NASCA

QUANTITATIVE LITERACY
Curriculum Statement

higher education
& training

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CONTENTS **PAGE**

1. Introduction

The Department of Higher Education and Training provides qualifications for students and out-of-school youth as part of contributing to the National Skills Development Strategy. This qualification is known as the National Senior Certificate for Adults (NASCA) and is offered at NQF Level 4 on the General and Further Education and Training Qualifications sub-framework. This qualification is aimed primarily at students in the age group 18 to 55 years old.

Quantitative Literacy is the ability to apply mathematical skills when encountering and solving problems relating to everyday real-life situations. Quantitative Literacy provides students with an awareness and understanding of the role that basic quantitative (numerical, statistical and spatial) skills play in the real world. This subject is driven by real-life contexts which underpin these basic quantitative skills. It also enables students to develop the ability and confidence to think quantitatively in order to interpret, critically analyse and solve problems in real-life situations.

The inclusion of Quantitative Literacy as a fundamental subject in the NASCA curriculum will ensure that South African citizens of the future are highly numerate. In the teaching and learning of Quantitative Literacy, students need to be provided with opportunities to engage with real-life problem situations in a variety of contexts to enable them to consolidate and extend basic quantitative skills. Quantitative Literacy will thus result in the ability to understand relevant terminology and to make sense of quantitative information communicated in tables, graphs, diagrams, maps, plans and texts. Furthermore, Quantitative Literacy will also develop the use of a variety of basic quantitative skills to critically analyse situations and creatively solve everyday problems.

In everyday life students are faced with quantitative situations which require them to be confident self-managing persons. These situations frequently relate to financial issues such as hire-purchase agreements, mortgage bonds and investments. Other everyday situations include the ability to read maps, interpret timetables, estimate and calculate areas and volumes, and understand building and seating plans. Everyday situations such as food preparation and the use of medications, requiring the efficient use of ratio and proportion also embrace quantitative situations.

The workplace requires the use of basic quantitative skills in order to efficiently meet work-related demands so as to enable the person to be a contributing worker. To benefit from specialised training for the workplace, a flexible understanding of basic quantitative skills is often necessary. These skills must enable the person to, for example, deal with work-related formulae, read statistical charts, deal with schedules and understand instructions involving quantitative components.

To be a participating citizen in a developing democracy, it is essential that the student has acquired a critical stance with regard to quantitative situations presented in the media and other social platforms. The concerned citizen needs to be aware that statistical data can often be used to support opposing arguments, for example, for or against the use of an ecologically sensitive stretch of land for mining purposes. In this information and technological age, the power of numbers and quantitative ways of thinking often shape policies.

It is therefore clear that the intention of the NASCA Quantitative Literacy curriculum is geared to equip and empower students to become self-managing persons and to acquire the competence to confidently cope with life, employment and further studies. The over-arching design principle of this curriculum is to foreground authentic quantitative contexts in which adults find themselves and enable them to use mathematical skills and concepts to solve real-life problems. This approach is relevant, educationally sound and confidence-building.

Therefore, the NASCA Quantitative Literacy curriculum should enable the student to become a self-managing person, a contributing worker and a participating citizen in a developing democracy.

2. Aims

The National Senior Certificate for Adults (NASCA) aims to provide evidence that the students are equipped with a sufficiently substantial basis of discipline-based knowledge, skills and values to enhance meaningful social, political and economic participation, to form a basis for further and/or more specialist learning and possibly to enhance the likelihood of employment. In these respects, the NASCA promotes the holistic development of students. The intention is also that the quality of the learning offered by the NASCA will reinvigorate an interest in learning for many who have had negative experiences at school.

NASCA aims to service an identifiable need in the Community Education and Training (CET) system, not currently met by other qualifications on the NQF and to create pathways for further learning. It is designed to provide opportunities for people who have limited or no access to continuing education and training opportunities.

The objectives of the Quantitative Literacy curriculum are well-suited to students who have life experience and possibly employment experience. They extend the competence of the student to adequately cope with life and add value to these students as participants in the employment sector or fields of further or higher education.

NASCA aims to produce students who are able to:

2.1 Use quantitative and non-quantitative knowledge, skills and understanding to solve problems in real-life contexts, in a range of workplace, personal, further learning and community settings;

2.2 Demonstrate the necessary applied knowledge and skills identified for competence including the use of necessary technology;

2.3 Communicate arguments and strategies when solving problems using appropriate notation and terminology both written and oral;

2.4 Use quantitative and spatial skills effectively, efficiently and critically to make informed decisions in their daily lives;

2.5 Reflect on own learning in order to re-establish an interest in learning and further study;

2.5 Gain an opportunity to prepare for post-school options of employment and further training;

2.6 Improve quality of life and free the potential of each person.

3. Exit-Level Outcomes

The following are the expected Exit-Level Outcomes of Quantitative Literacy for students:

Exit-Level Outcome 1: Numbers and Operations in Finance

Use numbers and their relationships to estimate, calculate and investigate the financial aspects of personal, business and social life in order to solve problems in non-contrived real contexts.

The emphasis of this Exit-Level Outcome is on the investigation and solution of real-life problems requiring an understanding of numbers and their use in calculations, especially in financial situations, ranging from personal to social issues. Students should develop appropriate estimation and mental calculation skills to perform simple calculations. Appropriate and effective basic calculator skills are essential for the solving of problems.

Exit-Level Outcome 2: Measurement

Use measurement to estimate and calculate physical quantities in order to appreciate the value of area, perimeter, volume and time calculations in everyday life situations.

The emphasis of this Exit-Level Outcome is on the development of measurement skills, namely measuring length, weight, capacity and time by integrating conversions within and between the Metric and Imperial systems.

Exit-Level Outcome 3: Maps, Plans and Models

Use maps, plans, models and other representations in the physical world in order to interpret scales and describe locations on a map, plan trips using time schedules and understand assembly diagrams and instructions.

The emphasis of this Exit-Level Outcome is on the development of spatial understanding and skills relating to non-contrived real-life contexts. A variety of applications are available in Design, Art, Geography and other fields to develop these spatial skills.

Exit-Level Outcome 4: Data Handling and Probability

Collect, summarise, represent and analyse data and apply knowledge of basic statistics and simple probability concepts and skills in order to communicate, justify, predict and critically analyse results and draw relevant conclusions.

The emphasis of this Exit-Level Outcome is on the ability of students as consumers to interpret and use data. Students should be able to reflect on the use, misuse and meaning of different graphical representations of data in a variety of real-life situations. The critical awareness of data manipulation to support opposing views should be developed by students.

4. Learning Outcomes (LO) for Each Exit-Level

Content relating to essential mathematical skills must be foregrounded before the 4 content areas are taught as these skills will be integrated in all the content areas.	
Content Area 1 (CA 1): Numbers and Operations in Finance Estimate, calculate and investigate the financial aspects relating to personal, business and societal life to solve problems in real-life contexts.	
Exit-Level Outcome 1 (ELO 1) Use numbers and their relationships to estimate, calculate and investigate the financial aspects of personal, business and social life in order to solve problems in non-contrived real contexts. The emphasis of this ELO is on the investigation and solution of real-life problems requiring an understanding of numbers and their use in calculations, especially in financial situations, ranging from personal to social issues. Students should develop appropriate estimation and mental calculation skills to perform simple calculations. Appropriate and effective basic calculator skills are essential for the solving of problems.	
Learning Outcome 1 (LO 1)	
LO 1.1	Analyse personal and small business finances to understand the effects of taxation, inflation and changing interest rates on personal credit and investment growth options and then make meaningful decisions. We know this when the student is able to: 1.1.1 Solve problems in different authentic real-life contexts by using estimation and accurate calculation skills (including basic calculator skills) inclusive of the following: (a) Interest Calculations: Use simple interest formulae to determine the interest, the interest rate, the period of investment and the final amount; Use compound interest factor tables to determine the initial amount, the final amount and the interest amount. If the formula is used then the period must not exceed 2 years. (b) Inflation and Deflation: Calculate annual inflation / deflation for given products over multiple periods; Calculate and compare annual inflation deflation rates; Analyse and critically interpret the effects of inflation / deflation. (c) Hire-Purchase Using the Simple Interest Formula: Calculate the monthly installment, the total cost, the repayment period and the deposit amount. (d) Profit and Loss: Calculate cost price and selling price; Calculate profit or loss using a given formula; Calculate the percentage profit or loss using a given formula; The break-even concept in context.

	(e) Discounts: Calculate discounted amount using a given percentage; Calculate percentage discount; Calculate original amounts. (f) Value Added Tax (VAT): Calculate the VAT amount for given exclusive and inclusive prices; Calculate the exclusive price for a given inclusive price. (g) Personal Income Tax using given Personal Income Tax Tables: Identify taxable and non-taxable deductions; Identify tax brackets and rebates; Calculate annual gross and net salaries; Calculate taxable amount after non-taxable deductions; Calculate tax due after deduction of the rebate. (h) UIF: - Calculate UIF Contributions and Unemployment Benefits. (i) Currency Exchange Rates: Understand terms "strong and weak" relating to currency exchanges; Perform currency conversions using given conversion rates/tables; Calculate currency exchange rates between two currencies. 1.1.2 Analyse and critically interpret different financial situations inclusive of the following: • Personal and business finances; • The effects of taxation and fluctuating interest rates; • Income and expenditure; • The impact of changing interest (simple and compound) within personal and business finance contexts. 1.1.3 Interpret calculated answers appropriately to the given situation by: • Interpreting answers in context; • Reworking a problem if the calculated answer is not suitable or if the initial conditions change; • Logically interpreting and communicating calculated answers in relation to the problem.
LO 1.2	Analyse provincial and national budgets in terms of health and welfare issues, job opportunities, etc., using numerical skills and knowledge. We know this when the student is able to: 1.2.1 Critically analyse budgets by performing relevant calculations to verify budgeted amounts; 1.2.2 Compare budgets by performing relevant calculations.
LO 1.3	Use ratio, rate, proportions and percentages to solve problems. We know this when the student is able to: 1.3.1 Perform calculations using given percentages, ratios, rates; 1.3.2 Perform calculations using proportions (both direct and indirect); 1.3.3 Solve problems by calculating percentage, ratio, rate or proportion; 1.3.4 Increase or decrease values in a given ratio or percentage.

<table>
<tr><td></td><td>Sub-Topics</td></tr>
<tr><td></td><td>

Simple and compound growth and decay
(Formulae to be provided on Formula Sheet);
Inflation;
Hire Purchase Agreements;
Cost price and selling price;
Profit and Loss;
Taxation – VAT;
Personal Income Tax;
Currency conversions and fluctuations.

</td></tr>
<tr><td colspan="2"><u>Content Area 2 (CA 2):</u> Measurement
Use appropriate measuring instruments to estimate, calculate physical quantities to describe and represent properties of and relationships, between 2- and 3-dimensional objects.</td></tr>
<tr><td colspan="2">Exit-Level Outcome 2 (ELO 2)
Use measurement to estimate and calculate physical quantities in order to appreciate the value of area, perimeter, volume and time calculations in everyday life situations.

The emphasis of this Exit-Level Outcome is on the development of measurement skills, namely measuring length, weight, capacity and time integrating conversions within and between the Metric and Imperial systems.</td></tr>
<tr><td colspan="2">Learning Outcome 2 (LO 2)</td></tr>
<tr><td>LO 2.1</td><td>Solve 2-dimensional and 3-dimensional problems using measurement and calculations.

We know this when the student is able to:
(a) Convert units of measurement (length, mass and time) within the metric system;
(b) Convert units of measurement in context;
(c) Convert between the metric and imperial systems;
(d) Convert between degrees Fahrenheit to degrees Celsius using a given formula;
(e) Time calculations, both digital and analogue;
(f) Distance, time and average speed calculations using a given formula.</td></tr>
<tr><td>LO 2.2</td><td>Solve problems in 2-dimensional and 3-dimensional contexts by estimation, measurement and calculation of values which involve:

2.2.1 (a) Lengths, distances and perimeters (circumference);
(b) Areas of triangle, square, rectangle and circle including combinations of these shapes using given formulae;
(c) Surface areas of right prisms (cube, rectangular and triangular) and right cylinders using given formulae;
(d) Volumes of right prisms (cube, rectangular and triangular) and right cylinders using given formulae.
2.2.2 Check validity of measurements in solutions against the contexts in terms of suitability and degree of accuracy.</td></tr>
</table>

Content Area 3 (CA 3): Maps, Plans and Models Use maps, seating plans, layout plans and models to interpret and analyse spatial relations.	
Exit-Level Outcome 3 (ELO3) Use maps, plans, models and other representations in the physical world in order to interpret scales and describe locations on a map, plan trips using time schedules and understand assembly diagrams and instructions. The emphasis of this Exit-Level Outcome is on the development of spatial understanding and skills relating to non-contrived real-life contexts. A variety of applications are available in Design, Art, Geography and other fields to develop these spatial skills.	
Learning Outcome 3 (LO 3)	
LO 3.1	Represent and identify views of scale drawings of plans, maps and models and calculate measurements. We know this when the student is able to: (a) Identify different features shown on maps and plans; (b) Interpret different types of scales; (c) Determine scales for maps, plans and models; (d) Use and interpret scale drawings of plans, maps and models to identify views, estimate and calculate values according to scale; (e) Calculate actual length and distance using a given scale (*bar scale or number scale*).
LO 3.2	Use maps, seating plans and layout plans to interpret and analyse spatial relations. We know this when the student is able to use maps and grids, including compass directions to: 3.2.1 Determine locations and grid references; 3.2.2 Plan trips; 3.2.3 Describe routes between two different locations; 3.2.4 Describe relative positions.
	Sub-Topics
	• Conversion of units within the metric system; • Conversion of measurements between different scales and systems. (*conversion tables will be provided*); • Temperature conversions (*formulae to be provided on formula sheet*); • Scale drawings; • Floor plans, layout plans, seating plans and elevation views; • Maps, compass directions, location and position on grids; • Travel timetables and schedules; • Measurement of time (*including international time zones);* • Measurement of length, distance, volume, area, perimeter; • Polygons commonly encountered: triangles, squares, calculation of surface area and volumes of right prisms, and right cylinders (*formulae to be provided*) and combinations of these shapes; • Calculation of perimeter and area of common polygons and circles (*formulae to be provided*).

<table>
<tr><td colspan="2">Content Area 4 (CA 4) : Data Handling and Probability
Collect, summarise, display and analyse data and apply knowledge of statistics and basic probability to communicate, justify, predict and critically analyse findings and draw conclusions.</td></tr>
<tr><td colspan="2">Exit-Level Outcome 4 (ELO 4)
Collect, summarise, represent and analyse data and apply knowledge of statistics and simple probability concepts and skills in order to communicate, justify, predict and critically analyse results and draw conclusions.

The emphasis of this ELO is on the ability of students as consumers to interpret and use data.
Students should be able to reflect on the use, misuse and meaning of different graphical representations of data in a variety of real-life situations. The critical awareness of data manipulation to support opposing views should be developed by students.</td></tr>
<tr><td colspan="2">Learning Outcome 4 (LO 4)</td></tr>
<tr><td>LO 4.1</td><td>Use a representative sample from a population to solve a problem with due sensitivity to issues relating to bias.

We know this when the student is able to:
Understand problems on issues relating to social, environmental and political factors by:
4.1.1 Identifying samples and populations;
4.1.2 Using appropriate statistical methods for collecting, classifying, summarising, representing and interpreting data;
4.1.3 Comparing data from different sources and samples.</td></tr>
<tr><td>LO 4.2</td><td>Calculate measures of central tendency and spread of data.

We know this when the student is able to:
4.2.1 Understand that data can be summarised in different ways by calculating the following measures:
(a) Mean (b) Median (c) Mode (d) Range
4.2.2 Make comparisons and draw conclusions using the following measures:
(a) Mean (b) Median (c) Mode (d) Range (e) Percentiles and quartiles (interpretations only)</td></tr>
<tr><td>LO 4.3</td><td>Represent and analyse data and statistics.

We know this when the student is able to:
4.3.1 Select, justify and use a variety of methods to summarise and display data, inclusive of:
(a) Tallies;
(b) Tables, including frequency tables;
(c) Pie charts;
(d) Single and compound bar graphs;
(e) Line and broken line graphs;
(f) Scatter plots.
4.3.2 Select, justify and use a variety of methods to summarise and display data to describe trends.</td></tr>
</table>

LO 4.4	Critically evaluate and make recommendations to statistically based arguments. We know this when the student is able to: 4.4.1 Critically interpret data and representations thereof (with the awareness of sources of error and bias) in order to draw conclusions, make predictions, predict possible trends and critique other interpretations; 4.4.2 Identify and interpret use and misuse of statistics.
LO 4.5	**Working with simple concepts of probability in order to make sense of probability statements.** We know this when the student is able to: 4.5.1 Express probability values in terms of common fractions, decimal fractions and percentages; 4.5.2 Use tree diagrams to determine the probability of dependent events; 4.5.3 Effectively communicate conclusions and predictions that can be made from the analysis and representation of data, using appropriate terminology such as, trends, increase, decrease, constant, impossible, likely and even chance.
	Topics and Sub-Topics
	• Construction of questionnaires (*not examinable*); • Selection of populations and samples; • Classification of variables: qualitative, quantitative, discrete, continuous, dependent and independent; • Methods of tabulating data; • Tally and frequency tables (*grouped and ungrouped*); • Graphical representations: - Single and compound bar graphs; - Pie charts; - Line and broken-line graphs; - Scatter plots. • Calculation of measures of central tendencies and spread: - Mean, median, mode; - Range; - Percentiles and quartiles (*interpretations only*). • Critically interpret use and misuse of statistics. • Representing and calculating probability using tree diagrams. • Critically interpret probability statements. (*terminology such as, trends, increase, decrease, constant, impossible, likely, most likely, certain, even chance, etc.).*

5. Weighting of Cognitive Levels

Assessment can encompass different levels of cognitive demands ranging from the simple reproduction of facts to the detailed analysis and the use of varied and complex methods and approaches. Assessment in Quantitative Literacy follows the same principles and to determine the level of cognitive demand it is useful to use a hierarchy or taxonomy.

The PISA (Programme for International Students Assessment) Assessment Framework (OECD, 2003) provides a possible taxonomy for assessment of Quantitative Literacy based on what it calls competency clusters. Combined with the taxonomy levels outlined in the Subject Assessment

Guidelines (SAG) document (DOE, 2007), the following taxonomy levels for Quantitative Literacy is recommended:

Level 1: Knowing;
Level 2: Routine Procedures in Familiar Contexts;
Level 3: Multi-Step Procedures in a Variety of Contexts;
Level 4: Reasoning and Reflecting.

The four cognitive levels with level descriptors showing approximate percentages for all assessments are given in the table below.

Cognitive Level	Level Descriptors
Level 1: Knowing (30%) Assessed in Paper 1 only	Knowing questions serve two functions: **Function 1:** To ask questions about the context. **Function 2:** To test the ability using information readily available such as: • Interpreting contextualised information; • Using familiar techniques; • Performing basic calculations; • Explaining common terms. **Tasks at the knowing level of the Quantitative Literacy taxonomy require students to:**
	(a) Perform calculations using basic operations in context such as: • Algorithms for +, –, ×, and ÷; • Appropriate rounding of numbers; • Estimation; • Calculating a percentage of a given amount; • Arranging in ascending and descending order; • Conversions of one dimensional metric units.

	(b) Explain (define) meaning of terms/words/vocabulary relevant to a particular topic such as: • Break-even in context; • Interest, interest rate, inflation; • Gross pay, net pay, deductions, taxable income, rebate; • Area, perimeter, surface area, volume, radius, diameter; • Scales; • Floor plan, elevation plan and layout plan; • Qualitative, quantitative, categorical, numerical, discrete and continuous data; • Events and outcome.
	(c) Know formulae such as the area of a rectangle, a triangle and a circle where each of the required dimensions is readily available.
	(d) Read off information directly from given: • Bills, payslips, budgets, statements; • Maps, plans, models; • Graphs, tables; • Clocks, schedules, time tables.
	(e) Identify: • Exchange rates between two currencies from a table; • Interest rate; • Name of employee; monthly salary; etc. from a payslip; • Names of national roads or towns on route between two locations; • Scale on a map, plan or model; • Minimum and maximum values; • Percentage chance from a given text or information (without any calculation).
	(f) Measure lengths/distances accurately using instruments (*e.g., ruler and scales*)
	(g) Explain (show) how the following have been calculated: Total due / VAT / Total income / Profit / Loss / etc.
Level 2: Routine Procedures in Familiar Contexts (20%)	Questions requiring well known procedures / common tasks. The procedure / task to be performed is clear from the way the problem is posed. All the necessary information to solve the problem is readily available. Routine procedure questions commonly involve: • Single step calculations; • Repeating the same calculation several times; • Completing a familiar task.

	Tasks at level 2 of the Quantitative Literacy taxonomy require students to:
	(a) Read off: • Break-even values from two given graphs or tables; • Values from graphs showing simple and compound interest scenarios; • Appropriate tax values from a given tax deduction table; • Time values and perform calculations involving time; • Estimated values from a graph.
	(b) Identify: • Income tax bracket based on a given salary (monthly or annual); • On which plan or elevation a particular structure is shown; • Number of items on a plan using a given key; • All possible outcomes of an event.
	(c) Construct / draw / complete the following: • Income and expenditure statements / budgets for individual households; • Table of values/ frequency tables; • Graphs for given values.
	(d) Substitute values into given formulae.
	(e) Conversion of units of measure: • Temperature using a given formula; • Between systems using conversion factors (e.g. m^3 to litres) both 2-D and 3-D units.
	(f) Explain whether a particular event is more or less likely to occur.
	(g) Calculating or determining the following: • How an amount was calculated using a given formula; • Value of one currency using a given exchange rate; • Percentage increase or decrease of an amount or value; • Percentage mark up to compare selling and cost price of an item; • How the price of an item is affected by inflation or deflation; • Distance between two locations by identifying their positions using given distance values on a map; • Perimeter, area, surface area and volume using given formula; • The number of running metres e.g. carpet needed based on the dimensions of the floor; • Set of directions between two locations by identifying locations using given distance values on a map; • Set of directions to travel between two points on a map using street names or places; • Location on a map by interpreting a given set of directions; • Finding actual measurements or measured values using a given scale; • Mode, mean, median, range;

	• Probability of an event (percentage, decimal or fractional form).
Level 3: Multi-Step Procedures in a Variety of Contexts (30%)	Students must be able to perform multi-step procedures in a variety of contexts involving numerous (more than 3 steps) and complex calculations without any guidance or scaffolding. The procedure or method to solve the problem is not immediately obvious from the way the problem is posed. Students may have to decide on the most appropriate method/procedure to find a solution to the task **AND** students may have to perform one or more preliminary calculations before determining a solution to the task. Situations in a variety of mathematical and non-mathematical content or skills should be utilised from different topics in order to make sense of the problem. **Tasks at level 3 of the Quantitative Literacy taxonomy require students to:**
	(a) Complete a table of values that models loan scenarios **AND** include consideration of monthly interest calculation / monthly repayments / monthly outstanding amounts on the loan.
	(b) Convert between different systems using conversion tables by first identifying **AND** then using the appropriate conversion factor.
	(c) Interpret time values from timetables to determine departure / arrival and travelling times.
	(d) Estimate: • The distance between two locations on a map by first identifying the possible route **AND** using a given scale; • The travelling time between two or more locations using estimated travelling speeds **AND** known or calculated distances.
	(e) Construct: • An income/expenditure statement (over two years) for a business or a budget for a fund raising event; • Frequency table by using a given set of raw data by first sorting the data **AND** then deciding on the intervals.
	(f) Planning a trip using maps, distance charts, weather reports and other travel resources giving consideration to where to stop for petrol, estimated travelling distance, time and travelling costs.
	(g) Draw graph(s) without scaffolding or guiding questions to represent: • Consumption costs; • Production costs; • Income generated from the sale of an item; • Data using a given set of raw data by first sorting the data and then constructing a frequency table.

<table>
<tr><th></th><th></th></tr>
<tr><td>Level 4:
Reasoning and Reflecting (20%)
Assessed in Paper 2 only</td><td>Reasoning and reflecting questions can be divided into two groups:
Group 1:
Questions requiring a decision, opinion or prediction about a particular scenario based on calculations performed in previous questions or given information.
Examples:
Analysing calculations done previously AND then making a decision on the most suitable option for the relevant situation;
Critiquing a statement regarding some statistics reported in news media;
Predicting a projected income for a business based on available financial data;
Explaining which of two groups performed better by comparing given data;
Providing an opinion on possible reaction to a particular set of statistics;
Suggesting how a household can change the expenditure to improve the financial position by analysing a completed financial statement.
Group 2:
Posing and answering questions about which mathematics are required to solve a problem, select and use the mathematical content, recognise the limitations and consider other non-mathematical techniques / factors that may define or determine a solution to the problem.
Examples:
Decide on the most appropriate methods to compare costs between TWO service contracts by deciding whether to use tables, graphs or equations AND then perform necessary calculations AND then make sense of the calculations in order to make a decision;
Determine whether a business is in a healthy position by performing calculations to compare income and expenditure values;
Make a decision about the most suitable bank accounts by comparing bank charges of TWO different accounts for various transactions;
Investigate the effects of changes in the interest rates on a loan OR the impact of increasing the monthly repayment on a loan by using a given model of a loan scenario;
Make a decision about the most cost effective box for packaging an item AND comparing the boxes in terms of wasted space (volume) and materials (surface area).</td></tr>
</table>

	Tasks at level 4 of the Quantitative Literacy taxonomy require students to:
	(a) Make a deduction(s) about: • Implications for consumers to proposed increases to consumption tariffs; • Whether data collected is biased or valid based on the structure of the instrument used to collect the data OR the way in which the data was collected; • Trends or predictions for the future by analysing data organised in tables or graphs; • The fairness of a game by analysing a game of chance.
	(b) Describe differences or impact: • By comparing income and expenditure values for a business over a two year period; • Of increasing monthly repayments of a loan or investments; • Of making a lump sum payment into a loan or investment on the total cost of the loan or investment; • Projected versus actual budgeted values; • Differences between data sets by comparing measures of central tendencies and spread for **TWO** or more data sets.
	(c) Make recommendations as to how expenditure should be changed to improve the finances of a household or business by analysing a budget.
	(d) Construct / plan / complete / draw: • A model of a loan or investment with scaffolded or guiding questions; • A trip and costs by performing time calculations in conjunction with maps, travel resources and financial information.
	(e) Show by calculation how the price of an item may change if affected by inflation over a multiple time period.
	(f) Re-work an answer if the initial conditions change.
	(g) Determine the quantity of an item required by interpreting plans to determine dimensions **AND** then calculate measurements of surface areas or volumes and using conversion ratios.
	(h) Describe or critique: • An item represented on a plan; • The design of a structure shown on a plan; • The use and misuse of statistics by identifying and justifying recommendations.
	(i) Make connections of plans showing different views of a structure.
	(j) Make predictions about the chance of an event occurring by analysing a table of data.
	(k) Analyse / explain / justify / defend / interpret / critique / verify: • The relevance of the break-even points of two graphs in relation to the context;

	• How an individual's tax may have changed by comparing income tax tables over different tax periods; • A particular salary by using knowledge of inflation rates; • The effect of an increase in salary has on increased tax payments; • Why it is not necessarily true that the cost of an item in one country is much cheaper in another; • The scale at which an object is been drawn and suggest a more appropriate scale; • A proposed travel route in relation to distance, time costs etc. **AND** suggesting and justifying alternative routes; • With justification whether data is discrete or continuous; • Whether a probability statement makes sense; • The use of references to probability in news media.

6. Structure of Assessment

There will be **TWO** final examination papers of 3 hours duration, consisting of 150 marks each that will be nationally set and moderated at the end of the academic year.

6.1 Paper 1

- A basic knowing and routine applications paper;
- Will consist of five questions;
- The first four questions will each focus on a different context while the fifth question may consist of more than one context;
- Contexts must represent real-life situations and should not be contrived;
- All questions should integrate Assessment Criteria from more than one Content Area;
- All questions will include sub-questions assessing the first three cognitive levels (Level 1, Level 2 and Level 3).

6.2 Paper 2

- An application, reasoning and reflecting paper;
- Will consist of **FOUR** or **FIVE** questions;
- Questions will require more interpretation and application of the information provided;
- Contexts must represent real-life situations and should not be contrived;
- Each of the questions must focus on a different context;
- Each question must integrate Assessment Criteria from more than one Content Area;
- All questions will assess sub-questions from the last three cognitive levels (Level 2, Level 3 and Level 4).

6.3 Weighting of Content Areas in the Examination Papers

Content Area (CA)	Numbers & Operations in Finance	Measurement	Maps, plans and Models	Data Handling and Probability	TOTAL
	±25%	±20%	±20%	±35%	
Paper 1	38 (±5)	30 (±5)	30 (±5)	52 (±5)	150
Paper 2	38 (±5)	30 (±5)	30 (±5)	52 (±5)	150

Note: Basic Essential Mathematical Skills will be integrated with the 4 content areas and not assessed separately.

6.4 Weighting of Cognitive Levels in the Examination Papers

Cognitive Levels	LEVEL 1 Knowing	LEVEL 2 Routine Procedures in Familiar Contexts	LEVEL 3 Multi-Step Procedures in a Variety of Contexts	LEVEL 4 Reasoning and Reflecting
Paper 1	60% (±5%)	20% (±5%)	20% (±5%)	0%
Paper 2	0%	20% (±5%)	40% (±5%)	40% (±5%)
Total	**30% (±5%)**	**20% (±5%)**	**30% (±5%)**	**20% (±5%)**

7. Content

The content in the Quantitative Literacy curriculum is divided into two sections: Basic Essential Mathematical Skills and Content Areas.

7.1 Basic Essential Mathematical Skills

The skills in this section comprise the following:

- Numbers and calculations with numbers;
- Interpretation and communication of answers and calculations;
- Patterns, relationships and representations.

Much of the content in the Basic Essential Mathematical Skills Topics comprises elementary mathematical content and skills that students are expected to have already been exposed to in their formal schooling, namely, Grade 9 (*e.g.* number formats and conventions, percentages, drawing graphs from tables of values, and so on). The inclusion of this content provides lecturers/tutors with the opportunity to revise these important skills and thus provide students with the opportunity to explore these skills in contexts. It is envisaged that a well-founded grasp of the concepts in the Basic Essential Mathematical Skills Topics is necessary in order to make sense of the content and contexts outlined in the Content Area Topics.

The following topics must be incorporated and taught as Basic Essential Mathematical Skills:

- Number formats and conversions;
- Common fractions, decimals, percentages;
- Rounding and estimation;
- Positive and negative numbers (Addition and Subtraction only);
- Positive exponents, square and cube roots;
- Rate, Ratio (including unit ratio);
- Direct and Indirect proportion;
- Direct substitution into formulae;
- Operations with numbers and calculator skills;
- Making sense of graphs;
- Patterns and relationships;
- Representations of relationships in tables, equations and graphs;
- Working with two or more relationships and / or representations.

Content relating to Basic Essential Mathematical Skills, although not classified as separate content areas must be foregrounded before the following 4 Content Area Topics are taught as these skills will be integrated in the 4 Content Areas.

7.2 The Following Content Areas (CA) will Constitute the Quantitative Literacy Curriculum. Each Content Area will be Accorded Equal Weighting and Therefore the Same Allocation of Time Should be Given to Each Content Area.

CA 1 Numbers and Operations in Finance – Estimate, calculate, investigate and monitor the financial aspects of personal, business and national life and to investigate and solve problems in other contexts.

CA 2 Measurement – Use appropriate measuring instruments to estimate, calculate physical quantities and to describe and represent properties of and relationships, between 2-and 3-dimensional objects.

CA 3 Maps, Plans and Models – Use maps, time schedules, seating plans, layout plans and models to interpret, plan trips and analyse spatial relationships.

CA 4 Data Handling and Probability – Collect, summarise, display and analyse data and apply knowledge of statistics and basic probability to communicate, justify, predict and critically analyse findings and draw conclusions.

8. Recommended Study Hours

Quantitative Literacy is a 30-credit course, which relates to 300 notional study hours. It is anticipated that a typical one-year offering of the course will spread over 30 weeks, excluding time allocated for revision and examinations. Candidates are therefore expected to spend approximately 10 hours per week on this subject. The following table illustrates how time should be utilised:

A suggested time allocation for the course is shown on the table below:

Basic Skills & Content Area	Contact Teaching Time	Self-Study Time
Basic Essential Mathematical Skills Numbers and Operations in Finance Measurement Maps, Plans and Models Data Handling and Probability	**SIX** hours per week x 30 weeks = 180 hours	**FOUR** hours per week x 30 weeks = 120 hours
Total Course Notional Hours	**300**	

9. Approach to Teaching and Learning

All topics need to be taught in contexts besides the essential skills which need to be foregrounded before teaching the content areas. Contexts are essential for the development of Quantitative Literacy and require that the subject be embedded in the everyday lives of the students. Local community practices, the home environment and local industry provide a good source of relevant contexts to explore. Resources obtained from media can be used effectively to expose students to current happenings (locally, nationally and internationally).

The approach to developing Quantitative Literacy is to engage with contexts rather than to apply mathematics already learnt to a context. Being quantitatively literate is essential for the development of the responsible citizen, the contributing worker and the self-managing individual.

Motivation for Proposed Name Change for Subject from the Current Mathematical Literacy to Quantitative Literacy

The name of the subject should be Quantitative Literacy, since this subject underscores competence, not abstract, conjectural or algorithmic knowledge. It has as one of its overarching principles the objective of enabling students to confidently solve quantitative problems in real-life in contexts in which modern people live and work. These problems are often "messy", not straightforward and some require higher order reasoning skills and judgements.

A second reason for the name change is the negative connotation that Mathematical Literacy has acquired over its short history as a school subject. Because of the wider publics' ignorance of the actual curriculum of Mathematical Literacy in Grade 10-12, many people perceive it to be a second-rate, dumbed-down type of mathematics, even referred to as "Maths Lite" or a "step child" of core mathematics. This is a far cry from the reality of being able to solve complex real life problems which require comprehension of unfamiliar contexts, the ability to read from complex tables, interpret authentic graphs and analyse statistics in a variety of representations.

Finally, the research that the Umalusi curriculum team has undertaken in 2014 has demonstrated that the curriculum of this subject overlaps to a large extent with the subject which is known worldwide as Quantitative Literacy.

10. Glossary

- **Association –** a general term to describe the relationship between two variables. Two variables in bivariate data are *associated* or **dependent** if the pattern of frequencies of their bivariate values cannot be explained only by the frequencies of the univariate values. In contrast, two variables are *not associated* or **independent**, if the frequencies of bivariate values can be determined simply from the frequencies of the values of each variable.

- **Associative Law / Property –** the property of an operation which allows for the operation to be carried out by grouping the terms differently (e.g. for addition of real numbers: $(a + b) + c = a + (b + c)$ and for multiplication $(a \times b) \times c = a \times (b \times c)$.

- **Bar Graph / Diagram –** a diagram that uses horizontal or vertical bars to represent the **frequency** of classes (or groups or labels) in data consisting of observations of a categorical variable. The height or length of each bar is proportional to the frequency of the corresponding class, but the thickness of a bar has no meaning. The bars are not required to touch each other, and may be separated.

- **Bia –** a distortion of the data in a set due to irregularities in the collection of the data; an unjustified tendency to favour a particular point of view.

- **Break-Even Point –** the value of the independent variable at which the costs associated with various (two) pricing structures for a commodity become equal; the point at which expenditure and income are equal.

- **Circumference –** the (measure of) the perimeter of a circle.

- **Commutative Law/Property –** the property of an operation which allows for the order of the values operated with to be interchanged (e.g. for the addition of real numbers $a + b = b + a$ *and* for multiplication $a \times b = b \times a$.

- **Compass Direction –** the direction indicated with reference to the globe of the earth as north, south, east or west; the direction in degrees from the northerly direction in an anticlockwise sense.

- **Compound Growth –** the accelerated effect in the manner in which a quantity increases (or decreases) due to the factor causing the increase (or decrease) also acting on the increase (or decrease) in the amount itself (e.g. the growth in the amount invested when interest is calculated on interest, as in **Compound Interest**).

- **Compound Interest –** the calculation of the new amount *A* when the original amount (the principal), *P*, of money is subjected to interest being calculated on interest at the end of a period.
- **Continuous Variable –** a variable which ranges through all the real numbers on the interval applicable to it.
- **Data –** items of information that have been observed and recorded; can be categorical (e.g. gender), numerical (e.g. age), are often arranged in a list or table.
- **Dependent Variable –** the element of the range of a function which depends on the corresponding value(s) of the domain (e.g. in $y = f(x) = \pi x^2$ the area of a circle (*y*) depends of the radius, *x*. *x* is the **Independent Variable** and *y* the dependent variable).
- **Direct Proportion –** two variables, *x* and *y*, which are related by the equation $y = kx$, are said to be in direct proportion.
- **Discrete Variables –** variables for which the values do not take on all the real numbers within the range over which they vary; a discrete variable is often associated with a count and so takes the values of the counting numbers (e.g. 0, 1, 2, 3 …).
- **Event –** any subset of all the possible outcomes of an experiment. An event *occurs* at a particular experimental **trial** if *any one* of its constituent outcomes is the outcome observed for that trial.
- **Exchange Rate –** the price of a unit of the currency of one country in terms of the currency of another.
- **Experiment –** a repeatable activity or process for which each repetition gives rise to exactly one outcome drawn from the sample space (statistical experiment); gives rise to **univariate data** on the outcome of each **trial** (e.g. the observed face of a die) (simple experiment). The number of trials observed is the sample size *n*.
- **Frequency –** a count of the number of times a particular outcome or event was observed in data with a sample size *n*.
- **Frequency Table –** a table reporting the groups into which data values were organised, and the **frequency** of each group.
- **Global Positioning System –** a system using satellite and electronic technology, whereby a particular location on the earth's surface is determined in terms of its **latitude** and **longitude.**
- **Grid –** a pattern of lines usually drawn at right angles to each other to form rectangles.
- **Grouped Data –** data arising from organising n observed values into a smaller number of disjoint groups of values, and counting the frequency of each group; often presented as a **frequency table**.

- **Hire-Purchase –** the system whereby goods are bought by putting down a deposit and then periodically paying off the balance of the purchase price plus interest. Simple interest usually applies while insurance costs are commonly also included.
- **Inflation Rate –** a quantitative measure which indicates the rate at which the price of consumer goods is increasing over time.
- **Indirect/Inverse Proportion –** two variables, x and y, which are related to each other by the equation $y = k/x$ are said to be in inverse proportion.
- **Latitude –** the number of degrees that a location is north or south of the equator.
- **Longitude –** the number of degrees that a location is east or west of a line passing through the poles and Greenwich in Britain.
- **Median –** a value that splits the sample data of a numerical variable into two parts of equal size, one part consisting of all values less than the median and one part with all values greater than the median; most easily established if the data values are arranged in increasing or decreasing order.
- **Mode –** the most frequently occurring observation in a set of data.
- **Mortgage Bond –** a loan from a bank, usually for the purchase of property. The loan is subject to the payment of **compound interest** and is paid off in regular instalments which include interest and and capital.
- **Outcome** – the result of an experiment (in statistics) (e.g. the outcome of an experiment in which a dice is rolled can be any one of the natural numbers 1 through 6).
- **Percentiles** – values of ranked data separated into one hundred groups of equal size, especially when sample size n is very large.
- **Polygon** – a figure in a plane formed by some number of straight sides.
- **Probability** – for equally likely outcomes, the number of favourable outcomes divided by the total number of possible outcomes of an experiment.
- **Qualitative Data** – information or data arising from observations which are not numerical; can be categorical.
- **Quantitative Data** – data with values that are numerical; can be discrete (counted) or continuous (measured).
- **Right Cylinder** – a solid that has one axis of symmetry through the centre of the circular base and a uniform, circular cross-section.
- **Right Prism** – a prism whose lateral sides are perpendicular to its base.
- **Sample** – in statistics, a group of data chosen from all the possible data.
- **Tree Diagrams** – a diagram in which the possible outcomes of trials involving one or more events are indicated by line segments.
- **Trial** – each repetition of a statistical experiment.

11. References

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11.5 The PISA (Programme for International Students Assessment) Assessment Framework (OECD, 2003).

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