helping them understand the subject matter of the curriculum. Knowledge, concepts, and ideas can all be visually represented, and there are many ways to organise information.

Each visual tool offers advantages in making learning more accessible and engaging for learners, depending on the content and the learner's preferred style. Some of these are:

- **Visualisation:** Encouraging learners to create mental images to enhance comprehension of text by imagining the content.
- **Mind mapping:** A visual tool starting with a central idea, branching out to organise thoughts and show connections to a main topic.
- **Concept mapping:** A tool that shows relationships between ideas, allowing for multiple connections and directions, useful for brainstorming and note-taking.
- **Mnemonics:** Memory aids, using catchy phrases or images, that help retention.
- **Flow charts:** Outlining steps in a process, for decision-making or sequences.
- **Storyboards:** Comic strip-like visuals that sequence events, often used for planning creative writing projects.

Visualisations include a variety of visual aids, such as diagrams, infographics, sketch notes, mind maps, and videos, which can be integrated into different subjects across various age groups. We will focus on popular tools: mind mapping, infographics, and think boards.

19. 6 Advantages And Disadvantages of Imagery and Visualised Learning

Advantages

- **Enhanced visual learning:** Applications support visual learning by enabling the manipulation of images, videos, and visuals to clarify meaning.
- **Engagement:** Visual aids make learning interactive and interesting.
- **Comprehension and memory:** Combining words and images improves understanding and retention (Paivio, 2014; Mayer, 2017).
- **Critical thinking:** Visual tools like concept maps enhance higher-order thinking and problem-solving.
- **Active learning:** Visualisations promote active learning and simplify complex concepts (Roberts et al., 2017).
- **Conceptual connections:** Imagery helps link new and prior knowledge for deeper understanding (Collins & Olson, 2014).
- **Accessibility Visual** tools improve accessibility for non-native speakers.

Disadvantages

- **Accessibility:** Limited device or internet access can hinder participation.
- **Technical issues:** Software glitches disrupt learning and waste time.
- **Learning curve:** Varying tech skills among learners can slow tool adoption.
- **Ineffectiveness for some:** Auditory or kinaesthetic learners may struggle with visual aids.
- **Cognitive overload:** Poorly designed visuals can be overwhelming.
- **Misinterpretation:** Unclear visuals can cause misunderstandings.
- **Time-consuming:** Developing visual aids can be resource-intensive for educators.

19. 7 Techniques in Effective Imagery And Visualised Learning

There are various techniques to customise visual tools for designing visually appealing presentations, handouts, and interactive materials that align with the learning outcomes. Collaborative online platforms, such as Google Drive, allow learners to work together on a learning task. For instance, they can add and create materials that suit their learning preferences, such as pie charts or graphs. Integrating technology in teaching and learning is becoming increasingly sophisticated, as new developments offer multiple options for use. While paper-based visual methods are still widely used, technology has expanded the possibilities to include computer-based (e.g., desktops and laptops) and mobile devices (e.g., mobile phones and tablets). Software to support learning in the

classroom should prioritise free access and educational licences before opting for "paid-for versions" to ensure equity in access for the diverse learners in our classrooms.

Visual learning using paper-based methods offers many advantages. Despite the shift away from this conventional approach, it remains an effective tool for visualising learning. Advantages of using paper-based visual methods include:

- **Accessibility:** Materials are available to all learners.
- **Focus:** Learners can concentrate on tasks without digital distractions.
- **Tactile interaction:** Physical activities like drawing or writing enhance kinaesthetic learning and improve retention, offering a unique cognitive experience.

Technologies, such as those made available by Google (www.google.com) and Microsoft (www.microsoft.com), have become more widespread, especially as they become increasingly accessible to educators and learners. They provide affordances that would otherwise not be possible, such as:

- **Interactive learning:** Can be synchronous or asynchronous, allowing flexibility.
- **Deeper learning:** Hyperlinks and layered content provide access to expanded resources.
- **Visual tools:** Technology enables dynamic visuals like 3D animations to illustrate complex concepts, such as the movement of a pumping heart in Human Biology.

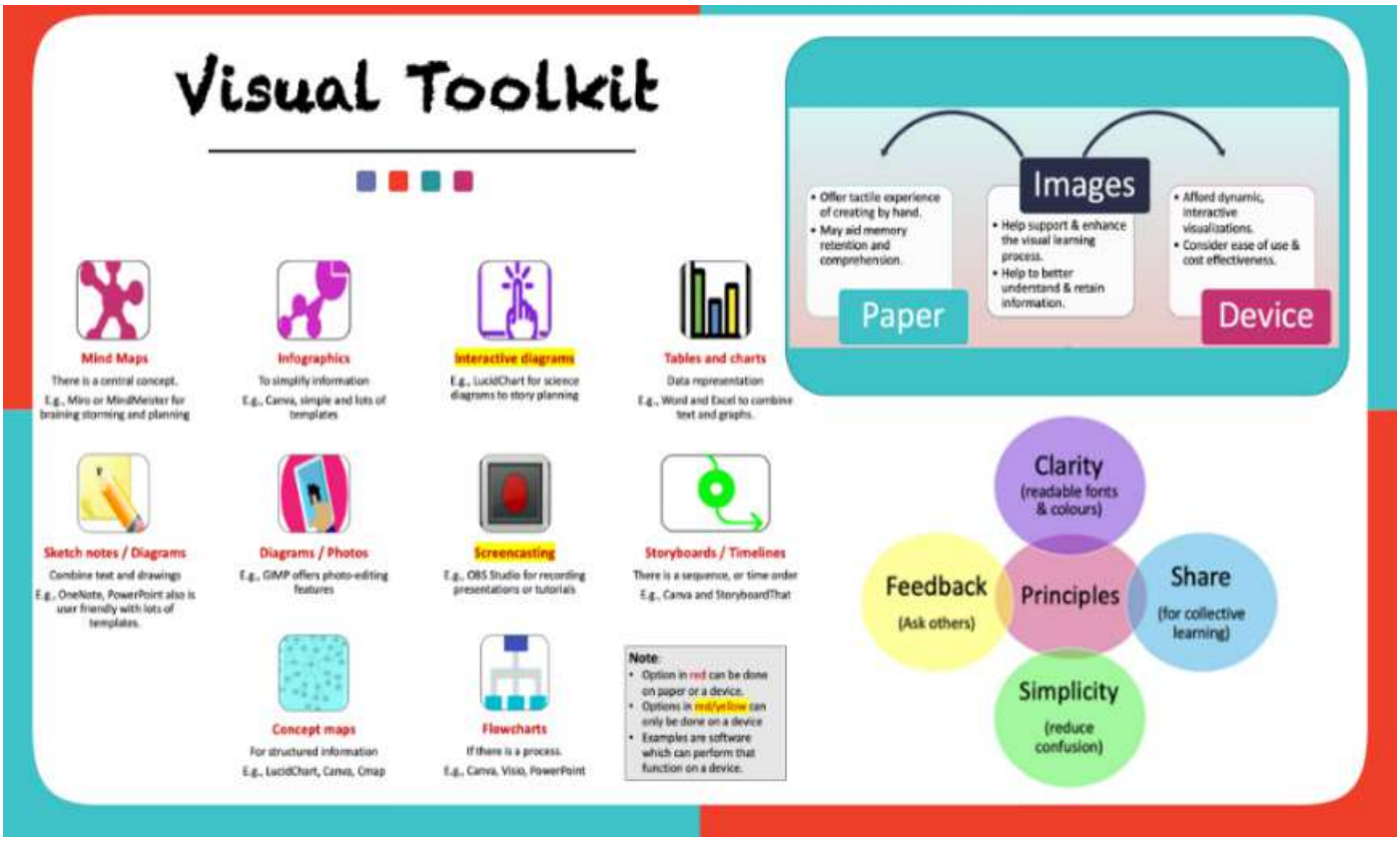


Figure 19.3: Visual Learning Toolkit (Source: https://flic.kr/p/2qeAdvk)

The Visual Toolkit image above (Figure 19.3) provides an overview of popular technology tools and platforms that facilitate visual learning. Follow the URL to see the enlarged version.

Example: Image - Fuel Tanker (Science)

The HAZCHEM image is connected to a science-focused environment. It is also useful in Problem-Based Learning (PBL) scenarios, where it can stimulate learning by presenting a series of questions that provide insights into specific topics.

For instance, this visual can enhance education in a Physical Science classroom through inquiry-based learning.

Please answer the following questions regarding the enlarged orange image at the bottom right of the tanker below.

1. Where are you likely to see such an information table? What does the HAZCHEM code "3YE" mean?
2. What type of liquid is likely being transported by this tanker?

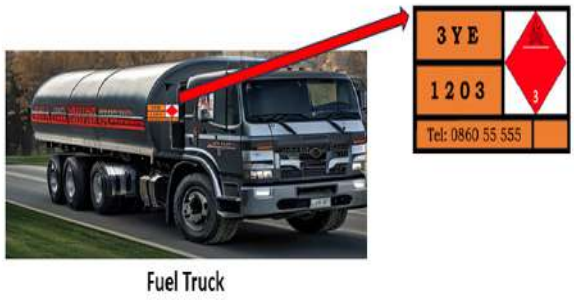


Figure 19.4: Fuel Truck (Source: https://flic.kr/p/2qeBpze)

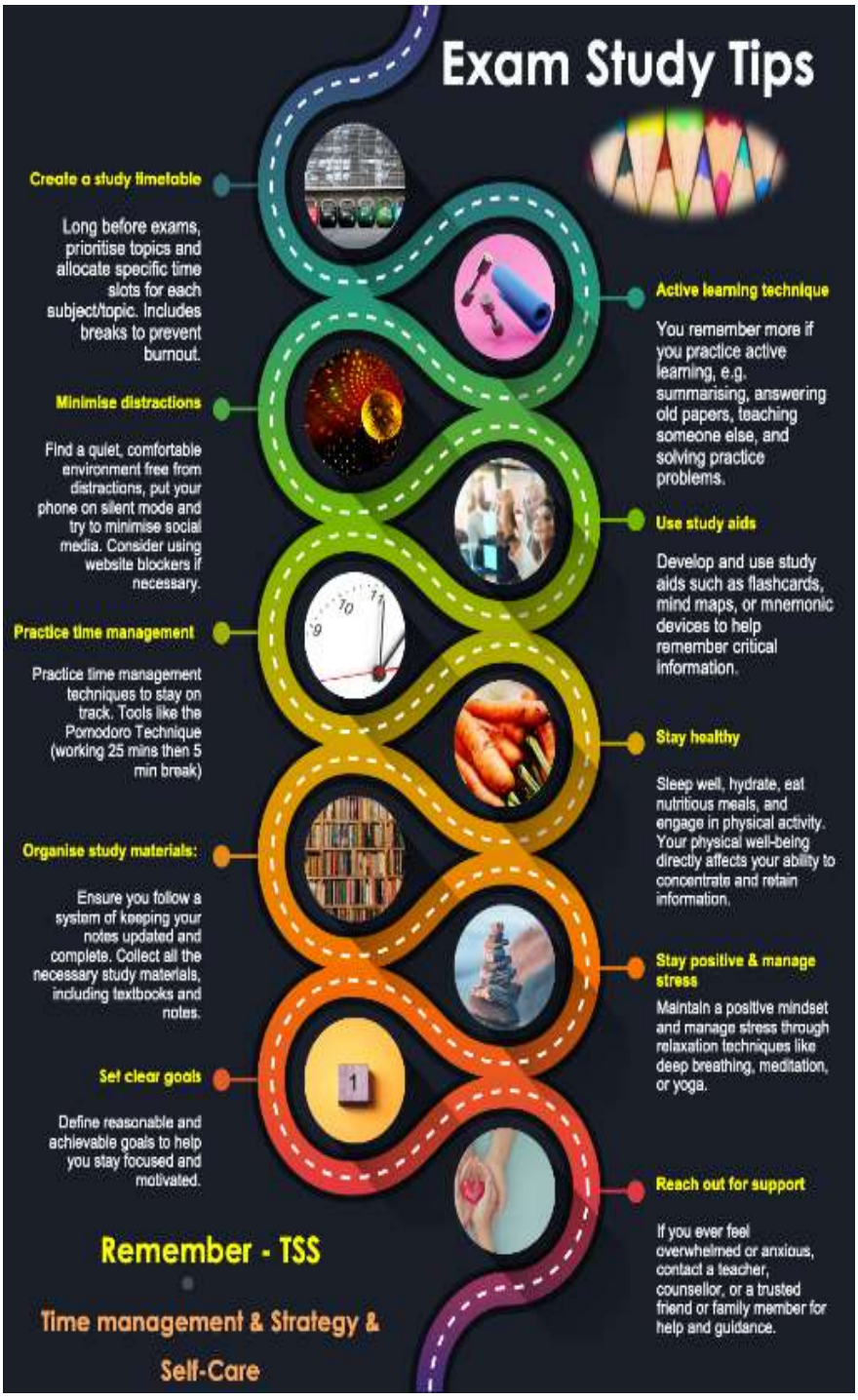


Figure 19.5: Infographic on Exam Study (Source: https://flic.kr/p/2qeBR2s)

Example: Infographic – Study Skills (Various subjects)

There are several reasons to use infographics for visual learning. Combining text and visuals can capture and hold learners' attention better than text alone. Presenting information in a clear and organised manner can make it easier for most learners to understand. Infographics can break down complex ideas into smaller 'chunks', facilitating the learning process. Therefore, analysing an infographic or any diagram requires critical thinking to interpret the information presented. This type of visual can be used in various subjects, from grammar rules and book summaries to human anatomy, the process of photosynthesis, art movement timelines, types of joints in woodworking, and anything in between. The overarching rule is that they must be clear, accurate, and relevant to the learning objectives for which they are used. Remember, infographics are a supplementary tool to enhance understanding, not a replacement for detailed teaching.

Depending on your subject and content, you might consider one of the following types of infographics:

- **Informational:** Combines graphics and text to explain concepts (e.g., events leading to World War I).
- **List:** Bullet points or checklists (e.g., common foreign phrases with translations).
- **Statistical:** Charts to present data (e.g., survey results on favourite school lunches).
- **Comparison:** Venn diagrams to compare options (e.g., plant vs. animal cells).
- **Geographic:** Maps to present location-based data (e.g., major world rivers).
- **Timeline:** Displays key dates (e.g., art movements from the Renaissance to Modern Art).
- **Process:** Flow diagrams to explain processes (e.g., the water cycle).

Example: Mind Map – Entrepreneurial growth (Economics / Accounting)

In its simplest form, mind mapping is a visual tool used to organise information. Psychologist Tony Buzan first popularised it as a note-taking and summarisation tool that maximises the different functionalities of the brain's two hemispheres. The left hemisphere is responsible for words, logic, sequences, and analysis, while the right hemisphere handles tasks associated with colours, emotions, shapes, and imagination. Mind mapping engages both sides of the brain and, in this way, serves as an active strategy to facilitate the learning process and enhance the mind's natural ability to think (Gavens et al., 2022; Van Rensburg et al., 2023).

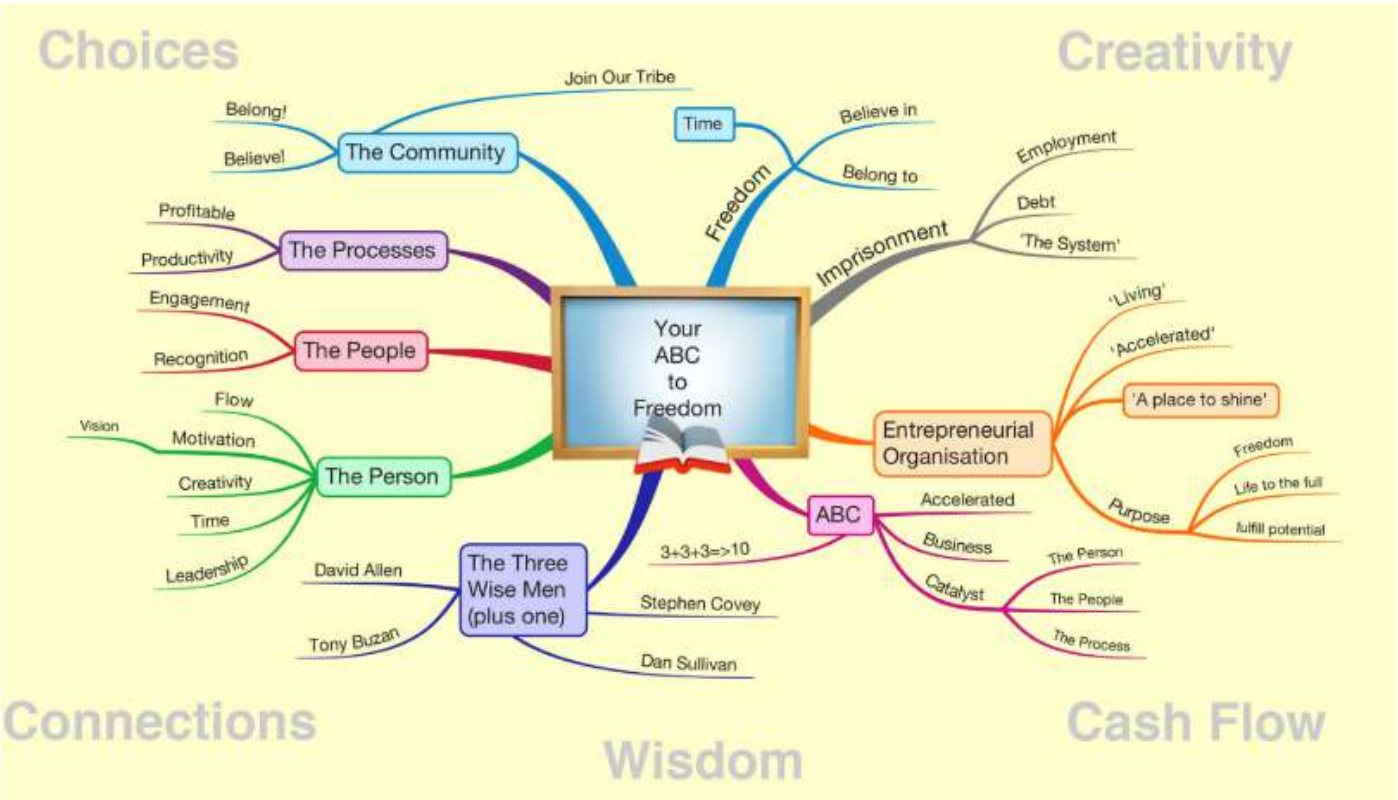


Figure 19.6: Example of Mind Map (Source: https://flic.kr/p/SGKCby)

In mind mapping, words, images, and other concepts are typically added to a core thought, while supporting ideas radiate from it. When creating a mind map, the primary subject is first positioned in the middle of the page or screen. Branches are then drawn by joining lines that extend from the primary word. Each subtopic branch represents a single thought related to the main topic. Images and diagrams can also be included to clarify concepts further. The objective is to transfer ideas from the abstract to the more tangible. Mind mapping encourages natural thought processes and creative expression. With eye-catching use of colour and images, mind maps are an excellent tool for stimulating the interest of artistic pupils and enhancing their engagement with the material. Additionally, visual appeal is expected to improve memory and recall, thereby accelerating the learning process.

Example: Think Board – Vocabulatory (Languages)

Dorothy Frayer and her colleagues initially developed the four-square think board model to assist learners in vocabulary development (Frayer et al., 1969). The Frayer Model is a four-square graphic organiser designed to help learners understand vocabulary. It includes the definition (what the word means), characteristics (key features of the word), examples (instances of the word), and non-examples (what the word is not). This model helps learners grasp and remember new terms by engaging with them in multiple ways. Frayer's model has also been used for various other purposes, including developing the conceptual knowledge of prospective educators (Akhtar & Saeed, 2022) and as a means for formative assessment to inform lecturers about learners' progress in meeting course outcomes (Keeley, 2013; Akhtar & Saeed, 2022).

Frayer's graphic and visually-oriented model can help learners select, represent, and organise information related to a critical concept. The representation of an idea or graphic concept aimed at activating learners' thinking about the topic during and after a lecture has been successfully adapted. An example Think Board can be seen in Case Study 2 below.

19.8 Do's and Don'ts in Imagery and Visualised Learning

Incorporating visual aids such as images, diagrams, and videos enhances learning by improving comprehension, retention, and engagement. These tools simplify complex information, making it more accessible to learners. Visual aids like mind maps and concept maps promote active learning, higher-order thinking, and problem-solving while catering to diverse learning preferences and fostering inclusivity. Additionally, imagery helps connect new knowledge to prior understanding and enhances accessibility for non-native speakers by providing extra context and clarity.

It's important to avoid the pitfalls of visual learning. Poorly designed visuals can cause cognitive overload, reducing their effectiveness; therefore, they should be clear, concise, and well-structured. Visual aids should supplement, not replace, traditional teaching. Educators must also consider accessibility, ensuring alternatives for learners with limited access to technology. New tools may present a learning curve, requiring support for varying skill levels. Furthermore, visual aids may not suit all learners, particularly auditory or kinaesthetic ones, and developing these tools can be time-consuming, especially in resource-constrained environments. Thoughtful implementation is key to maximising their effectiveness and ensuring all learners benefit.

19.9 Case Studies in Imagery and Visualised Learning

There are many possible avenues to explore, but we will focus on Mind Mapping and Think Boards. Mind Mapping helps students visually organise information by branching out from a central idea, fostering connections and deeper understanding. Think Boards encourage learners to break down problems or concepts into visual components, promoting active engagement and critical thinking.

Case Study 1: Introducing Concepts through Prior Knowledge, Imagery, and Infographics
In today's lesson, a lecturer working with Year 1 pre-service student teachers introduce the concepts of lesson

planning and classroom observation. The objective is for student teachers to identify different elements when observing a taught lesson.

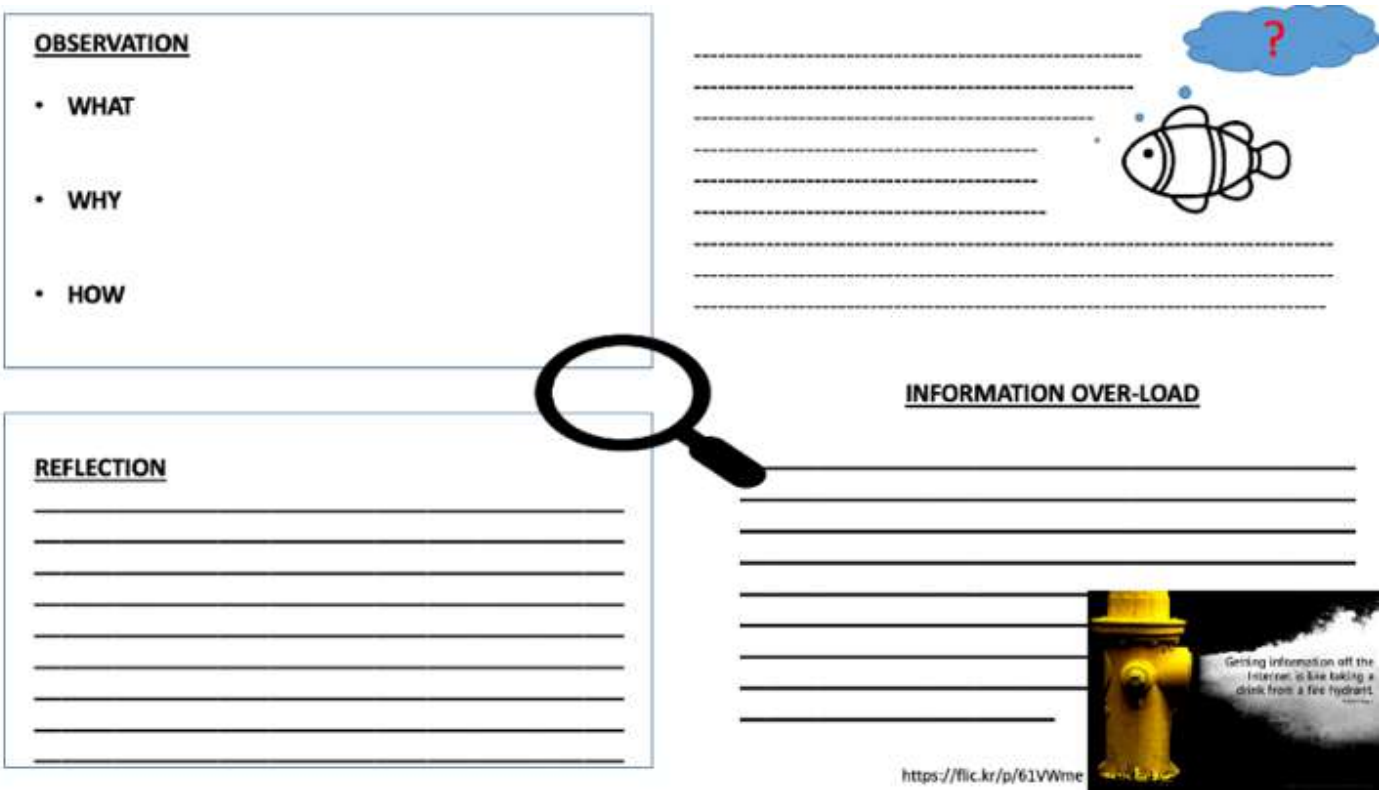
The lecturer begins by prompting the students: "What image comes to mind when I say 'classroom'? Draw on your background knowledge from years of being in a classroom to form a mental image."
Next, the lecturer instructs: "Now, imagine you're zooming in on that image. Take a moment to focus on the detailsdraw that image in your notebook."
Once students have completed their drawings, the lecturer continues: "Below your image, write a description of what you see in words. Focus on the key elements that stand out to you."
Finally, the lecturer asks the students: "Using both your drawing and description, make a list of all the details you've included in your image."

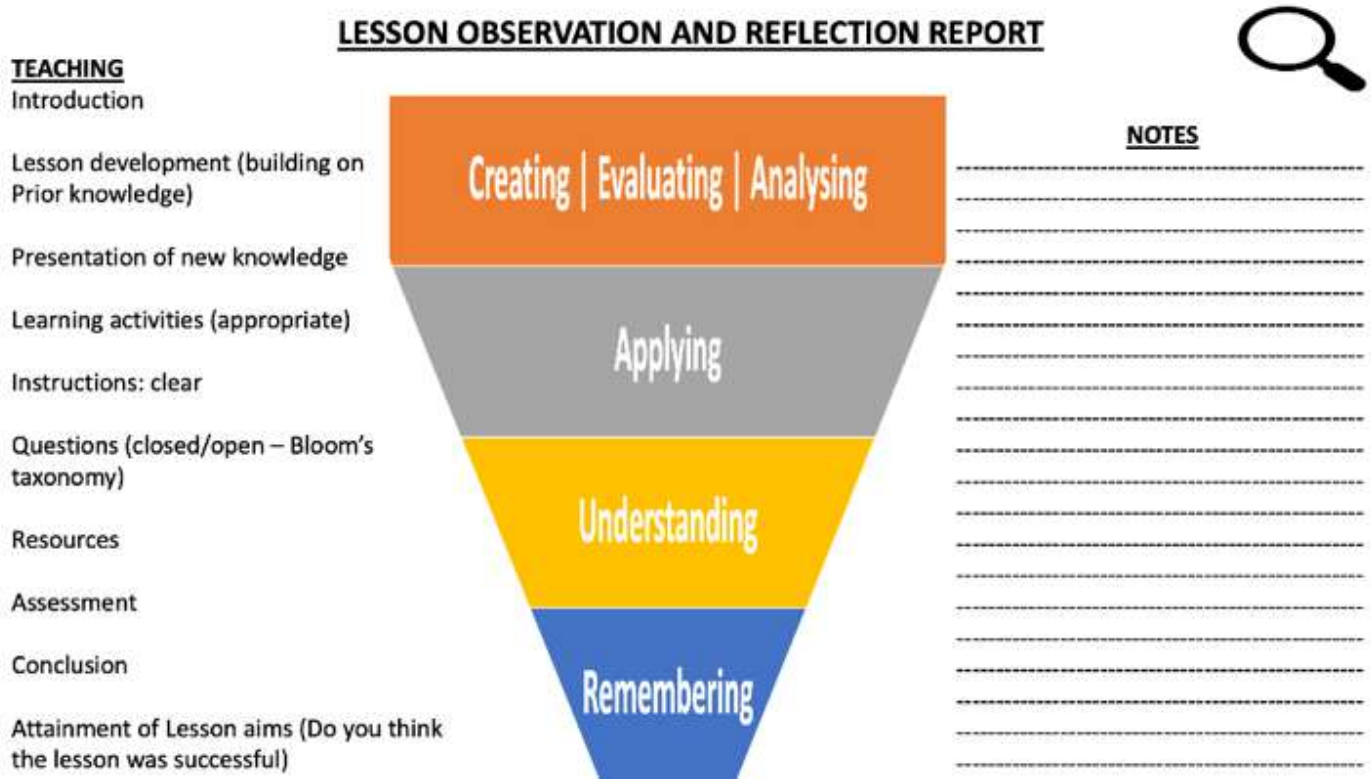
The class then collaborates to create a mind map, combining the individual observations and details each student has noted to form a comprehensive visual representation of a classroom.

Case Study 2: Introducing Concepts Using a Visual Hook and Guided Observation – Think Board

In today's lesson, a lecturer is working with Year 1 pre-service student teachers, introducing the concepts of lesson planning and classroom observation. The objective is for the student teachers to identify the various elements involved when observing a lesson being taught.

Figure 19.7: Think Board Example (Sources: https://flic.kr/p/2qeGgyP & https://flic.kr/p/2qeNrjA)





The lecturer starts the session by saying: "I am going to show you a short video. As you watch, use page 2 of the think board I handed out to you to list everything you observe. Pay attention and comment on the following aspects:"

1. What is the topic of the lesson?
2. How does the teacher introduce the lesson?
3. How does the teacher use the students' prior knowledge to introduce the content?
4. What activities do the children engage in to master today's content?
5. What teaching aids or resources does the teacher use to make the content more accessible to understand?
6. What types of questions does the teacher ask during the lesson?
7. How does the teacher check whether the children understand the lesson?
8. How does the teacher conclude the lesson?
9. After the video, the lecturer facilitates a discussion, guiding the students in comparing their observations and identifying key elements in the lesson structure.

19.10 Conclusion

In conclusion, visualised learning and imagery significantly benefit education by enhancing comprehension, retention, and engagement. By incorporating visual tools such as mind maps, infographics, and think boards, educators can cater to diverse learning preferences and promote active learning and critical thinking. However, the effective implementation of these strategies requires careful consideration of potential challenges, including cognitive overload, accessibility issues, and the varied learning preferences of students. Technology also plays a crucial role in expanding the potential of visual learning, providing access to dynamic tools like interactive diagrams, 3D models, and simulations, which further enhance engagement and understanding. When thoughtfully integrated, visual learning techniques can markedly improve educational outcomes, making them invaluable in modern teaching practices.

19.11 Reflective Questions

1. What elements of the chapter could contribute most to enhancing learner learning and recall, and why?
2. How could visual aids enhance the comprehension of complex topics?

3. What guidelines or tips does the chapter offer for effective analysis of visual information?
4. What advantages, if any, would using technological tools hold for visual learning?
5. How does the chapter define a "visual learning toolkit"?

19.12 References

Akhtar, M., & Saeed, M. (2021). Effect of frayer model and think-pair-share as target assessment methods on academic achievement of prospective science teachers. Harf-o-Sukhan, 5(3), 110-118.

Cochrane, T., & Bateman, R. (2010). Smartphones give you wings: Pedagogical affordances of mobile Web 2.0. Australasian Journal of Educational Technology, 26(1), 1-14.

Collins, J. A., & Olson, I. R. (2014). Knowledge is power: How conceptual knowledge transforms visual cognition. Psychonomic bulletin & review, 21, 843-860.

Frayer, D. A., Fredrick, W. C., & Klausmeier, H. J. (1969). A schema for testing the level of concept mastery: Report from the project on situational variables and efficiency of concept learning. Wisconsin Research and Development Center for Cognitive Learning..

Gavens, N., Doignon-Camus, N., Chaillou, A. C., Zeitler, A., & Popa-Roch, M. (2020). Effectiveness of mind mapping for learning in a real educational setting. The Journal of Experimental Education, 90(1), 46-55.

Jawed, S., Amin, H. U., Malik, A. S., & Faye, I. (2019). Classification of visual and non-visual learners using electroencephalographic alpha and gamma activities. Frontiers in Behavioral Neuroscience, pp. 13, 1-15.

Keeley, P. (2013). Is it a rock? Continuous formative assessment. Science and Children, 50(8), 34–37.

Mayer, R. E. (2017). Using multimedia for e-learning. Journal of Computer-Assisted Learning, 33(5), 403–423.

Paivio, A. (2014). Intelligence, dual coding theory, and the brain. Intelligence 47, 141–158.

Raiyn, J. (2016). The role of visual learning in improving learners' high-order thinking skills. Journal of Education and Practice, 7(24), 115–121.

Retorta, M. S., & Cristovão, V. L. L. (2017). Visually impaired Brazilian learners learning English with smart phones: Overcoming limitations. Languages, 2(3), 1-27.

Roberts, J. C., Ritsos, P. D., Jackson, J. R., & Headleand, C. (2017). The explanatory visualization framework: An active learning framework for teaching creative computing using explanatory visualizations. IEEE transactions on Visualization and Computer Graphics, 24(1), 791-801.

Van Rensburg, G. H., Botma, Y., & Roets, L. (2023). Educators' ability to use concept mapping as a tool to facilitate meaningful learning. Contemporary Nurse, 59(3), 238-248.