YEAR 2

SEMESTER 2

Four-Year B.Ed. Course Manual

Teaching and Assessing Mathematics

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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

ACKNOWLEDGEMENTS

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.

Thanks also goes to all T-Tel staff members who worked to support production of these course manuals, particularly Beryl Opong-Agyei and Gideon Okai. Their frankness and co-operative attitude complimented the team approach used to produce this manual.

We are indebted to the Ministry of Education and the Ghana Tertiary Education Commission (GTEC) for the general support and specific helpful advice provided during production of the course manuals. Recognition and thanks must go to Chief Technical Advisor for T-TEL and Policy Advisor to the National Education Reform Secretariat, Akwasi Addae-Boahene, Prof. Mohammed Salifu, the Director General of GTEC and Mr. Jerry Sarfo the coordinator for the colleges of education, who in diverse ways supported during the course manual writing workshops.

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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 Manual Writing Guide

Resources for Course Manual Writing

- Soft copies of the CWG, New Four-Year B.Ed. Curriculum introduction
- Soft and hard copies of the course specifications for the subject for year one and two
- Soft and hard Course Manual Writing Guide (CMWG)
- Relevant subject texts

Target Audience

- College of Education Tutors
  Teacher Education University Lecturers
- Student Teachers
- Mentors

The purpose of course manuals

- To provide a lesson by lesson overview of the course, building on, adapting and developing the material in the course specifications
- To provide a resource to support professional development sessions for tutors/lecturers on how to plan for and teach courses from the New Four-Year B.Ed. Curriculum
- To inform tutors /lecturers, student teachers and others working with student teachers about:
  - what is to be taught and why
  - how it can be taught
  - how it should be assessed
- To support consistency in the implementation of the New Four-Year B.Ed. across institutions who train teachers
- To ensure that all **training** information on skills, processes, and other information necessary to perform the teaching task are together in one place.
- To operationalize the Teacher Education Reform Policy; the requirements of the NTS & NTECF and the Four-Year B.Ed.

Guiding principles of course manual writing

1. They are written with the learner, the student teacher, in mind: what they will *be able* to cope with and only include what student teachers need to know, understand, be able to do and be as a basic school teacher
2. They take in to consideration the learner's, the student teacher's, context and possible barriers to, and enablers for, learning
3. They are written with the tutors /lecturers who are going to teach the course in mind. Tutors must be able to adapt and develop the plans in course manuals to fit the context they are teaching in and to support their teaching
4. They are aligned to the key principles and practices of the Teacher Education Reform Policy: the NTS, the NTECF and the New Four-Year B.Ed.
5. They are written to provide opportunities for student teachers to develop and apply knowledge during supported teaching in school
6. They are written to reflect the stage of student teacher development, set out in the model for progress in the New Four-Year B.Ed.
7. They are written to support progress in student teacher learning, including building on prior learning from the previous programme or course/s and supporting progress to the next course.
8. They are to be used as self-study tools.
9. They are written to have the following characteristics: easy to read; uses active voice and avoids jargon; uses bullet points to offset text; uses images

What a teacher educator needs to know, understand and use to inform what they do

- The aims and structure of the education system and Education strategic Plan
- The Basic School Curriculum
- The Inclusion Policy
- The teacher education system: The National Teacher's Standards, the vision for teacher education and the core principles of the New Four-Year B.Ed.
- Andragogy, effective methods and practices for teaching adult learners
- Assessment Literacy. Assessment for, of and as learning -Educative Assessment

Guidance for completing the course manual writing proforma: two sections

A. Course Information						
Title Page						
i. Course name: as in course specification unless important reason why not						
ii. The vision for the New Four-Year B.Ed. Curriculum						
''To transform initial teacher education and train highly qualified, motivated new teachers who are effective, engaging and fully prepared to teach the basic school curriculum and so improve the learning outcomes and life chances of all learners they teach as set out in the National Teachers' Standards. In doing this to instil in new teachers the Nation's core values of honesty, integrity, creativity and responsible citizenship and to achieve inclusive, equitable, high quality education for all learners. ''						
iii. Course Details: as in course specification unless important reason why not						
Pre-requisite/s	The programme / previous semester courses studied.					
Co-Requisites	Links to other courses being taught, support coherence in student experience and avoid duplication					
Course Level		Course Code		Credit Value	3	
Table of contents						
Each manual will include: 1. The goal for the subject or learning area 2. Course description 3. Key contextual factors 4. Core and cross cutting issues, including equity and inclusion 5. Course Learning outcomes 6. Course content 7. Teaching and learning strategies 8. Course Assessment components 9. Reading and reference list 10. Handouts, power points and other resources for lessons 11. Plans for each lesson in the semester						
A. Course information						
1. Goal for the Subject or Learning Area						
This can be found in subject goal document. It should be a short statement which captures what new teachers will know, understand and be able to do in this subject at the end of their training. This statement should be linked to achieving the vision for the curriculum.						
2. Key contextual factors						
This can be found in the course specification. It should address what needs are to be considered to reflect the Ghanaian context at local and national levels.it includes potential knowledge and skills gaps and any specific: gender, cultural, linguistic, conceptual, infrastructural issues, for example, that might be barriers to learning for student teachers and eventually basic school children? E.g. issues of subject related bias that need addressing. Potential barriers to learning must be explicitly addressed to enable student teachers to achieve the learning outcomes.						
3. *Course Description*						
This can be found in the course specification. This brief statement should provide a clear understanding of what studying this course involves, what student teachers will get out of studying this course.						
4. *Core and transferable skills and cross cutting issues, including equity and inclusion*						
This can be found in the course specification. Which core and transferable skills or cross cutting issues will be applied or developed through this course? This needs to be made explicit to student teachers. Are there specific issues to do with equity and inclusion which must be addressed so that all student teachers can fully take part? For example, issues related to gender and mathematics or science.						
5. Course Learning Outcomes			***6. Learning indicators***			
These are in the course specification. The course learning outcomes should specify the expectations of what the student teachers will know, understand and be able to do at the end of the course ***not*** what student teachers will do **on** the course. They must be appropriate and realistic to the learner's abilities, experience, the identified level of the course and *content.* They must be measurable – allowing assessment of student teacher achievement			• Measurable/assessable/observable performances that provide evidence of learning or other changes taking place in student teachers' behaviour which demonstrate that they have met the learning outcome/s. • What the student teacher will need to do to show they have achieved the learning outcome. (in an inclusive lesson, this should vary and be responsive to student teacher's individual characteristic)			

7. Course content

In the course specification. This should provide an outline of the academic and / or practical content of the course. It should be clear how this content relates to the achievement of the intended learning outcomes. The name of each unit in the course should be *briefly* set out – the name should make it clear what the unit is about.

Unit	Topic	Sub-topic (If any)	Teaching and learning activities to achieve the learning outcome

8. Course Assessment Components

In the course specification. The NTS and the NTECF require a move away from largely examination-based assessment to strategies to enable assessment of student teachers' skills, knowledge and understanding against the learning outcomes and through these the against the NTS

- There should be a maximum of 3 assessment components per 3 credit-course; to avoid over loading student and tutors/ lecturers
- The learning outcomes to be assessed by each assessment component should be identified.
- Each assessment component should explicitly reference the NTS or aspects of the NTS it will assess.
- Each assessment component should include:
  - The category or type, for example: written, coursework or practical, teaching, examination, collaborative project or presentation, poster, TLM
  - The type of assessment: of, for and /or as.
  - An indication of the size of each assessment component (e.g. duration of exams, word limit of written submissions, length of presentations; whether presentations have an individual or group etc.).
  - The weighting of each assessment component should be expressed as a % of total course mark (overall in each course: 60% continuous assessment of course work, 40% examination of course work).
- Each assessment should be manageable and relevant to supporting the student teachers' development.

The guidance on assessing student teachers from the NTS, the NTECF the CWG and the New Four Year B.Ed. should be used.

9. Teaching and learning strategies

Detail in this section should show how the total learning hours will be used to achieve the intended learning outcomes, to provide a guide to the teaching and learning strategies to be used. Each teaching strategy should be selected as most appropriate to achieving the learning outcomes. This may include team teaching or additional tutors. As stated in the B.Ed. experiential learning and interactive teaching approaches are encouraged

10. Required Reading and reference list

One or two compulsory texts which must be made available to the student teachers and a SHORT list of 5 relevant references. These lists should be annotated with the key value of each text. Use APA style of writing.

11. Teaching and Learning Resources

Instructional resources required to support learning during the course e.g.: TLMs, lab and workshop equipment, videos, projectors

Course related professional development for tutors/ lecturers

This is not included the course manual but professional development needs must be identified to ensure all tutors / lecturers are prepared to teach the course identify any specific topics or issues which may be challenging for tutors / lecturers.

B. Semester lesson plans

Guidance for Lesson planning

The expanded format is ddesigned to support writing lessons which address the key features of the new B.Ed. curriculum

The completed format will be an important piece of evidence for CoE in being awarded **Transitional Support Funding (TSF)**

Things to consider when writing and reviewing lessons:

- Will all student teachers be able to achieve the learning outcomes and demonstrate the indicators by undertaking the activities set out in the lesson?
- What might be barriers to learning? How can you address these barriers?
- How does the lesson support progress in and or consolidate student teacher learning; including building on prior learning and supporting progress to next lessons?
- How will you can address transition from school to CoE in the first semester?
- Are there explicit links between learning outcomes, learning indicators and assessments?
- Do all activities support student teachers in achieving the lesson learning outcomes?
- Is there an emphasis on interactive, learner focused approaches to training new teachers?
- Does it explicitly address cross cutting -issues: equity and inclusion, gender, SEN, ICT?

- Does it explicitly develop core skills, including: professional values and attitudes, classroom enquiry and reflection?
- Overall the lesson must be 'do-able' for the student teacher
    - in the time available
    - with the skills, knowledge and understanding they have

Title of Lesson **Lesson Duration**							
Lesson description	**It is essential that student teachers know what this lesson is about. The lesson description should be short, clear, and accessible to all students.**						
Previous student teacher knowledge, prior **learning (assumed)**	• What links to previous knowledge / prior learning need to be built in to the lesson? • Prior learning could be from: this course and previous lessons; from senior high school; from supported teaching in school/practicum; from other courses. NB important to build on work from previous lessons • If you are unsure about previous knowledge or prior learning how you need to check for this as part of the activity in the lesson/s. If the expected prior knowledge is not adequate you will need to modify the lesson.						
Possible barriers to learning in the lesson	• What specific conceptual, linguistic, social, cultural, conceptual, gender, or ability related issues might stop student teachers in achieving the learning outcomes; act as barriers to their learning? • How will you address these? • Does this lesson require that student teachers examine their own bias? If so, you will need to plan to support and address this						
Points on equity, inclusivity (gender, SEN), and addressing diversity	• You need to represent and address diversity in your lesson-plan. Are there multiple diversity issues (see diversity wheel)? • How would these issues be addressed with student teachers during activities for both their own learning and the learning of the students they will teach? • How are issues of diversity (equity and inclusion) addressed in your lesson plan so that student teachers can see diversity modelled during this teaching and learning activity? • How are issues of diversity (equity and inclusion) addressed in your lesson plan so that student teachers can learn how to address it with the students they will teach? • For example: gender stereotype issues related to: PE, literacy and language, science and mathematics.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face**	**Practical Activity**	**Work-Based Leaning**	**Seminars**	**Independent Study**	**e-learning opportunities**	**Practicum**
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Work based learning:** to allow students to undertake observation, enquiry and/or hands-on development work (mostly TVET) **Seminars:** to generate group and individual creativity, discussion and reflection: student and / or tutor led **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities* –** involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right. **Practicum (supported teaching in school):** support to enable student teachers to experience and learn from the basic school context by doing observations and child study in Y1 to full class teaching in and action research in Y4.						
• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.**	• What is the main thing you want student teachers to know, understand and be able to do as a result of this lesson? • Is this lesson aimed at: Learning or embedding a new concept? Developing a skill? Understanding how various concepts and skills come together to create a body of knowledge? Practicing the application of new knowledge? • This will relate back to the overall intention and learning outcomes for the course.						

<table>
<tr><td>• Write in full aspects of the NTS addressed</td><td colspan="4"></td></tr>
<tr><td>• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td colspan="2">Learning Outcomes
• The learning outcomes for the lesson will enable student teachers to achieve the purpose for the lesson.
• For example, in mathematics: student teachers are prepared to teach a specific mathematics operation. In this instance, the learning outcomes would be the things the students would need to know and do in order to be able to teach the operation.
• What the student teacher will know and be able to do as a result of this lesson. ‘By the end of the lesson the student will….’
• Learning outcomes may be developed and re-visited over a number of lessons
• Be realistic in terms of what can be achieved in any one lesson
• Some learning outcomes may address specific student teacher needs</td><td colspan="2">Learning Indicators
• Measurable/assessable/observable performances that provide evidence of learning or other changes taking place in student teachers’ behaviour which demonstrate that they have met the learning outcome/s.
• What the student teacher will need to do to show they have achieved the learning outcome. (in an inclusive lesson, this should vary and be responsive to student teacher’s individual characteristic)</td></tr>
<tr><td rowspan="2">Content of lesson picked and developed from the course specification

Unit/s covered from the course specification:</td><td>Time or stage
Identify how much time will be required for each part of the lesson</td><td>Topics and sub-topics (if any):</td><td colspan="2">Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study</td></tr>
<tr><td></td><td></td><td>Teacher Activity</td><td>Student Activity</td></tr>
<tr><td></td><td></td><td></td><td>• Plan to model what is expected of student teachers
• Plan for activities to support student teachers in working towards and / or demonstrating achieving the learning outcomes.
• Where possible set up activities with students as active participants
• Make links to other aspects of the New Four-Year B.Ed. programme or between subject and pedagogic knowledge
• State if team teaching involved or additional tutors contributing</td><td>For example: Interactive and collaborative group and pair work, e.g.,
• identifying, developing, presenting and evaluating suitable resources and materials
• picking out key points from education texts, raising questions and issues
• sharing practice and experience
• preparing for school visits
• self and peer assessment
Other examples
• Student teacher led seminars
• ICT e.g. discussion using VLE
• Video observation of and analysis of teaching
• Role-play</td></tr>
<tr><td>Which core or transferable skills will be used or developed and how</td><td colspan="4">Core and transferable skills include: critical thinking, problem solving, social skills, creative thinking and communication skills, use of ICT</td></tr>
<tr><td>Which cross cutting issues will be addressed or developed and how</td><td colspan="4">Cross cutting issues include: assessment literacy and assessing students’ progress and professional values and attitudes, reflection and classroom enquiry</td></tr>
</table>

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Assessment as learning: ongoing self-assessment by student teachers reflecting on their own learning and making adjustments so that they achieve deeper understanding, occurs throughout the learning process. *This needs to be planned for in the lesson*. • Assessment of learning: is usually summative and is mostly done at the end of a task, unit of work, placement etc. Weighted Assessment Components in course outlines. *This needs to be planned for in the lesson*. • Assessment for learning: is using assessment as a means of finding out what students know, understand and are able to do and using that information to adapt teaching approaches and to differentiate according to different student needs, it occurs through the learning process, may be part of the Assessment components, and it occurs when assessing prior learning • Differentiation in lessons (UDL guidelines): the lesson needs to include a range of teaching and assessment strategies to motivate and reach all learners • The approach to assessment in lessons must be appropriate to the teaching and learning strategies
Instructional Resources	This may include: handouts, power points, examples of children's work, video, ICT activities, examples of previous student teachers' work
Required Text (core)	
Additional Reading List	

Lesson 1

Year of B.Ed.	2	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	The Mathematics Curriculum	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and understanding of the current upper primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge and skills to analyse the similarities and differences between the standard-based curriculum and the objective-based curricula. Emphasis will be placed on the effectiveness of which the curricula support children's learning of mathematics. The lesson will help student teachers to develop their capability in creating accessible, safe, secure, and happy learning environment for middle childhood children including those with special education needs. In addition, student teachers will explore evidence of assumptions on equity and inclusivity in the official mathematics curriculum and how teachers are supported to improve current classroom practice.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and theories in the learning of mathematics in Upper primary, as well as, Learning, Teaching, and Applying Number and Algebra.		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ☒	Practical Activity ☒	Work-Based Leaning ☐	Seminars ☐	Independent Study ☒	e-learning opportunities ☒	Practicum ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.**	The purpose of the lesson is to; • equip student teachers with knowledge of the nature and structure of a good mathematics curriculum and skills to analyse the similarities and differences between the standard-based curriculum and the objective-based curricula.		
• **Learning Outcome for the lesson, picked and developed from the course specification** • **Learning indicators for each learning outcome**	**Learning Outcomes**	**Learning Indicators**	**Identify Which cross-cutting issues-core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?**
	• Demonstrate knowledge and understanding of key definitions of curriculum offered by different authors;	• Outline and analyse the different definitions of curriculum based on different views and to come out with differences and similarities	• Communication skills: through critiquing and analysing presentations
	• Demonstrate knowledge and understanding of key philosophies and goals of the current upper primarymathematics curriculum	• Outline the major philosophies underlying the current standard–based upper primarymathematics curriculum and the goals to be achieved as compared to the objective-based curriculum	• Ethics and values of teaching: through supporting student teachers to understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of young children
	• Demonstrate the core and transferrable skills like problem solving and creativity and taking advantage of the affordances of ICT integrating it into teaching and learning **(NTS**	• Use knowledge gained from learning theories in mathematics to design appropriate problem-solving tasks.	• Problem solving, critical and creative thinking: through objective analysis of facts and concept that will lead to creative thinking
	• Demonstrate an understanding of the principles for the selection of objectives; selection of concepts; selection of learning activities/experiences and developmentally appropriate TLMs	**Poster/TLM** • Identify and describe the principles for the selection of objectives; selection of concepts; selection of learning activities or experiences and developmentally appropriate TLMs	• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS

Topic T	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
The mathematics curriculum	What is curriculum? Standards-based versus objective-based curriculum Choosing aims and competencies mathematics learning	**3 Hours**	Introduce student teachers to the course manual for them to develop awareness of the nature and demand of the course as well as what is expected of them Engage student teachers in a brainstorming session to outline meaning and different views of the concept of curriculum; Orchestrate a discourse based on the meaning of curriculum by posing questions and tasks that elicit, engage, and challenge each student teacher's thinking; Give a verbal exposition on the nature and structure of the current standards-based and objective-based curricula Ask student teachers to clarify and justify their ideas orally and in writing Provide copies of the official KG-P3 curriculum (NACCA) for student teachers to analyse Monitor student teachers' participation in discussion based on factors that influence the choice of aims and competencies of a mathematics curriculum Encourages each student teacher to participate in Assign student teachers to write on what a good mathematics curriculum is. ***(PD Themes 1 & 3)***	Participate in the discussion based on the introduction of the course manual by asking questions and giving comment; Participate in the brainstorming session to outline their conceptions of curriculum to the best of their knowledge; Search the definition(s) and meaning of curriculum on the internet and to discuss their findings in small groups Engage actively in the discourse to answer questions posed and to explain or justify their responses; Listen attentively to the verbal exposition and ask questions for clarification or provide comment(s) to ensure participation and understanding of the nature and structure of the current standards-based and objective-based curricula; Engage in a think-pair-share session to clarify and justify their ideas orally and in writing Examine the official KG-P3 curriculum (NACCA), analyse critically, and outline the aims and required competencies that is required of the learners Outline the differences and similarities between NACCA's standards-based and CRDD's objective-based curricula for upper primarymathematics; Discuss the factors that affect the choice of aims and competencies of a mathematics curriculum

				Write a reflective paper on the topic "what is a good mathematics curriculum for upper primarypupils?

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: reflective paper presentation** Student teachers to write a reflective paper on the features of a good upper primarymathematics curriculum,Outline and analyse the different definitions of curriculum based on different views, come out with differences and similarities, as well as the major philosophies underlying the current upper primarypupils'mathematics curriculum.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 1a) Critically and collectively reflects to improve teaching and learning. 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* *3l) Listens to learners and gives constructive feedback* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*Group and individual presentation) Identify and describe the principles for the selection of objectives, concepts and learning activities or experiences, using variety of resources including ICT tools. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(class exercise)* Outline the similarities and differences between NaCCA's standards-based curriculum and CRDD's objective-based curriculum. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity*.
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html.
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.

CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using the "Read my mind" word games to reinforce concept developed) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule;

Lesson 2

Year of B.Ed.	2	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Counting and Number Relationships						Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and conceptual understanding of counting and number relationships as treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of number relationships in upper primary children. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include counting, representing numbers in multiple ways in both English and a Ghanaian languages and number relationships Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.							
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and theories in the learning of mathematics in Early Grade. They have also studied Number and Algebra, the Year one Semester One course. The lesson on Mathematics curriculum has also exposed them to the nature of the current early grade mathematics curriculum.							
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.							
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☐	**e-learning opportunities** ☒	**Practicum** ☐	
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.							

• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.**	The purpose of the lesson is to; equip student teachers with the knowledge and understanding needed to handle the content of the early grade mathematics, specifically, concepts based on counting and understanding of number relationships and to devise possible strategies to address potential deficiencies that can serve as barriers of effective learning by all young children.		
• **Learning Outcome for the lesson, picked and developed from the course specification** • **Learning indicators for each learning outcome**	**Learning Outcomes**	**Learning Indicators**	**Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?**
	• Demonstrate knowledge and understanding of how early adolescents grow, develop and learn number concepts and other mathematics concepts in the upper primary curriculum (**(NTS, 2b)**	• Identify and justify the appropriateness or situational favourableness of the various uses of numbers and their operations.	• Ethics and values of teaching: demonstrate the ethics of the profession bearing in mind the unique characteristics of middle childhood child, Teachers' Standards, child's rights, laws protecting children
	• Demonstrate competencies in using differentiated instructional strategies, with a focus on a thematic approach which promotes play-based learning to cater for the needs of all children in the early grade classroom, including those with SEN **(NTS 3f, pg. 14)**	• Outline and analyse strategies young children use in developing pre-number concepts such as classification, ordering (seriation), patterning, one-to-one correspondence, and conservation of number. • Outline how the knowledge and understanding of the pre-number concept influence children's understanding of counting and number relationships.	• Needs of the student teachers: Consciously identify and address the needs of student teachers and to inspire them for effective transfer of knowledge • Problem solving, critical and creative thinking: through objective analysis of facts and concept that will lead to creative thinking
	• Demonstrate knowledge and understanding of how communication promote early adolescents' development and use of number concepts such as cardinal, ordinal, and nominal;	• Identify and describe the basic principles underlying the cardinal, ordinal, and nominal uses of number and to develop effective communicative skills needed for engaging young learners in a mathematics discourse.	• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS • Communication skills: through critiquing and analysing presentations

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Counting and Number Relationships	Counting and representing numbers in multiple of waysin both English and a Ghanaian language	**3 Hours**	Engage student teachers in a review of the previous lesson to ensure a smooth transition from discussing the nature and structure of the curriculum and looking at the development of content knowledge and pedagogical content knowledge of counting and number relationships. Engage student teachers through mental drills to serve as a starter for the lesson, using skip counting forwards and backwards from given numbers. Assign student teachers to groups based on different cultural backgrounds to explore socio-cultural activities in their various settings and outline the implicit use of number in the nominal sense in such activities (e.g., using numerals to identify certain cultural troupes Ask student teachers to count in both English language and some Ghanaian languages Ask student teachers to define the term number and numeral and establish their differences React to the definitions and interpretations of number and numeral given by student teachers. Engage student teachers to match and assign numbers to given groups of objects (fingers, number cards, numeral cards, etc.)	Participate in the review of the previous lesson to ensure a smooth transition from discussing the nature and structure of the curriculum, by asking questions and/or providing insight into issues relating the nature and structure of the curriculum and the development of competencies in planning and teaching concepts based on counting and number relationships. Participate in the warm up exercise to prepare them for the lesson ahead. Form groups based on their different cultural backgrounds to explore socio-cultural activities in their various settings and outline the implicit use of number in the nominal sense in such activities (e.g., using numerals to identify certain cultural troupes). Count or compare groups of up to 9 objects and then up to 19 objectsin various ways using both English language and some Ghanaian languages Define the term number and numeral and establish their differences and ask question(s) for clarification Match and assign numbers to given groups of objects (fingers, number cards, numeral cards, etc.) Skip count to 1000 by 2s, 5s, 10s,

			Assign student teachers to skip count to 1000 by 2s, 5s, 10s, 25s and 100s, starting at a multiple of these numbers, using a number chart Initiate and facilitate a discussion on how numbers can be represented in different ways	25s and 100s, starting at a multiple of these numbers, using a number chart Participate actively in the discussion based on the different representations of given numbers Engage actively in the discourse to answer questions posed and to explain or justify their responses;
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: reflective paper presentation** Student teachers to write a reflective paper on how to match and assign numbers to given groups of objects using appropriate TLMs and other relevant materials.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 1a) Critically and collectively reflects to improve teaching and learning. 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* *3l) Listens to learners and gives constructive feedback* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*Group and individual presentation) Student teachers to write short lesson plan for teaching numbers and numerals for peer review. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(class exercise)* Assign student teachers to write short notes on how to establish the relationship between numbers and numerals. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-			

	d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html.
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using the "Read my mind" word games to reinforce concept developed) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule;

Lesson 3

Year of B.Ed.	2	Semester	2	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Place value 10 to 1,000	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and conceptual understanding of place valueas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of counting and representing numbers in multiple ways including place valuein both English and a Ghanaian languagesamongupper primary children. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about place values and create classroom environment that nurtures number sense. Specific areas to be covered include counting, representing place values in multiple ways amongupper primary childrenMost essentially, and they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, as well as, counting and number relationships.		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ☒	Practical Activity ☒	Work-Based Leaning ☐	Seminars ☐	Independent Study ☒	e-learning opportunities ☒	Practicum ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="4">The purpose of the lesson is to;
• equip student teachers with the knowledge, skills and strategies for promoting understanding of number relationships in early grade children.(NTS 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes
• devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense.
(NTS
2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in.
3k) Integrates a variety of assessment modes into teaching to support learning</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td colspan="2">Learning Indicators</td><td>Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>• Demonstrate knowledge and understanding of principles of counting and representation of numbers in multiple ways (both English and a Ghanaian language)
• Demonstrate the development of number concepts and other mathematics concepts in the upper primary level
• Demonstrate skills in identifying traits of professionalism in school using knowledge and experiences gained from interacting with your peers during lessons and group work and subsequently make appropriate journal entries (NTS, 1d, 1f, 1g, & 2a</td><td colspan="2">• Outline and analyse how repeated opportunities to proceed from concrete manipulation to pictorial and symbolic representation of numbers can be developed.
• Identify, explain, and/or analyse the principles underlying counting and use this to describe given numbers and the relationships between the
• Identify numbers in different positions around a given number and to describe the relationships between such quantities or numbers;
• Provide SRJ recordings of professional values demonstrated and attitudes during engagements with people including pupils, mentors, tutors, and peers</td><td>• Problem solving, critical and creative thinking:through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary.
• Communication skills: through critiquing and analysing presentations
• Problem solving, critical and creative thinking: through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary.
• Ethics and values of teaching: demonstrate the ethics of the profession bearing in mind the unique characteristics of middle childhood child, Teachers' Standards, child's rights, laws protecting children</td></tr>
<tr><td>Topic Title</td><td>Sub-topic(s)</td><td>Stage/ Time</td><td colspan="2">Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.</td></tr>
<tr><td></td><td></td><td></td><td>Teacher Activity</td><td>Student Activity</td></tr>
<tr><td>Place value 10 to 1,000</td><td>Counting and representing numbers in multiple ways including place valuein both English and a Ghanaian language</td><td>3 Hours</td><td>Review the previous lesson on counting and number relationships</td><td>Participate in the review by asking questions and commenting on relevant issues;</td></tr>
</table>

			Engage student teachers in a warm up activity that is relevant to the lesson to serve as a starter for the lesson, e.g., a place value game. Assign student teachers to design a place value chart or any relevant TLM to explore concepts on place value Assign student teachers in their collaborative groups to identify and explain place value concepts that are relevant for the development of mathematical ideas at the upper primary level Orchestrate discussion based on the physical representation of numbers in multiple ways, for example, group objects to illustrate the number of hundreds, tens, and ones in a given number Lead a discussion on strategies for selecting appropriate models to represent given numbers. Provide copies of the official P4-P6 curriculum (NACCA) for student teachers to analyse how place value concepts are developed ***(PD Themes 1 & 3)***	Play a place value game and/or any relevant games they are familiar with and are related to the lesson; Design place value chart based on using base ten structured materials i.e. 100s, 10s and 1s, (bundled/loose sticks; a flat, long, and unit lego-blocks; flat, strip and loose square cut-outs; etc.) using both English and a Ghanaian language for exploring concepts involving place value Identify and explain place value concepts that are relevant for the development of mathematical ideas at the upper primary level, for example, describing the place values of digits in given numbers Engage in a think-pair-share session to clarify and justify their ideas orally and in writing, for example, express numbers less than 100 as "so many" tens and "so many" ones as well as, numbers greater than 100 but less than 1000 as "so many"hundreds, "so many" tens, and "so many" ones Pay attention to the exposition and ask questions for clarity. Use manipulatives and other relevant TLMs to model and explain the place value concept Examine the official P4-P6 NACCA curriculum and analyse critically how place value concepts are outlined and to provide instructional procedures and activities that support the development of place value concepts

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: reflective paper presentation** Assign student teachers to outline the differences and similarities between NaCCA's standards-based and CRDD's objective-based curricula with respect to place value concepts.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) Assign student teachers to use manipulatives and other relevant TLMs to model and explain the place value concept. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(class exercise)* Assign student teachers to write short notes on how to establish the relationship between numbers and numerals. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters number charts; ten frames, video clips downloaded from the internet; tape measure
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html.
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure and other relevant low cost or no cost materials to develop number relationships;

Lesson 4

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Addition of numbers within 99and then numbers within 999	**Lesson Duration**	**3 Hours**
Lesson description	This lesson focuses on developing knowledge and conceptual understanding addition of numbers within 99and then numbers within 999as treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of addition of numbers within 99and then numbers within 999. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include 1-digit, 2-digit and 3-digit addition as putting together and counting on; mentalstrategies -composing numbers, constant difference, decomposing numbers, etc.;.Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, as well as, counting and number relationships.		
Possible barriers to learning in the lesson	• Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. • Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. • Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary • The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. • Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. • Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. • Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☒	**e-learning opportunities** ☒	**Practicum** ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="3">The purpose of the lesson is to;
• equip student teachers with the knowledge, skills and strategies for representing numbers in multiple ways including place value.
• devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td>Learning Indicators</td><td>Identify Which cross-cutting issues-core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>• Demonstrate knowledge and understanding of models and interpretations of addition of 1-, 2 and 3-digit numbers;

• Demonstrate knowledge and understanding of how place value permits efficient representation of whole numbers and the development beginning number sense

• Demonstrate knowledge and understanding of how communication promotes young children’s development and use of place value concepts</td><td>• Explain and illustrate with appropriate models (bundles of tens and hundreds, tens and ones), the meaning of each digit in given multi-digit numbers;

• Explain why the value of a digit depends upon its placement within a numeral;

• Decompose numbers up to 1,000 into 100s, 10s, and 1s, in multiple ways (e.g., 600 = 100 +100 + 100 +100 +100 + 100 or 300 + 200 + 100, etc.,)

• Compare numbers up to 1,000 with similar digits but different values (769 versus 967) and numbers which are completely different (796 versus 456)

• Identify, explain, and/or analyse the principles underlying the place value concept (that the value of each place is ten times as the value of the next place to the right)</td><td>• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS

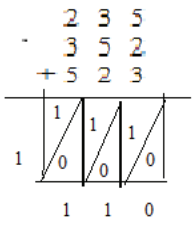
• Communication skills: through critiquing and analysing presentations

• Problem solving, critical and creative thinking: through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary

• Digital literacy: Surfing the internet for relevant information on curriculum terminologies.

• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS</td></tr>
</table>

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Addition: numbers within 99; and then numbers within 999	1-digit, 2-digit and 3-digit addition as putting together and counting on Mentalstrategies - composing numbers, constant difference, decomposing numbers, etc.;	**3 Hours**	Engage student teachers in a review of the previous lesson on place value Engage student teachers in a warm up activityinvolving identification of numbers in different positions around a given in a number chart Engage student teachers in an interactive, fun activity involving addition of whole numbers. For example, ask student teachers to give any three-digit number, transpose the number in two ways to have three 3-digit. The activity is based on finding the sum of the three numbers before doing the actual computation. Thus, if a student teacher mentions 235, the other two transposed numbers will be 352, and 523, in such a way that none of the digit will be in the same position to obtain 2 3 5 3 5 2 +5 2 3 11 1 0	Participate in the review based on place value Demonstrate mental additionstrategies (sums within 99 and then sums within 200) Participate in an activity to identify numbers in different positions around a given number in a number chart  For example, the number to the right of 750 is 800, below 750 is 1,050; to the left of 750 is 700; on top of 750 is 450. What are the numbers around 550 in the various positions? Participate in in the interactive, fun activity involving addition of whole numbers. For example, ask student teachers to give any three-digit number, transpose the number in two ways to have three 3-digit. The activity is based on finding the sum of the three numbers before doing the actual computation Work out more examples in their collaborative groups and to establish the principles underlying the fun activity.

			Assign student teachers to use manipulatives to demonstrate addition as putting together; and addition as counting on, involving decomposition and composition of numbers to be submitted later for peer review Ask student teachers to solvesimple addition of everyday addition problems using 'counting on strategies Lead a discussion on strategies for selecting appropriate models for adding whole numbers using knowledge and understanding of place value. Assign student teachers to analyse the official P4-P6 curriculum (NACCA) how concepts based on addition of whole numbers are developed ***(PD Themes 1 & 3)*** Use an exposition to introduce the addition of whole numbers using lattice addition strategy, e.g.,  This shows that the lattice addition strategy gives the same result.	Use manipulatives to demonstrate addition as putting together; and addition as counting on involving decomposition and composition of numbersto be submitted later for peer review Act out a simple addition situation and apply 'counting on strategies to model an addition and solve a simple, everyday addition problems within 20. Listen attentively to the verbal exposition and ask question for clarification or provide comment(s) to ensure participation and understanding of the nature and principles underlying the addition of whole numbers Analyse the official P4-P6 curriculum (NACCA) how concepts based on addition of whole numbers are developed. Read further on the the differences and similarities between the standards-based and objectives-based curricula based on place value concepts Pay attention to the exposition meant for the introduction of addition of whole numbers using the lattice addition strategy. Ask questions and/or give comments to enhance understanding. Work more examples in groups for consolidation

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** Student teachers are assigned to outline different strategies for solving problems based on everyday addition such as 'counting on'andlatticestrategiesand to justify its usefulness or otherwise .(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) • Assign student teachers to use manipulatives and models to demonstrate addition as 'putting together' and 'counting on', involving decomposition and composition of numbers to be submitted later for peer review. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(class exercise)* Assign student teachers to outline and analyse the various mental additionstrategies for sums within 99 and then sums within 200. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html.
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use the lattice addition strategy for solving problems in addition of whole numbers

Lesson 5

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Classroom assessment in mathematics in the Upper Primary 1	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and conceptual understanding assessment as treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of addition of assessment in the Upper Primary level. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include syllabus guidelines for classroom assessment and Effective assessmentskills. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, as well as, counting and number relationships and place value.		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ☒	Practical Activity ☒	Work-Based Leaning ☐	Seminars ☐	Independent Study ☒	e-learning opportunities ☒	Practicum ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="3">The purpose of the lesson is to;
equip student teachers with the knowledge, skills and strategies for representing numbers in multiple ways including place value.
devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td>Learning Indicators</td><td>Identify Which cross-cutting issues-core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>Demonstrate understanding of syllabus guidelines for classroom assessment and skills of effective assessment for teaching mathematics in the specialism including design an assessment tool with the rubrics [NTS 2b, 3l, 3m].

Value as well as respect equity and inclusivity in the mathematics classroom by [NTS, 1f];</td><td>• Explain syllabus guidelines for classroom assessment for learning (AfL), assessment of learning (AoL) and assessment as learning (AaL)
• Explain the steps and strategies involved in designing a good assessment tool
• Design an assessment tool with the rubrics for assessing mathematics learning in upper primary
• Design and implement appropriate remediation in upper primary (i.e. Do action research)
• Appreciate the contributions of, and supports, colleagues in the mathematics classroom.
• Cooperate with colleagues in carrying out mathematics tasks.
• Engage in reflective thinking about how mathematics was taught in student teachers basic school days.</td><td>• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS
• Communication skills: through critiquing and analysing presentations
• Assessment literacy: through modelling of effective assessment strategies and record keeping
• Assessment literacy: through modelling of effective assessment strategies to deal with remediation
• Respect and diversity: designing lesson for diverse learners with different learning styles
• Personal development: through collaborating with peers in the development and presentation of tasks
• Equity and inclusivity: Providing equitable learning opportunities for all learners</td></tr>
</table>

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Classroom assessment in mathematics in the Upper Primary 1	Syllabus guidelines for classroom assessment Effective assessmentskills	**3 Hours**	Engage student teachers in a discussion based on their past experiences about examinations; Examine student teachers' conceptions of assessment and give feedback Assign student teachers to examine guidelines on classroom assessment in the old and current upper primarylevel mathematics curricula; Give a verbal exposition on purposes of different forms of assessment (e.g., assessment for learning, assessment of learning, and assessment as learning) in mathematics learning in upper primary level; Assign student teachers to search on the internet for detailed information on the features of effective assessment ***(PD Themes 1 & 3)***	Participate in the discussion by giving their past experiences on B.E.C.E, WASSCE, and other relevant examination; Provide responses based on the questions posed and react to feedback. Study the old and current early grade mathematics curricula for guidelines on classroom assessment; write and present a short report on how effective assessment influence learning of upper primary level mathematics in small groups Pay attention during the exposition and participate by asking questions and giving comments; outline the similarities and difference among the forms of assessment (e.g., assessment for learning, assessment of learning, and assessment as learning) in mathematics learning in upper primary level; Do internet search on the features of effective and outline assessment strategies and to discuss the implications of this in classroom instruction;
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** • Assign student teachers to write a reflective paper based on the similarities and differences among the forms of assessment and their implications for classroom practice.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners			

	whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) Student teachers are assigned to Identify and explain the various forms of assessment and their respective features. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* Assign student teachers to outline some content and lifelong learning standards and their relevance to educational assessment standards in terms of planning and delivery of instruction. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 6

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Classroom Assessment of Mathematics in the Upper Primary	**Lesson Duration**	**3 Hours**
Lesson description	This lesson focuses on developing knowledge and conceptual understanding assessment as treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of addition of assessment in the Upper Primary level. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include design and use of assessment tools and the rubrics.Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity. Most essentially, the lesson will provide opportunities for student teachers to explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity to promote effective learning of mathematics in the upper primary and to people them for STS acuities.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☒	**e-learning opportunities** ☒	**Practicum** ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities* –** involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="5">The purpose of the lesson is to;
explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity to promote effective learning of mathematics in the early grade.</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td colspan="2">Learning Outcomes</td><td colspan="2">Learning Indicators</td><td>Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td colspan="2">Demonstrate knowledge and understanding of forms and features of assessment;

Demonstrate knowledge and understanding of the changing face of educational assessment, as well as, appreciation for important part of the educational assessment standards for planning and delivery of instruction</td><td colspan="2">• Identify and explain the various forms of assessment and their respective features;
• Outline similarities and differences among the forms of assessment and their implications for classroom practice;
• Identify and explain factors that have contributed to the changing face of educational assessment ;</td><td>• Assessment literacy: through modelling of effective assessment strategies and record keeping
• Assessment literacy: through modelling of effective assessment strategies to deal with remediation
• Communication skills: through critiquing and analysing presentations</td></tr>
<tr><td rowspan="2">Topic Title</td><td>Sub-topic(s)</td><td>Stage/ Time</td><td colspan="3">Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.</td></tr>
<tr><td colspan="2">Teacher Activity</td><td>Student Activity</td></tr>
<tr><td>Classroom assessment in mathematics in the Upper Primary 2</td><td>Design and use of assessment tools and the rubrics.</td><td>3 Hours</td><td colspan="2">Review the lesson based on the forms of assessment

Engage student teachers in a discussion based on the features of different types of assessment tools;

Give a verbal exposition on how to plan, design, and develop different types of assessment tools

Assign student teachers to search on the internet for detailed information on the strategies for developing assessment tools for children in the upper primary level

Model how to plan, design, and develop assessment tools for the upper primary level</td><td>Participate in the review by asking questions and commenting on relevant issues;

Contribute to the discussion by asking questions and commenting on issues based on the features of various types of assessment tools;

Pay attention to the verbal exposition verbal exposition and ask question for clarification or provide comment(s) to ensure participation and understanding of how to plan, design, and develop different types of assessment tools

Search the internet for types and strategies for developing assessment tools for upper primary level</td></tr>
</table>

			Assign student teachers to write sample questions (items) and to facilitate a self-correcting and self-monitoring session; ***(PD Themes 1 & 3)*** Ask student teachers to begin informal discussions withupper primary teachers in their STS schools about how they plan, design, and develop assessment tools; Assign student teachers to design a performance task to assess specific content and lifelong learning standards, with emphasis on requiring them to locate and analyse information as well as draw conclusions about it; Lead student teachers in an interactive practical-based activity to learn how to design reflective journals and portfolio and to discuss the purposes of a portfolio Engage student teachers to search the internet for definitions of evaluation and explore stages in the assessment process Discuss with student teachers how to use judgments in making decisions and preparing reports; Lead a discussion on how to provide opportunities for upper primary children to monitor and evaluate their own learning	Participate in the session for planning, designing, and developing appropriate assessment tools for early grade learners and discuss the purpose and format of types of assessment tools, as well as test blue print and how it is used to plan, design, and develop classroom assessment tasks for upper primary level Examine the official P4-P6 curriculum (NACCA), analyse critically how the various concepts of addition of numbers up to 99 has been structuredare to be taught; Engage actively in the mock writing session and to engage in self-correcting and self-monitoring mode to justify why their attempts are okay or otherwise; Participate in the discussion based on strategies for planning, designing, and developing assessment tools that are relevant for upper primary learners, as well as, appropriate models to represent given numbers; Engage in a think-pair-share session to clarify and justify their ideas orally and in writing Design a performance task to assess specific content and lifelong learning standards, with emphasis on requiring them to locate and analyse information as well as draw conclusions about it; Design reflective journals and portfolio through a practical-based interactive activity and to discuss some of the purposes of a portfolio as follows: to I. demonstrate growth II. show the processes used in work and play III. develop compilations of favourite or personally important works IV. show the development of various works or products

				V. demonstrate achievement VI. communicate to parents and other stakeholders VII. use in the evaluation of a programme Use internet search to explore definitions and various views of evaluation of assessment tasks and techniques within the scope of assessing young children's learning progress Take part in the discussion based on how to use judgments in making decisions and preparing reports for young children Participate in the discussion based on how to provide opportunities for young children to monitor and evaluate their own learning
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1: *Formative assessment*** **Summary Assessment Method: Group assignment** • Engage student teachers in item writing based on lessons 1-5 (Assessment for learning) **Weighting**: 20% • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) engage student teachers to peer review the items constructed by others in component one above. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* student teachers are given mid semester exercise **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*			
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart			
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html			
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.			

CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 7

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 **7** 8 9 10 11 12

Title of Lesson	Micro Lessons and use of technology across upper primary numeracy 1	**Lesson Duration**	**3 Hours**
Lesson description	This lesson focuses on developing knowledge and conceptual understanding micro lessons and use of technology across upper primary numeracyas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of micro lessons and use of technology across upper primary numeracyin the Upper Primary level. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include importance of lesson planning micro lesson planning formats and design of micro lessons. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☒	**e-learning opportunities** ☒	**Practicum** ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="3">The purpose of the lesson is to;
explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when designing teacher-made assessment tools to ensure effective learning of mathematics in the early grade.</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td>Learning Indicators</td><td>Identify Which cross-cutting issues-core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>• Demonstrate knowledge and understanding of how to plan, design, and develop appropriate classroom assessment tools;

• Demonstrate knowledge and understanding of assessment standards and how they are linked to dimensions of learning;

• Demonstrate knowledge and understanding of and appreciation for important part of the educational assessment standards for planning and delivery of instruction</td><td>• Identify the various tools (observation guide, questionnaire, interview protocol, checklist, and tests) and their respective features;
• Identify the content and the structure of the various assessment tools which are developmentally appropriate for young children

• Identify and explain factors that have contributed to the changing face of educational assessment ;

Outline the underlying principles of how to plan, design, and develop teacher-made assessment tools which are appropriate assessment tools for the early grade level, either individually or in small groups</td><td>• Assessment literacy: through modelling of effective assessment strategies and record keeping

• Assessment literacy: through modelling of effective assessment strategies to deal with remediation

• Assessment literacy: through modelling of effective assessment strategies that takes care of learners developmental needs

• Communication skills: through critiquing and analysing presentations

• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS</td></tr>
</table>

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Micro Lessons and use of technology across upper primary numeracy1	Importance of lesson planning Micro lesson planning formats Design of micro lessons	**3 Hours**	Engage student teachers to discuss any of their STS report based on an observation of a mathematics lesson Ask student teachers to discuss the key features of a lesson and to identify key characteristics of productive planning in their collaborative group to be shared in class Lead student teachers in a discussion based on micro lesson planning formats Engage student teachers in a collaborative practical activities involving planning, designing, and preparation of manipulatives and other models for teaching selected concepts in upper primary mathematics Model how to plan, design, and develop lessons for teaching selected mathematics concepts in upper primaryusing appropriate manipulatives and ICT tools Assign student teachers to write sample lesson plans for peer teaching ***(PD Themes 1 & 3)***	Discuss a report on an observation in groups and to share with the class. This is to prepare the grounds for a discussion on the role of lesson planning in teaching mathematics in upper primary. Participate in the review by asking questions and commenting on relevant issues, including the role of planning on teaching mathematics in the upper primary. Play mental games student teachers are familiar with and are related to the lesson, e.g., a place value game which involves a player calling out a 3-digit number and another player instantly mentioning the difference between the 3-digit number called and its reverse before actually doing the subtraction of the smaller of the two numbers from the larger. Thus, if the first player calls out 492, the responds from the second player should be 198, the difference between 492 and 294. Participate in the discussion of the components of lessons with special emphasis on micro lessons Pay attention to the modeling process and ask questions and/or give comments to enhance clarity.

				Examine the official P4-P6 curriculum (NACCA), analyse critically how the various concepts select a topic and plan a lesson based on it. Plan, design, and develop lessons for teaching selected mathematics concepts in upper primary Pay attention to the modeling process and ask questions and/or give comments to enhance clarity. Write sample lesson plans in collaborative groups for peer teaching to be submitted later

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** Assign student teachers to write a reflective paper on how to plan, design, and develop lessons for teaching selected mathematics concepts in upper primary.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) Student teachers are assigned to examine the official P4-P6 curriculum (NaCCA), analyse critically how the various concepts select a topic and plan a lesson based on it. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* Student teachers present their lessons for colleaguestocritique. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada:

	Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 8

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 **8** 9 10 11 12

Title of Lesson	Micro Lessons and use of technology across upper primary numeracy 2	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and conceptual understanding micro lessons and use of technology across upper primary numeracyas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of micro lessons and use of technology across upper primary numeracy in the Upper Primary level. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include engagement in micro teaching with peers and exploration of technology use in the Upper Primary. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity	Work-Based Leaning	Seminars	Independent Study	e-learning opportunities	Practicum
	☒	☒	☐	☐	☒	☒	☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.**	The purpose of the lesson is to explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when using and evaluating teacher-made assessment tools to ensure effective learning of mathematics in the early grade.		
• **Learning Outcome for the lesson, picked and developed from the course specification** • **Learning indicators for each learning outcome**	**Learning Outcomes**	**Learning Indicators**	**Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?**
	• Demonstrate knowledge and understanding of effective strategies for administering educational assessment tools to enhance learning;	• Develop strategies for administering various types of assessment tools; • Design marking schemes for scoring a teacher-made test and provide accurate interpretation of assessment results of a small group of young children	• Assessment literacy: through modelling of effective assessment strategies and record keeping • Assessment literacy: through modelling of effective assessment strategies to deal with remediation
	• Demonstrate knowledge and understanding of strategies for scoring and interpreting assessment results	• Describe how to use information to evaluate; that is, to grade, to judge young children's progress, and to judge young children's attitudes toward the learning of mathematics in early grade	• Problem solving, critical and creative thinking**:** through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary
	• Demonstrate understanding of how to evaluate assessment tasks based of certain criteria, such as techniques and trends in early grade assessment;	• Explain how learning outcomes can help one to plan valid evaluation procedures • Evaluate given assessment tasks based on techniques and trends in early grade assessment for developmentally appropriateness	• Communication skills: through critiquing and analysing presentations • Assessment literacy: through modelling of effective assessment strategies that takes care of learners developmental needs

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Micro Lessons and use of technology across upper primary numeracy 2	Engagement in micro teaching with peers Exploration of technology use in the Upper Primary	**3 Hours**	Engage student teachers to discuss any of their STS report based on an observation of a mathematics lesson Lead student teachers in a discussion based on the use of technology in micro lesson planning Engage student teachers in a collaborative practical activities involving planning, designing, and preparation of manipulatives and other models for teaching selected concepts in upper primary mathematics using ICT Engage student teachers in micro teaching of lessons to ensure they consider the principles underlying equity and inclusivity through the use of multiple teaching strategies. Encourage student teachers to provide genuine feedback on the instructional strategies used by their colleagues Assign student teachers to write a reflective paper on their views of the micro teaching sessions and the experiences and add it to their portfolios	Discuss a report on an observation in groups and to share with the class. This is to prepare the grounds for a discussion on the role of lesson planning in teaching mathematics in early grade. Participate in the discussion based on the use of technology in micro lesson planning Plan, design, and develop lessons for teaching selected mathematics concepts in upper primary using ICT Participate in the micro teaching of lessons with emphasis on applying the principles underlying equity and inclusivity through the use of multiple teaching strategies. Provide genuine feedback on the instructional strategies used by their colleagues meant for improving their teaching skills. Write a reflective paper on their views of the micro teaching sessions and the experiences and add it to their portfolios

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** • Assign student teachers to demonstrate using practical activities involving planning, designing, and preparation of manipulatives and other models to teach selected concepts in upper primary mathematics using ICT • Write a reflective paper on their views of the micro teaching sessions and the experiences and add it to their portfolios (Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*individual presentation) Student teachers are assigned to outline how multiple teaching strategies promote equity and inclusivity. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* Student teachers present their lessons for colleagues to critique. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3, 5** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule;

	• How to use tape measure to develop number relationships;

Lesson 9

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Subtraction of whole numbers within 19 and then numbers within 99	Lesson Duration	3 Hours

Lesson description	This lesson focuses on developing knowledge and conceptual understanding Subtraction of whole numbers within 19 and then numbers within 99as treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of Subtraction of whole numbers within 19 and then numbers within 99. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include 1-digit and 2-digit subtraction as removing or take a part; counting down and mentalstrategies: difference, friendly jump, making doubles, compensation, decomposing numbers, constant difference; and problem solving. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils..

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity	Work-Based Leaning	Seminars	Independent Study	e-learning opportunities	Practicum
	☒	☒	☐	☐	☒	☒	☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities* –** involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="3">The purpose of the lesson is to;
explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when designing teacher-made assessment tools to ensure effective learning of mathematics in the early grade.</td></tr>
<tr><td rowspan="4">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td>Learning Indicators</td><td>Identify Which cross-cutting issues-core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>• Demonstrate knowledge and understanding of how to plan, design, and develop appropriate plan for a micro lesson</td><td>• Exhibit knowledge and application of learning theory, content knowledge, middle childhood learners' developmental needs, and how to use these to plan a lesson to meet the early grade curriculum goals</td><td>• Needs of the student teachers: makingconscious efforts to identify and address these needs and to inspire them for effective transfer of knowledge</td></tr>
<tr><td>• Demonstrate competencies in using differentiated instructional strategies, with a focus on a thematic approach and which promotes play-based learning to cater for the needs of all children in the early years` classroom, including those with SEN (NTS 3f, pg. 14)</td><td>• Outline contextual considerations, ICT tools and TLMs including community resources that create a bridge between the curriculum goals and middle childhood learners' experiences
• Plan a lesson using learner-centred learning strategies that match upper primary children's level of thinking.
• Undertake small scale classroom enquiry focussed on children's learning and progress, demonstrating an emerging ability to reflect on their developing understanding of teaching, learning and assessing children in early grade mathematics. (equity and inclusion)
• Outline strategies that cater for the needs of all children in the early years` classroom, including those with SEN</td><td>• Use of ICT: by integrating ICT in developing number and other concepts in the mathematics classroom. (CLO 2)
• Respect and diversity: designing lesson for diverse learners with different learning styles
• Equity and inclusivity: Providing equitable learning opportunities for all learners
• Equity and inclusivity: Providing equitable learning opportunities for all learners
• Needs of the student teachers:makingconscious efforts to identify and address these needs and to inspire them for effective transfer of knowledge</td></tr>
</table>

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Subtraction: of numbers within 19and then numbers within 99	1-digit and 2-digit subtraction as removing or take a part; counting down and mentalstrategies: difference, friendly jump, making doubles, compensation, decomposing numbers, constant difference; and problem solving	**3 Hours**	Engage student teachers in a warm up involving working with tens, by highlighting the point that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 have the same relationship as the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9. Encourage student teachers who have observed lessons based on subtraction of whole numbers up to 99 in their STS sessions to share their report to the class. Ask student teachers to outline interpretations for the operation of subtraction in groups and share their work Provide a forum for feedback from peers as others present their work Assign student teachers to outline the instruction approaches suggested by the CRDD and NACCA curricula and to submit later Give a verbal exposition on an overview of teaching the subtraction algorithm and explore student teachers' views about this. Engage student teachers in an interactive discussion to explore the thinking models	Participate in the warm up involving working with tens and contribute to the discussion by asking questions and commenting on how this activity is related to the lesson under review. For example, student teachers should be supported reflect on the fact that since 2 + 3 = 5 and 20 + 30 = 50, then 5 −2 = 3 means 50 −20 = 30 Share STS report based on subtraction of whole numbers up to 99. Issues arising out of the presentation by some student teachers are discussed Outline the meaning and interpretations for the operation of subtraction, including physical and pictorial models for each interpretation of the operation, in groups and share their work Critique others presentation to ensure understanding by all Critique others presentation to ensure understanding by all Outline the instructional strategies suggested by the CRDD and NACCA curricula by examining the official P4-P6 curriculum (NACCA), analyse critically how the various concepts of subtraction of numbers up to 99 has been structuredare to be taught, as compared to that of CRDD. Pay attention to the exposition by asking questions as well as give comments including sharing their views about the subtraction algorithm Participate in the discussion to explore the thinking models for subtraction (i.e., take away,

			for subtraction (i.e., take away, comparison, and missing addend) with emphasis on how Ghanaian upper primary approach each of them ***(PD Themes 1 & 3)***	comparison, and missing addend) with emphasis on how Ghanaian upper primary approach each of them Play mental games that student teachers are familiar with and are related to the lesson, e.g., a place value game which involves a player calling out a 3-digit number and another player instantly mentioning the difference between the 3-digit number called and its reverse before actually doing the subtraction of the smaller of the two numbers from the larger. Thus, if the first player calls out 492, the responds from the second player should be 198, the difference between 492 and 294.
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** • Assign student teachers to outline the instruction approaches suggested by the CRDD and NaCCA curricula and to be submitted later (Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*group presentation) • Student teachers are assigned to explore the thinking models for subtraction (i.e., take away, comparison, and missing addend) with emphasis on how Ghanaian upper primary approach each of them. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* write class exercise on models for teaching subtraction, (including physical and pictorial models) for each interpretation of subtraction.. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3,** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*			

Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 1

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 **10** 11 12

Title of Lesson	Shape, space and Measurement 1	**Lesson Duration**	**3 Hours**
Lesson description	This lesson focuses on developing knowledge and conceptual understanding shape, space and measurementas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of shape, space and measurement. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include 2-D shapes and 3-D objects; characteristics of 2-D shapes and 3-D objects and relationships among and between 2-D shapes and 3-D objects. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☒	**e-learning opportunities** ☒	**Practicum** ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.

<table>
<tr><td>• Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.</td><td colspan="4">The purpose of the lesson is to;
explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when designing teacher-made assessment tools to ensure effective learning of mathematics in the early grade.</td></tr>
<tr><td rowspan="2">• Learning Outcome for the lesson, picked and developed from the course specification
• Learning indicators for each learning outcome</td><td>Learning Outcomes</td><td colspan="2">Learning Indicators</td><td>Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?</td></tr>
<tr><td>Demonstrate knowledge of early grade pedagogical knowledge and pedagogical content knowledge to deliver the ECE curriculum (NTS 2c, pg. 13, 3e & 3g, pg. 14) [NTECF P1 (3), pg. 20]

Demonstrate skills in identifying traits of professionalism in school using knowledge and experiences gained from interacting with peers during lessons and group work and subsequently make appropriate journal entries (NTS, 1d, 1f, 1g, & 2a</td><td colspan="2">• Use appropriate pedagogical content knowledge to deliver the upper primary curriculum

• Reflect on and record their experiences in their professional portfolios during their STS school visits.

• Write a reflective learning journal that shows progress of student teachers' observation on how early adolescents learn mathematics.

• Provide SRJ recordings of demonstrated professional values and attitudes during engagements with people including pupils, mentors, tutors, and peers</td><td>• Respect and diversity: designing lesson for diverse learners with different learning styles

• Social and communication skills: consciously develop observation and presentation skills during classroom instructions to support student teachers to transfer this to STS

• Communication skills: through critiquing and analysing presentations

• Ethics and values of teaching: through supporting student teachers to understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of the early adolescent learner</td></tr>
<tr><td>Topic Title</td><td>Sub-topic(s)</td><td>Stage/ Time</td><td colspan="2">Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.</td></tr>
<tr><td></td><td></td><td></td><td>Teacher Activity</td><td>Student Activity</td></tr>
<tr><td>Shape, space and Measurement 1</td><td>2-D shapes and 3-D objects;

characteristics of 2-D shapes and 3-D objects</td><td>3 Hours</td><td>Ask student teachers to discuss in groups and give their past experiences of how they learned concepts based on 2-D and 3-D shapes.

List some 2-D shapes and have student teachers provide definitions of such shapes in groups and later share their responses.</td><td>Give past experiences about how they were taught concepts based on 2-D and 3-D shapes

Provide definitions of such shapes in groups and later share their responses to enable them develop awareness of their current level of understanding of such concepts.</td></tr>
</table>

	Relationships among and between 2-D shapes and 3-D objects;		Identify and address misconceptions that student teachers might have. Assign student teachers to describe the common features or attributes of a collection of 2D and 3D shapes Engage student teachers in an interactive group activity to sort a collection of 2D shapes by one or two features or attributes and explain the sorting rule used (repeat for 3D); Group student teachers and task them to identify examples of 2D and 3D shapes in the classroom and the community Assign student teachers to undertake a mini project to build boxes and design packages e.g., making rectangular prisms to develop the concept of surface area by counting the number of unit squares needed to wrap a rectangular box Lead a discussion to find the 11 flat patterns made with six squares that can fold into a cubic box using grid sheets and other relevant materials Have student teachers discuss their views about the activities outlined for the lesson	Participate in the discussion for addressing potential misconceptions that they may have to enhance conceptual understanding of such concepts. Describe the common features or attributes of a collection of 2D and 3D shapes to begin identifying relationships between some 3-D shapes and the corresponding 2-D shapes that form them; Sort a collection of 2D shapes by one or two features or attributes and explain the sorting rule used (repeat for 3D); Discuss in groups to outline examples of 2D and 3D shapes in the classroom and the community. Participate in a mini project to buildboxes and design packages e.g., making rectangular prisms to develop the concept of surface area by counting the number of unit squares needed to wrap a rectangular box to be presented later; Engage in an interactive activity to find the 11 flat patterns made with six squares that can fold into a cubic box Participate in the discussion of their views about the activities outlined for the lesson and record the findings in their journals

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** Student teachers are assigned to list some 2-D and 3D shapes and provide definitions of such shapes and describe the common features or attributes of a collection of 2D and 3D shapes. (Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*group presentation) • Assign student teachers to undertake a mini project to build boxes and design packages e.g., making rectangular prisms to develop the concept of surface area by counting the number of unit squares needed to wrap a rectangular box to be submitted for grading. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* Student teachers to outline and discuss some misconceptions of a collection of 2D and 3D shapes... (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3,** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames)

	• Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 11

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 **11** 12

Title of Lesson	Shape, space and Measurement 2			**Lesson Duration**	**3 Hours**		
Lesson description	This lesson focuses on developing knowledge and conceptual understanding shape, space and measurementas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of shape, space and measurement. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include measurement of lengths using arbitrary units (or referents) and standard measurements. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition						
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-Based Leaning** ☐	**Seminars** ☐	**Independent Study** ☒	**e-learning opportunities** ☒	**Practicum** ☐
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.						

• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description.**	The purpose of the lesson is to; explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when designing teacher-made assessment tools to ensure effective learning of mathematics in the early grade.		
• **Learning Outcome for the lesson, picked and developed from the course specification** • **Learning indicators for each learning outcome**	**Learning Outcomes**	**Learning Indicators**	**Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?**
	Demonstrate knowledge and understanding about how young children develop and learn concepts based on subtraction in early grade (professional values, knowledge & practice) **(NTS, 2b)** Demonstrate competencies in devising and using differentiated instructional strategies, with a focus on a thematic approach and which promotes play-based learning to cater for the needs of all children in the early years` classroom, including those with SEN **(NTS 3f, pg. 14)** Demonstrate the core and transferrable skills like problem solving and creativity and taking advantage of the affordances of ICT integrating it into teaching and learning **(NTS**	• Select and use developmentally appropriate models and strategies for teaching subtraction that emphasize the physical, cognitive, emotional and social development of the child. • Use learner-centred learning strategies that make connections between theories of learning mathematics in upper primary and how to apply them in practical teaching. To match middle childhood learners' level of thinking. • Outline and analyse strategies young children use in developing subtraction concepts such as the expanded notation algorithm, the standard subtraction algorithm, etc., • Use knowledge gained from earning theories in mathematics to design appropriate problem-solving tasks. • Recognise and use developmentally appropriate and positive behaviour management skills	• Respect and diversity: designing lesson for diverse learners with different learning styles • Social and communication skills: consciously develop presentation skills during classroom instructions to support student teachers to develop mathematical language • Respect and diversity: designing lesson for diverse learners with different learning styles • Personal development: Through presentation and developing of arguments • Problem solving, critical and creative thinking**:** through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary • Problem solving, critical and creative thinking**:** through objective analysis of problems (tasks) that will lead to creative thinking and assessment strategies appropriate for upper primarylearners

Topic Title	Sub-topic(s)	Stage/ Time	Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.	
			Teacher Activity	**Student Activity**
Shape, space and Measurement	Measure lengths using arbitrary units (or referents) and standard measurements	**3 Hours**	Lead student teachers in a review of their previous knowledge of 2-D shapes and 3-D objects for traces of misconceptions Distribute models of everyday objects including designs in fabrics, tiles, as well as generalized geometric shapes for them to explore 2-D shapes and their characteristics Engage student teachers in an interactive activity to draw shapes and use their skills and experiences to construct solids from paper or cards Engage student teachers to look at packets and boxes to explore how they have been constructed and what their nets are, and to make 3-D geometrical models by linking faces or edges Task student teachers to d raw 2-D shapes in different orientations on grids and to think of the relationship of solids to their nets; ***(PD Themes 1 & 3)*** Assign student teachers to use designs from fabrics and pictures of houses and other structures from the environment to create albums in groups to be included in their portfolios Introduce student teachers to the	Participate in the review by asking questions and commenting on relevant issues including the correction of their misconceptions about given concepts to ensure effective participation and learning by all. Sort a collection of 2-D shapes by one or two features or attributes and to explore the sorting rule used. This should be repeated for 3-D shapes Use assorted models and other outdoor materials to explore 2-D shapes and their characteristics and to describe the common features or attributes of a collection of 2-D and 3-D shapes Draw shapes and use their skills and experiences to construct solids from paper or cards. This and other activities are done with a focus on the standards-based curriculum. Student teachers should therefore examine the official KG-P3 curriculum (NACCA), analyse critically how concepts based on shape and space has been structured and are designed to be taught; Look at packets and boxes to explore how they have been constructed and what their nets are and to make 3-D geometrical models by linking faces or edges Draw 2-D shapes in different orientations on grids and to think of the relationship of solids to their nets in their collaborative groups and present their work in class

			concepts and principles of measurement as found in the upper primary official mathematics curriculum to be submitted for peer review Engage student teachers in an interactive activity to develop further the concept of length using geodot paper. Introduce the concept of perimeter as an application of measurement of length Lead student teachers in the closure of the lesson	Engage in a nature walk to the market and other places to take pictures of houses, designs in fabrics, and other relevant materials to create albums for practical instructional activities and to be included in their portfolios Discuss the attribute of length, in small groups, and write on how to plan and teach this attribute with emphasis on (i) comparingand ordering objects according to the attribute (ii) outlining how to measure using non-standard and standard units (iii) selecting an appropriate unit and tool for the attribute of length The write-up should include application of appropriate techniques, tools, and means of determining the measurement of the attribute. For example, the report should include how to (i) measure with multiple copies of units of the same size (ii) use repetition of a single unit to measure anything larger than the unit (iii) use appropriate tools to measure (iv) develop common referents for measures to make estimates and comparisons Participate in the activity to explore the concept of length using geodot paper. Explore further the concept of

				perimeter using practical activity Participate in the closure of the lesson by pointing out the core points in the lesson as well as asking questions for clarification of concepts not well captured
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** ***Formative assessment*** **Summary Assessment Method: Group assignment** Student teachers are assigned to use designs from fabrics and pictures of houses and other structures from the environment to create albums in groups to be submitted for grading.(Assessment for learning) **Weighting**: 20% **Related CLOs**: 1, 2, 3 **NTS**: 2 b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. *2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes* 3m) Identifies and remediates learners' difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*group presentation) • Assign student teachers to explore the concept of length using geodot paper and discuss the concept of perimeter using practical activity. (Assessment as learning) **Weighing**: 20% **Related CLOs**: 1, 2, 3 **NTS:** 2f) Demonstrate value as well as respect for equity and inclusion in the mathematics classroom (knowledge) *3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning* • **Component 3:** *Formative assessment* **Summary of assessment Method:** *(teacher made test)* student teachers to discuss the measurement of length comparingand ordering of objects using non-standard and standard units. (Assessment of learning) **Weighting: 20%** **Related CLOs: 2, 3,** **NTS:** 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. 2f) Demonstrate value, as well as, respect for equity and inclusion in the mathematics classroom (knowledge) 3k) Integrates a variety of assessment modes into teaching to support learning. *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity.*			
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart			
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html			

Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule; • How to use tape measure to develop number relationships;

Lesson 12

Year of B.Ed.	2	Semester	1	Place of lesson in semester	12 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Problems solving and logical reasoning	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and conceptual understanding problems solving and logical reasoningas treated in the current Upper Primary mathematics curriculum. Basically, the lesson seeks to equip student teachers with the knowledge, skills and strategies for promoting understanding of problems solving and logical reasoning. Student teachers will devise possible strategies to model how to pose questions that encourage thinking about numbers and create classroom environment that nurtures number sense. Specific areas to be covered include Solve problems, and engage in logical reasoning. Most essentially, they will explore instructional strategies that incorporate principles underlying equity and inclusivity.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the nature and structure of curriculum, counting and number relationships, place values as well as addition		
Possible barriers to learning in the lesson	○ Primary school teachers have knowledge of the need to create safe, secure and happy learning environment; but they are less capable in creating accessible, safe, secure and happy learning environments for middle childhood children including those with special educational needs (SEN) to learn successfully. ○ Primary school teachers are aware of the characteristics of children within the stage of middle childhood; however, they are less familiar with the implications of the characteristics (i.e. cognitive, physical, emotional, psychosocial) of middle childhood to teaching and learning. ○ Currently, those teaching primary school are trained to teach all classes from early grade through JHS and gain breadth of knowledge without the necessary depth for teaching all subjects and abilities of upper primary ○ The school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN. ○ Primary school teachers are less knowledgeable and competent in applying differentiated instruction and assessment; consequently, they are less able to promote inclusion of all children. ○ Primary school teachers are familiar with ICT, but they are less confident in integrating ICT in teaching and learning. ○ Primary school teachers are familiar with how to conduct classroom inquiry; however, teachers are less motivated to conduct classroom inquiry to improve teaching and support learning, an essential skill to ensure the full participation of all pupils.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ☒	Practical Activity ☒	Work-Based Leaning ☐	Seminars ☐	Independent Study ☒	e-learning opportunities ☒	Practicum ☐

Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	**Face-to-face:** opportunity for an extended and coherent line of argument. It includes discussion, brainstorming, question and answer, etc. This can be tutor and / or student teacher led. It should not usually be the main mode. **Practical Activity:** enabling experimentation and the analysis and discussion of issues, documents and materials, as well as physical activities. **Independent study:** to enable students to engage with relevant and appropriate materials to promote individual and collaborative enquiry, more in-depth analysis and development. This can be part of any of the above modes **E-learning *opportunities*** – involving the use of interactive packages and virtual learning environments. This can be part of any of the above modes of delivery. It is unlikely to be a delivery mode in its own right.
• **Purpose for the lesson, what you want the students to achieve, serves as basis for the learning**	The purpose of the lesson is to help student teachers • explore assessment strategies that incorporate principles underlying equity, differentiation and inclusivity when designing teacher-made assessment tools to ensure effective learning of mathematics in the early grade. • develop the required expertise to assess early grade learners based on what is

outcomes. An expanded version of the description.	happening in the classroom • use observations and samples of children's work		
• **Learning Outcome for the lesson, picked and developed from the course specification** • **Learning indicators for each learning outcome**	**Learning Outcomes**	**Learning Indicators**	**Identify Which cross-cutting issues- core and transferable skills, inclusivity, equity and addressing diversity. How will these be addressed or developed?**
	Demonstrate the core and transferrable skills like problem solving and creativity and taking advantage of the affordances of ICT integrating it into teaching and learning **(NTS**	• Outline and analyse strategies young children use in developing subtraction concepts such as the expanded notation algorithm, the standard subtraction algorithm, etc.,	• Problem solving, critical and creative thinking**:** through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary
	Demonstrate knowledge of age appropriate instructional strategies for teaching shape and space and how to recognise and support children's progress against appropriate developmental milestones and the expectations of the Early Grade mathematics Curriculum **(NTS 3k,pg. 14)**	• Select and use developmentally appropriate models and strategies for teaching subtraction that emphasize the physical, cognitive, emotional and social development of the child.	• Ethics and values of teaching: through supporting student teachers to understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of the early adolescent learner
		• Use learner-centred learning strategies that make connections between theories of learning mathematics in upper primary and how to apply them in practical teaching. To match middle childhood learners' level of thinking.	• Respect and diversity: designing lesson for diverse learners with different learning styles
	Demonstrate the core and transferrable skills like problem solving and creativity and taking advantage of the affordances of ICT integrating it into teaching and learning **(NTS**	• Outline and analyse strategies young children use in developing subtraction concepts such as the expanded notation algorithm, the standard subtraction algorithm, etc., • Use knowledge gained from learning theories in mathematics to design appropriate problem-solving tasks. • Recognise and use developmentally appropriate and positive behaviour management skills	• Problem solving, critical and creative thinking**:** through objective analysis of facts and concept that will lead to creative thinking and assessment strategies appropriate for upper primary Background of student teachers:by making conscious efforts to include them in the teaching and learning situation, as well as, engage them in reflective thinking about how mathematics was taught in their basic and high school days

				• Respect and diversity: designing lesson for diverse learners with different learning styles
Topic Title	**Sub-topic(s)**	**Stage/ Time**	**Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative groupwork or independent.**	
			Teacher Activity	**Student Activity**
Problems solving and logical reasoning	Solve problems, and engage in logical reasoning	**3 Hours**	Engage student teachers in a review of previous lessons based on addition, subtraction, and shapes, space, and measurement by asking different groups to focus on selected aspects Have the various groups present what they have outlined for their peers to provide feedback; Comment on individual and group participation and to link the activity to the need for problem solving in the teaching and learning of mathematics at all level, and most especially, at the upper primary level Give a verbal exposition and interspersed with questioning and discussion (supported with video clips)on how children solve problems in mathematics Lead a discussion on what problem solving in mathematics means, first by eliciting the views of student teachers and then providing information about models of problem solving suggested by experts such as Polya Engage student	Participate in the review of previous lessons based on addition, subtraction, and shapes, space, and measurement by asking different groups to focus on selected aspects Participate in the group presentation and to provide feedback to ensure participation by all Pay attention to feedback and give comments or ask questions for further clarification Pay attention to the verbal exposition and discussions (supported with video clips)on how children solve problems Participate in the discussion on what problem solving in mathematics means, first by eliciting the views of student teachers and then providing information about models of problem solving suggested by experts such as Polya

			teachers in practical activities to act out or role play children's problem solving activities on the topics in Units 2-6.	Participate in practical activities to act out or role play children's problem solving activities on the topics in Units 2-6.
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• **Component 1:** *Formative assessment* **Summary Assessment Method**: Review of the year 2 semester 2 lessons Student teachers to review the semester one course with tutor. • **Component 2:** *Formative assessment* **Summary of assessment Method:***(*whole class activity) Student teachers discuss and submit their learning journals for considerations • **Component 3:** *Summative assessment* **Summary of assessment Method:** *(whole class activity)* Student teachers to discuss end of semester examination issues with tutor, submit projects • *Note: The assessment procedures should make room for differentiation - gender, equity, SEN, and inclusivity*			
Instructional Resources	Posters, number charts; ten frames, video clips downloaded from the internet; tape measure; ten-structured materials; beads; hundreds frame, place value chart			
Required Text (core)	Arthur, J., Grainger, T. & Wray, D. (2006). Learning to Teach in the Primary School. Canada: Taylor & Francis e-Library. https://www.pdfdrive.com/learning-to-teach-in-the-primary-school-d20209294.html Confer, C. (2005). Teaching Number Sense. Sausalito: Math Solutions Publications. https://www.pdfdrive.com/teaching-number-sense-grade-1-d184198309.html. Manitoba Education, Citizenship and Youth (2006). Rethinking classroom assessment with purpose in mind: assessment for learning, assessment as learning, assessment of learning. https://www.pdfdrive.com/assessment-for-learning-assessment-as-learning-assessment-of-learning-d6259529.html			
Additional Reading List	Lakoff, G. &Núñez, R. E. (2000). *Where Mathematics comes from*. New York: Basic Books. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Tutor notes*. Accra: Unimax Publishers. Martin, J. et. al. (1994). *Mathematics for teacher training in Ghana: Students activities*.Accra: Unimax Publishers.			
CPD Needs	• How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using ten frames) • Instructional strategies needed to consciously engage student teachers to participate effectively and to be ready to share their past experiences without fear of ridicule;			