

YEAR 3

SEMESTER 2

Four-Year B.Ed. Course Manual

Science: Teaching and Assessment in Science





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FOREWORD

These Initial Teacher Education course manuals were developed by a team consisting of members from Colleges of Education and four universities namely the University of Ghana, Kwame Nkrumah University of Science and Technology, University of Education, Winneba, and University for Development Studies. This team was originally constituted by the National Council for Tertiary Education (now the Ghana Tertiary Education Commission) in 2019 to support the delivery of the new B.Ed. curriculum with assistance from T-TEL and UK Aid. The revision, finalization and printing of these manuals took place in 2021 with support from T-TEL and Mastercard Foundation.

The course manuals have been produced for use as general guides for the delivery of the new four-year B.Ed. curriculum in Colleges of Education in collaboration with their affiliated universities. They are designed to support student teachers, tutors, and lecturers in delivering a complete B.Ed. course for training student teachers which meets the requirements of the National Teachers' Standards, enabling them to teach effectively in basic schools.

The first section of the manuals is focused on the course information and vision for the B.Ed. curriculum. The second section presents the course details, goal for the subject or learning area, course description, key contextual factors as well as core and transferable skills and cross-cutting issues, including equity and inclusion. The third section is a list of course learning outcomes and their related learning indicators. The fourth section presents the course content which is broken down into units for each week, the topic and sub-strands and their related teaching and learning activities to achieve the learning outcomes and the teaching and learning strategies. This is followed by course assessment components in section five. Each manual contains a list of required reading and references as well as teaching and learning resources. The final section presents course related professional development for tutors and lecturers to be able to use each section of the manual.

Field instructions to guide Supported Teaching in School are integrated into the course manuals to provide the student teacher with guidance in developing teaching throughout the entire period of study to be able to meet the requirements of the National Teachers' Standards (NTS) and the National Teacher Education Curriculum Framework (NTECF). To ensure maximum benefit the course manuals should be used in addition to other resources such as the NTS, NTCEF, National Teacher Education & Assessment Policy and the National Teacher Education Gender Equality and Social Inclusion (GESI) Strategy and Action Plan.. This will help to ensure that student teachers' learning is integrated within the wider teacher education policy framework.

Professor Mohammed Salifu

Director General, Ghana Tertiary Education Commission

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The course manuals were developed through the collaborative efforts of a team of individuals from Colleges of Education, University of Ghana, Kwame Nkrumah University of Science and Technology, University of Education, Winneba, and University for Development Studies. They were produced in association with the Ghana Tertiary Education Commission of the Ministry of Education, Ghana.

A participatory team approach was used to produce this set of resources for tutors/lecturers, mentors, and student teachers. We are grateful to the specialists who contributed their knowledge and expertise.

Special thanks to Professor Jophus Anamuah-Mensah - T-TEL Key Advisor, Dr. Eric Daniel Ananga - T-TEL Key Advisor for Curriculum reform and Beatrice Noble-Rogers who provided key editorial, review and content input and facilitated the process of drafting and finalising the course manual.

Patricia Appiah-Boateng and Gameli Samuel Hahomene, served as typesetting and formatting coordinators and designed and produced the illustrations, tables, and other graphics which appear in the pages. They spent time and effort designing and redesigning the graphic layout and producing the camera-ready copy resulting in a set of materials that are easy to use, read, and reference.

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INTRODUCTION TO COURSE MANUALS

Welcome to this B.Ed. Course manual.

Following the accreditation of the B.Ed. by the national accreditation Board with its recognition as a world class teacher education curriculum, the decision was taken to support effective implementation through the development of course manuals. The course manuals provide tutors and lecturers with the materials necessary to support teaching each of the B.Ed. courses. The manuals adhere directly to, and emphasise, the principles and standards set out in the NTS, NTECF and in the B.Ed. and will help ensure operationalising the Government's teacher education reform Policy.

The manuals serve the following purposes:

- they are the key educational agreements between the training institution and the student teachers. In this way student teachers know what the expectations are for them and for the training they will receive.
- they lay out the course outcomes, content, strategies, and assessment, thereby providing direction to and consistency in training and B.Ed. implementation among tutors across the country.
- they are explicit documents that provide other institutions with information on which to base transfer/ articulation decisions.

Specifically, they also:

- support coherent lesson planning and teaching which will enable student teachers to achieve the NTS and become good teachers who ensure all pupils' learning whilst offering tutors the flexibility for adaptation for local needs and contexts.
- Provide a lesson by lesson overview of the course, building on and developing the material in the course specifications.
- Inform tutors, student teachers and others working with student teachers about:
 1. What is to be taught and why.
 2. how it can be taught.
 3. how it should be assessed.
- Provide opportunities for student teachers to develop and apply knowledge during supported teaching in school, creating a strong bond between learning in school and in the training institution.
- Reflect the stage of student teacher development, set out in the model for progress across the four years of the B.Ed.
- Can be used as self-study tools by student teachers.
- Ensure that all information necessary to inform teacher training is in one place (serves as reference document).
- The manuals are the basis of the codes and university professional development sessions to ensure Principals, tutors, lecturers and heads of department are fully familiar with the details of: courses, outcomes, content, approaches, assessments and lessons.

Who are course manuals for:

- College of Education Tutors
- Teacher Education University Lecturers
- Student Teachers
- Mentors and Lead Mentors
- All Those with An Interested In Teacher Education.

USING THIS MANUAL

Writers of the manuals engaged widely with colleagues in each subject area at each stage of development. Besides, writers envisaged themselves in varied contexts as they wrote, to suggest methodologies and strategies for teaching the strands which would ensure student teachers are enabled to achieve the learning outcomes. In view of our commitment to creativity, problem solving, collaboration and to lifelong learning, we expect that individual tutors will “own” their manuals and become user-developers. Lessons in the manuals will be strands for weekly Pd meetings where tutors/lecturers will situate the lessons in the contexts of their colleges and their student teachers, to maximize the benefits.

It is also expected that tutors will model the best pedagogic practices for student teachers. Key among such practices is the communication of the importance of having a personal teaching philosophy. We expect that tutors and lecturers will explicitly communicate their personal teaching philosophies to their student teachers during the first meeting of every course. In preparation for this, we suggest you set out your personal teaching philosophy and how it will be demonstrated in your teaching using, or adapting, the sample sentence introductions below.

My teaching philosophy is

In view of this philosophy, I will facilitate this course by/through

Course Title	Teaching and Assessment in Science for Upper Primary						
Course Code	SCE 321	Level: 300		Credit value: 3		Semester 2	
Pre-requisite	Successful completion of Integrated science for Upper Primary 1 Courses (SCE 211 and SCE 221)						
Course Delivery Modes	Face-to-face <input checked="" type="checkbox"/>	Practical Activity <input checked="" type="checkbox"/>	Work-Based Learning <input checked="" type="checkbox"/>	Seminars <input checked="" type="checkbox"/>	Independent Study <input checked="" type="checkbox"/>	e-learning opportunities <input checked="" type="checkbox"/>	Practicum <input type="checkbox"/>
Course Description	<p>The course for semester two of year two, Preparing to Teach Upper Primary Science, uses the universal design for learning approach to extend basic science concepts in the following content areas: sources of magnetism, digestive system and life of a mosquito. This is done through appropriate pedagogies such as Talk for learning approaches, demonstrations, nature walk, concept mapping, problem-based teaching /learning, and video presentations. Authentic assessment modes such as concept mapping, report writing from field trips and nature walks, and mind maps. The teachers' attention must be focused on the need for equity and the provision for SEN. This course will continue to emphasize on the essential attitudes and values of professional science teaching such as honesty, carefulness, accuracy in all class activities and reports from work-based learning. The student teacher, in this course, will strengthen their portfolio and study the topics in upper primary integrated science curriculum for their practicum. Finally, this course will equip the student teachers with skills to continuously develop their professional teaching portfolio and sets targets for their long-life learning (NTS 1b, p. 12, 1c, p. 12; NTS 2b, 2c, p.13).</p>						
Course Learning Outcomes	Outcomes On successful completion of the course, student teachers will be able to:			Indicators Indicators to show outcomes are achieved			
	1. Demonstrate knowledge in the concept of magnetism, list the properties of magnets and construct an electric circuit to show the flow of current. (NTS 3a, 3h, p14: NTS 2c, 2d, 2e, p13)			1.1 Student teachers are able to use concept maps to present properties of magnet 1.2 Model a sketch of simple electrical circuit.			
	2. Demonstrate adequate knowledge and understanding of the life cycle of mosquito, identify and describe the organs of the digestive system as well as how energy is obtained from food (NTS 3a, 3h, p14: NTS 2c, 2d, 2e, p13)			2.1 Present a chart showing the stages of life cycle of mosquito. 2.2 Present a model showing organs of the human digestive system. 2.3 Provide concept map on functions of the organs of the human digestive system. 2.4 Demonstrate the processes of respiration.			
	3. Plan a 30-minute lesson on <i>sources and effect of heat gain or loss in daily life</i> that ensures that barriers to learning are identified, addressed and overcome and the appropriate assessment processes are applied (NTS 3a, 3h, p14: 2c, 2d, 2e, p13)			3.1. Prepare a 30-minute activity and fun-filled differentiated (inclusive) lesson plan 3.2. Develop appropriate assessment tools for teaching heat loss or gain. 3.3. Devise differentiating activities for special needs/strengths			
	4. Co-plan to teach a motivating, fun-filled, learner-centred lesson (with mentor/peer) on <i>energy</i> so that it extends the learning of all children, no matter their socio-cultural, linguistic background, age, aptitude, strengths and weaknesses with ICT and multimedia with the appropriate use of authentic assessment modes for the lesson (NTS p.14:3a; NTECF p.20. (KG – P6)			4.1. Write an all-inclusive lesson plan 4.2. Develop learner-centred multi-media teaching materials 4.3. Write a lesson plan that indicates appropriate authentic assessment modes for assessing the lesson. 4.4. A list of indigenous beliefs and their corresponding scientific truths			
	5. Exhibit professional and ethical teaching standards to respond to the demands of the community (that is, work with mentor, families and external professionals) to demonstrate values			5.1. Produce reports/photographs on home visits with learners and mentor/ PTAs/ staff meetings 5.2. Produce exhibits/photographs of classroom settings that demonstrate removal of barriers to learning			

		such as critical thinking, patience, precision, accuracy, honesty and orderliness (NTS2f, p.1; NTECF p.42)	5.3. Reports on individual and group work activities 5.4. Produce checklists, Lesson notes, and reflective journals in portfolios 5.5. Produce evidence of Tutor/Mentor reports 5.6. Photographs or real collection of culturally relevant materials for science lessons	
Course Content	Units	Topics	Sub-Topics (if any)	Teaching and Learning activities to achieve learning outcomes
	1	Heat and Magnetism	1.1 Characteristics of magnets and differences between magnet and non-magnet 1.2 Meaning of heat and sources of heat 1.3 Effect of heat loss or gain (expansion, evaporation, contraction, condensation, water cycle)	1.1.1 Engage in practical activities to investigate the characteristics of magnets 1.1.2 Use practical activities to investigate the differences between the terms magnets, magnetic and non-magnetic materials 1.1.3 Brain storm student teachers to come out with the meaning of heat, its sources and its effect on objects 1.1.4 Discuss how heat affect the phases of the water cycle
	2	Life cycle of mosquito	1.2 Stages of life cycle of mosquito	2.4.1 Video/u-tube simulation on the life cycle of the mosquito/practical lab set up to follow life cycle of the mosquito
	3	Digestive system of humans and respiration	3.1 Main organs of digestive and respiratory systems 3.2 Functions of parts of the digestive and respiratory systems	3.1.1 Use of concept mapping to present main organs of the digestive and respiratory organs and their functions 3.2.1 Video/u-tube to study functions of main organs of digestive and respiratory systems
	4	Electrical circuit	4.1 Components of electrical circuits, conductors and insulators	4.1.1 Shower thoughts/discussions on the components 4.1.2 Simulations and multimedia presentations on working electrical circuit.
	5	Co-planned teaching and Assessment	5.1. Co-planning of varied teaching lessons and Assessment modes towards the inculcation of life-long learning practices 5.2. Plan to teach, motivate, assess and extend the learning of all children consistently, no matter their socio-cultural, linguistic background, age, aptitude, strengths and weaknesses 5.3. Co-plan with mentor to deliver challenging, active, fun-filled, learner-centred and motivating lessons with ICT and multimedia (NTS p.14:3a; NTECF p.20. (KG –B9))	5.1.1. Student teachers make lesson plan with well-defined intended outcomes that take into consideration differentiated instruction and assessment for, as and of learning. 5.2.1 Resident tutor to assign tasks for student teachers to provide answers to during their 6-week internship sessions 5.3.1 Discussion of student teachers' reports on assigned tasks

Course Assessment	<p>Component 1: Summative Assessment Practice Summary of Assessment Method: <i>(Note: Choose one of the following for assessment)</i> Quizzes/Exams/ Report writing/Poster/ Presentations/ Professional portfolios Core skills to be acquired: Cognitive, literacy, numeracy, writing and reading Weighting: 40% Assess Learning Outcomes: CLO 1, CLO 2, CLO 3</p>
	<p>Component 2: Formative Assessment Practice Summary of Assessment Method: <i>(Note: Choose one of the following for assessment)</i> Presentations/ Concept Mapping/Practical Activities/ evidence of values learned/Group work/Evidence of equity and inclusivity/transferable skills Core skills to be acquired: Honesty, carefulness, accuracy and tolerance, Weighting: 40% Assesses Learning Outcomes: CLO: 3</p>
	<p>Component 3: Formative Assessment Practice Summary of Assessment Method: <i>(Note: Choose one of the following for assessment)</i> Peer Review evidence of portfolio/lesson plan and annotations/tutorial meetings with the student to discuss their teaching observation progress and areas for development. Core skills to be acquired: Weighting: 20% Assesses Learning Outcomes: CLO4 & CLO5</p>
Instructional Resources	Some resources that would be required to successfully enable an inclusive integrated science teaching would be Laboratory equipment, Chemicals, Smartphones, Tablets, Laptops, Desktop computer, software that allow teachers to work better, Subject based instructional tools/applications, Smart boards, Smart screens, Open ERs – YouTube, projectors and virtual laboratories
Required Text	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J.W., Fometu, E., & Wiredu, M. B. (2008). <i>Ghana Association of Science Teachers Integrated Science for Senior High Schools</i> . Accra: Unimax MacMillan.
Additional Reading List	Abbey, T.K., & Essiah, J.W. (1995). <i>Ghana Association of Science Teachers Physics for Senior High Schools</i> . Accra: Unimax Macmillan. Ameyibor, K. & Wiredu, M. B. (2006). <i>Ghana Association of Science Teachers Chemistry for Senior High Schools</i> . Accra: Unimax MacMillan. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V. & Obeng-Ofori, D. (2011). <i>SWL Integrated Science for Senior High Schools: Students Book</i> . Accra, Ghana; Sam-Woode Ltd. Zumdahl, S. S., & Zumdahl, S. A. (2009). <i>Chemistry</i> . Belmont, CA: Cengage Learning ISBN: 13;978-3311097

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