MINISTRY OF EDUCATION

BIOMEDICAL SCIENCE

For Senior High Schools

TEACHER MANUAL

YEAR 1 - BOOK 2

NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

MINISTRY OF EDUCATION

REPUBLIC OF GHANA

Biomedical Science

For Senior High Schools

Teacher Manual

Year One - Book Two

NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

BIOMEDICAL SCIENCE TEACHER MANUAL

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INTRODUCTION

The National Council for Curriculum and Assessment (NaCCA) has developed a new Senior High School (SHS), Senior High Technical School (SHTS) and Science, Technology, Engineering and Mathematics (STEM) Curriculum. It aims to ensure that all learners achieve their potential by equipping them with 21st Century skills, competencies, character qualities and shared Ghanaian values. This will prepare learners to live a responsible adult life, further their education and enter the world of work.

This is the first time that Ghana has developed an SHS Curriculum which focuses on national values, attempting to educate a generation of Ghanaian youth who are proud of our country and can contribute effectively to its development.

This Book Two of the Teacher Manual for Biomedical Science covers all aspects of the content, pedagogy, teaching and learning resources and assessment required to effectively teach Year One of the new curriculum. It contains information for the second 12 weeks of Year One. Teachers are therefore to use this Teacher Manual to develop their weekly Learning Plans as required by Ghana Education Service.

Some of the key features of the new curriculum are set out below.

Learner-Centred Curriculum

The SHS, SHTS, and STEM curriculum places the learner at the center of teaching and learning by building on their existing life experiences, knowledge and understanding. Learners are actively involved in the knowledge-creation process, with the teacher acting as a facilitator. This involves using interactive and practical teaching and learning methods, as well as the learner's environment to make learning exciting and relatable. As an example, the new curriculum focuses on Ghanaian culture, Ghanaian history, and Ghanaian geography so that learners first understand their home and surroundings before extending their knowledge globally.

Promoting Ghanaian Values

Shared Ghanaian values have been integrated into the curriculum to ensure that all young people understand what it means to be a responsible Ghanaian citizen. These values include truth, integrity, diversity, equity, self-directed learning, self-confidence, adaptability and resourcefulness, leadership and responsible citizenship.

Integrating 21st Century Skills and Competencies

The SHS, SHTS, and STEM curriculum integrates 21st Century skills and competencies. These are:

- **Foundational Knowledge:** Literacy, Numeracy, Scientific Literacy, Information Communication and Digital Literacy, Financial Literacy and Entrepreneurship, Cultural Identity, Civic Literacy and Global Citizenship
- **Competencies:** Critical Thinking and Problem Solving, Innovation and Creativity, Collaboration and Communication
- **Character Qualities:** Discipline and Integrity, Self-Directed Learning, Self-Confidence, Adaptability and Resourcefulness, Leadership and Responsible Citizenship

Balanced Approach to Assessment - not just Final External Examinations

The SHS, SHTS, and STEM curriculum promotes a balanced approach to assessment. It encourages varied and differentiated assessments such as project work, practical demonstration, performance assessment, skills-based assessment, class exercises, portfolios as well as end-of-term examinations and final external assessment examinations. Two levels of assessment are used. These are:

- Internal Assessment (30%) – Comprises formative (portfolios, performance and project work) and summative (end-of-term examinations) which will be recorded in a school-based transcript.
- External Assessment (70%) – Comprehensive summative assessment will be conducted by the West African Examinations Council (WAEC) through the WASSCE. The questions posed by WAEC will test critical thinking, communication and problem solving as well as knowledge, understanding and factual recall.

The split of external and internal assessment will remain at 70/30 as is currently the case. However, there will be far greater transparency and quality assurance of the 30% of marks which are school-based. This will be achieved through the introduction of a school-based transcript, setting out all marks which learners achieve from SHS 1 to SHS 3. This transcript will be presented to universities alongside the WASSCE certificate for tertiary admissions.

An Inclusive and Responsive Curriculum

The SHS, SHTS, and STEM curriculum ensures no learner is left behind, and this is achieved through the following:

- Addressing the needs of all learners, including those requiring additional support or with special needs. The SHS, SHTS, and STEM curriculum includes learners with disabilities by adapting teaching and learning materials into accessible formats through technology and other measures to meet the needs of learners with disabilities.
- Incorporating strategies and measures, such as differentiation and adaptative pedagogies ensuring equitable access to resources and opportunities for all learners.
- Challenging traditional gender, cultural, or social stereotypes and encouraging all learners to achieve their true potential.
- Making provision for the needs of gifted and talented learners in schools.

Social and Emotional Learning

Social and emotional learning skills have also been integrated into the curriculum to help learners to develop and acquire skills, attitudes, and knowledge essential for understanding and managing their emotions, building healthy relationships and making responsible decisions.

Philosophy and vision for each subject

Each subject now has its own philosophy and vision, which sets out why the subject is being taught and how it will contribute to national development. The Philosophy and Vision for Biomedical Science is:

Philosophy: Every Learner can be equipped to excel in pursuit of further studies and/ or working life in the biomedical science domain through comprehension of foundational concepts, problem-based inquiry, experimentation and ethical development of clinically translatable solutions to healthcare delivery in a well-supported teacher-learner environment.

Vision: Learners equipped with 21st century skills and competencies as well as understand the core biomedical science principles and research techniques required to define healthcare challenges and develop interventions and innovations to human health conditions.

SUMMARY SCOPE AND SEQUENCE

S/N	STRAND	SUB-STRAND	YEAR 1			YEAR 2			YEAR 3		
			CS	LO	LI	CS	LO	LI	CS	LO	LI
1.	Biomedical Science In Society	Biomedical Science Practice	1	1	3	1	1	3	1	1	3
		Biosafety	1	1	3	1	1	3	1	1	3
2.	Human Body System	Anatomy and Physiology	1	1	3	1	1	3	1	1	4
		Diseases and Disorders	1	1	3	2	2	8	1	1	4
3.	Biomedical Intervention	Diagnostic Devices	1	1	3	1	1	3	1	1	3
		Therapeutic Devices	1	1	3	1	1	3	1	1	3
4.	Biomedical Innovations	Research and Design In Biomedical Science	1	1	4	1	1	2	1	1	2
Total			**7**	**7**	**22**	**8**	**8**	**25**	**7**	**7**	**22**

Overall Totals (SHS 1 – 3)

Content Standards	**22**
Learning Outcomes	**22**
Learning Indicators	**69**

SECTION 5: MEDICAL DIAGNOSTIC DEVICES

Strand: **Biomedical Intervention**

Sub-Strand: Diagnostic Devices

Learning Outcome: *Explain medical intervention, identify, and describe various diagnostic medical interventions.*

Content Standard: Explore medical interventions and their relevance to diagnosis.

INTRODUCTION AND SECTION SUMMARY

In this section, learners are introduced to the concepts of biomedical interventions by defining medical interventions in relation to diagnosis, therapy and prevention as well as their importance. Additionally, learners explore medical intervention for therapy and prevention of diseases and disorders. The section also compares primitive medical intervention to modern interventions. It also explains their importance, challenges and how both methods are applied in healthcare delivery in Ghana. The section concludes with a discussion of common diagnostic devices and their functions.

The weeks covered by the section are

Week 13: *Define medical intervention in relation to diagnosis, therapy and prevention.*

Week 14: *Compare and contrast primitive diagnostic and medical interventions and modern diagnostic devices.*

Week 15: *Explore the significance of the various diagnostic devices used for medical intervention.*

SUMMARY OF PEDAGOGICAL EXEMPLARS

To achieve the content standard for this section, the following pedagogical exemplars are recommended: using initiating talk-for-learning, structuring talk-for-learning and digital learning, learners share their experiences on the essence of medical intervention in diagnosis, therapy and prevention of diseases and disorders. Through activity-based and experiential learning strategies, learners experience how various diagnostic tools are used and their basic troubleshooting. To promote learners' ability to search for information, let learners research from other resources on modern medical interventions and compare them to primitive medical intervention.

SUMMARY OF ASSESSMENT

To assess learners' ability to show an understanding of medical intervention in relation to diagnosis, therapy and prevention, levels 1, 2, 3 and 4 assessments are recommended. Using DOK level 1 assessment, learners' ability to recall knowledge shared on medical intervention, characteristics of primitive diagnostic intervention and examples of diagnostic devices are assessed. Using DOK level 2 assessment learners' conceptual understanding is assessed on how to classify medical devices into diagnostic and therapeutic devices as well as the challenges of employing primitive diagnostic tools. Using DOK levels 3 and 4 assessment, learners' strategic reasoning abilities are assessed on how diagnostic devices are used and troubleshooted if need be.

Week 13

Learning Indicator: *Define medical intervention in relation to diagnosis, therapy, and prevention.*

Theme or Focal Area: Define medical intervention for diagnosis, examples, and its importance.

What is medical intervention?

Medical intervention can be defined as: any action, procedure, or treatment performed by healthcare professionals with the purpose of preventing, diagnosing, treating, or managing health conditions or diseases in individuals.

These interventions include a wide range of activities, such as vaccinations and lifestyle modifications, to complex surgical procedures and medications. The goal of medical interventions is to promote health, alleviate suffering, improve quality of life, and/or prolong life expectancy. They are typically guided by evidence-based practices and tailored to meet the specific needs of each patient.

Medical intervention for diagnosis can be defined as: the various procedures, tests, and techniques used by healthcare professionals to identify and determine the cause of a patient's medical condition.

Medical intervention for therapy can be defined as: treatments and procedures that healthcare professionals use to manage, alleviate symptoms, promote healing, and improve the overall well-being of individuals with medical conditions.

Medical intervention for prevention can be defined as: measures taken by healthcare professionals to minimise the risk of developing certain diseases, injuries, or health conditions.

Here are some examples of medical interventions for:

1. **Diagnosis**
   a. **Physical examination**: a comprehensive evaluation of a patient's body to assess general health, and identify visible abnormalities or symptoms such as body temperature, blood pressure, heart rate and respiratory rate.
   b. **Medical history**: gathering information about a patient's past and current medical conditions, family history, and lifestyle factors that may contribute to their health issues.
   c. **Laboratory tests**: analysis of blood, urine, or other bodily fluid samples to measure specific markers, detect infections, assess organ function, and identify abnormalities.
   d. **Imaging studies**: techniques such as X-rays, computed tomography (CT) scans, magnetic resonance imaging (MRI), ultrasound, and positron emission tomography (PET) scans, which provide detailed images of internal structures to aid in diagnosing various conditions.
   e. **Genetic testing**: analysis of a patient's DNA to identify genetic mutations or variations that may contribute to certain diseases or conditions.

2. **Therapy**
   a. **Medication**: prescribing pharmaceutical drugs to treat various conditions, such as antibiotics for infections, analgesics for pain relief, or antihypertensives for high blood pressure.
   b. **Physical therapy**: using exercises, stretches, and other physical modalities to improve mobility, strength, and flexibility after injuries or surgeries.
   c. **Psychotherapy**: providing talk therapy or counselling to address mental health issues like depression, anxiety, or trauma.
   d. **Radiation therapy**: using high-energy radiation to target and destroy cancer cells in specific areas of the body.

e. **Chemotherapy**: administering drugs to kill cancer cells or inhibit their growth throughout the body.

f. **Occupational therapy**: helping patients regain independence and function in daily activities after illness or injury.

g. **Speech therapy**: assisting individuals with speech and language disorders to improve communication skills.

h. **Immunotherapy**: boosting the body's immune response to target and fight cancer cells.

3. **Prevention**

a. **Vaccination**: administration of vaccines to stimulate the body's immune system and protect against infectious diseases such as influenza, measles, mumps, rubella, and more.

b. **Screening tests**: regular screenings to detect diseases or risk factors early on, such as mammograms for breast cancer, colonoscopies for colorectal cancer, and blood pressure checks for hypertension.

c. **Lifestyle counselling**: healthcare professionals provide advice and support to help individuals adopt healthier behaviours, such as smoking cessation, healthy diet planning, and regular exercise.

d. **Genetic counselling**: providing information and guidance about the risk of inheriting certain genetic conditions and available options for prevention or early detection.

e. **Environmental interventions**: implementing measures to reduce exposure to environmental hazards that may cause health problems, such as air pollution controls or lead abatement.

f. **Injury prevention programs**: initiatives designed to prevent injuries, such as car seat safety education, fall prevention measures for the elderly, and workplace safety programs.

g. **Health education and awareness campaigns**: promoting public awareness about various health issues and educating individuals on preventive measures and early warning signs.

Discussions on the importance of medical interventions should be based on the following:

1. **Diagnosis**

a. **Accurate diagnosis**: proper diagnosis is the foundation for effective treatment. Without a clear understanding of a patient's condition, it is challenging to provide appropriate care.

b. **Early detection**: timely diagnosis can lead to the identification of diseases in their early stages, improving the chances of successful treatment and better outcomes.

c. **Disease management**: knowing the precise condition allows healthcare providers to develop tailored treatment plans and provide necessary education and support to patients.

2. **Therapy**

1. **Disease management**: therapeutic interventions are essential for managing chronic conditions, controlling symptoms, and preventing disease progression.

2. **Pain relief**: many therapeutic interventions aim to reduce pain and improve the quality of life for patients experiencing discomfort.

3. **Preventing complications**: early and effective therapy can prevent complications associated with certain medical conditions, reducing the risk of severe outcomes.

4. **Restoring function**: therapeutic interventions like physical therapy and occupational therapy can help patients regain lost abilities and independence.

5. **Psychological support**: psychotherapy and counselling provide emotional support and guidance, promoting mental well-being.

6. **Prolonging life**: some medical interventions, such as cancer treatments, can extend a patient's life expectancy and improve survival rates.

3. **Prevention**
   a. **Reduced disease burden**: preventive measures can reduce the overall burden of diseases on individuals, families, and communities, leading to better health outcomes.
   b. **Cost-effectiveness**: prevention is often more cost-effective than treating advanced diseases, as it reduces the need for expensive medical interventions and hospitalisations.
   c. **Improved quality of life**: preventing diseases and injuries helps individuals maintain better physical and mental well-being, leading to an improved quality of life.
   d. **Longer lifespan**: preventive measures can contribute to increased life expectancy and healthy ageing.
   e. **Public health impact**: widespread preventive interventions can lead to improved population health and the control of infectious disease outbreaks.
   f. **Health equity**: targeted preventive measures can address health disparities and ensure that everyone has access to essential preventive services.
   g. **Empowerment**: medical interventions for prevention empower individuals to take control of their health and make informed decisions about their well-being.

Pedagogical exemplars

Think-Pair-Share: Ask learners, "What happens when you are sick?" After individual reflection, learners discuss their ideas in pairs, then share them with the class. This activates prior knowledge and introduces the concept of medical intervention.

Initiating talk for learning: Teacher leads a discussion on the essence of medical intervention and how it is needed for the diagnosis and therapy or treatment of diseases as well as the preventive measures of diseases.

Digital Learning: Based on the discussion, each group uses online resources (approved educational websites or databases) to find examples of medical interventions related to their assigned category. Encourage them to consider different areas of medicine (for example cardiology, oncology).

Key Assessment

Level 1 (Recall): Define medical intervention in terms of the following: diagnosis, therapy, and prevention.

Level 2 (Conceptual understanding): Charts are provided containing the various medical devices for medical intervention, classify them under diagnosis and therapy.

Learning Tasks

Consider implementing at least one of the following learning tasks to reinforce understanding and knowledge acquisition among learners.

1. Show learners a picture of a doctor or a nurse examining a patient. Learners in mixed-ability groups discuss the different tools and techniques the health professional might use to understand the patient's condition. This introduces the concept of diagnosis.
2. Present a short case study of a patient with a particular illness. In groups, learners brainstorm different medical interventions that might be used for diagnosis, treatment, and preventing the spread of the illness.
3. In groups, learners develop a short PSA (public service announcement) promoting the importance of a specific preventive medical intervention (e.g., vaccination, regular check-ups). This can be presented to the class or a wider audience (school announcements).

Conclusion

In this lesson, learners are introduced to the concepts of medical intervention for diagnosis, therapy, and prevention. Examples of these medical interventions as well as their importance are discussed.

Week 14

Learning Indicator: *Compare and contrast primitive diagnostic medical interventions and modern diagnostic devices.*

Theme or Focal Areas:

1. **Discuss the primitive diagnostic medical intervention and the challenges encountered.**
2. **Discuss the modern diagnostic medical intervention and the steps taken to advance the primitive interventions.**
3. **Discuss the similarities and differences between primitive and modern modes of medical diagnosis.**

Discuss the primitive diagnostic medical intervention and the challenges encountered.

Introduction

Primitive diagnostic medical interventions refer to the early methods and techniques used by early human societies to diagnose medical conditions and ailments. These interventions are often based on observations, traditional knowledge, and rudimentary tools. Some traditional diagnostic interventions used in Ghana, particularly in rural or underserved areas, may include:

1. **Observation and history taking**: traditional health attendants often rely on careful observation and detailed patient histories to identify symptoms and patterns indicative of specific illnesses. This method is still widely used, especially in communities where access to medical facilities and technology is limited.
2. **Physical Examination**: traditional health providers conduct physical examinations to assess patients' overall health and identify physical signs of illness or disease. This may involve percussion (tapping the surface of a body part to learn the condition of the parts beneath by the resultant sound), and auscultation (listening to heart rate and respiratory rate) to detect abnormalities in different body systems.
3. **Herbal medicine and traditional healing**: traditional healers in Ghana often use herbal remedies, spiritual rituals, and traditional diagnostic methods based on cultural beliefs and practices. These may include divination, consultations with ancestors or spirits, and the use of plants, herbs, and other natural substances for diagnosis and treatment.
4. **Pulse diagnosis**: traditional healers may assess the pulse to gather information about the patient's health status and diagnose underlying conditions. Different pulse qualities, rhythms, and characteristics are believed to correspond to specific organs and imbalances in the body.
5. **Palpation and inspection**: traditional healers also rely on palpation and inspection techniques to examine specific areas of the body, such as the abdomen, to identify tenderness, swelling, or other abnormalities.

Traditional diagnostic methods may have been prevalent in the past; however, they continue to play a significant role in healthcare delivery, especially in rural and remote areas where access to modern healthcare services is limited. While they laid the foundation for modern medicine, they have also encountered significant challenges due to their limited understanding of anatomy, physiology, disorders and diseases.

Discussions on the primitive diagnostic medical intervention and challenges should be based on the following:

1. **Observation and empirical knowledge**: primitive diagnostic methods rely heavily on observation of physical signs and symptoms. Physicians and healers would often gather information about a patient's condition through visual examination, palpation, and questioning about their symptoms. While this approach could sometimes lead to accurate diagnoses, it is also prone to errors due to subjectivity and lack of standardised techniques. Again, primitive medical practices were often passed down through oral traditions and were not adequately documented. This lack of standardised procedures made it difficult to refine diagnostic methods or share medical knowledge across generations or cultures.

2. **Herbal remedies and traditional healing:** many ancient civilizations used herbal remedies and traditional healing practices to diagnose and treat illnesses. Healers would rely on their knowledge of medicinal plants and their properties to alleviate symptoms and restore health. While some herbal remedies did have medicinal value, many were based on folklore and superstitions, leading to inconsistent and unpredictable outcomes.

3. **Astrology and superstitions:** in some ancient cultures, diagnoses were influenced by astrology and superstitions. The alignment of celestial bodies or other supernatural beliefs played a significant role in determining a person's health and illness. This approach often lacked scientific validity and could lead to misdiagnosis and inappropriate treatments. The influence of astrology, religious beliefs, and superstitions in medical diagnosis led to unfounded conclusions and irrational treatments. These practices delayed the development of evidence-based medicine and hindered scientific progress.

4. **Limited understanding of anatomy and physiology:** without a comprehensive understanding of human anatomy and physiology, early healers and physicians struggled to accurately diagnose and treat medical conditions. This lack of knowledge hindered their ability to identify the root causes of illnesses and devise effective treatments.

5. **Ineffective treatments:** many primitive diagnostic interventions were based on inaccurate theories and lacked scientific evidence. Consequently, the treatments resulting from these diagnoses were often ineffective or even harmful, leading to patient suffering and sometimes death. For example, different cultures and regions had their own medical beliefs and practices. This diversity often led to contradictory diagnostic approaches and treatments, making it challenging to establish a unified and effective medical system. For example, bloodletting was a common diagnostic and therapeutic intervention in ancient medical practices, based on the humoral theory. According to this theory, illnesses were caused by an imbalance of bodily fluids (humours). Bloodletting aimed to restore balance by removing excess blood. However, this practice often led to severe complications and did more harm than good.

Discuss the modern diagnostic medical intervention and the steps taken to advance the primitive interventions.

Introduction

Modern diagnostic medical interventions have evolved significantly from the primitive methods used in ancient times. Advances in medical science, technology, and research have led to more accurate, reliable, and evidence-based diagnostic techniques. Some key aspects of modern diagnostic medical intervention and the steps taken to advance from the primitive methods are discussed below.

Discussions on the steps taken to advance the primitive diagnostic medical intervention should be based on the following:

1. **Scientific method and evidence-based medicine**: one of the most significant advancements in modern medicine is the adoption of the scientific method. Medical practitioners now rely on empirical evidence, clinical trials, and rigorous research to establish the efficacy of diagnostic

techniques, use of replicates, placebos, controls and treatments. Evidence-based medicine ensures that decisions are based on objective data rather than superstitions or traditions.

2. **Anatomy and physiology**: the understanding of human anatomy and physiology has grown exponentially over the centuries. Detailed knowledge of the body's organs, systems, and functions has provided a solid foundation for accurate diagnosis. This understanding helps medical professionals pinpoint the causes of illnesses and design targeted treatment plans.
3. **Laboratory tests**: advances in laboratory technology have revolutionised diagnostic medicine. Blood tests, urine tests, genetic testing, and other biomarker analyses can identify specific diseases, assess organ function, and detect abnormalities at a cellular level. These tests aid in diagnosing various conditions and tracking treatment progress.
4. **Telemedicine and remote diagnostics:** with the advancement of technology, telemedicine has become a valuable tool for diagnostic support. Patients in remote areas or with limited access to healthcare can receive expert consultations and diagnostic evaluations through telemedicine platforms. Continuous education and training: Modern healthcare professionals undergo extensive education and training, ensuring they stay up-to-date with the latest diagnostic techniques and medical advancements. Continuous education fosters improved diagnostic skills and ensures patients receive the best possible care.

Discuss the similarities and differences between primitive and modern modes of medical diagnosis.

Discussions on the similarities between primitive and modern modes of medical diagnosis should be hinged on the following:

1. **Observational approach:** both primitive and modern diagnostic methods involve observation of patients' signs and symptoms. In both cases, healthcare providers gather information about the patient's condition through visual examination, palpation, and questioning.
2. **Need for patient history:** both primitive and modern diagnostic approaches require obtaining a patient's medical history. Understanding a patient's past medical issues, family history, and lifestyle factors can provide valuable insights for diagnosis.
3. **Diagnostic reasoning:** the process of diagnosing medical conditions involves reasoning based on available information. In both primitive and modern settings, healthcare providers use their knowledge and experience to analyse the symptoms and make an educated diagnosis.
4. **Limitations and challenges:** both primitive and modern diagnostic methods face limitations and challenges. In the past, limited knowledge and rudimentary tools hindered accurate diagnoses, while modern medicine also encounters diagnostic challenges due to complex diseases and varied presentations.

Discussions on the differences between primitive and modern modes of medical diagnosis, may be based on:

1. **Scientific basis:** the most significant difference lies in the scientific basis of modern diagnostic methods. Modern medicine relies on evidence-based practices, scientific research, and clinical trials, while primitive diagnostic methods are often based on folklore, superstitions, and traditional knowledge.
2. **Technological advancements:** modern medical diagnosis benefits from advanced technologies, such as medical imaging (X-rays, MRI, CT scans), laboratory tests, molecular diagnostics, and sophisticated medical instruments. In contrast, primitive methods relied on simple tools and techniques, like herbal remedies and observation. Again, modern diagnostic methods offer much greater precision and specificity. With advanced tools and tests, healthcare providers can identify diseases at an early stage, target specific genetic mutations, and detect abnormalities with high accuracy. Primitive methods lacked this level of precision.

3. **Specialisation and expertise:** modern medicine has led to specialisation, where healthcare professionals focus on specific areas of medicine, such as cardiology, oncology, neurology, etc. This specialisation allows for more in-depth knowledge and improved diagnostic accuracy in specific medical domains, which was not prevalent in primitive times.
4. **Global Collaboration and Knowledge Sharing:** modern medical diagnosis benefits from global collaboration and knowledge sharing. Researchers, clinicians, and medical professionals around the world can communicate and share advancements, leading to faster progress and better patient care.
5. **Documentation and Standardization:** modern medical practices emphasise documentation, record-keeping, and standardisation of diagnostic procedures. This ensures consistency in diagnosis and treatment across different healthcare settings, whereas primitive methods lacked such standardised practices.

Pedagogical exemplars

Structuring talk-for-learning: Show a video or invite a resource person to give a presentation on developments in medical diagnostic devices and interventions from ancient to modern times **(Scan QR code 10 & 11 on page 22 for videos)**. As learners watch videos or invite a resource person to give a presentation, they critically observe and acquire knowledge on the development of medical diagnostic devices.

Talk-for-learning: In a whole class discussion, guide learners to discuss the challenges with the primitive diagnostic medical intervention and research on the steps that were taken to advance the primitive form into modern diagnostic devices. Learners are able to appreciate both the local and foreign resources that are used to advance the primitive diagnostic device into modern diagnostic devices.

Activity-Based Learning:

Learners create a flowchart on the various stages in the advancement of diagnostic devices from ancient to modern times **(Scan QR code 10 or 11 for a reference video)**. Working in pairs, learners create a table on the similarities and differences between primitive and modern modes of medical diagnosis.

Learners should explore their creative abilities as they create a flowchart on the various stages in the advancement of a diagnostic device.

Key Assessment

Level 1 (Recall): Give at least two characteristics of the primitive diagnostic medical intervention.

Level 2 (Conceptual understanding): List and explain at least two challenges encountered in using primitive diagnostic medical intervention.

Level 3 (Strategic reasoning): Outline the steps considered to bring about the advancement of the primitive diagnostic medical intervention into the modern form.

Level 4 (Extended critical thinking and reasoning): Explain why primitive diagnostic medicine could no longer function in the 21st century and why there is the need to use the modern diagnostic devices in the 21st century.

Learning Task

Consider implementing at least one of the following learning tasks to reinforce understanding and knowledge acquisition among learners.

1. Present learners with a video that depicts historical practices of medical diagnosis. For example, pulse reading, imaging. After watching the video, learners discuss the potential challenges faced with these primitive diagnostic methods (e.g., accuracy, limitations in understanding). This can be done as a whole-class discussion or small group brainstorming.
2. Learners are to observe the use or practise of some diagnostic tools (such as thermometer, sphygmomanometer, pulse oximeter and RDTs) and techniques (such as using the back of your hand to check temperature on the forehead, using your fore fingers to check the pulse rate) and discuss the similarities and differences.
3. As a class, learners collaboratively create a flowchart on the whiteboard or a large sheet of paper. Trace the historical development of a specific diagnostic tool (example thermometer) from its primitive form to modern technology.

Conclusion

In this lesson, learners are introduced to the concepts of primitive and modern medical interventions for diagnosis. Based on the introduction, the primitive and modern diagnostic interventions are compared. The challenges encountered in the primitive diagnostic medical intervention are discussed with emphasis on the steps taken to advance the primitive interventions. The differences and similarities between these two interventions are also explored.

Week 15

Learning Indicator: *Explore the significance of the various diagnostic devices used for medical intervention.*

Theme or Focal Areas:

1. **List the various diagnostic devices and their functions.**
2. **Discuss troubleshooting and its importance for the various diagnostic devices.**

List the various diagnostic devices and their functions.

Diagnostic devices play a crucial role in medical practice by helping healthcare professionals assess and diagnose various conditions and diseases.

Here is a list of some common diagnostic devices and their functions:

1. **Thermometer:** measures body temperature, helping to identify fever or hypothermia.

Fig. 23: *Thermometer*

2. **Blood Pressure Monitor:** measures blood pressure to assess cardiovascular health and identify hypertension or hypotension. These monitors can be digital (Fig 24a) or analogue (Fig 24b)

Fig. 24a: *Digital blood pressure monitor*

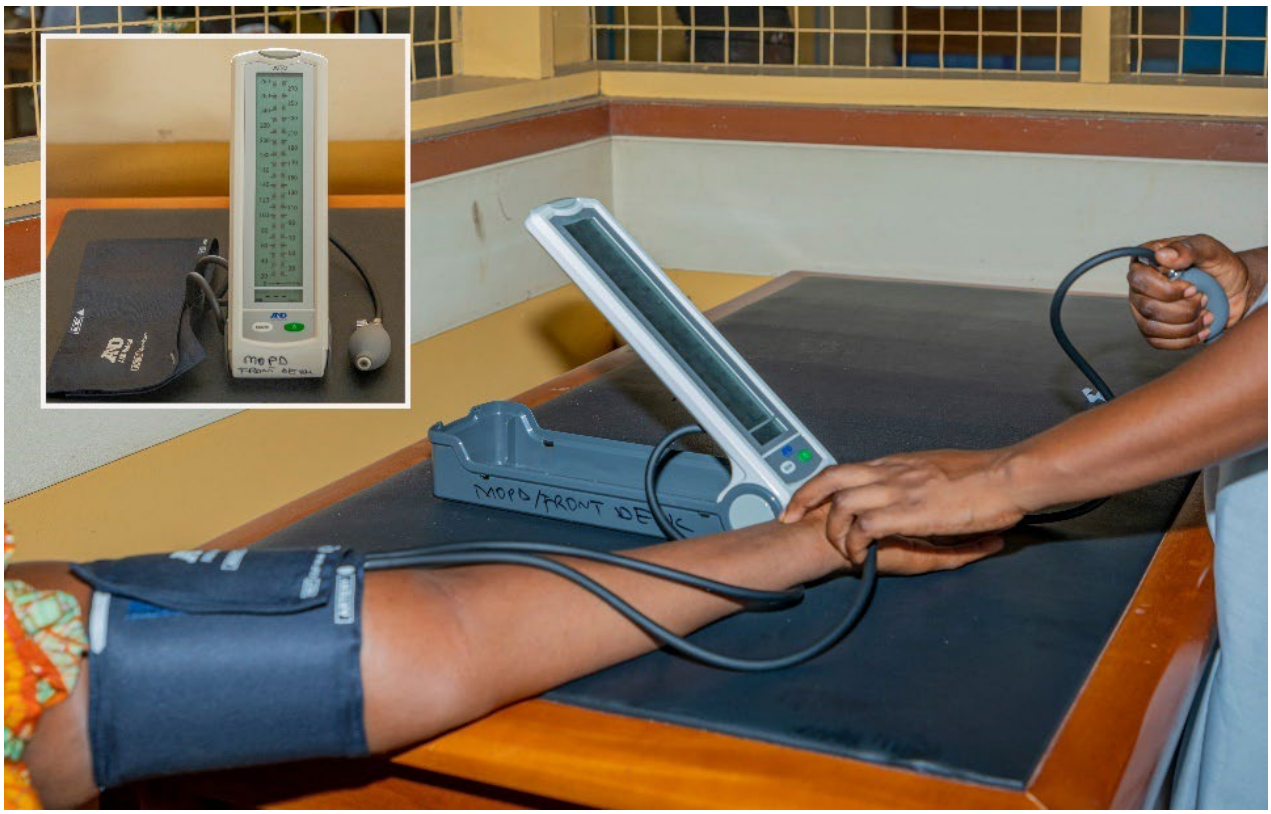

Fig. 24b: *Sphygmomanometer*

3. **Stethoscope:** Allows doctors to listen to internal sounds such as heartbeats, lung sounds, and bowel sounds to detect abnormalities. For example, assessing breath sounds (such as crackles, wheezes, or diminished breath sounds) may indicate respiratory conditions such as pneumonia, asthma, chronic obstructive pulmonary disease (COPD), or pulmonary oedema. An example is shown in Fig. 25.

Fig. 25: *Stethoscope*

4. **Pulse oximeter:** measures the oxygen saturation level in the blood. It gives real-time measurements of oxygen saturation and pulse rate. It helps assess respiratory function and detect hypoxemia by aiding in the assessment, monitoring, and management of various respiratory and cardiac conditions.

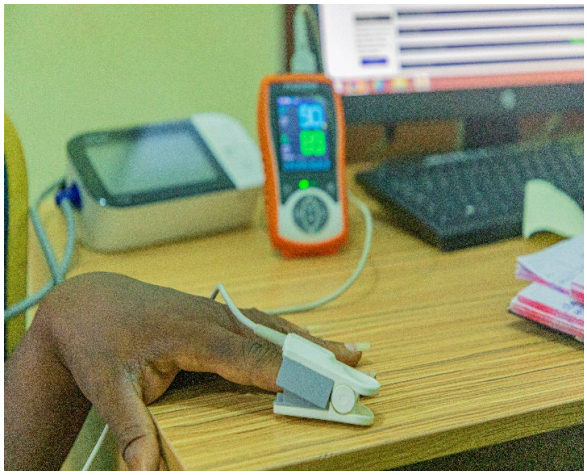

Fig. 26: *Pulse Oximeter*

5. **Glucometer:** Also known as blood glucose meter, measures blood glucose levels in patients with diabetes

Fig. 27: *Blood Glucose Meter*

6. **Otoscope:** allows examination of the ear canal and eardrum, aiding in diagnosing ear infections and other ear-related conditions.

Fig. 28: *Otoscope*

7. **Ophthalmoscope:** enables the examination of the interior of the eye, aiding in the diagnosis of eye disorders and diseases.

Fig. 29: *Ophthalmoscope*

8. **Endoscope:** a flexible tube with a camera and light source, used to visualise internal organs and structures for diagnostic and surgical purposes.

Fig. 30: *Endoscope*

9. **Electrocardiogram (ECG or EKG) and Echocardiogram:** ECG (**Fig 31)** records the electrical activity of the heart, helping to diagnose various cardiac conditions. It helps to show how fast, regular, strong and timed the heartbeats are whereas an echocardiogram uses ultrasound to check for anomalies in the heart's structure (**Scan QR code 12 for a short video on echocardiogram reading**).

Fig. 31: *Electrocardiogram (ECG or EKG)*

10. **Electroencephalogram (EEG):** records the electrical activity of the brain, assisting in diagnosing epilepsy and other neurological conditions.

Fig. 32: *Electroencephalogram (EEG)*

11. Haematology Analyser: measures and analyses various components of blood, aiding in the diagnosis of anaemia, infections, and other blood-related disorders.

Fig. 33: *Haematology Analyser*

12. **Rapid Diagnostic Test (RDTs) Kits**: these are devices for rapid and convenient testing for diagnosis of malaria (Fig. 34 (a)), HIV (Fig.34 (b)) and Pregnancy (Fig. 34 (c)) which are commonly used in Ghana.

(a) **(b)** **(c)**

Fig. 34 Rapid Diagnostic Tests (RDTs) Kit

13. **Urinalysis Strip:** used to test urine for various markers, aiding in diagnosing urinary tract infections and kidney disorders.

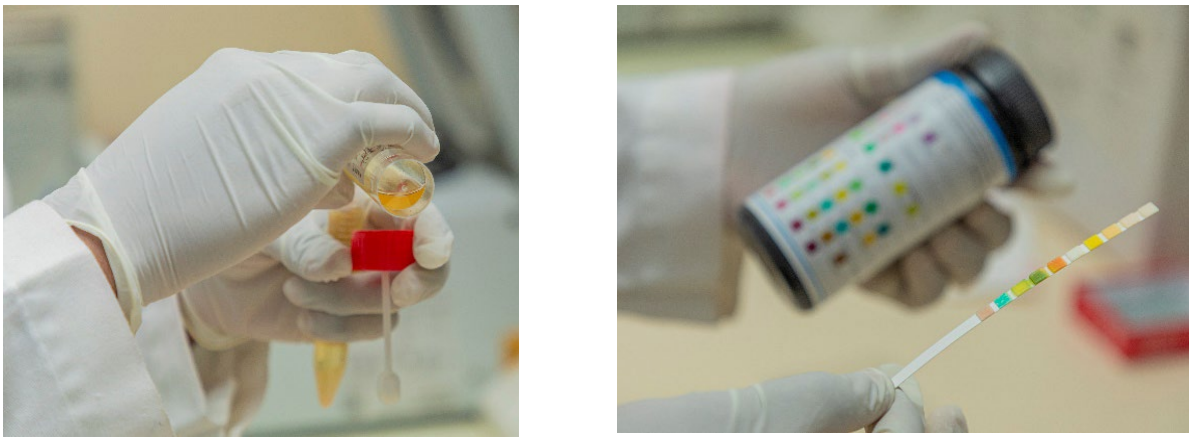

Fig.35: *Urinalysis Strip*

14. **Spirometer:** measures lung function and helps diagnose respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD).

Fig 36: *Spirometer*

15. **Imaging tools:** These are essential in modern medicine for diagnosing, monitoring, and treating various medical conditions. They provide detailed visualisations of the internal structures and functions of the body, allowing healthcare providers to accurately assess the presence, location, extent, and severity of diseases or abnormalities. Here are some common uses of imaging tools for medical diagnosis:

    a. **X-ray Machine:** produces images of internal structures to detect bone fractures, lung infections, and other abnormalities.

Fig. 37 (a): *X-ray Machine*

    b. **Ultrasound Machine:** uses high-frequency sound waves to create images of internal organs, foetus during pregnancy, and other soft tissues.

Fig. 37 (b): *Ultrasound Machine*

c. **Magnetic Resonance Imaging (MRI):** utilises strong magnetic fields and radio waves to generate detailed images of internal organs and structures.

Fig. 37 (c): *Magnetic Resonance Imaging (MRI)*

d. **Computed Tomography (CT) Scanner:** Combines X-rays and computer technology to produce cross-sectional images of the body.

Fig 37(d): *Computed Tomography (CT) Scanner*

Fig. 37: *Imaging Tools*

Discuss troubleshooting and its importance for the various diagnostic devices.

Introduction

Troubleshooting is the process of identifying, analysing, and resolving problems or malfunctions that occur in various systems, devices, equipment, or processes. It involves systematic investigation and problem-solving techniques to diagnose the root cause of a malfunction and implement solutions to restore functionality or improve performance. Troubleshooting of diagnostic devices is essential. Troubleshooting diagnostic devices is of paramount importance in the medical field.

Importance of troubleshooting diagnostic device

Here are some reasons highlighting the importance of troubleshooting diagnostic devices:

1. Accuracy of diagnoses: diagnostic devices are designed to provide accurate and reliable results. Regular troubleshooting helps identify and rectify any issues that could affect the accuracy of test results, ensuring that patients receive the correct diagnosis and appropriate treatment.

2. Patient safety: malfunctioning diagnostic devices can pose risk to patient's safety. Troubleshooting ensures that these devices are functioning properly and are safe to use, preventing potential harm to patients.
3. Quality assurance: regular troubleshooting is an essential part of quality assurance programs in healthcare settings. It helps maintain the standard and consistency of test results, contributing to better patient care and treatment outcomes.
4. Cost-effectiveness: timely troubleshooting can prevent the need for costly repairs or replacements of diagnostic devices. By addressing issues early, healthcare facilities can extend the lifespan of their equipment and optimise their investment.
5. Efficient work flow: well-functioning diagnostic devices improve the efficiency of healthcare processes. Troubleshooting helps identify and resolve equipment-related bottlenecks, enabling smoother workflow and faster turnaround times for test results.
6. Compliance with regulations: Troubleshooting is essential for maintaining compliance with regulatory standards and guidelines. Healthcare facilities must adhere to specific requirements related to the calibration, maintenance, and performance of diagnostic devices.
7. Data integrity: diagnostic devices generate critical patient data. Troubleshooting ensures that the data produced is reliable, accurate, and securely stored, supporting evidence-based decision-making in patient care.

List basic troubleshooting for the various diagnostic devices.

Here are some general steps and troubleshooting tips for common diagnostic devices:

1. **Thermometer**
   a. Check the battery: make sure the battery is functional and properly inserted.
   b. Calibration: ensure the thermometer is calibrated correctly to provide accurate readings.
   c. Cleaning: clean the thermometer probe before and after each use to avoid contamination.
2. **Blood Pressure Monitor**
   a. Positioning: ensure the patient's arm is positioned correctly and at heart level during measurement.
   b. Cuff fit: verify that the cuff size is appropriate for the patient's arm circumference.
   c. Calibration: regularly check and calibrate the device to maintain accuracy.
3. **Stethoscope**
   a. Check tubing and earpieces: inspect the tubing for cracks or damage that may affect sound transmission. Ensure earpieces fit properly.
   b. Cleanliness: keep the stethoscope clean and free from debris to avoid sound distortion.
4. **Pulse Oximeter**
   a. Proper placement: ensure the oximeter is correctly placed on a finger or earlobe for accurate readings.
   b. Battery: check the battery level to ensure sufficient power for operation.
   c. Motion artefacts: advise the patient to remain still during measurements to avoid false readings.
5. **Electrocardiogram (ECG or EKG)**
   a. Electrode placement: confirm that the electrodes are placed correctly on the patient's skin as per the standard positions.
   b. Cable connection: check the cable connections to the ECG machine for any loose or damaged wires.

6. **X-ray Machine**
   a. Positioning: ensure the patient is positioned correctly for the desired X-ray view.
   b. Technical issues: if the X-ray image quality is poor, check for technical malfunctions or calibration errors.
7. **Ultrasound Machine**
   a. Probe positioning: ensure proper probe placement for the desired ultrasound image.
   b. Calibration: regularly calibrate the machine to maintain image accuracy.
8. **Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) Scanner**
   a. Technical support: if the machine is not functioning correctly, contact the manufacturer's technical support or a service engineer.
9. **Spirometer:**
   a. Calibration: regularly calibrate the spirometer as per the manufacturer's instructions.
   b. Proper use: train users on how to perform a spirometer correctly to obtain reliable results.
10. **Glucometer**
    a. Test strip compatibility: ensure the test strips used are compatible with the specific meter model.
    b. Test strip storage: store the test strips according to the manufacturer's guidelines to maintain accuracy.

Pedagogical Exemplars

Experiential learning: Embark on a field trip or due to limitations on handling actual medical equipment, consider a virtual tour of a hospital or diagnostic lab. This can be done through pre-recorded videos or interactive websites that showcase various diagnostic devices and their functions. Watch videos on how the various diagnostic devices are used in medical practice for the treatment of diseases. Learners appreciate the uniqueness of each gender through male and female participation in the operation of the diagnostic device.

Project-based learning: In group, present a report on how the various diagnostic devices are used as well as how the troubleshooting is done in order to yield a positive test result for the patients. As learners work in groups to perform troubleshooting on diagnostic devices, they share tasks and responsibilities among themselves. Learners embrace different opinions as they work in groups.

Key Assessment

Level 1 (Recall): Name at least any three diagnostic devices and their functions.

Level 2 (Conceptual understanding): Create a photo collage that portrays at least three diagnostic devices.

Level 3 (Strategic reasoning): Learners in groups must make a report on the experience gained in the usage of the diagnostic device during an organised field trip.

Level 4 (Extended critical thinking and reasoning): With the knowledge gained learners must explain how troubleshooting is performed on any diagnostic device.

Learning Task

1. Divide the class into teams. Present a scenario where a patient has symptoms, but the cause is unclear. Learners discuss the different diagnostic tools doctors might use to reach a diagnosis. This highlights the importance of various devices in medical practice.
2. Present a simulated scenario where a diagnostic device is malfunctioning (for example, blurry X-ray image). In groups, learners brainstorm potential causes and solutions for troubleshooting the device, considering safety protocols.

Conclusion

In this lesson, the various medical diagnostic devices and their functions are discussed. Troubleshooting of some common medical devices is considered underlining the importance of troubleshooting which is necessary for reliable and accurate results.

Section Review

This section is a review of all the lessons taught for the last 3 weeks and a summary of what the learners should have learnt.

1. Definition of medical intervention for diagnosis, therapy and prevention, giving examples and their importance.
2. Discussion of primitive medical intervention and the challenges it encounters.
3. Discussion of modern medical intervention and the steps taken to advance from primitive interventions.
4. Description of the differences and similarities between primitive and modern mode of medical diagnosis.
5. Listing various diagnostic devices, their functions and basic troubleshooting.

Medical interventions are used for diagnosing, treating, and preventing illnesses. These interventions are important for health and wellbeing. The history of medical intervention is explored in the use of primitive diagnostic methods. The limitations of early diagnostic tools and how medicine has advanced to create more accurate and reliable tests led to the development of modern diagnostic tools. To maintain the operation of these modern diagnostic devices, basic troubleshooting of these devices is important for accurate diagnosis for effective treatment and illness prevention.

Additional Reading

QR Code 10

QR Code 11

QR Code 12

SECTION 6: THERAPEUTIC DEVICES

Strand: **Biomedical Intervention**

Sub-Strand: Therapeutic devices

Learning Outcome: *Identify the forms of therapy, describe the roles of the various therapists and the tools they use in healthcare delivery.*

Content Standard: Demonstrate an understanding of the use of therapeutic devices for medical intervention.

INTRODUCTION AND SECTION SUMMARY

In this section, learners are introduced to the world of therapy and the devices used to support a person's well-being. Over the next three lessons, learners explore various therapeutic fields and the problems they address. The first lesson introduces what therapy is and its characteristics. Different therapists, such as physical therapists, occupational therapists, and counsellors are also discussed. Learners discover the unique approaches each therapist uses to help people with physical injuries, challenges with daily activities, as well as mental and emotional difficulties. From ultrasound machines used for muscle recovery to weighted blankets for anxiety relief, learners explore therapeutic devices and how these play a role in therapy sessions in the third lesson. By the end of these lessons, learners have a broader understanding of how therapy and therapeutic devices can support an individual's physical, mental, and emotional health.

The weeks covered by the section are

Week 16: *Identify the various forms of therapy.*

Week 17: *Investigate who a therapist is and enumerate the various specialties.*

Week 18: *Identify the various therapeutic devices used by the therapist*

SUMMARY OF PEDAGOGICAL EXEMPLARS

To achieve the content standard for this section, the following pedagogical exemplars are recommended. Using experiential and collaborative learning, learners explore their understanding of various forms of therapy, who a therapist is and the roles they play as well as observe the various therapeutic devices used during a therapy session. Through activity-based and project-based learning strategies, learners individually write short notes on the various forms of therapy and in mixed-ability groups role-play the duties of the different professions in therapy.

SUMMARY OF ASSESSMENT

To appraise learners' ability to show an understanding of what therapy is, the different professions in therapy and various types of therapeutic devices assessment levels 1, 2, 3 and 4 are recommended. To assess learners' ability to recall the knowledge acquired on what a therapy is, DOK level 1 assessment is used. Learners' conceptual understanding is assessed on the forms of therapy and their characteristics using DOK level 2 assessment strategies. Using DOK levels 3 and 4 assessment, learners' strategic reasoning and critical thinking abilities are assessed on the explanation of who a therapist is, the various forms of therapy performed and the significance of the various forms of therapeutic devices to the therapist.

Week 16

Learning Indicator: *Identify the various forms of therapy.*

Theme or Focal Areas:

1. **Definition of therapy**
2. **Characteristics of therapy**

Definition of therapy

Therapy can be defined as: a professional intervention or treatment process aimed at improving, relieving or healing an individual's mental, emotional, or physical well-being.

Therapy can be beneficial for individuals facing various physical, emotional and mental health issues or life challenges.

NOTE: Therapy is a specific type of treatment that focuses on addressing mental, emotional, or psychological concerns through structured therapeutic interventions, whereas treatment refers to any intervention or approach aimed at addressing a health condition, whether physical, mental, or emotional.

Characteristics of therapy

The characteristics of therapy can vary depending on the specific type of therapy and the approach used. However, there are some common characteristics that are typically present in therapeutic interventions.

Here are some key characteristics of therapy:

1. **Confidentiality and trust:** a crucial aspect of therapy is establishing a safe and confidential environment where clients feel comfortable sharing their thoughts, feelings, and concerns without fear of judgement.
2. **Boundaries and ethical conduct:** maintenance of appropriate professional boundaries and adherence to ethical guidelines are necessary.
3. **Active listening:** therapy involves engaging in active listening, carefully attending to what the client is saying and providing appropriate responses. This helps clients feel heard and understood.
4. **Assessment:** at the beginning of therapy, an initial assessment is conducted to gather information about the client's background, current issues, and personal goals. This assessment helps in understanding the client's unique circumstances to help tailor their treatment.
5. **Communication and expression:** through open and honest communication, clients can explore their emotions, thoughts, and behaviours in a supportive and non-judgemental environment. This process can help gain insights into underlying issues and develop coping strategies.
6. **Follow-up and progress monitoring:** throughout therapy, regular check-ins with the client to assess progress toward the established goals are done and adjustments may be made to the treatment plan as needed.

List the different types of therapies and how they are carried out.

There are various types of therapies available to address a wide range of physical, mental, and emotional health issues.

Here are some common types of therapies and a brief overview of how they are carried out:

1. **Psychotherapy/Psychodynamic Therapy**

   Psychodynamic therapy is based on the assumption that a person is having emotional problems because of unresolved experiences, generally unconscious conflicts, often stemming from childhood. This therapy delves into the unconscious mind to explore unresolved conflicts, childhood experiences, and emotional issues. It focuses on exploring the unconscious mind and how early childhood experiences can influence our thoughts, feelings, and behaviours in the present. This type of therapy can help people gain insight into the roots of their emotional problems and develop healthier coping mechanisms.

Fig. 38: *Psychotherapy/Psychodynamic Therapy*

2. **Cognitive Behavioural Therapy (CBT)**

   CBT is a type of psychotherapy that helps people identify and change negative patterns of thinking and behaviour. It is based on the idea that our thoughts, feelings, and behaviours are all interconnected. CBT is a talk therapy that helps individuals identify negative thought patterns and behaviours and replace them with healthier ones. Client's distorted thoughts are challenged to develop coping strategies for managing emotions and behaviours.

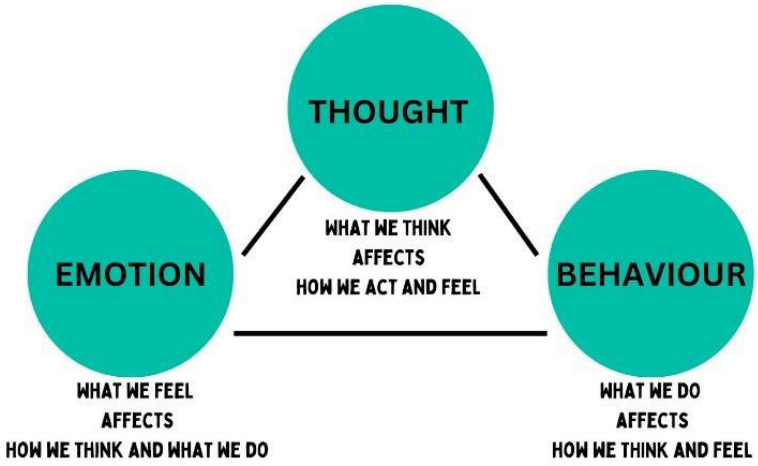

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Fig. 39: *Cognitive Behavioural Therapy (CBT)*

3. Group Therapy

Group therapy involves a small group of individuals who share similar concerns or challenges. A therapist leads the group, fostering a supportive environment where members can share experiences, offer feedback, and gain insights from each other.

Fig. 40: *Group Therapy*

4. Art and music therapy

Art therapy uses music and art to help clients' express emotions and explore their inner thoughts and feelings. Paintings, drawings, or other creative activities such as playing or listening to music may be used to facilitate the therapeutic process.

Fig. 41: *Music and Art Therapy*

5. Occupational Therapy

Occupational therapy focuses on helping individuals regain or enhance their ability to perform daily activities. Clients develop skills and use adaptive strategies to improve their independence and quality of life.

Fig. 42: *Occupational Therapy*

6. **Physical Therapy**

Physical therapy aims to improve mobility, strength, and function in individuals with physical impairments or injuries. Exercises, physiotherapy, and other techniques are used to promote healing and recovery.

Fig. 43: *Physical Therapy*

7. **Speech Therapy**

Speech therapy addresses speech and language disorders, communication challenges, and swallowing difficulties. Various exercises and techniques are used to improve communication skills.

Fig. 44: *Speech Therapy*

Pedagogical exemplars

Experiential Learning: Invite a resource person to give a talk, or a teacher should deliver a PowerPoint presentation on various forms of therapy. Learners appreciate both local and global examples of the various forms of therapy. Learners learn to express their opinions and ideas in a supported environment.

Collaborative Learning: Based on the talk, learners work in groups to identify the different types of therapies and consult books and other relevant sources to categorise them into the various forms of therapy. Learners appreciate the diversity in persons and learn to work together to accomplish tasks.

Activity-Based Learning: Individually write short notes on the various forms of therapy based on the presentation and the sources referred to. Learners learn to identify and classify the various forms of therapy.

Key Assessment

Level 1 (Recall): What is therapy?

Level 1 (Recall): List the various forms of therapy.

Level 2 (Conceptual understanding): Give at least three characteristics of therapy.

Level 3 (Strategic reasoning): Explain the various forms of therapy and their relevance.

Level 4 (Critical thinking and reasoning): Deduce how any of the forms of therapy can be performed.

Learning Tasks

1. In a whole class discussion, brainstorm on some reasons why an individual will need therapy as a form of treatment.
2. Invite a therapist (example physical therapist, occupational therapist, or a counsellor) to give a presentation about their specific field of therapy. Encourage the speaker to discuss the types of problems they address and the techniques they use.
3. After the presentation, divide learners into groups. Provide them with a list of various therapies (example speech therapy, music therapy, animal-assisted therapy). Working together, learners research and categorise the therapies based on the type of condition or issue they address (example physical, mental, emotional).
4. Assign each learner a specific type of therapy. Learners research and create a short poster or presentation explaining the therapy, its purpose, and the tools or techniques used. This allows for individual exploration and knowledge consolidation.

Conclusion

In this lesson, learners are introduced to therapy and the characteristics of therapy as well as the various forms of therapies.

Week 17

Learning Indicator: *Investigate who a therapist is and enumerate the various specialties.*

Theme or Focal Area: Who is a therapist?

A therapist can be defined as:

i. a trained and licensed professional who provides therapeutic services to individuals, or groups to address various mental, emotional, behavioural, and physical challenges.

ii. counsellors, psychotherapists, or mental health professionals who help clients improve their mental and emotional well-being, cope with difficulties, and work through personal issues.

List the various professions in therapy and the role played.

Here are some common types of therapists and their areas of specialisation:

1. **Psychologist:** a psychologist is a health professional trained in conducting psychological assessments, diagnosing mental disorders, and providing various forms of therapy. Aside from providing therapy, psychologists conduct research to study mental processes and human behaviour by observing, interpreting, and recording how people relate to one another and the environment.

   Some techniques used by psychologists include:

   a. psychological testing
   b. behavioural testing
   c. relaxation techniques
   d. mindfulness techniques

   Psychologists usually work with individuals with mental health disorders such as:

   a. anxiety disorders
   b. depression
   c. bipolar disorder
   d. eating disorders
   e. trauma
   f. personality disorders

   Psychologist also see people facing life challenges such as:

   a. relationship issues
   b. family issues
   c. stress management
   d. grief and loss
   e. self-esteem issues

2. **Licensed Professional Counsellor (LPC):** LPCs are mental health professionals with a specialisation in helping clients cope with mental, emotional, and behavioural issues. They use psychotherapy and other counselling techniques to help clients improve their mental health and well-being. They use a more person-centred approach, often working with individuals, couples, or families to address various mental health concerns.

Some examples of LPCs are:

a. **Marriage and family therapist:** MFTs are specialised in providing therapy to couples and families, focusing on improving relationship dynamics and communication. They can help couples who are struggling with communication, conflict, or infidelity. They can also help families who are dealing with issues such as child behavioural problems, parenting challenges, or grief and loss.

b. **Clinical social worker:** Clinical social workers are health professionals who provide psychotherapy and counselling services to individuals, families, and groups. They often work in community settings, such as hospitals, schools, and mental health clinics. They can help with a wide range of issues, including mental health disorders, substance abuse, and social problems. They may also assist clients with accessing community resources.

c. **Art and Music Therapist:** art and music therapists help clients explore their emotions and thoughts through art, music, and creative expression.

d. **Substance Abuse Counsellor**: substance abuse counsellors specialise in helping individuals struggling with addiction to drugs or alcohol. They provide support, education, and therapy for recovery and relapse prevention.

e. **Trauma Therapist**: trauma therapists specialise in treating individuals who have experienced traumatic events. They use evidence-based techniques to help clients process and heal from trauma-related symptoms.

3. **Psychiatrist:** psychiatrists are trained health professionals/medical doctors who specialise in mental health diagnosis, treatment, and prevention of mental, emotional and behavioural disorders. They prescribe medication and provide psychotherapy to treat mental health disorders.

Psychiatrists can treat a wide range of mental health conditions, including:

a. anxiety disorders

b. depression

c. bipolar disorder

d. schizophrenia

e. eating disorders

f. obsessive-compulsive disorder (OCD)

g. post-traumatic stress disorder (PTSD)

h. attention deficit hyperactivity disorder (ADHD)

i. substance use disorders (sometimes in collaboration with addiction specialists)

Psychiatrists utilise a variety of techniques to diagnose and treat mental health conditions.

Here are some of the common techniques used by psychiatrists:

a. medication

b. psychotherapy

c. psychological testing

d. light therapy

4. **Occupational therapist**: they are healthcare professionals whose work is to help people develop, recover, and improve while maintaining the skills that they need to live their lives. They usually help people regain or improve the skills they need to perform daily activities (occupations) after an injury, illness, disability, or even age-related limitations. Their goal is to enhance a person's independence and overall well-being by focusing on the occupations or tasks that hold meaning and importance in their lives.

They employ a wide range of techniques which includes the following:

a. activity analysis
b. activity practice
c. adaptive equipment training
d. splinting and orthotics
e. sensory integration
f. environmental modifications
g. mental health support
h. compensatory strategies

5. **Physical therapist**: is a healthcare professional who helps people improve their ability to move and function in their daily lives. They work with individuals who have experienced injuries, illnesses, or disabilities that limit their mobility or cause pain. The goal of physical therapists is to restore functionality by improving movement and increasing motion range in specific body areas. Physical therapists utilise a variety of techniques to help patients improve their mobility, function, and overall well-being.

   Here's a breakdown of some of the most common treatments:

   a. Manual Therapy Techniques such as:
      i. joint mobilisations and manipulations
      ii. soft tissue mobilisation
      iii. strengthening exercises
      iv. range-of-motion exercises
      v. balance and coordination exercises

   b. Modalities such as:
      i. heat therapy
      ii. cold therapy
      iii. electrical stimulation
      iv. ultrasound
      v. assistive devices

6. **Speech therapist**: speech therapists are healthcare professionals who work to evaluate, diagnose, and treat speech, language, swallowing, and voice disorders. They work with people of all ages, from infants to older adults. Speech therapists help people improve their communication skills and overall quality of life. Speech therapists use a variety of techniques to help people improve their communication skills.

   These may include:

   a. Exercises to improve muscle strength and coordination in the mouth and throat.
   b. Strategies for improving speech clarity and fluency.
   c. Techniques for using alternative communication methods, such as sign language or picture boards.
   d. Training in using augmentative and alternative communication (AAC) devices.

   NOTE: Refer to **Fig. 45** in **Additional Reading** for some differences between psychologists and psychiatrists.

Pedagogical exemplars

Experiential Learning: Learners embark on a visit to a therapist or listen to a presentation by a therapist about their profession and job schedule. Learners appreciate the uniqueness of each gender as a therapist. Learners appreciate both local and global examples of a therapist.

Activity-based learning: In groups, learners role-play the duties of the various professionals involved in providing therapy. Learners work in mixed-ability groups and appreciate the diversity in every individual to accomplish tasks. Learners learn to tolerate their peers as they share tasks and ideas on how to play out their assigned profession.

Key Assessment

Level 3 (Strategic reasoning): Explain who a therapist is, and the roles they play in medical intervention.

Level 4 (Critical thinking and reasoning): Explain the differences between a psychiatrist and a psychologist.

Level 4 (Critical thinking and reasoning): Based on the knowledge acquired on who a therapist is and their roles, deduce the skills needed as a therapist.

Learning Tasks

1. Engage learners in a simulated classroom therapy session or invite a therapist (if available) to simulate a therapy session focussed on general topics like communication, career choices, managing peer pressure and stress. Learners critically observe the whole session and share their observations on the following with the whole class:
   a. communication style and approach.
   b. techniques used.
2. In mixed-ability groups, provide learners with a list of therapists (the list should include a variety of therapists from the list of therapists studied). Each group randomly chooses a therapist from the list through a ballot. Based on the therapist chosen, each group should:
   a. Research and prepare a brief presentation or role-playing scenario depicting the role(s) and responsibilities of their chosen therapist. This should include information about the population they work with, the issues they address, and the therapeutic techniques they employ.
   b. Present the brief presentation or role-play scenario to the class, highlighting key aspects of the therapist's role and the types of clients they may encounter.

Conclusion

In this lesson, learners are introduced to who a therapist is. The various specialists are also discussed as well as the people they see and the techniques they use to administer the various forms of therapies.

Week 18

Learning Indicator: *Identify the various therapeutic devices used by the therapist.*

Theme or Focal Area: List the various therapeutic devices and tools as well as their functions.

Therapeutic devices are medical tools and equipment used to aid in the treatment and management of various health conditions.

Here is a list of some common therapeutic devices and their functions:

1. **Transcutaneous Electrical Nerve Stimulation (TENS) Unit:** Transcutaneous electrical nerve stimulation (TENS) unit is a therapeutic device that uses low-voltage electrical currents to relieve pain. A TENS unit is a small device that delivers current through electrodes placed on the skin near the painful area. The electrical stimulation triggers the body to release endorphins, natural painkillers produced by the body.

   Function: provides electrical stimulation to nerves through the skin to alleviate pain, particularly for chronic or acute pain conditions, menstrual cramps or headaches.

Fig. 46: *Transcutaneous Electrical Nerve Stimulation (TENS) Unit*

2. **Continuous Positive Airway Pressure (CPAP) Machine:** CPAP machine delivers a constant stream of compressed air through a hose and mask that is worn while sleeping. The pressurised air keeps the airway open, preventing the blockages and allows normal breathing throughout the night.

   Function: delivers a continuous flow of air pressure to keep the airways open during sleep, commonly used to treat obstructive sleep apnoea (OSA). OSA is a condition where breathing repeatedly stops and starts during sleep because of blocked airways. CPAP also improves quality of sleep, reduces daytime sleepiness and health risks such as stroke and high blood pressure.

Fig. 47: *Continuous Positive Airway Pressure (CPAP) Machine*

3. **Nebulizer:** A nebulizer is a medical device used to deliver medication directly into the lungs in the form of a mist. A nebulizer converts liquid medication into a fine mist, which is inhaled directly into the lungs. This mist can be easily inhaled deep into the lungs through a mouthpiece or face mask. This method allows medication to be absorbed quickly and efficiently.

   Function: It is beneficial for treatment and management of respiratory conditions like asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis and other diseases and disorders that affect breathing.

Fig. 48: *Nebulizer*

4. **Cold Pack (Ice Pack):** Cold packs, also known as gel packs or ice packs, are a common tool used in physical therapy for various therapeutic purposes. Cold temperatures cause blood vessels to constrict (vasoconstriction), reducing blood flow to an area thereby, decreasing swelling and inflammation. Cold therapy also numbs an area of interest and reduces the perception of pain by acting on nerve fibres in the area.

   Functions: Cold therapy is a versatile tool used in physical therapy for various reasons such as:

   a. reducing swelling and inflammation
   b. injuries and post-surgical pain management
   c. muscle spasm management
   d. headache relief especially tension headaches.

Fig. 49: *Cold Pack (Ice Pack)*

5. **Heating Pad:** Heating pad is an electric heating pad which is used to apply localised heat to a specific area of the body. This targeted heat application offers various benefits in physical therapy and pain management. When heat is applied to the skin, it provides heat that is absorbed by the underlying tissues. This warmth triggers several physiological responses such as:

   a. increased blood flow due to dilation of blood vessels (vasodilation) which delivers more oxygen and nutrients to the area, promoting healing and tissue repair.

   b. blockage of pain signals and an increase in the production of endorphins and natural painkillers, leading to pain reduction and relief.

   c. relaxation of tight muscles to improve flexibility which makes movement easier and less painful.

   d. loosening of stiff joints and soft tissues which improves the range of motion.

   Functions: Physical therapists often recommend heating pad therapy for various reasons such as:

      i. managing pain associated with muscle strains, spasms, arthritis, and chronic pain conditions.

      ii. loosening or relaxing tight muscles as well as improving joint flexibility and thereby making daily activities and exercise routines easier.

      iii. increasing blood flow, which can accelerate healing after injuries or surgeries by delivering essential nutrients to the targeted tissues.

Fig. 50: *Heating Pad*

6. **Medical compression tools:** medical compression tools are tools used in physical therapy for various conditions. They come in different forms, each applying controlled pressure to target areas, promoting healing, and improving function. Some examples of medical compression tools include compression garments. Compression garments are elastic garments which come in various forms such as stockings and arm sleeves. They provide graduated compression which aids circulation and reduces swelling and blood clots.

   Functions: Physical therapists use medical compression tools for the following reasons:

   i. compression promotes blood flow which is crucial for accelerating healing and tissue repair by optimising nutrient delivery.

   ii. compression garments effectively reduce swelling caused by fluid buildup and thereby improving mobility and comfort.

   iii. compression helps alleviate pain associated with muscle strains, sprains, lymphedema, and post-surgical discomfort.

   iv. compression garments may improve body awareness (proprioception) in the limbs, especially after injuries, promoting better balance and coordination.

Fig. 51: *Compression Garments*

7. **Cervical Traction Device:** Cervical traction devices are medical devices used in physical therapy to apply a pulling force (traction) or depression to target the neck and upper spine for therapeutic purposes. It is designed to relieve pressure by applying gentle pulling force on the cervical vertebrae, intervertebral discs, and surrounding soft tissues, thereby alleviating pain, reducing muscle tension, and promoting spinal alignment. They work to create space between the vertebrae, which can potentially alleviate pain and stiffness associated with various neck conditions.

   Function: The pulling force from cervical traction is beneficial in the following ways:

   i. helps to slightly separate the vertebrae in the neck, potentially relieving pressure on pinched nerves and spinal cord.

   ii. increases the space between vertebrae thereby improving blood flow to the area, promoting healing and reducing inflammation.

   iii. helps to relax tight muscles in the neck and upper back, which contribute to pain and stiffness.

Fig. 52: *Cervical Traction Device*

8. **Prosthesis and Orthosis**: A prosthesis is an artificial device that replaces a missing body part, most commonly a limb. Prosthesis can also be used to replace other missing body parts, such as eyes, ears and teeth (dentures). In physical therapy, prosthesis helps patients to achieve optimal function in missing body parts. Orthoses are external supportive devices worn to improve the function of an existing limb or body parts. Examples of orthoses are casts, splints, braces and corrective footwears.

Functions: Prostheses and orthoses offer a range of benefits in physical therapy, playing crucial roles in a patient's rehabilitation journey. Here is a breakdown of the key advantages they provide:

Prostheses

i. prostheses offer amputees improved mobility allowing them to regain the ability to walk, climb stairs, and perform daily activities independently. This significantly enhances their quality of life and fosters a sense of normalcy.
ii. physical therapy with a prosthesis focuses on retraining balance and coordination. This leads to safer ambulation (walking) and reduces the risk of falls improving overall well-being.

Orthoses

i. Orthoses like casts and splints immobilise the injured area, preventing movement and promoting faster and proper bone, ligament, or muscle healing.
ii. By providing support, reducing inflammation, and improving joint mechanics, orthoses can significantly alleviate pain associated with various conditions.
iii. Orthoses enhance mobility and function by promoting stability, reducing pain, and improving balance. This allows for better participation in daily activities and exercise routines.
iv. Certain orthoses, like ankle braces for people with weak ankles, help prevent future injuries by providing support and addressing alignment issues.

Fig. 53 (a): *Examples of prostheses (Legs for Africa, 2021)*

Fig. 53 (b): *Examples of orthoses*

9. **Mobility Aids:** Mobile aids are tools used to improve a person's mobility and independence. They are often used by people who have difficulty walking or who need extra support to stay balanced. Mobile aids are recommended by physical therapists to help patients improve their mobility and function. Examples of mobile aids are canes, crutches, walkers and wheelchairs.

   Function: Mobile aids provide increased stability, mobility and reduced pain. They empower patients to participate more actively in therapy routines and daily activities and thereby foster a sense of independence.

Fig. 54: *Mobility aids*

10. **Phototherapy devices:** Phototherapy devices are light therapy devices that use ultraviolet (UV) light on exposed skin to treat various conditions such as skin disorders and jaundice (hyperbilirubinemia). During phototherapy, the skin is exposed to ultraviolet (UV) light for a set amount of time. This form of treatment is safe for all ages and is a common treatment for newborn jaundice. In physical therapy, phototherapy is a non-invasive treatment modality used to manage a variety of conditions**.**

    Function: Phototherapy devices offer a range of benefits in therapy. These include the following:

    i. phototherapy helps reduce inflammation in the skin, which can be beneficial in conditions like psoriasis and eczema.

    ii. certain types of phototherapy help suppress the overactivity of the immune system in the skin. This plays a role in psoriasis.

    iii. phototherapy promotes healing of the skin and improves the appearance of conditions like psoriasis and vitiligo.

    iv. In jaundiced babies, phototherapy helps reduce the level of bilirubin, so it does not become harmful.

Fig. 55: *Phototherapy (Light Therapy) Devices*

Pedagogical exemplars

Experiential Learning: To provide learners with hands-on experience of therapeutic devices and tools commonly used in clinical practice, learners embark on a field trip to a hospital or watch a video of some therapeutic devices and tools being used by a therapist. Learners in mixed-ability groups observe different devices and tools, document their observations of the various therapeutic devices and tools being used and deduce their functions. Learners appreciate both local and global examples of the various therapeutic devices.

Project-based Learning: In groups, learners research specific devices and tools explaining their functions and uses. Learners can get creative by brainstorming and sketching ideas for new therapeutic devices to address particular challenges such as mobility (walking, grasping objects), injury, chronic pain, breathing challenges and broken limbs. Learners embrace diversity and tolerate the views of others as they work in groups. Consider providing additional support or differentiated instruction for learners who may need it.

Key Assessment

Level 1 (Recall): List at least three therapeutic devices and tools.

Level 3 (Strategic reasoning): Explain the significance of therapeutic devices to the therapist.

Level 4 (Critical thinking and reasoning): Based on your knowledge of therapeutic devices and tools to the therapist, explain with an example how a therapist will operate or carry out treatment for a patient in the absence of an appropriate therapeutic device.

Learning Tasks

1. Present learners with pictures or videos of different therapy sessions such as physical therapy, occupational therapy, speech therapy, and ask them to identify any devices or tools they see being used.
2. In mixed-ability groups, present learners with a list of challenges faced in our day-to-day activities such as difficulty with mobility (walking, grasping objects), injury, chronic pain, breathing challenges and broken limbs. Each group randomly chooses a challenge from the list through a ballot. Based on the chosen challenge, each group should:
    a. Research on existing therapeutic devices that address their chosen challenge using available resources such as the internet and textbooks.
    b. Brainstorm and propose a design for a new therapeutic device which addresses the chosen challenge. Take the following into consideration:
        i. Functionality: How are people going to use the device?
        ii. User-friendliness: How easy will it be to use the device?
        iii. Accessibility: Can people of all abilities use your device?
        iv. Materials: What materials are easily available and will be comfortable for users?

Present your proposed therapeutic device to the whole class. In your presentation, explain your design process and choices.

Conclusion

In this lesson, learners are introduced to the various devices and tools used by therapists in their line of duty. The functions of these devices and tools are also discussed.

Section Review

This section is a review of all the lessons taught for the last 3 weeks and a summary of what the learners should have learnt.

1. Definition of therapy and its characteristics.
2. Therapists and their various specialities
3. Different types of therapies and how they are carried out.
4. Therapeutic devices and tools used by therapists, and their functions.

In this section, learners will be introduced to what a therapy is and its characteristics. Learners will also discuss who a therapist is and examples of the different specialities, such as physical therapists, occupational therapists, and counsellors. Learners will study the different types of therapies and the unique approaches each therapist uses to help people with physical injuries, challenges with daily activities, as well as mental and emotional difficulties. Overall, these lessons will highlight the progress made in medical interventions, using therapy and the importance of therapeutic devices and tools for effective treatment.

Additional Reading

Fig. 45: *Differences between a psychologist and a psychiatrist*

SECTION 7: RESEARCH AND DESIGN IN BIOMEDICAL SCIENCE

Strand: **Biomedical Innovation**

Sub-Strand: Research and design in Biomedical Science

Learning Outcome: *Use credible online resources to research and propose solutions for healthcare problems.*

Content Standard: Demonstrate knowledge on how to access and use information from credible sources.

INTRODUCTION AND SECTION SUMMARY

In this section, learners tackle the critical skill of evaluating online information for biomedical research and problem-solving. Over the next six weeks, various aspects of navigating through reliable healthcare information is explored. The first lesson focuses on website credibility. Learners will develop a "cheat-sheet" or checklist to assess the trustworthiness of information available online by considering factors like source reputation, relevance, and publication date. They will discuss the dangers of misinformation and its impact on scientific research and discoveries. The second lesson guides learners to search and identify reliable scientific articles. Learners will explore search strategies for general databases and specialised tools like PubMed. By learning how to assess factors like peer-review, author expertise and publication date, learners will become confident in finding credible research sources. The final lessons tackle real-world healthcare challenges in Ghana. Learners will identify pressing issues, systematically analyse causes and symptoms and brainstorm solutions. They will explore different approaches like technology, education, and policy changes, fostering a sense of agency in addressing local healthcare needs. By the end of the section, learners will be equipped to navigate through online resources critically, identify trustworthy online resources and develop solutions to improve healthcare in their communities.

The weeks covered by the section are:

Week 19: *Analyse website content and assess overall credibility of the information.*

Week 20: *Use online search engines and journal databases to locate reliable scientific articles.*

Week 21: *Use different approaches to propose solutions to healthcare problems in the country.*

Weeks 22 and 23: *Make an effective presentation of scientific information on a healthcare issue.*

SUMMARY OF PEDAGOGICAL EXEMPLARS

To foster learners' interest and participation in this section, the following pedagogical exemplars are recommended. Using talk-for-learning strategy, learners discuss website credibility and its impact on science. To research topics and assess information credibility using specific criteria as well as identify local healthcare problems and research solutions using various resources, project-based learning strategy was used. Through exploratory learning, learners also practise finding credible information online and explain why they trust their sources. Through class discussion using talk-for-learning, learners explore steps to identify health problems, causes, effects, and solutions. Activity-based learning will allow learners to create individual presentations on a chosen healthcare issue, covering causes, effects/symptoms, and potential solutions.

SUMMARY OF ASSESSMENT

To examine learners' understanding of the use of credible online resources to research and propose solutions for healthcare problems, level 3 assessment is recommended throughout the section. Using DOK level 3 assessment, learners' strategic reasoning abilities are explored in discussing how credible information can be accessed on websites i.e. identify a reliable scientific article using online search engines; systematically identify healthcare problems in their local community and Ghana at large as well as discuss the different approaches needed to solve the identified healthcare problems.

Week 19

Learning Indicator: *Analyse website content and assess overall credibility of the information.*

Theme or Focal Area: Discuss how credible information can be accessed on websites.

Introduction

Credible information refers to information that is trustworthy, reliable, and based on verifiable evidence. Examples of credible sources of information include government websites, academic journals, institution websites, books from established publishers, websites, and publications from reputable organisations e.g., World Health Organization (WHO), Ghana Health Service (GHS), Ghana Registered Nurses and Midwives Association (GRNMA). Not all information from websites should be accepted as true and credible. Some websites may publish false and misleading information. For example, social media and user-generated content (for example, Facebook, X and WhatsApp.), unverified websites, Wikipedia.

Credible scientific information can be evaluated by looking at the following criteria:

a. reputation of the host or author.

b. relevance of information.

c. how recent is the publication date.

d. asking experts.

e. verification from trusted sources such as WHO, PubMed and GHS.

f. consideration of personal biases of authors.

Discuss the implication of false information on research and science.

False information, also known as misinformation or false data, is any piece of information or data that is factually inaccurate, misleading, or not supported by evidence. False information, when introduced into scientific research can lead to negative consequences including drawing incorrect conclusions, damaging the reputation of authors and the institutions associated with the research, ethical concerns, loss of trust, hindrance to innovation and waste of resources. To overcome the impact of false information on scientific research, the principles of fact-checking, peer-review, transparent data sharing and data validation must be adhered to.

Pedagogical exemplars

Managing talk for learning: Learners engage in a whole class discussion on the implication of false information on research and science and also how to assess the credibility of information on websites based on the following criteria:

a. reputation of the host or author

b. relevance of information

c. how recent is the publication date

d. asking experts

e. verification from trusted sources such as WHO, PubMed and GHS

f. consideration of personal biases of authors

Guide learners to use the internet to search for credible information and apply assessment criteria to indicate the credibility of an internet source and justify the choice of judgment.

Project-based learning: In mixed ability groups and based on learners' understanding of what credible information is, guide learners to develop a checklist for assessing the credibility of information assessed on a website. Learners then research on a given topic on the internet (for example treatment of sickle cell) with each group assessing the credibility of the information retrieved based on the checklist they created. Learners in groups present their findings to the class. To support the exchange of knowledge through peer review, learners use online and media resources to review the solutions of others to specified health problems and formulate their own solutions.

Key Assessment

Level 3 (Strategic reasoning): Learners research any Biomedical Science-related topic on the internet and present to the class, how website content was analysed explaining the criteria used to categorise the information accessed as credible information. Based on learners' knowledge of how to analyse website content, learners explain the criteria used to categorise information accessed as credible.

Learning Tasks

1. Learners use a website maze to find information online. Present a scenario where learners need to find information online to solve a problem (for example, planning a healthy meal). Lead a class discussion about how to assess the trustworthiness of websites they encounter. Explore criteria like source reputation, information relevance, and date of publication. Discuss the dangers of false information in research and science.
2. In mixed-ability groups, provide learners with a list of health-related topics such as the benefits of a new exercise program, adding fruits to diet and the effects of dehydration on the body. Each group randomly chooses a health-related topic. Using the criteria discussed in class, learners do the following:
   a. Evaluate the credibility of information found on several websites.
   b. Identify biases and search for reputable sources like government health agencies or peer-reviewed journals.
   c. Create a short presentation or infographic for the class, explaining their chosen topic and the websites they evaluated. They should highlight the most credible sources and explain how they identified them.

Conclusion

In this lesson, learners are introduced to accessing information from websites and assessing the credibility of information retrieved from these websites. Learners also discuss the criteria for identifying credible information.

Week 20

Learning Indicator: *Use online search engines and journal databases to locate reliable scientific articles.*

Theme or Focal Area: Discuss how credible information can be accessed on websites.

Identify a reliable scientific article using online search engines and journal databases.

Identifying a reliable scientific article using online search engines and journal databases can be a critical step in conducting research. The following are steps to help identify trustworthy and scientific articles:

1. Start with established databases for example, Google Scholar, PubMed, Scopus etc.
2. Check for articles that have undergone peer-review.
3. Check the reputation of the journals the articles are published in.
4. Check authors' institutions of affiliation.

Reputation of a journal includes several features such as the sponsors or societal organisation supporting the journal, the aim, scope and mission statement, as well as the publisher of the journal. Reputable journals rely on peer-review and in some cases may have a board of experts in their respective fields serving as editorial staff. These features can attribute confidence in a journal making it a source of credible information for research.

Pedagogical exemplar

Exploratory learning: Learners use online search engines like Google to search for credible information and give reasons why they think the information is credible. As learners research and use technological tools to prepare their presentations, they gain experiential training on how to assess credible information on the internet.

Key Assessment

Level 3 (Strategic reasoning): Learners are asked to search for remedies for a disease condition (for example, sickle cell anaemia). Learners make a list of two to three references that are considered credible and three references that are not credible and provide reasons for their answers.

Learning Tasks

1. Learners brainstorm as a class: Where do scientists typically publish their findings?
2. Learners use a general search engine (like Google) to find information about a specific scientific topic (e.g., climate change, benefits of a new medication). After their search, learners discuss the challenges of finding reliable scientific information in this way. Introduce scientific databases (PubMed) to learners. Using articles found in the scientific databases, learners work in pairs to analyse the credibility of the information.
3. Provide learners with a checklist of criteria (for example, peer-reviewed, author affiliation, date of publication). Learners justify their assessment of each article's credibility.
4. They create a short presentation or infographic for the class that summarises the key findings of the article in an easy-to-understand way. Encourage them to consider their audience and tailor their communication style accordingly

Week 21

Learning Indicator: *Use different approaches to propose solutions to healthcare problems in the country.*

Theme or Focal Area: Discuss the different approaches needed to solve healthcare problems in the country.

Based on the specific needs of a country, there are several approaches that can be adopted and tailored to help solve healthcare problems in the country and improve the overall health and well-being of the population. To solve the healthcare problems of a country, there is a need for a comprehensive and all-rounded approach.

Examples of such approaches include:

1. **Universal healthcare coverage:** this ensures access to quality healthcare for all citizens. For example, accessing medical care through the National Health Insurance Scheme (NHIS), and government-funded programs such as nationwide COVID-19 vaccination and immunisation of babies are beneficial in promoting the overall health of citizens.
2. **Health education and prevention:** creating awareness of the benefits of and promoting healthy lifestyles, vaccinations and regular screenings can help prevent many diseases and early detection for prompt treatment.
3. **Healthcare infrastructure and resources:** investing in healthcare infrastructure, such as hospitals, clinics, Community Health Planning and Services (CHPS) compounds and medical equipment, is crucial for meeting the growing healthcare demands of the population. Additionally, ensuring an adequate supply of healthcare professionals, including doctors, nurses, pharmacists, biomedical scientists and laboratory technologists, is essential for providing quality care.
4. **Research and innovation:** encouraging research in healthcare and medical sciences can lead to breakthroughs in treatments, disease prevention, and medical technologies.
5. **Disaster preparedness and response:** a healthcare system must be prepared to handle public health emergencies and disasters effectively. Investing in disaster preparedness, training healthcare workers, and establishing contingency plans to save lives during crises. For example, putting up temporary structures to accommodate patients with infectious diseases.

Discuss how research and innovation can solve healthcare problems.

Research and innovation are key approaches in finding solutions to several healthcare problems. Discussions on some ways in which research and innovation can make a significant impact in solving healthcare problems should be based on the following points:

Advancing medical knowledge: research helps in expanding our understanding of diseases, their causes, risk factors, and treatment options. Through scientific studies and clinical trials, researchers can identify new medical breakthroughs and therapies that can lead to better health outcomes.

Developing new treatments and therapies: innovation in pharmaceuticals and medical technology can lead to the development of new drugs, vaccines, medical devices, and therapies. These advancements can address previously untreatable or poorly managed conditions and improve patients' quality of life.

Preventive healthcare: research can identify effective preventive measures to reduce the incidence of diseases. By understanding risk factors and promoting healthy behaviours, healthcare systems can focus on prevention rather than just treatment.

Improving access to healthcare: research can help identify barriers to healthcare access and propose solutions to make healthcare more equitable and affordable. This can include telemedicine, mobile health (mHealth) solutions, and community-based care models such as the CHPS compounds.

Pedagogical exemplars

Managing talk-for-learning: Guide learners in discussions on previously mentioned approaches to solving healthcare problems. In discussions, consider Ghana as a nation with a diverse population facing various health challenges such as infectious diseases (for example, the case of COVID-19 and malaria), malnutrition (for example, Kwashiorkor) and limited access to healthcare services. Look at some of the strategies like the NHIS the country has employed to solve such healthcare problems like the cash-and-carry system in healthcare delivery.

Project-based learning: Learners work in pairs to identify a healthcare problem in their environment and consult online resources, resource persons, books, or libraries to search for possible remedies to the identified problem. The learners then propose solutions using the information derived from the various sources. Learners use online and media resources to review the solutions of others to specified health problems and formulate their solutions. Learners work with their peers in mixed-ability groups and assign roles to members in the group and let them work together in peace and harmony to promote inclusion and responsibility. to achieve the desired outcome.

Key Assessment

Level 3 (Strategic reasoning): For a specified health problem in your locality, propose a solution after a thorough review of literature on the internet.

Learning Tasks

1. As a class, brainstorm and create a visual map on the board or a large sheet of paper. This map can represent the local community and learners can identify areas with limited healthcare access, specific health concerns, or existing healthcare resources. This activity builds on prior knowledge and fosters empathy for community health issues.
2. Divide learners into mixed-ability groups, ensuring a variety of strengths and perspectives are represented. Each group chooses a healthcare challenge identified in the community health map (Task 1). Encourage them to research and propose solutions using different innovative approaches. These approaches could include:
    a. **Technological Solutions**: Developing a mobile app for appointment scheduling or medication reminders.
    b. **Educational Campaigns**: Creating a community outreach program to raise awareness about a specific health issue.
    c. **Policy Advocacy**: Researching and proposing changes to local healthcare policies to improve access or affordability.
3. Learners should be further challenged to develop a plan to raise awareness or advocate for their chosen healthcare solution. This could involve creating a public service announcement, writing a letter to a local official, or organising a school health fair.

Week 22

Learning Indicator: *Make an effective presentation of scientific information on a healthcare issue.*

Theme or Focal Area: Identify any healthcare problem, its causes, effects/symptoms, and possible solutions.

1. ***How to identify a healthcare problem in society.***

   Identifying a healthcare problem involves a systematic approach to understanding the issues and challenges faced by individuals or populations in the healthcare context. Here are the steps to identify any healthcare problem:

   a. **Conduct surveys or interviews:** conducting surveys or interviews with patients of the affected population can provide deeper insights into the problem and its impact.

   b. **Identify contributing factors:** look for potential causes of the healthcare issue under investigation as well as relevant information on how potential causes lead to the manifestation.

   c. **Consult literature and evidence:** conduct a thorough review of existing scientific literature and evidence related to the issue. This step ensures that you build on previous knowledge and avoid duplication of efforts.

   d. **Analyse data and trends:** use data analysis and statistical methods to identify patterns, trends and associations related to the healthcare problem. This step can help to quantify the extent of the problem issue's magnitude and understand potential risk factors.

   e. **Formulate a problem statement:** based on the gathered information and analysis, formulate a clear and concise problem statement that describes the healthcare problem and its significance.

2. ***How to identify the cause of the healthcare problem.***

   Identifying the cause of a healthcare problem requires a systematic and evidence-based approach. Whether it is an individual patient's health issue or a broader public health concern, here are the steps to help identify the cause of the healthcare problem:

   a. **Gather patient or population data:** collect comprehensive data related to the healthcare problem from individual patients (in case of a specific patient) or from the affected population (in case of a public health concern). This includes medical history, symptoms, demographic information, lifestyle factors and any relevant environmental exposures.

   b. **Perform physical examination and diagnostic tests:** for individual patients, conduct a thorough physical examination and order relevant diagnostic tests to assess the patient's health status and identify any underlying medical conditions.

   c. **Conduct medical history interviews:** for individual patients, take a detailed medical history to understand the timeline of symptoms, past medical conditions, family history, and any potential triggers or events that may be related to the healthcare problem.

   d. **Utilise data analysis and statistics:** use data analysis and statistical methods to identify associations, correlations, and potential causal relationships between various factors and the healthcare problem.

   e. **Peer review and validation:** seek peer review and validation of findings by experts in the field to ensure the robustness of the conclusions.

3. ***How to analyse the effect of the healthcare problem.***

   Analysing the effects of a healthcare problem involves a systematic approach to examine the consequences and impacts of the problem on individuals, communities, and the healthcare system.

Discussions on the steps to analyse the effects of a healthcare problem should be based on the following points:

a. **Identify data sources:** determine the sources of data that can provide information on the effects of the healthcare problem. These sources may include medical records, patient surveys, health databases, public health reports and relevant government or organisational data.

b. **Quantitative and qualitative analysis:** use appropriate research methods, tools and data analysis techniques to quantify the effects of the healthcare problem. Analyse trends and patterns over time and among different population groups.

c. **Examine health outcomes:** assess the health outcomes and consequences associated with the healthcare problem. This includes understanding the impact on morbidity, mortality, disability, and quality of life for affected individuals.

d. **Consider socio-economic effects:** evaluate the socio-economic effects of the healthcare problem on individuals and communities. This involves looking at factors like healthcare costs, lost productivity, and social implications.

e. **Interpret findings:** interpret the results of your analysis in the context of the healthcare problem and its implications for individuals, communities, and the healthcare system.

f. **Summarise and communicate results:** summarise the findings and organise them in a clear and concise manner. Communicate the results to relevant stakeholders, policy incidence rates, mortality rates, or other relevant metrics. Analyse trends and patterns over time and among different population groups.

Analysing the effects of a healthcare problem provides valuable insights for addressing the issue effectively, developing targeted interventions and implementing evidence-based policies to improve health outcomes and the overall healthcare system.

How to provide solutions to a healthcare problem.

Providing a solution to a healthcare problem requires a thoughtful and systematic approach. *Here are the steps to effectively provide a solution to a healthcare problem:*

1. **Understand the problem and cause relationship:** thoroughly understand the healthcare problem you are addressing in the context of how the cause is related to the problem. Analyse its causes, effects, and the population it affects. Ensure you have a clear and accurate understanding of the issue before proceeding with potential solutions.

2. **Review existing evidence and best practices:** conduct a comprehensive review of existing scientific literature, research studies and evidence-based guidelines related to the healthcare problem. Identify successful interventions and best practices that have been used to address similar issues.

3. **Monitor and evaluate:** implement the solution and continuously monitor its progress. Evaluate its effectiveness in the defined goals and the intended impact. Use data and feedback to make improvements as needed.

4. **Involve stakeholders in implementation:** engage stakeholders in the implementation process. Their involvement and support are crucial for the success and sustainability of the solution.

5. **Sustain the solution:** develop strategies to sustain the solution over the long term. This may involve securing funding, building capacity, periodically evaluating the solution and updating it and integrating the solution into existing healthcare systems and practices.

Providing a solution to a healthcare problem requires a collaborative effort, involving various stakeholders, evidence-based practices, and a commitment to continuous improvement. By following these steps, you can increase the likelihood of implementing an effective solution that positively impacts healthcare outcomes and addresses the identified problem.

Pedagogical exemplar

Talk for learning: Through a whole class discussion, explain the steps used to identify any healthcare problem, its causes, effects/symptoms, and possible solutions. Learners contribute their ideas orally as the teacher discusses the steps for identifying any healthcare problem, its causes, effects/symptoms, and possible solutions.

Key Assessment

Level 1 (Recall): List the steps taken to identify healthcare problems and their causes in society.

Level 3 (Strategic reasoning):

1. Discuss the steps used to analyse the effects of healthcare problems in Ghanaian society.
2. Discuss the steps taken to provide a solution to the health care problem in the Ghanaian society.

Learning Tasks

1. Present learners with a specific healthcare problem relevant to Ghana (example, malaria, malnutrition). Using the "Talk for Learning" pedagogy, guide learners through the steps to analyse the problem:
   a. Causes: What factors contribute to the occurrence of this health issue?
   b. Effects/Symptoms: What are the physical, social, and economic impacts of this problem?
   c. Possible Solutions: Brainstorm potential solutions and discuss their feasibility and effectiveness.

Learners can then conduct brief individual research to gather more information about the chosen healthcare problem.

2. Assign each group a different healthcare problem to research. Using the information gathered, each group creates a presentation to raise awareness about their chosen issue. Encourage them to consider their audience (example, classmates, community members) and tailor their presentation style accordingly. Presentations can include elements like infographics, videos, or role-plays to effectively communicate the problem, its effects, and possible solutions

Week 23

Learning Indicator: *Make an effective presentation of scientific information on a healthcare issue.*

Theme or Focal Area: Identify any healthcare problem, its causes, effects/symptoms and possible solutions.

In urban society of Ghana, a health fair and community health assessment are organised by the local health department and healthcare providers to identify health problems, their causes, symptoms/effects and explore possible solutions. The event takes place in a central park and attracts a diverse representation of residents from different neighbourhoods.

Identify the healthcare problem

Step 1: Health Fair and Community Participation. The health fair features booths offering various health screenings, educational materials, and interactive activities. Residents of all ages attend the event, including families, seniors, and young adults. The organisers encourage active participation and feedback from the attendees.

Step 2: Data Collection and Health Screenings. During the health fair, participants are encouraged to complete health questionnaires to gather information about their health status, lifestyle habits, and healthcare access. Health screenings, such as blood pressure checks, BMI measurements, and blood glucose tests, are conducted on-site to identify potential health issues.

Causes of the healthcare problem

Step 3: Causes and Risk Factors. The collected data reveals several potential health problems and their causes/risk factors:

1. High rates of obesity and sedentary lifestyle due to limited recreational facilities and unhealthy eating habits.
2. Inadequate access to healthcare services in certain neighbourhoods, leading to delayed diagnosis and management of health conditions. Widespread tobacco use and exposure to second-hand smoke due to the lack of smoking cessation resources and tobacco-free policies.
3. Mental health issues arising from high levels of stress, especially among learners and working professionals.
4. Insufficient knowledge about preventive healthcare measures, leading to lower rates of immunizations and screenings.

Symptoms or Effects of the healthcare problems

Step 4: Symptoms and Effects. The health fair and questionnaires reveal the following symptoms/effects related to the identified health problems:

1. Obesity-related: residents report fatigue, joint pain and decreased mobility due to excess weight.
2. Limited healthcare access: individuals from certain neighbourhoods share experiences of delayed treatments, leading to worsened health conditions.
3. Tobacco-related: several individuals complain of respiratory issues, persistent cough and stained teeth due to smoking.
4. Mental health: participants mention experiencing anxiety, depression and sleep disturbances due to stress. Preventive healthcare gaps: residents express concern about missing routine screenings, leading to late detection of health issues.

Possible Solutions to the healthcare problems

Step 5: Community Validation and Feedback. The health department holds community forums and meetings to present the findings and gather feedback from residents. Local organisations and community leaders participate, providing additional insights into the identified health problems.

Step 6: Developing Interventions. Collaborating with healthcare providers, community organisations, and local leaders, the health department formulates evidence-based interventions to address the identified health problems:

1. Establishing community gardens and promoting farmers' markets to increase access to fresh produce and encourage healthier eating habits.
2. Setting up mobile healthcare units and Tele-health services to improve healthcare access in underserved areas.
3. Implementing smoking cessation programs and advocating for smoke-free policies in public places. Organising stress management workshops, mental health awareness campaigns, and counselling services.
4. Conducting health education workshops and community outreach programs to promote preventive healthcare practices.

Step 7: Implementation and Evaluation. Over the course of the year, the health department implements the interventions in collaboration with local partners. Progress is closely monitored through data collection, health screenings, and regular community feedback. The team evaluates the impact of the interventions on health outcomes and makes necessary adjustments for improvement.

Fig. 56: *Addressing health challenge in the society*

In a rural society in Ghana, the local community decides to organise a Health Awareness Fair to address various health problems prevalent in their society. The fair is set to be held in the village square, and everyone, including health professionals, local leaders, and volunteers, is actively involved in making it a success.

1. **Identifying health problems:** the village leaders and health professionals conduct a survey and gather data to identify the most common health problems affecting the community. They find that malaria, malnutrition, and waterborne diseases are among the primary health concerns.
2. **Causes of health problems:** to better understand the causes of these health problems, a group of volunteers' visits households and conducts interviews with the residents. They discover that stagnant water, improper waste disposal, and lack of awareness about proper hygiene practices

contribute to the prevalence of malaria and waterborne diseases. Additionally, limited access to nutritious food and lack of education about balanced diets are identified as root causes of malnutrition.

3. **Symptoms and effects:** during the Health Awareness Fair, health professionals set up booths to educate the community about the symptoms and effects of each health problem. For instance, they explain that malaria can cause fever, headaches, and fatigue, and if left untreated, it can lead to severe complications, especially in young children and pregnant women. Malnutrition can result in stunted growth and weakened immune systems, making individuals more susceptible to various illnesses.

4. **Possible solutions:** the fair focuses on promoting preventive measures and implementing sustainable solutions. Here are some of the initiatives presented:
   a. Malaria Prevention: volunteers distribute mosquito nets and educate the community about their proper use. They also demonstrate how to identify and eliminate mosquito breeding sites around homes.
   b. Waterborne Disease Prevention: health professionals discuss the importance of clean water and sanitation. They introduce simple water purification methods, such as using chlorine tablets and boiling water before consumption.
   c. Nutrition Education: nutritionists conduct workshops on the importance of a balanced diet and demonstrate how to prepare nutritious meals using locally available ingredients. They emphasise the significance of breastfeeding and proper weaning practices for young children.
   d. Hygiene Promotion: volunteers organise interactive sessions to educate community members about handwashing, personal hygiene and proper waste disposal. They distribute soap and hand sanitizers to encourage healthy practices.
   e. Community Health Centre: the village leaders and health professionals plan to establish a community health centre where residents can access basic healthcare services, including regular check-ups and vaccinations.
   f. Health Monitoring and Follow-up: a system for health monitoring and follow-up is introduced, where local volunteers periodically visit households to ensure that preventive measures are being followed, and provide further support if needed.

By implementing these solutions, the community aims to improve the overall health and well-being of its residents, reduce the burden of preventable illnesses and promote a sustainable approach to healthcare. The Health Awareness Fair becomes a regular event, fostering a culture of health-consciousness and community engagement in tackling health problems in the local Ghanaian society.

Pedagogical exemplars

Activity-based Learning: Individually, prepare a PowerPoint presentation to the class on an identified healthcare problem, its causes, effects / symptoms, and possible solutions. Learners identify health problems in the society, consult others and critically analyse the remedies published or recommended to suggest solutions to identified problems.

Initiating Talk for learning: Learners contribute to the discussion by expressing their thoughts among their peers in an environment that is free from fear or intimidation during the presentation. Offer a variety of resources for research, catering for different learning styles (for example, online articles, videos, interviews). Allow learners to choose presentation formats that suit their strengths (for example, PowerPoint, infographic, poster).

Key Assessment

Level 3 (Strategic reasoning): Prepare interactive PowerPoint slides to present proposed solutions to identified health problems in your locality.

Learning Tasks

1. Put learners into small groups. Challenge each group to research and identify a current healthcare problem affecting their community. Encourage them to use a variety of resources, such as online databases, interviews with healthcare professionals, or local news reports. Each group creates a short presentation highlighting the chosen problem.
2. Building on Task 1, if appropriate for the chosen healthcare problem, learners can delve deeper using the scientific investigation method. They can brainstorm potential causes, research relevant data, and hypothesise about factors contributing to the problem. This activity promotes critical thinking and research skills.
3. Learners return to their small groups. Using credible online resources (emphasise the importance of credibility!), each group researches and proposes evidence-based solutions to their chosen healthcare problem. They then develop a brief action plan outlining how they could raise awareness or advocate for their proposed solutions in the community. This could involve creating a public service announcement, organising a school health fair, or writing a letter to a local official.

Section Review

This section is a review of all the lessons taught for the last six weeks and a summary of what the learners should have learnt.

1. Identification of credible online sites?
2. How to use online search engines and journal databases to find credible scientific articles.
3. Different approaches to developing solutions to healthcare problems in the country.
4. How to effectively prepare and present scientific information on a healthcare issue.

In this section, the skills to identifying credible sources for locating information online are discussed with focus on how to use online search engines effectively to find credible scientific articles. The different approaches to developing solutions to healthcare problems are also discussed. The skills of communicating scientific information through preparation of PowerPoint and effective presentations are also practiced. Together, learners appreciate how healthcare problems move from the identification stage to the investigation stage and then to the solution implementation stage.

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