YEAR 2

SEMESTER 1

Four-Year B.Ed. Course Manual

Theories in the Learning of 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

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

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

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

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

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.

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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 ……

Mathematics Course Manual

A. Course Information

Title Page

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

Course Details

Course name	**Theories in Learningupper primary mathematics**				
Pre-requisite	**Senior High School Mathematics, Psychological basis of learning**				
Course Level	**200**	Course Code		Credit Value	**3 Hours**

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Goal for the Subject or Learning Area

This coursewill prepare student teachers to be competent and knowledgeable enough to facilitate teaching and learning of mathematics and demonstrate commitment to equity and inclusivity in their work, in order to maintain acceptable values and attitudes, knowledge and skills for application in real life.

Course Description

This is the first mathematics course in the upper primary specialism which focuses on developing an understanding of what student teachers should know about how people think about mathematics and how children's understanding of how mathematics develops. It will provide an overview of philosophies of mathematics and how to teach mathematics in the upper primary. It seeks to prepare student teachers to explore the underlying conception about mathematics in the official mathematics curriculum and current views that support children's active participation of classroom instruction and assessment practices. It also covers discussion of theoretical perspectives of how children learn mathematics and factors that influence learning (NTECF, p. 21).

There is therefore the need for tutors to design strategies for auditing of related pedagogical content knowledge to establish and address student teachers' learning needs, perceptions and misconceptions in the Theories in the Learning of Mathematics.

Additionally, student teachers will develop awareness of equity, inclusivity and diversity issues, especially in respect of being able to identify the main developmental milestone of children in the grade, as they interact with pupils during small group and observation in supported teaching in schools (NTECF, p.45).

This course is expected to support student teachers learn how to teach mathematics in the official curriculum and begin to develop their professional identities by reflecting and making connections between theory and practice for teaching upper primary mathematics. The course will prepare student teachers to demonstrate a growing understanding of the requirement of the NTS, in terms of professional practice, knowledge, values and attitudes.

The learning outcomes would be assessed through a combination of formative and summative assessments including coursework, individual and group assignments/, presentations and mathematics histories.

Key contextual factors

- 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 mathematics 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 mathematics.
- 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 mathematics.
- 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 in mathematics; 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 of mathematics.
- 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 mathematics, an essential skill to ensure the full participation of all pupils.
- Primary school teachers work with parents and other stakeholders in SMCs and PTAs; however, some of these teachers exhibit less positive attitude and supportive professional relationship with children, GES officials, mentors, parents and

other stakeholders.

Core and transferable skills and cross cutting issues, including equity and inclusion

- Core and transferable skills include: critical thinking, problem solving, social skills, creative thinking and communication skills, use of ICT.
- Cross cutting issues include: assessment literacy and assessing students' progress and professional values and attitudes, reflection and classroom enquiry

Background of student teachers: An effort was made in year one to transition student teachers from diverse backgrounds to teacher education programme. They have also been introduced to psychological basis of learning as a course in pedagogy. Student teachers are aware of their own learning styles, interest and individual characteristics as means of learning. However, these experiences were not specifically related to teaching and learning of mathematics, especially how children develop and learn mathematics. Tutors need to engage student teachers to how mathematics should be taught to children in the upper primary. Another major challenge is the lack of qualified upper primary teachers, leading to rote-based learning in Ghanaian basic school settings.***(CLO 4)***.

Needs of the student teachers: Student teachers may have different needs (such as hunger, stress, sickness, financial, etc.) that are likely to affect their participation and learning in the mathematics classroom. Conscious efforts should be made to develop skills and competencies to identify and address the various needs of children as they observe, interact and teach small groups of children during (STS).

Inclusivity: Student teachers can identify their own beliefs/bias about diversity, inclusion and equity, classroom instructional and assessment practices should consciously be designed to cater for learner diversity to promote learning opportunity for all. This will position them to begin to reflect on how to provide support for all learners in the mathematics classroom, irrespective of their challenges. Also, it will help them to understand that learners learn in different ways and that this can be used to support their own learning and that of their peers. ***(CLO 3).***

Problem solving, **critical and creative thinking:** Mathematical critical thinking is based on objective analysis of facts which will lead creative thinking and problem-solving. Problem-solving is the central focus of mathematics instructions as well as an integral component of assessment.
Problem-solving techniques should therefore be consciously employed in the teaching and learning of theories in learning of mathematics. ***(CLO 1, 2)***

Social and communication skills: Communication is an important skill in the teaching and learning of mathematics. Presentation of classroom instructions should support student teachers to develop mathematical language, including symbols and vocabulary. There is the need to promote interactive pedagogy in the mathematics classroom to enhance critical thinking and interpersonal relationship among student teachers for extended learning outcome. **(*CLO 1*)**

Use of ICT: The influence of IT in this 21st century cannot be overemphasized. Introduction of technology tools in the teaching and learning of mathematics influence what and how mathematics is to be taught. There is a low competency level of early childhood teachers in integrating ICT into their teaching and learning process.Therefore, student teachers should be supported to learn to integrate ICT in the grade mathematics teaching and learning processes **(NTS, 3j**)

Cultural issues: The multicultural nature of the Ghanaian child calls for classroom instructional and assessment practices (including examples) shouldaddress socio-cultural issues emerging from the teaching and learning of mathematics (***CLO 4***).

Gender issues in Mathematics: Upper primary education is perceived by society as less demanding field and also not regarded as important as JHS and SHS, Discuss to demystify the notion–(***CLO 3)***

Course Learning Outcomes	**Learning Indicators**
On successful completion of the course, student-teachers will be able to: **1.** Demonstrate knowledge and understanding about the characteristics ofmiddle childhood: growth, development and learning mathematics in upper primary(professional values, knowledge & practice) **(NTS, 2b)**	• Select and use developmentally appropriate strategies for teaching that emphasize the physical, cognitive, emotional and social development of the child. • Use play-based learning strategies that match upper primary children's level of thinking. • Make connections between theories of learning mathematics in upper primary and how to apply them in practical teaching.
Demonstrate knowledge and skills in developing a professional portfolio with evidence from observations (NTS, 1a, e, & f)	Use appropriate ICT tools (audio, braille, embossers) to compile artefacts and reports from observations and other achievements as contents in a professional portfolio and also showing creativity in design

2. Demonstrate knowledge of early years pedagogical knowledge and pedagogical content knowledge to deliver the upper primary curriculum **(NTS 2c, pg. 13, 3e & 3g, pg. 14) [NTECF P1 (3), pg. 20]**	• 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 children learn mathematics.
3. 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 middle childhood classroom, including those with SEN **(NTS 3f, pg. 14)**	• Plan a lesson using play-based 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 upper primary mathematics. (equity and inclusion) • Outline strategies that cater for the needs of all children in the early years` classroom, including those with SEN
4. Demonstrate knowledge of age appropriate assessment strategies and recognise and support children's progress against appropriate developmental milestones and the expectations of the Upper primary mathematics Curriculum **(NTS 3k,pg. 14)**	• Outline age appropriate assessment strategies for theories in learning mathematics in the upper primary • recognise and support children's progress against appropriate developmental milestones • critique the expectations outlined for the Upper primary mathematics Curriculum
Demonstrate skills in identifying traits of professionalismin school (NTS, 1d, 1f, 1g, & 2a)	• Provide SR J recordings of demonstrated professional values and attitudes during engagements with people including pupils, mentors, tutors, and peers
5. Demonstrate the core and transferrable skills such as problem solving and creativity and taking advantage of the affordances of ICT integrating it into teaching and learning of mathematics**(NTS 3j)**	• Use knowledge gained from learning theories in mathematics to design appropriate problem-solving tasks. • Recognise and use developmentally appropriate and positive behaviour management skills
6. Demonstrate competencies in carrying out classroom inquiry and action research and reflect on their teaching practices for continuous professional development **(NTS 1a, 1b,1c 3b, *NTECF: crosscutting issues; Core skills, Professional values and attitudes*)**	• Carry out action research and classroom enquiry to improve practice in the upper primary classroom • reflect on their teaching practices for continuous professional development (CPD) in mathematics teaching. • Reflect on and record their experiences in their professional portfolios – through this, student teachers will begin working towards meeting the NTS requirement.

Suggested Teaching and Learning Strategies

- Observation techniques,
- Designing of reflective journals and portfolios,
- discussions of concepts and misconceptions,
- investigations to arrive at generalizations,
- problem-solving strategies,
- collaborative activities (think-pair-share),
- multiple representations (Principle of multiple embodiment),
- establishing connections between and theory and practice.

Course Assessment Components

mponent 1: Subject Portfolio Assessment (30% overall)

- Selected items of students work(2 of them 10% each)-30%
- Midterm assessment -20%
- Reflective journal 40%
- Organization of the subject portfolio-10% (how it is presented /organized

Student teachers to submit the following by the end of the semester;
Group presentation, individual assignment, worksheet exercises, reflective papers for peer review, Course work,(collaborative project or presentation, etc., for example

- a final portfolio in mathematics, with emphasis on Upper primary Curriculum and relative to theories of learning,**(Course work)**
- journal entries based on their experiences in how children learn mathematics in upper primary.**(Assignment)**
- report of STS observation and small group teaching in upper primary mathematics classroom. (**collaborative project or presentation)**
- class/home assignment, class exercise, assessing reflective journals, teacher made short test, etc., for example

(NTS 2e)*Understands how children develop and learn in diverse contexts and applies this in his or her teaching.*

Component 2: Subject Project Assessment (30% overall score)

- Introduction; a clear statement of aim and purpose of the project-10%
- Methodology; what the student teacher has done and how achieve the purpose of the project-20%
- Substantive or main section-40%
- Conclusion – 30%

ster/TLM: student teacher to design and produce developmentally and age-appropriate TLMs from locally available materials for peer teaching upper primary mathematics. This suggests that student teachers are expected to Produce and use a variety of teaching and learning resources including ICT, to enhance learning(NTS 3j): *Produces and uses a variety of teaching and learning resources including ICT, to enhance learning*

Component 3: End of Semester Examination- (40% overall)

Required Reading and Reference List

Garegae, K. G. (2001). Teachers' beliefs about mathematics, its teaching and learning and the communication of these beliefs to students: A case study in Botswana.Unpublished Doctoral dissertation. University of Manitoba, Canada

Sriraman, B., & English, L. (2005). Theories of mathematics education: A global survey of theoretical frameworks/trends in mathematics education research. ZentralblattfürDidaktik der Mathematik (International Reviews on Mathematical Education), 37(6), 450–456.

Martin, J. et. al. (1993). *Mathematics for teacher training in Ghana: Tutor notes,* Accra: Unimax Publishers.

Martin, J. et. al. (1993). *Mathematics for teacher training in Ghana: Students activities*. Accra: Unimax Publishers.

Ministry of Education. (2019). *Mathematics curriculum for primary schools (basic 1 - 3).* Accra: Ministry of Education.

Kashefi, H. (2017). Teaching and learning theories applied in Mathematics classroom among Primary school teachers DOI: 10.1109/WEEF.2017.8467070

Sriraman, B., & English, L. (2005). Theories of mathematics education: A global survey of theoretical frameworks/trends in mathematics education research. ZentralblattfürDidaktik der Mathematik (International Reviews on Mathematical Education), 37(6), 450–456.

Anghileri, J. (2006). Scaffolding practices that enhance mathematics learning. Journal of Mathematics Teacher Education, 9,33–52. doi:10.1007/s10857-006-9005-9

https://www.pdfdrive.com/multiple-intelligences-mi-the-theory-its-implications-d4106293.html

https://www.pdfdrive.com/intelligence-reframed-multiple-intelligences-for-the-21st-century-d158133116.html

Teaching and Learning resources

Maths posters
Manipulatives and visual aids
Computers and other technological tools
Set of Mathematical instruments

Course related professional development for tutors/ lecturers

Lesson 1

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

Title of Lesson	Why do we teach mathematics in school?						Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing an understanding of what we know about how people think about mathematics and how an understanding of mathematics develops. It provides an overview of philosophies of mathematics and mathematics education and explores student teachers' beliefs about mathematics and philosophies of mathematics implicit in the official mathematics curriculum and current classroom practice(NTECF, p. 21. This course is designed to prepare student teachers to begin thinking about the unique characteristics of learners in our basic schools within the age and grade bracket they will teach. The areas to be covered include children's developmental stages, how children learn mathematics and associated theories, and other psychological factors influencing learning. Another area that is considered is developing awareness of equity and diversity issues. (NTECF, p.45). This first lesson introduces student teachers to the course learning outcomes in the three assessment components of the course.								
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation;								
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.								
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. **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.								
• **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;** • Introduce student teachers to the upper primary specialism course manual to enable them develop awareness of what they are expected of in this lesson. • develop student teachers' understanding of the nature and importance of mathematics, as well as, how to teach mathematics to upper primary learners.								
• **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 skills of observation and reporting on class teaching and wider school activities **(in**		**Inclusion and Equity** • Produce well-prepared induction schedule and procedures			**Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher;			

	School) **(NTS 3k,pg. 14)** *(College & School induction by tutors,school heads, lead mentors and mentors)* Demonstrate knowledge andunderstanding of the key features of the basic school curriculum (BSC); and specifically focusing on core subjects and their associated expected learning outcomes (NTS, 2a). Demonstrate skills in preparing and writing a personal teaching philosophy statement (NTS, 1f)	• Provide records of group work activities and/or cooperative learning for student teachers during observations • Make oral presentations ofknowledge gained during induction and observation by student teachers in their groups. **Managing transitions** • Show records of specific observations from wider school environment and induction • Report on small group discussions with mentors and peers on the key features of the official basic school curriculum • List identified key features in the BSC. **Teaching** • Provide a write-up of the beginning teacher's self-awareness, beliefs, and values of teaching and learning (personal teaching philosophy)	• Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination) • Identify/screen students, within a class, who might need: group, targeted, of intensive interventions and plan accordingly (identify support HR) Work with families and external professionals to ensure barriers to leaning are identified, addressed and overcome **Managing transitions** Through approach to class management/organisation from K-3 thematic approaches to being taught by a class-teacher to subject – based subject specialist teaching **Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity

Topic	**Sub-topic(s)**	**Stage/ Time**	**Teaching and learning to activities to achieve learning outcomes depending on delivery mode selected. Teacher-lead collaborative group work or independent.**	
			Teacher Activity	**Student Activity**
		40 mins	Introduces student teachers to the Course Manual and discuss the various components including assessment procedures **(See** Course Assessment Components**),** ***(PD Theme 1)***	Participate in the discussion of various components of the course manual, take opportunity to ask questions about the Course Manual including assessment procedures. Outline their expectations and views about the mathematics course.

WEEK 1 Why do we teach mathematics in school?	Definition and importance of Mathematics to the Upper primary teacher	20 mins	Introduce the lesson by giving a historical account of how mathematics was used by various generations and how it has been used to solve problems in different parts of the world, generations after generations; ***(PD Themes 1 &3)***	Listen attentively to the tutor or lecturer's verbal exposition and ask questions for clarification or provide comment(s) to ensure participation and understanding; Engage in a think-pair-share session to outline the importance of Mathematics to people in various trades and professions in our Ghanaian cultural settings;
		20 mins	Engage student teachers in a discussion based on how mathematics is used currently and its future prospects ***(PD Themes 1& 3)***	Search the definition(s) and meaning of Mathematics on the internet and to discuss their findings to their findings in groups of five or six.
		20 mins	Assign student teachers to explore the meaning and definition(s) of Mathematics through internet search and to discuss their findings; ***(PD Themes 3 & 4)***	Alert peers of distortions of facts and principles as they present their findings; Use appropriate ICT tools to record teacher-pupils' classroom interactions and wider school activities in their SRJs
	How does Mathematics relate to society?	20 mins		
		40 mins	Monitor student teachers as they search the internet for definitions of Mathematics and to refine any potential distortions or misconceptions in their narrations; (***PD Theme 1***	Engage in a group discussion to explore the application of Mathematics in the Ghanaian society. This discussion should also consider how our cultural practices and artefacts can be used in teaching of school mathematics in the Upper primary;
	What does it mean to learn and teach Mathematics?	20 mins	Poses the question "How does Mathematics relate to society?" ***(PD Theme 2)***	Pay attention to and also participate in the discussion of their own perception of how Mathematical concepts are learned
			Use Power point presentation interspersed with questioning to discuss opposing views of how	Use appropriate ICT tools to record teacher-pupils' classroom interactions and

			young children learn or develop certain Mathematical concepts; ***(PD Themes 1 & 3)*** Assign student teachers to write a reflective paper on "What does it mean to learn and teach Mathematics?,as a consolidation exercise to be presented in the next lesson. ***(PD Theme 1)***	wider school activities in SR Js Read further about what it means to reflect on the historical development of the numeration system and the contributions of different civilizations and cultures have made until the emergence of the Hindu-Arabic base ten system
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Student teachers to discuss and begin building their professional teaching portfolios (PTP) to be presented at end of the 10th week of the semester. • Student teachers are assigned to write a short reflective paper, maximum one page, on the influence of a teacher's values, importance and philosophy of mathematics on how children learn mathematics (Assessment as learning) NTS 1a- Critically and collectively reflects to improve teaching and learning. This will be included in the professional teaching portfolios (PTP) • NTS 3j - Produces and uses a variety of teaching and learning resources including ICT, to enhance learning.NTS 3h - Sets meaningful tasks that encourages learner collaboration and leads to purposeful learningStudent teachers are assigned, in small groups, to do a brief internet search on the following: (to be presented for peer review)			
Instructional Resources	Posters; video clips; downloads; models, etc.			
Required Text (core)	Sriraman, B., & English, L. (2005). Theories of mathematics education: A global survey of theoretical frameworks/trends in mathematics education research. ZentralblattfürDidaktik der Mathematik (International Reviews on Mathematical Education), 37(6), 450–456.			
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 based on theories of learning in upper primary mathematics. • How to manage transition of home to school. • Understand the various characteristics and uniqueness of upper primary learners. • How to design tasks for assessment procedures for assessment of, as and for learning. • Instructional strategies needed to consciously engage student teachers on how to design and produce portfolios, journals and STS reports.			

Lesson 2

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

Title of Lesson	Teacher beliefs about mathematics and their relation to teaching				**Lesson Duration**	**3 Hours**	
Lesson description	This lesson focuses on developing an understanding of what we know about how people think about mathematics and how an understanding of mathematics develops. It provides an overview of philosophies of mathematics and mathematics education and explores trainee teachers' beliefs about mathematics and philosophies of mathematics implicit the official mathematics curriculum and current classroom practice. It also covers children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning. Student teachers will be led to share their viewsof equity and diversity issues in the teaching of mathematics.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
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. **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.						
• **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;** • audit content knowledge and experiences of student teachers to establish and address their learning needs, perceptions and misconceptions about the learning and teaching of numeracy in Upper primary • develop student teachers' awareness of howteachers' beliefs about mathematics can influence their teaching						
• **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 different perspectives (beliefs and values) of mathematics	**Inclusion and Equity** • Outline and analyse different perspectives on mathematics and discuss their differences and similarities;	**Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma				

	• Demonstrate an understanding of relevant professional values and attitudes in teaching Upper primary mathematics	• Describe conceptions about mathematics implicit in their own beliefs; • Develop short personal beliefs about the teaching and learning of mathematics; • Reflect critically on their own learning experiences and use the skills gained to plan for continuous personal and professional development **Ethics and values of teaching** • Outline relevant professional Values, as well as, show how respect for equity and inclusivity can promote effective learning in the Upper primary mathematics classroom		• Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination) • Identify/screen students, within a class, who might need: group, targeted, of intensive interventions and plan accordingly (identify support HR) Work with families and external professionals to ensure barriers to leaning are identified, addressed and overcome **Ethics and values of teaching**: • know, understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of early adolescent child • know Teachers' Standards, child's rights, laws protecting children **Communication** • Use English as the medium of instruction Support learners to make the transition from L_1 as a medium of instruction at lower primary to L_2 as medium of instruction from upper primary
Topic	**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**
Teacher beliefs about mathematics and how this influences learning and teaching of mathematics in Upper primary.	Definitions and interpretations of the concepts: beliefs attitudes and values Implications of teacher attitude on pupils' learning ofmathematics in the Upper primary	**10 mins** **20 mins** **60 mins**	Review the previous lesson by asking student teachers to present their reflective paper on the importance of mathematics to society; ***(PD Theme 1)*** Give an exposition based on the concepts, attitudes, beliefs, and values ***(PD Theme 3)*** Engage student teachers in a discussion on how teachers' attitudes influence Upper primarylearner's learning of mathematical concepts; ***(PD Theme 1& 3)***	Participate in the discussion to review the previous lesson; Listen attentively to the tutor or lecturer's verbal exposition on the concepts; attitudes, beliefs, and values and ask questions for clarification or provide comment(s) to ensure participation and understanding; Engage in a think-pair-share session to outline and discuss the effect of teachers' attitudes on the learning and teaching of mathematicsat the Upper primary;

	Making connections between teacher beliefs and practice and developing mathematical task	**40 mins** **30 mins** **20 mins**	Assign student teachers to use a table to illustrate the differences and similarities among the concepts:values, attitudes, and beliefs; ***(PD Theme 1)*** Use Power point presentation, interspersed with questioning, to discuss how learners' attitude and beliefs influence their own learning of Mathematical concepts; ***(PD Themes 1 & 3)*** Assign student teachers to write a reflective paper on "What does it mean to learn and teach Mathematics?"as a consolidation exercise to be presented in the next lesson. ***(PD Theme 1)***	Create a table that illustrates the similarities and differences among values, attitudes, and beliefs and how these impact learning in Upper primary; Discuss the importance of Mathematics to people in various trades and professions in our Ghanaian cultural settings; Pay attention to and also participate in the discussion of how young children's attitude, beliefs, and values affect their learning of Mathematical concepts. Read further about what it means to Reflect on how learners' attitude and beliefs influence their own learning of Mathematical concepts
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Student teachers are to begin recording important ideas and experiences in their SRJ by writing few lines about their past experiences of mathematics and compare that to their experience of the ne B. Ed. mathematics curriculum (Assessment as learning) NTS 1a - Critically and collectively reflects to improve teaching and learning. This is to be included in their professional teaching portfolios (PTP). NTS 3j - Produces and uses a variety of teaching and learning resources including ICT, to be included in their portfolios. NTS 3e - Employs a variety of instructional strategies that encourages student participation and critical thinking. • Student teachers to write a reflective paper on how respect for equity and inclusivity can promote effective learning through participation in the Upper primary mathematics classroom (Assessment of Learning) (NTS 3g) *Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes.*			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet; journal articles based on beliefs, attitudes, and values within the context of mathematics teaching and learning			
Required Text (core)	Garegae, K. G. (2001). Teachers' beliefs about mathematics, its teaching and learning and the communication of these beliefs to students: A case study in Botswana.Unpublished Doctoral dissertation. University of Manitoba, Canada			
Additional Reading List	Radford, L. Theories in Mathematics Education: A Brief Inquiry into their Conceptual Differences 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; • Understand the various characteristics and uniqueness of upper primary learners(transitioning from early grade and preparing for adolescence) as suggested by various perspectives			

	• How to design tasks for assessment procedure for assessment of, as and for learning to satisfy upper primary learning experiences • Instructional strategies needed to consciously engage student teachers on how to design and produce portfolios, journals and STS reports.

Lesson 3

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	Beliefs underlying the current Upper primary official curriculum and inclusive classroom practice			**Lesson Duration**	**3 Hours**		
Lesson description	This lesson focuses on beliefs underlying the current Upper primary official curriculum and inclusive classroom practice. Areas of concentration include the Nature of Upper primary mathematics curriculum and Implications of this for classroom practice with emphasis on inclusion and equity from a reflective perspective. Student teachers will be required to participate in interactive activities including independent study to develop an understanding of what the curriculum they will use to teach entails. Thus, the lesson provides an overview of philosophies of mathematics and mathematics education and explores the beliefs implicit in the official mathematics curriculum and current classroom practice. The lesson has the tendency to develop student teachers' awareness of equity and diversity issues.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about curriculum						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-BasedLeaning** ☐	**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. **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.						
• **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;** provide an overview of philosophies of mathematics and mathematics education and explores the beliefs implicit in the official mathematics curriculum and current classroom practice						
• **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 understanding of different beliefs underlying the current Upper primary official curriculum and inclusive classroom practice	• Outline, describe and analyse different philosophies implicit in their personal beliefs that coincide or otherwise with those embedded in the current Upper primary curriculum	**Communication** • Use English as the medium of instruction Support learners to make the transition from L_1 as a medium of instruction at lower primary to L_2 as medium of instruction from upper primary				

	Demonstrate an understanding of relevant professional values and attitudes in teaching Upper primary mathematics	• Explain the influence of a teacher's values and philosophies of mathematics in students' learning • Write a short personal philosophy of teaching and learning of mathematics in Upper primary • Reflect critically on their own learning experiences and use the skills gained to plan for continuous personal and professional development • Describe differing conceptions about mathematics based on student teachers' own beliefs, values, and attitudes.	**Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination) **Ethics and values of teaching**: • know, understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of early adolescent child Teachers' Standards, child's rights, laws protecting children

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**
Beliefs underlying the current Upper primary official curriculum and inclusive classroom practice	Nature of Upper primary mathematics curriculum	**10 mins**	Project the learning outcomes and indicators for student teachers to know what is expected of them.	Read the learning outcomes and indicators to help monitor what they are going through.
		20 mins	Review the previous lesson by asking student teachers to present their reflective papers on the importance of mathematics to society; ***(PD Theme 1)***	Participate in the discussion to review the previous lesson;
	Implications for classroom practice relating to the concepts of inclusion and equity from a reflective perspective	**60 mins**	Give an exposition based on inclusion and equity ***(PD Theme 3)***	Listen attentively to the tutor or lecturer's verbal exposition on the concepts attitudes, beliefs, and values and ask questions for clarification or provide comment(s) to ensure participation and understanding;
		50 mins	Engage student teachers in a discussion on how teachers' knowledge and understanding of inclusivity and equity	Engage in a think-pair-share session to outline and

	Making connections between teacher beliefs and practice and developing mathematical task	**40 mins**	can influence their interpretation of the beliefs underlying Upper primary mathematics curriculum ***(PD Theme 1& 3)*** Assign student teachers to write a reflective paper on "What does it mean to learn and teach Mathematics as a consolidation exercise to be presented in the next lesson. ***(PD Theme 1)***	discuss the effect of teachers' attitudes on the learning and teaching of mathematics at the Upper primary; Read further about what it means to reflect on the historical development of the numeration system and the contributions of different civilizations and cultures have made until the emergence of the Hindu-Arabic base ten system
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	***1.*** Reflect critically on their own learning experiences and use the skills gained to plan for continuous personal and professional development and to record this in their SRJ (Assessment for learning) NTS 1a- Critically and collectively reflects to improve teaching and learning. ***2.*** Write a one paragraph personal philosophy teaching with respect to upper primary mathematics, to be included in their SRJ (Assessment for learning) NTS 3a - Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Garegae, K. G. (2001). Teachers' beliefs about mathematics, its teaching and learning and the communication of these beliefs to students: A case study in Botswana.Unpublished Doctoral dissertation. University of Manitoba, Canada.			
Additional Reading List	Radford, L. Theories in Mathematics Education: A Brief Inquiry into their Conceptual Differences 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 based on theories of learning in upper primary mathematics. • Understand the various characteristics and uniqueness of upper primary learners and how to use this in planning to teach. • How to design tasks for assessment procedures for assessment of, as and for learning. • How to monitor the progress of student teachers' portfolios, journals and STS reports.			

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	Beliefs underlying the current Upper primary official curriculum and inclusive classroom practice 2				**Lesson Duration**		**3 Hours**
Lesson description	This lesson focuses on developing an understanding of what we know about how people think about mathematics and how an understanding of mathematics develops. It provides an overview of philosophies of mathematics and mathematics education and explores trainee teachers' beliefs about mathematics and philosophies of mathematics implicit the official mathematics curriculum and current classroom practice. It also covers children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning. The lesson has the tendency to develop student teachers' awareness of equity and diversity issues.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-BasedLeaning** ☐	**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. **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.						
• **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; develop student teachers' understanding of underlying beliefs, attitudes, and values within the context of teaching and learning mathematics and their implications for classroom practice relative to understanding learning difficulties in mathematics e.g. dyscalculia						
• **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 secure knowledge and understanding of relevant professional values and attitudes		**Teaching** • Critically reflect on their own learning experiences and teaching and use them to plan for continuous personal development		**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills		

	Demonstrate an understanding of relevant professional values and attitudes in teaching Upper primary mathematics	**Inclusion and Equity** • Outline the need for developing values as well as to promote respect for equity and inclusivity in the mathematics classroom **Ethics and values of teaching**: • Analyse different perspectives on the need for developing professional values and attitudes	• Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination) **Ethics and values of teaching**: • know, understand and demonstrate the ethics of the profession bearing in mind the unique characteristics of early adolescent child Teachers' Standards, child's rights, laws protecting children	
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**
Beliefs underlying the current Upper primary official curriculum and inclusive classroom practice 2	Underlying assumptions of beliefs, attitudes, and values within the context of teaching and learning mathematics Implications for classroom practice relative to understanding learning difficulties in mathematics e.g. dyscalculia	**10 mins** **20 mins** **60 mins**	Project the learning outcomes and indicators for student teachers to know what is expected of them. Review the previous lesson by asking student teachers to present their reflective paper on the importance of mathematics to society; ***(PD Theme 1)*** Give an exposition based on the concepts, attitudes, beliefs, and values with respect to how they influence the implementation of any curriculum ***(PD Theme 3)***	Read the learning outcomes and indicators to help monitor what they are going through. Participate in the discussion to review the previous lesson; Pay attention to the verbal exposition on the concepts, attitudes, beliefs, and values and how they influence the implementation of a curriculum Reflect on the implications of the discussions held above on their classroom observation

	Making connections between teacher beliefs and practice and developing mathematical tasks	**40 mins** **30 mins** **20 mins**	Engage student teachers in a discussion on how teachers' attitudes influence upper primary learner's learning of mathematical concepts; ***(PD Theme 1& 3)*** Assign student teachers to use a table to illustrate the differences and similarities among the concepts, values, attitudes, and beliefs; ***(PD Theme 1)*** Use Power point presentation, interspersed with questioning, to discuss how learners' attitude and beliefs influence their own learning of Mathematical concepts; ***(PD Themes 1 & 3)***	Engage in a think-pair-share session to outline and discuss the effect of teachers' attitudes on the learning and teaching of mathematics at the Upper primary; Create a table that illustrates the similarities and differences among values, attitudes, and beliefs and how these impact learning in Upper primary; the importance of Mathematics to people in various trades and professions in our Ghanaian cultural settings; Pay attention to and also participate in the discussion of how early adolescent learners' attitude, beliefs, and values affect their learning of Mathematical concepts. Read further about what it means to Reflect on the historical development of the numeration system and the contributions of different civilizations and cultures have made until the emergence of the Hindu-Arabic base ten system
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Student teachers to reflective and discuss underlying assumptions of beliefs, attitudes (such as commitment, flexibility in ideas, tolerance, respect for evidence, reflection, etc), and values (such as respect, diversity, equity, team work, truth and integrity) within the context of teaching and learning of the basic school mathematics curriculum. Assign student teachers, in their small groups to: ○ Design and produce developmentally and age-appropriate TLMs from locally available materials that can be used to teach number, shape and patterns in the Upper primary mathematics. (NTS 3j, pg. 14) ○ Write an accompanying guide for each of the TLM explaining how to use them and which aspects of teaching Upper primary mathematics they are designed to address. ○ Identify the learning outcomes that likely to be achieved N/B: consider Upper primary learners' cultural, linguistic, socio-economic and educational backgrounds in designing the TLMs as well as theoretical perspectives that influence the choice of material and they were produced. Deadline for submission: 11th week of the semester			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Garegae, K. G. (2001). Teachers' beliefs about mathematics, its teaching and learning and the communication of these beliefs to students: A case study in Botswana.Unpublished Doctoral dissertation. University of Manitoba, Canada			
Additional Reading List	Ministry of Education. (2010). *Teaching syllabus for core mathematics* (Senior High School). Accra: Ministry of Education, Science and Sports. 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside

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	Major theories of learning in Upper primary mathematics in inclusive classrooms				**Lesson Duration**	**3 Hours**	
Lesson description	This lesson focuses on developing an understanding of major theories of how upper primary children develop and learn mathematics. It provides an overview of theories of learning mathematics in upper primary. Emphasises will be placed on major theories of learning and teaching of Upper primary mathematics in inclusive classrooms. Specifically, socio-cultural, activity theory and situated cognition perspectives will be discussed to enable student teachers develop appropriate knowledge and competencies for handling children in upper primary classrooms.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with conceptsbased child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.						
• **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;** • develop student teachers' understanding of socio-cultural, activity theory and situated cognition perspectives and their implications for practice						
• **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 the theoretical basis of learning mathematics in upper primary	**Inclusion and Equity** • Generate examples of children's individual differences based on their membership in various subcultures;	**Inclusion and Equity** • Human development (early adolescence) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias,				

	• Demonstrate knowledge and understanding of and appreciation for the contributions made by some theorists whose works are relevant to Upper primary professionals	**Teaching** • Suggest age-appropriate strategies for learning and teaching mathematics to upper primary children • Outline similarities and differences among socio-cultural, activity, and situated cognition theories and to indicate their relevance in learning and teaching mathematics in Upper primary classrooms **Characteristics of early adolescence**: • Write short notes on contributions made by learning theorists such as the Johann Heinrich Pestalozzi, Friedrich Froebel, Maria Montessori, Jean Piaget, and Jerome Bruner, etc. • Compare conceptions about the learning of mathematics implicit in the works of the theorists mentioned above and indicate how knowledge and understanding of their theories can support the teaching of mathematics in the Upper primary **Assessment for, as and of learning**: • Reflect critically on their own learning experiences are influenced by the theorists listed above.	stereotypes and institutional discrimination) **Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning **Assessment for as and of learning**: • know, understand and guide early adolescent child to engage in self-assessment and • use other age-appropriate and learner-friendly assessment formats

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**
Major theories of learning and teaching of Upper primary mathematics in inclusive classrooms	• Socio-cultural perspectives • Activity theory perspectives • A situated cognition perspective	**10 mins**	Review the previous lesson through questioning technique and to connect key issues that are emerging to the new lesson ***(PD Theme 1)***	Participate in the discussion to review the previously learned material lesson
		20 mins	Project the learning outcomes and indicators for student teachers to know what is expected of them. ***(PD Theme 1)***	Read the learning outcomes and indicators to help monitor what they are going through.
		50 mins	Give a short exposition based on socio-cultural, activity theory and a situated cognition perspectives ***(PD Theme 3)***	Listen attentively to the tutor or lecturer's verbal exposition on the different theoretical perspectives under review.
		40 mins	Engage student teachers in a discussion on the similarities and differences of the theoretical perspectives mentioned above. ***(PD Theme 3)***	Engage in a think-pair-share session to outline and hold a discussion on how similar or different the three theoretical perspectives mentioned are;
	Making connections between the theoretical perspectives and learning of mathematics in upper primary	**30 mins**	Provide guided practice opportunities for student teachers to search for information about Johann Heinrich Pestalozzi, Friedrich Froebel, Maria Montessori, Jean Piaget, and Jerome Bruner using cooperative learning techniques (each group will search for information about one of the theorists). ***(PD Theme 1& 3)***	Participate in the guided practice session to search for information about Johann Heinrich Pestalozzi, Friedrich Froebel, Maria Montessori, Jean Piaget, and Jerome Bruner using cooperative learning technique and demand corrective feedback.
		20 mins	Relate the various theories to how they explain the way upper primary children learn mathematics	Take note of the assignment given; Read further about other relevant theoretical perspectives

		10 mins	Assign student teachers to read further on the topic treated to prepare for the next lesson ***(PD Themes 1 & 3)***	
Lesson assessments – evaluation of learning:of, for and as learning within the lesson	1. As a student teacher how would you use the ideas of any of the following theorists: Friedrich Froebel, Maria Montessori, Jean Piaget, and Jerome Bruner in teaching a named concept in the Upper Primary mathematics classroom? 2. Outline four (4) cultural practices and artefacts from your locality and explain how any one of them can be used in the teaching a named concept in the Upper Primary mathematics syllabus. For example, using draught board for teaching fractions. NTS 2f - Takes accounts of and respects learners' cultural, linguistic, socio-economic and educational backgrounds in planning and teaching. Outline three (3) age-appropriate strategies for learning and teaching mathematics to Upper Primary children and present. NTS 3g - Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes. To be submitted in the eleventh week			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Kashefi, H. (2017). Teaching and learning theories applied in Mathematics classroom among Primary school teachers DOI: 10.1109/WEEF.2017.8467070			
Additional Reading List	Brunner, J. Jerome Bruner's Theory of Education: From Early Bruner to Later Bruner. Wilson, S. M., & Peterson, P. L. (2006). Theories of Learning and Teaching: What Do They Mean for Educators? Washington, DC 20036-3290 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside			

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	Major theories of learning and teaching of Upper primary mathematics in inclusive classrooms 2			**Lesson Duration**		**3 Hours**	
Lesson description	This lesson focuses on developing an understanding of what we know about how people think about mathematics and how an understanding of mathematics develops. It provides an overview of philosophies of mathematics and mathematics education and explores trainee teachers' beliefs about mathematics and philosophies of mathematics implicit the official mathematics curriculum and current classroom practice. It also covers children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.						
• **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;** • develop student teachers' understanding of theories of learning e.g., cognitive, constructivist and behaviourist perspectives and their implications for practice						
• **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 Constructivism Behaviourism, Cognitivism theoretical perspectives of learning		**Teaching** • Outline the different facets of Constructivism, Behaviourism, Cognitivism and discuss their views on learning • Compare and contrast the		**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills		

	• Demonstrate knowledge and understanding of the implication of Constructivism Behaviourism and Cognitivism theoretical perspectives of learning Upper primary mathematics	constructivism, Behaviourism, Cognitivism as learning theories **Characteristics of early adolescence**: • Reflect critically on the implications of the above-mentioned theoretical perspectives on the learning of mathematics at the upper primary level	• Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning

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**
Major theories of learning and teaching of Upper primary mathematics in inclusive classrooms 2	• A cognitive perspective • Constructivism • Behaviourism • Implications for practice	**10 mins**	Review the previous lesson through questioning technique ***(PD Theme 1)***	Participate in the discussion to review the previous lesson;
		20 mins	Project learning outcomes and indicators on a screen for student teachers to read and be aware of what is ahead.	Read the learning outcomes and indicators to develop awareness of the expectations in the lessons
		60 mins	Give an exposition based on cognitive, behaviourism constructivism and their implications on the learning of mathematics in upper primary ***(PD Theme 3)***	Pay attention to the verbal exposition on the on cognitive, constructivism and their implications on the learning of mathematics in upper primary;
		60 mins	Engage student teachers in a discussion cognitivist, constructivist, behaviourism and other theoretical perspectives and how they explain the way upper primary children learn mathematical concepts; ***(PD Theme 1 & 3)***	Engage in a think-pair-share session to outline and discuss the effect of cognitivist, constructivist and other theoretical perspectives on the learning and teaching of mathematics in the Upper primary;
		30 mins	Assign student teachers to read on the theorists such as Lev Vygotsky,	Search on the internet for information about Lev Vygotsky, Skemp and

			Skemp etc. and their contributions to the learning of mathematics in the upper primary ***(PD Theme 1)***	other relevant theorists whose works explain how upper primary children develop and learn mathematical concepts Read further about the importance of learning theories in the learning and teaching of mathematics in the upper primary. (to be presented in the next class)
Lesson assessments – evaluation of learning:of, for and as learning within the lesson	• Student teachers are assigned to present a paper on the similarities and differences among socio-cultural, activity, and situated cognition theories and to indicate their relevance in learning and teaching mathematics in Upper primary classrooms to be submitted the following week for peer review • Student teachers tocomplete worksheet based on comparing and contrasting the Constructivism, Behaviourism, and Cognitivism as learning theories in class. (Assessment as Learning) (NTS3g) *Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes.to be discussed in class*			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Sriraman, B., & English, L. (2005). Theories of mathematics education: A global survey of theoretical frameworks/trends in mathematics education research. ZentralblattfürDidaktik der Mathematik (International Reviews on Mathematical Education), 37(6), 450–456.			
Additional Reading List	Radford, L. Theories in Mathematics Education: A Brief Inquiry into their Conceptual Differences 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 worksheets as tools for assessment. • How to design and/or use some innovative materials and ideas for teaching selected concepts (e.g. developing and using the “Read my mind” number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside			

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	Children and Mathematics					**Lesson Duration**	**3 Hours**
Lesson description	This lesson focuses on developing knowledge and understanding of what we know about how children in Upper primary think about mathematics and how their understanding of mathematics develops. It provides an overview of psychological principles that explain what mathematics children are capable of learning and how they think as they go through given activities. It also highlights children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning. The lesson has the tendency to deepen student teachers' awareness of equity and diversity issues.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation; Student teachers have been introduced to some major theories in the learning of mathematics in the upper primary						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.						
• **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; • develop student teachers' understanding of how children learn mathematics at the upper primary level						
• **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 different ways Upper primary children learn mathematical concepts as	**Inclusion and Equity** • Describe how respect for gender, equity and inclusivity in the mathematics classroom promote learning for all	**Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma				

	proposed by theorists and their relevance		• Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination)
	• Demonstrate an understanding of relevant theories and principles of learning and their implications for teaching Upper primary mathematics	**Characteristics of early adolescence**: • Identify theories and theoretical principles that are relevant to the learning and teaching of mathematics in the Upper primary classroom. • Analyse portions of the Upper primary official mathematics curriculum to identify which theoretical perspectives form the bases of the curriculum.	**Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning
	Demonstrate knowledge and understanding of the influence of learners' characteristics on classroom teaching and learning	**Teaching** • Observe and write a report on how Upper primary children (each student teacher will observe a couple of children) learn given mathematics concepts and to outline the implications of this for effective classroom instruction of mathematics for young children. • Reflect critically on their own learning experiences and use this as a basis for analysingrelevant theories and principles of learning and their implications for teaching Upper primary mathematics	**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity

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**
Children and Mathematics	Children's Number readiness experiences	**10 mins**	Review the previous lesson on major theories of learning mathematics in Upper primary ***(PD Theme 1)***	Participate in the discussion to review the previously learned material;

	Concepts for Number Readiness • *Understanding size, shape and patterns* • *Ability to count verbally (first forward, then backward)* • *Recognizing numerals* • *Identifying more and less of a quantity* • *Understanding one-to-one correspondence (for example, matching sets or knowing which group has four and which has five)* Logical and psychological approaches to learning mathematics	**30 mins** **60 mins** **40 mins** **40 mins**	Engage student teachers to outline theorists whose work are relevant to the development of young children and how they learn mathematics Give an exposition on theories that explain how children develop number readiness such *Understanding size, shape and patterns; Ability to count verbally; Recognizing numerals; Understanding one-to-one correspondence* ***(PD Theme 3)*** Engage student teachers in a discussion based on logical and psychological approaches to learning mathematics. ***(PD Theme 1& 3)*** Assign student teachers to discuss different theoretical principles that explain Upper primary children's learning of mathematics. ***(PD Theme 1)*** Analyse portions of the Upper primary official mathematics curriculum to identify which theoretical perspectives form the bases of the curriculum. ***(PD Theme 1)***	List from memory theoretical perspectives and principles of learning that are relevant to Upper primary children Listen attentively to the tutor or lecturer's verbal exposition on the concepts attitudes, beliefs, and values and ask questions for clarification or provide comment(s) to ensure participation and understanding; Engage in a think-pair-share session to outline and discuss on logical and psychological approaches to learning mathematics. Discuss theoretical principles that explain how children learn given mathematics concepts in Upper primary Read further about how early children learn mathematics

Lesson assessments – evaluation of learning: of, for and as learning within the lesson	PROJECT 2 (10%) Analyse portions of the Upper primary official mathematics curriculum to identify which theoretical perspectives form the bases of the curriculum. Write a report on how Upper primary children (each student teacher will observe a couple of children) learn given mathematics concepts and to outline the implications of this for effective classroom instruction of mathematics for young children. (Assessment of Learning) (NTS 3o)*Demonstrates awareness of national and school learning outcomes of learners')Uses objective criterion referencing to assess learners* *To be submitted in the eleventh week*
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;
Required Text (core)	Kashefi, H. (2017). Teaching and learning theories applied in Mathematics classroom among Primary school teachers DOI: 10.1109/WEEF.2017.8467070
Additional Reading List	Anghileri, J. (2006). Scaffolding practices that enhance mathematics learning. Journal of Mathematics Teacher Education, 9,33–52. doi:10.1007/s10857-006-9005-9 . 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside

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	Characteristics of children's developmental stages				**Lesson Duration**		**3 Hours**
Lesson description	This lesson focuses on developing an understanding of characteristics of children's developmental stages. It provides an overview of some theories on how children develop.Emphasis will be placed on children's developmental levels, how children learn mathematics, and other psychological factors influencing learning. The lesson has the tendency to deepen student teachers' awareness of equity and diversity issues.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based child growth, development, and maturation; Student teachers have been introduced to the nature and importance of mathematics						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☒	**Work-BasedLearning** ☐	**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. **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.						
• **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;** • develop student teachers' understanding of characteristics of children's developmental stagesand its implication for teaching at the upper primary level						
• **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 understanding of characteristics of children's developmental stages	**Characteristics of early adolescence**: • Describe differing theoretical views about children's developmental stages and their implications for classroom teaching and learning of mathematics; • Analyse theoretical	**Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning				

	• Demonstrate knowledge and understanding of children's physical, language, speech, social, emotional, and cognitive and intellectual development	perspectives which are relevant to how children develop and learn mathematics in upper primary **Teaching** • Reflect critically on their own learning experiences and suggest theoretical perspectives that ex plain these modes of development. • Outline theories that explain physical, language, speech, social, emotional, and cognitive and intellectual development **Communication** • Discuss how upper primary children physical, language, speech, social, emotional, and cognitive and intellectual development affect their learning of mathematics	**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Communication** • Use English as the medium of instruction • Support learners to make the transition from L_1 as a medium of instruction at lower primary to L_2 as medium of instruction from upper primary

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**
Characteristics of children's developmental stages	Meaning and types of development e.g. Physical, language and speech, social and emotional, and cognitive development within the context of Upper primary teaching and learning of numeracy	**10 mins** **50 mins** **120 mins**	Review the previous lesson through questioning based on how early children learn mathematics ***(PD d on Theme 1)*** Give a verbal exposition on the meaning and types of development with emphasis on physical, language and speech, social and emotional, and cognitive development within the context of Upper primary ***(PD Theme 3)*** Assign student teachers (in small groups) to search for information on the internet about the contributions of any one of the following: • Johann Heinrich Pestalozzi, • Friedrich Froebel, • Maria Montessori,	Participate in the discussion to review the previous lesson; Pay attention to the verbal exposition on theories of learning mathematics in Upper primary and ask questions for clarification to ensure effective understanding; Discuss how Engage in a small group session to outline and discuss the contributions offered by given theorists to the learning of mathematics in Upper primary (each group will look for information on one theorist); Present information

			• Jean Piaget, and • Jerome Bruner's in to understanding learning of mathematics in Upper primary ***(PD Theme 3)***	obtained briefly in class and to intensify the search outside class hours to write a paper on children's number readiness
Lesson assessments – evaluation of learning:of, for and as learning within the lesson	Student teachers to discuss their mathematics related STS reports in class for colleagues to critique and give feedback for improvement. (Assessment of learning) NTS 3f - Pays attention to all learners, especially girls and students with Special Educational Needs, ensuring their progress.			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Walshaw, M. (2017). Understanding mathematical development through Vygotsky, Research in Mathematics Education, 19:3, 293-309, DOI:10.1080/14794802.2017.1379728			
Additional Reading List	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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside			

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	Multiple intelligences						Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing an understanding of the foundations of multiple intelligence theory and the influence of this on personal development. The lesson will focus on the foundations of multiple intelligence theory, multiple intelligences theory and implications for teaching numeracy in the Upper primary. It provides an overview of principles of multiple intelligences, description of the dimensions of Howard Gardner's multiple intelligences and how it relates to learning styles							
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts-based child growth, development, and maturation; Student teachers have been introduced to the characteristics of children's developmental stages							
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.							
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.							
• **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;** • audit knowledge and experiences of student teachers to establish and address their learning needs, perceptions and misconceptions in multiple intelligences. • Prepare them for teaching at the upper primary level to be competent and confidence in handling diverse learners							
• **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 understanding of the meaning and principles of multiple intelligences		**Characteristics of early adolescence**: • Outline and analyse principles of multiple intelligences • Describe the dimensions of Howard Gardner's multiple intelligences • Compare multiple intelligences with learning styles			**Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning		

	• Demonstrate knowledge and understanding of implications of multiple intelligences in classroom practice	• Reflect critically on their own learning experiences and how these relate to multiple intelligences **Teaching** • Outline how the dimensions of Howard Gardner's multiple intelligences can be used in teaching upper primary children	**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity

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**
Multiple intelligences	The foundations of multiple intelligence theory Multiple intelligences theory and personal development	**10 mins** **50 mins** **50 mins** **40 mins** **30mins**	Review the previously learned material; ***(PD Theme 1)*** State the learning outcomes for the lesson ***(PD Theme 1)*** Use a short exposition to present a highlight of Gardner's principles of multiple intelligences ***(PD Theme 3)*** Assign student teachers to do internet search on the theme "foundations of multiple intelligences" and to write short notes for group discussion ***(PD Theme 1 & 3)*** Engages student teachers in a discussion based on multiple intelligences theory and personal development ***(PD Theme 1)*** Use Power point presentation, interspersed with questioning, to discuss the implications of the multiple intelligence in the teaching and learning ***(PD Themes 1 & 3)***	Participate in the discussion to review the previous lesson; React to the statement of the learning outcomes through giving comments or questioning. Listen attentively to the tutor or lecturer's verbal exposition on the foundations of multiple intelligences and ask questions for clarification or provide comment(s) to ensure participation and understanding; Search on the theme "foundations of multiple intelligences and prepare short notes and to present the findings in groups Participate actively in the discussion of multiple intelligences theory and to identify the need to understand its implications in the Upper primary mathematics classroom Engage in a think-pair-share session to outline and discuss the implications of the multiple intelligence in the teaching and learning

	Implications for teaching numeracy in the Upper primary		Assign student teachers to read further on why student teachers have to develop understanding of multiple intelligences theory.	Read further on why they have to develop understanding of multiple intelligences theory.
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Compare multiple intelligences withdifferent learning styles (eg. Kinaesthetic, auditory and visual) and use this knowledge to plan a lesson in upper primary mathematics in class (Assessment as Learning) (NTS 2f)*Takes accounts of and respects learners' cultural, linguistic, socio-economic and educational backgrounds in planning and teaching.*			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	https://www.pdfdrive.com/multiple-intelligences-in-the-classroom-e888894.html			
Additional Reading List	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. https://www.pdfdrive.com/multiple-intelligences-mi-the-theory-its-implications-d4106293.html https://www.pdfdrive.com/intelligence-reframed-multiple-intelligences-for-the-21st-century-d158133116.html			
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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside			

Lesson 10

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	Factors that affect teaching and learning of numeracy in Upper primary				**Lesson Duration**	**3 Hours**	
Lesson description	This lesson focuses on developing an understanding of factors that affect children's learning of mathematics. It provides an overview of principles of teaching and learning Upper primary Numeracy as found in the current. This lesson will expose student teachers to knowledge and understanding of what young children's developmentally appropriate strategies for learning mathematics. Knowledge of the developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning, form part of this lesson. Student teachers will also develop awareness of equity and diversity issues.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts-based child growth, development, and maturation; Student teachers have been introduced to the principles of multiple intelligences						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.						
• **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;** • Create awareness of the various factors that affect upper primary children's learning of mathematics and how these can inform their teaching practices						
• **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 understanding of factors that affect upper primary children' learning and teaching of	**Teaching** • Outline and analyse different broad composition of factors; (teacher-based, home-based, school-based, natural and student based-factors) that affect	**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child				

	upper primary numeracy Demonstrate knowledge and understanding of the Principles of teaching and learning in Upper primary Numeracy based on teacher-student factors	upper primary children' learning and teaching of upper primary numeracy • Describe conceptions about teacher-student ratio as pre-requisites of teaching and learning of Upper primary Numeracy • Discuss the conceptions about the principles of teaching and learning in Upper primary Numeracy based on teacher-student factors **Characteristics of early adolescence**: • Outline (some) principles of teaching and learning mathematics in the current Upper primary mathematics curriculum and analyse their effectiveness	to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning	

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**
Factors that affect teaching and learning of numeracy in Upper primary	Principles of teaching and learning in Upper primary Numeracy	**10 mins**	Review the previous lesson by asking student teachers to present their work on the implications of multiple intelligences on teaching and students' learning. ***(PD Theme 1)***	Participate in the discussion to review the previous lesson;
		50 mins	Give an exposition on the factors that affect teaching and learning of numeracy in Upper primary to highlight some principles of teaching and learning of upper primary numeracy ***(PD Theme 3)***	Pay attention to the tutor or lecturer's verbal exposition on the principles of teaching and learning and ask questions for clarification to ensure understanding;
	Teachers' knowledge of the major factors (that affect upper primary children's learning of mathematics)	**50 mins**	Engage student teachers in a discussion on how teachers' knowledge of major factors affecting children's learning can influence their classroom practice ***(PD Theme 1 & 3)***	Participate in a think-pair-share session to outline and discuss the factors that affect children's learning of mathematics and implications of this on teachers' classroom practice
			Provide student teachers	Outline the principles

	Teachers' knowledge of learner-teacher ratio factor	**30 mins** **40 mins**	with selected pages of the Upper primary mathematics curriculum to outline some specific learner-teacher ratio factors learning and teaching of numeracy in Upper primary ***(PD Theme 1)*** Use Power point presentation, interspersed with questioning, to discuss how knowledge of factors can influence the choices teachers make in their instructional practices. ***(PD Themes 1 & 3)*** Assign student teachers to read further on why student teachers have to develop understanding of factors affecting upper primary children teaching and learning and write a reflective paper to be presented in the next class meeting. ***(PD Theme 1)***	of learning and teaching mathematics in Upper primary and to describe how they will use such knowledge and understanding to support their activities in their school visits. Participate in the discussion of how knowing the factors that affect children's learning of Mathematical concepts can influence teachers' teaching of mathematics. Write a brief report based on the interview conducted for presentation in class.

Lesson assessments – evaluation of learning:of, for and as learning within the lesson	Student teachers are assigned (in their small groups) to Identify and design variety of TLRs for named concepts (such as fractions, decimal number, place, shape and space, etc.) using locally available materials
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;
Required Text (core)	Jim C. (2003). An Overview of Theories of Learning in Mathematics Education Research.
Additional Reading List	Poynter, A., & Tall D. Relating theories to practice in the teaching of mathematics 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside

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	Factors *that* affect teaching and learning numeracy in Upper primary				**Lesson Duration**	**3 Hours**	
Lesson description	This lesson focuses on developing knowledge and understanding of factors that affect children's learning of mathematics. Specific areas of interest include Socio-cultural factors, attitude, and anxiety and the Implications of these for classroom practice. Student teachers will be engaged using a variety of strategies to ensure effective participation of all. Special attention will be given developmentally appropriate strategies arerelevant for Upper primary children's developmental levels. Discussions and use of instructional resources, as well as, assigned tasks will focus on how Upper primarychildren learn mathematics and associated theories, and other psychological factors influencing learning. The lesson will also look at the need for developing awareness of equity and diversity issues as potential factors that can influence children's learning of mathematics.						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts-based child growth, development, and maturation; Student teachers have been introduced to an aspect of factors that affect children's learning of mathematics;						
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.						
Lesson Delivery – chosen to support students in achieving the outcomes	**Face-to-face** ☒	**Practical Activity** ☐	**Work-BasedLeaning** ☐	**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. **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.						
• **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;** • develop in student teachers an awareness and understanding of how socio-cultural factors, attitudes, beliefs, and anxiety can influence their learning and teaching of mathematics;						
• **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 different		**Characteristics of early adolescence**: • Outline and analyse different factors that influence Upper primary		**Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and		

	factors that affect Upper primary children's learning of mathematics and implications of this for classroom practice • Demonstrate knowledge and understanding socio-cultural factors; attitude; anxiety that influence learning and teaching of Upper primary mathematics	children's learning of mathematics • Describe their views about how teacher content knowledge, pedagogical knowledge, and pedagogical content knowledge that affect children's learning of mathematics in Upper primary. **Inclusion and Equity** • Outline and analyse how socio-cultural factors; attitude and anxiety that influence learning and teaching of Upper primary mathematics; • Reflect critically on the impact of socio-cultural factors; attitude; anxiety on classroom practices • Discuss how the cultural dimensions Hofstede (1980) can be used in teaching upper primary children	behaviour of early adolescent learners and tap into those characteristics to promote learning **Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination)	

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**
Factors *that* affect teaching and learning numeracy in Upper primary	Socio-cultural factors; attitude; anxiety; Implications for classroom practice	10 mins 50 mins 60 mins 40 mins	Review the previous lesson by asking student teachers to present an outcome of the short interview with about two children on school visit ***(PD Theme 1)*** Give an exposition based on socio-cultural factors, attitudes, beliefs, values and anxiety. ***(PD Theme 3)*** Engage student teachers in a discussion on how teacher content knowledge, pedagogical	Present short reports and participate in the discussion to review the previous lesson; Listen attentively to the tutor or lecturer's verbal exposition on the concept's attitudes, beliefs, values and anxiety. and ask questions for clarification or provide comment(s) to ensure participation and understanding; Engage in a think-pair-share session to outline and discuss the effect of teachers' teacher content knowledge, pedagogical

		20 mins	knowledge, and pedagogical content knowledge that affect children's learning of mathematics in Upper primary ***(PD Theme 1& 3)*** Use Power point presentation, interspersed with questioning, to discuss how teachers' professionalvalues and attitudes remain important factors in their teaching of Upper primary mathematics ***(PD Themes 1 & 3)*** Assign student teachers to write a reflective paper on the topic "The role of the teacher in promoting effective learning of mathematics in Upper primary "to be submitted the following week ***(PD Theme 1)***	knowledge, and pedagogical content knowledge that affect children's learning of mathematics in Upper primary Create a table that illustrates the similarities and differences among values, attitudes, and beliefs and how these impact learning in Upper primary; Pay attention to and also participate in the discussion of how teachers' professional values and attitudes remain important factors in their teaching of Upper primary mathematics
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	**Student teachers to submit the following;** 1. a final portfolio in mathematics, with emphasis on upper primary mathematics Curriculum and relative to theories of learning, **(Course work)**(Assessment as learning) NTS 3k - Integrates a variety of assessment modes into teaching to support learning. (30%) 2. Project work report on designing TLMs for teaching in upper primary. **(Project)** (Assessment as learning) NTS 3h - Sets meaningful tasks that encourages learner collaboration and leads to purposeful learning. (30%)			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Tsafe, A. K. (2012). Effective Learning of Mathematics: From Theory to Practice. Volume 13 (2)			
Additional Reading List	Joan, M. E. & Katharine R. S. (). Integrating Social, Moral, and Cognitive Developmental Theory: Implications of James Fowler's Epistemological Paradigm for Basic Writers 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously connect mathematical ideas, as well as, connect mathematics to other curriculum areas and to the world outside			

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	Factors that affect learning and teaching of numeracy in Upper primary	Lesson Duration	3 Hours
Lesson description	This lesson focuses on developing knowledge and understanding of factors that affect children's learning of mathematics. Specific areas of interest include Social and emotional intelligence and how these influence upper primary children's learning of mathematics and its Implications for classroom practice. Student teachers will be engaged using a variety of strategies to ensure effective participation of all. The lesson will also look at the need for developing awareness of equity and diversity issues as potential factors that can influence children's learning of mathematics.		
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been taught psychological basis of teaching and learning and are familiar with concepts based on child growth, development, and maturation; Student teachers have been introduced to socio-cultural factors; attitude and anxiety		
Possible barriers to learning in the lesson	Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about number and numeration system.		

Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ☒	Practical Activity ☐	Work-BasedLeaning ☐	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. **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.
• **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; • develop in student teachers an awareness and understanding of how social and emotional intelligence, among other factors, like attitudes, beliefs, and anxiety can influence their learning and teaching of mathematics;

• **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 understanding of social and emotional intelligence and how this influences upper primarychildren's learning of mathematics	**Characteristics of early adolescence**: • Outline and analyse different roles that teachers play in developing children's emotional intelligence	**Characteristics of early adolescence**: • Possessing the ability to understand and manage the characteristics and behaviour of early adolescent learners and tap into those characteristics to promote learning

	• Demonstrate knowledge and understanding of how to validate the feelings of others in a busy classroom.	**Teaching** • Describe teachers' concerns for teaching emotional intelligence; • Discuss the basic ingredients of emotional and social intelligences (e.g. self-awareness, self-control, empathy, personal motivation and relationships skills) • Develop a short personal strategies for identifying interpersonal and intrapersonal intelligences and to discuss how these influence classroom practice **Inclusion and Equity** • Reflect critically on how upper primary children feel about learning of mathematics • Outline and analyse how Social and emotional intelligence influences the promotion of equity and inclusivity in the mathematics classroom	**Teaching** • Knowledge and understanding of and ability to teach and assess the range of subjects • Recognizing and using the interrelatedness of subjects to support children's learning • Guide early adolescent child to acquire life-long and independent learning skills • Building foundations for life and later learning in literacy, numeracy and critical thinking and creativity **Inclusion and Equity** • Human development (childhood) and developmental milestones • Transition from 1-class model to subject-teacher; • Establishment of personal bias and stigma • Opportunities to explore diversity within the class/subject and potential barriers to inclusion (including personal bias, stereotypes and institutional discrimination)

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**
Factors that affect learning and teaching of numeracy in Upper primary	Social and emotional intelligence and children's learning of mathematics What social qualities are to be nurtured in children to promote effective learning of mathematics in Upper primary classroom?	**20 mins** **30 mins** **30 mins** **40 mins** **40 mins** **20 mins**	Review the previous lesson through questioning; ***(PD Theme 1)*** Project learning outcomes and indicators for student teachers to read Provide verbal exposition on social and emotional intelligence Hold a discussion on the role of acceptance, tolerance, cooperation, striving for the common, and other values in promoting classroom learning and successful life for all. Leads a discussion on how teachers' knowledge of learners' social and emotional intelligence influence group formation and effective group activities Monitors student teachers as they search the internet for social qualities that children need to be effective partners in the learning of mathematics. ***(PD Theme 1& 3)*** Assign student teachers to write a reflective paper on "The need for developing appropriate social qualities in Upperprimary learners" for effective learning and a healthy life. ***(PD Theme 1)***	Participate in the discussion to review the previous lesson; Read learning outcomes and indicators to become aware of what is expected of them. Pay attention to the verbal exposition based on social and emotional intelligence and children's learning of mathematics Participate in the discussion on the role of acceptance, tolerance, cooperation, striving for the common, and other values in promoting classroom learning and successful life for all. Participate in the discussion on how teachers' knowledge of learners' social and emotional intelligence influence group formation and effective group activities Search the internet for social qualities that children need to be effective partners in the learning of mathematics Discuss their findings briefly in small groups on the implications of these for teachers' classroom instructional practices. Read further about what it means to develop social qualities and to reflect through writing on the implications of this on their preparation to become effective teachers. Outline some social qualities they consider very important for children's

				emotional and social development and how this can influence children's learning of mathematics (through independent study and to present later for grading). Write a reflective paper on how teachers' knowledge of children's social and emotional intelligence can affect their classroom practices (to be submitted for grading)
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Review of previous lessons and preparation for end of the semester examination based on learning theories in upper primary mathematics. (End of semester examination 40%)			
Instructional Resources	Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet;			
Required Text (core)	Tsafe, A. K. (2012). Effective Learning of Mathematics: From Theory to Practice. Volume 13 (2)			
Additional Reading List	Joan, M. E. & Katharine R. S. Integrating Social, Moral, and Cognitive Developmental Theory: Implications of James Fowler's Epistemological Paradigm for Basic Writers 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" number and word games to reinforce concept developed) • Instructional strategies needed to consciously apply the knowledge gained as guidelines for forming groups and promoting effective group work to ensure inclusion.			

[1]**Component 1: Subject Portfolio Assessment (30% overall)**

- Selected items of students work(2 of them 10% each)-30%
- Midterm assessment -20%
- Reflective journal 40%
- Organization of the subject portfolio-10% (how it is presented /organized

[2]**Component 2: Subject Project Assessment (30% overall score)**

- Introduction; a clear statement of aim and purpose of the project-10%
- Methodology; what the student teacher has done and how achieve the purpose of the project-20%
- Substantive or main section-40%
- Conclusion – 30%

Component 3: End of Semester Examination- (40% overall)

[1]See rubrics on Subject Portfolio Assessment in Annex 6 of NTEAP
[2]See rubrics on Subject Project Assessment in Annex 6 of NTEAP