Introduction

‘A strong focus on literacy and numeracy is essential: all children and young people require these skills to gain access to learning and to succeed in life. Confidence and competence in literacy and numeracy provide the foundations for lifelong learning.’

Building the Curriculum 3

This professional learning resource is for all members of the learning community to work on together, in small groups or departments or as individuals. The resource offers a range of rich materials for in-service days and other professional learning. It is designed to meet the needs of individual practitioners, groups within schools, learning communities, and education authority staff with responsibility for numeracy. The resource lends itself well to promoting professional reflection, dialogue and debate about numeracy and how to improve it. It offers a reference point for teachers to evaluate the quality of the delivery of the numeracy aspect of the mathematics curriculum and numeracy across learning as experienced by learners across stages and at transition points.

Numeracy, alongside literacy and health and wellbeing, sits at the heart of Curriculum for Excellence, as the knowledge, skills and attributes which equip children and young people for learning, life and work.

This professional learning resource provides guidance and advice to help inform learning and teaching practices in line with the main objectives of the Scottish Survey of Literacy and Numeracy (SSLN). It provides practitioners with more detail on children’s and young people’s strengths and areas for improvement in numeracy identified within the in-depth analysis of the SSLN numeracy survey data.

SSLN allows exploration of children and young people’s performance across the numeracy organisers. This professional resource aims to share with practitioners, children’s and young people’s performance in:

- Time

The resource aims to help you to use these findings to:
- reflect on your own practice in developing and promoting numeracy,
- consider how to enhance children’s and young people’s numeracy skills, to support their learning across the curriculum,
- plan how to develop your practice to incorporate some new concepts and ideas, and
- share views on numeracy across learning.

The analysis of children’s and young people’s performance within these numeracy organisers provide an opportunity to reflect on and explore planning for effective learning, teaching and assessment.
Note
Areas for strength may still have an aspect which should be improved. This is denoted by an asterisk.

Accurate reading of the time is a vital life skill used routinely every day for learning, life and work. For example, to arrange business meetings, to plan journeys and arrival times.

Time - P4 - First Level

The main area impacting on P4 learners’ performance within time was their knowledge and understanding of:

- clocks
- language of time and representing time
- calendars

<table>
<thead>
<tr>
<th>Early level</th>
<th>First level</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am aware of how routines and events in my world link with times and seasons, and have explored ways to record and display these using clocks, calendars and other methods.</td>
<td>I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day.</td>
</tr>
<tr>
<td>MNU 0-10a</td>
<td>MNU 1-10a</td>
</tr>
<tr>
<td>I can use a calendar to plan and be organised for key events for myself and my class throughout the year.</td>
<td></td>
</tr>
<tr>
<td>MNU 1-10b</td>
<td>I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers.</td>
</tr>
<tr>
<td>MNU 1-10c</td>
<td></td>
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</tbody>
</table>
Strength

Learners at P4 demonstrated that they can:

- read times involving o’clock, half past, quarter past and quarter to on an analogue clock face
- recognise quarter to and quarter past
- match analogue to digital time*

Almost all learners can read the time from a clock face when it is exactly on the hour e.g seven o’clock.

Most can read half past and the majority can read quarter past and quarter to when given the time displayed on a clock.

For example two thirds of learners were able to answer this type of question accurately.

What is the time on this clock?

I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day.

MNU 1-10a

<table>
<thead>
<tr>
<th>o’clock</th>
<th>half past</th>
<th>quarter past</th>
<th>quarter to</th>
<th>other times e.g. ten past</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost all</td>
<td>most</td>
<td>majority</td>
<td>less than half</td>
<td></td>
</tr>
</tbody>
</table>

Reading time from a single representation of an analogue clock
From a choice of four clock faces most learners were able to identify the correct time on a clock face when the time was o’clock.

The majority of learners were able to identify when it was half past and quarter to and past as shown in the example below.

Tick (✓) the clock which shows quarter to seven.

The majority of learners were able to match digital and analogue time when it was twenty to or twenty past. However the most commonly made errors are set out within the area for improvement section below.

Tick the clock that shows the same as this digital time.
Area for Improvement

Learners’ responses at P4 indicate the need to improve their knowledge, understanding and skills within the concept of time in the following areas:

- confidently reading times beyond o’clock and half past
- match digital to analogue *

Learners had difficulty with reading clock faces that showed times such as seven fifty five and ten past eight. This then impacts on their ability to carry out questions which are context based as they have difficulty reading the time and using this to calculate a solution.

Learners in P4 were making the following common error.

When learners match digital to analogue time, the most common wrong answer indicated that learners were taking the minutes from the digital clock and dropping the zero to assign the minute hand to a number on the 12 hour clock as illustrated below.
Strength

Most learners in P4 were able to:

- match 12 hour time to words
- use am and pm appropriately

The majority of learners in P4 can match 12 hour time to the written form.

For example, 12.15 pm = quarter past 12
Most learners’ responses show that they can use am and pm appropriately when asked if an event occurred in the morning or the afternoon.

For example

```
Write the following time using am or pm

Ten past 3 in the afternoon = 3.10 pm
```

The most common incorrect answer showed that learners could use am and pm appropriately but just under half were not able to write ten past 3 in the 12 hour system. This then impacted on their ability to represent time on a clock face as outlined below.

Area of improvement

Learners’ at P4 answers to questions demonstrated that they should improve their knowledge, understanding and skills within the concept of time in the following areas:

- convert from 24 hour to 12 hour
- represent time on a clock face
Less than half of learners were able to convert from 24 hour time to writing the time in a 12 hour format using am and pm. For example, a gym class starts at 1400 hours, write down what time the class started at in 12 hour time?

Only a few learners were able to show the time on a clock face as illustrated in the example below. They were unable to place the hour hand in the correct position demonstrating a lack of understanding of the movement of the hands.

On the clock face, draw in an **hour hand** and a **minute hand** to show the time **nine twenty five**.

**Reflective question:**

- What approaches do you use to draw learners’ attention to the movement of the hands on a clock?

**Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:**

**T&L: Wmnet: Teaching Clock**
Interactive whiteboard clock for teaching time. Hour hand moves with minute hand as a real clock.
https://www.topmarks.co.uk/time/teaching-clock

**T&L: Topmarks: On Time Advanced Level.**
Interactive Whiteboard resource. Read digital times and set the hands on an analogue clock.
http://www.sheppardsoftware.com/mathgames/earlymath/on_time_game4.swf

**CLPL: Wikihow**
Three ways to teach learners how to tell the time
http://www.wikihow.com/Teach-Kids-to-Tell-Time
Strengths

At P4, almost all learners demonstrated that they can:

- estimate the time within a real life context

Learners are able to select an appropriate unit of time when applied to a real life context.

<table>
<thead>
<tr>
<th>How long does it take to boil a kettle?</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 seconds</td>
</tr>
<tr>
<td>5 minutes</td>
</tr>
<tr>
<td>5 hours</td>
</tr>
<tr>
<td>5 days</td>
</tr>
</tbody>
</table>

Time calculations

Strengths

At P4, almost all learners demonstrated that they can:

- calculate time ahead

Learners were able to calculate a new time by adding on one hour from a given time, where the time is given on the hour e.g. It is 2 pm, what is the time 3 hours later?

Two thirds of learners were able to calculate the time when they had to add on 15 minutes and it didn’t cross over into the next hour. The successful responses were higher when they had a visual representation of the clock and choice of answers.
Area for Improvement

At P4, learners perform less well calculating time intervals that involve:

- time ahead and time behind
- calculations using hours and minutes

Learners' difficulties in reading time impacts on their ability to answer accurately questions involving time ahead and time behind.

Less than half were able to calculate a time 15 minutes slower from the time shown. Learners were more successful as can be seen in the two examples below when they have a choice and a visual stimulus to help them, similar to the examples in strengths section above.

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**Pat looks at the clock and says “the programme starts in 15 minutes”**

When does the programme start? Tick (√) one box.

- A  quarter past five
- B  five to five
- C  quarter to two
- D  twenty five past five

---

The clock is 15 minutes slow.

What is the correct time?

Answer _______________________

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Less than half of learners could calculate the time difference illustrated below.

| Jamie arrived at school at 8.40 am. |
| Rachael arrived at 9.05 am.     | Answer: ___________________ minutes |
|                                  | How much earlier did Jamie arrive? |

**Reflective Question:**

- How are you developing learners’ competence and confidence in working with time intervals time in real-life, relevant situations?

**Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:**

**T&L: TES Teachers TV:** *Problem Solving and Other Topics*
Contextualised time problem solving video clip for learners
(Problem 1: Aunt Anna’s Visit)
http://www.tes.co.uk/teaching-resource/Teachers-TV-Problem-solving-and-Other-Topics-6046026/
Strengths

At P4 the majority of learners were able to:

- extract information from a diary
- extract information from a simple daily timetable

At P4 the majority of learners were able to extract the correct information recorded in a diary and from a simple daily timetable.

The pupils in P6 plan a Christmas Fayre

<table>
<thead>
<tr>
<th>Christmas Fayre</th>
<th>Time allocation</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.15 pm - 12.45 pm</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>12.45 pm - 1.15 pm</td>
<td>P2</td>
</tr>
<tr>
<td></td>
<td>1.15 pm - 1.45 pm</td>
<td>P3</td>
</tr>
<tr>
<td></td>
<td>1.45 pm - 2.15 pm</td>
<td>P4</td>
</tr>
<tr>
<td></td>
<td>2.15 pm - 2.45 pm</td>
<td>P5</td>
</tr>
<tr>
<td></td>
<td>2.45 pm - 3.15 pm</td>
<td>P7</td>
</tr>
</tbody>
</table>

What class is at the Fayre at 1 pm?

Answer________________________
Strengths

Learners at P4 demonstrated that they can use a calendar to record events and retrieve information such as:

- order months of the year
- the day or time of an event
- the day of a regularly occurring event.
- a given day and month.

Almost all learners were able to order the months of the year in questions similar to this.

Questions that are set within contexts involving simple extraction of information, or recording a given date on a calendar provided, have a higher success rate than those that are not set within a context.

The calendar shows the collection days for recycling bins during March and April.

On what day of the week is the recycling bin collected?

<table>
<thead>
<tr>
<th>March</th>
<th>Su</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>Sa</th>
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<td>9</td>
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<td>31</td>
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</table>

<table>
<thead>
<tr>
<th>April</th>
<th>Su</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>Sa</th>
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<td>7</td>
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<td>30</td>
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</tbody>
</table>
At P4, learners perform less well in these areas:

- number of days in a month
- using a range of information along with calendars

Less than half of learners were able to work out the answer to questions, similar to this one, that involve applying their knowledge of the number of days in a month.

<table>
<thead>
<tr>
<th>What is the date and day before Tuesday 1st June?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of week</td>
</tr>
</tbody>
</table>

In the question below less than a third of learners knew how many days were in a given month and were unable to work out a date which went beyond the end of the month.

The opening of a new supermarket was to be on the 22 June.
The supermarket opened 11 days late.
When did the supermarket open? ________________________________

16 % of learners answered 32 or 32 June. Why do you think this was?

Word problems seem to present a greater challenge to learners. Learners have difficulty in identifying the key pieces of information they need to answer a question accurately.

Where learners were given information to use alongside a calendar, they demonstrated that they were not confident in handling information and in using it to identify and calculate dates on a calendar.
In question A the majority of learners were able to circle the correct date.

In question B, a third of learners were able to identify a date two weeks from the date circled in the question.

Pat is sowing some seeds on the second Tuesday in April

When should Pat plant the seedlings into pots?

<table>
<thead>
<tr>
<th>Question A</th>
<th>Circle this day on the calendar</th>
</tr>
</thead>
</table>

| A 7th April |  
| B 14th April |  
| C 21st April |  
| D 28th April |  |

<table>
<thead>
<tr>
<th>April</th>
</tr>
</thead>
<tbody>
<tr>
<td>M T W Th F Sa Su</td>
</tr>
</tbody>
</table>
| 1 2 3 4 5  
| 6 7 8 9 10 11 12 |
| 13 14 15 16 17 18 19 |
| 20 21 22 23 24 25 26 |
| 27 28 29 30 |

<table>
<thead>
<tr>
<th>Day 1</th>
<th>After 2 weeks</th>
<th>After another 3 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow seeds in a tray</td>
<td>Plant seedlings into pots</td>
<td>Plant seedlings outside</td>
</tr>
</tbody>
</table>

Reflective question:

- What activities do you do on a regular basis to encourage learners to apply other knowledge and understanding of the number of days in each month and the order of the months of the year?
Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

**T&L: YouTube clip: Days in the Month Song**
30 days has September song to support learners to remember no. of days in each month
https://www.youtube.com/watch?v=drH3_Flt85g

**T&L: Maths Frame – Using a Calendar**
Interactive whiteboard activity, poses questions for learners to practises working out calendar durations http://mathsframe.co.uk/en/resources/resource/261/using_a_calendar

**CLPL: BBC class clips CLIP 13565 Using a Calendar**
Contextualised time problem solving video clip for learners involving growing seeds and using a calendar. http://www.bbc.co.uk/learningzone/clips/using-a-calendar/13565.html

Reflective questions:

Within your establishment, how often do you plan effective learning, teaching and assessment that:

- develops learners’ competence and confidence in reading and using clocks?
- develops learners’ competence and confidence in using calendars?
- integrates learning across the numeracy organisers?
- supports learners to recognise appropriate strategies for solving word problems?
- provides a blend in the nature and frequency of examples selected to ensure appropriate challenge and development of key skills?
Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

**T&L: BGFL: Stop the Clock Game: The 24 hour Clock**
Times are shown on an analogue clock, learners must stop the clock and record the digital time (taking account of 24 hour notation).

**T&L: Teaching clock**
Learners can move the hands to show what the time would be if the clock was fast/slow
http://www.cambridge.org/elt/resources/young/interactive/clock/index.htm

**T&L: TES iboard**
Time duration word problems involving language such as early/late.
http://www.iboard.co.uk/iwb/Time-Problem-Generator-Level-2-Less-than-an-hour-across-the-hour-468

**T&L: Crick web: Numeracy Tools**
Coloured teaching clock with option to hide minute/hour hand
http://www.crickweb.co.uk/ks2numeracy-tools.html#Toolkit%20index2a

**T&L: TES iboard: Three Hares Race Durations**
Learners calculate time durations with visual number line for visual support (digital displays)
http://www.iboard.co.uk/iwb/Three-Hares-Race-Durations-2625

**T&L: TES iboard: Time Calculations Game Level 2**
Less than an hour duration but across the hour. Learners must read the contextualised word problems and calculate the duration.
http://www.iboard.co.uk/activity/Time-Calculations-Game-Level-2-Less-than-an-hour-duration-but-across-the-hour-478

**T&L: TES iboard: Age 5 – 7 Time**
Various interactive whiteboard activities for practising calculating time intervals/durations. Questions posed as word problems. Adaptable to meet learners’ individual needs
http://www.iboard.co.uk/activities/page/2/subject/maths/years/7-9/path/measuring_time

**CLPL: TES: Time duration**
Instructional Powerpoint presentations showing time durations in hours and minutes, counting on and back.
The main areas impacting on P7 learners’ performance in time were their knowledge and understanding of:

- converting units of time
- time calculations
- applying time in familiar and unfamiliar situations
- timetables

<table>
<thead>
<tr>
<th>First level</th>
<th>Second level</th>
<th>Third level</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day.</em></td>
<td><em>I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning.</em></td>
<td>Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.</td>
</tr>
<tr>
<td><strong>MNU 1-10a</strong></td>
<td><strong>MNU 2-10a</strong></td>
<td><strong>MNU 3-10a</strong></td>
</tr>
<tr>
<td><em>I can use a calendar to plan and be organised for key events for myself and my class throughout the year.</em></td>
<td><em>I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use.</em></td>
<td></td>
</tr>
<tr>
<td><strong>MNU 1-10b</strong></td>
<td><strong>MNU 2-10b</strong></td>
<td></td>
</tr>
<tr>
<td><em>I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers.</em></td>
<td><em>Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance.</em></td>
<td></td>
</tr>
<tr>
<td><strong>MNU 1-10c</strong></td>
<td><strong>MNU 2-10c</strong></td>
<td></td>
</tr>
</tbody>
</table>
Strength

Learners at P7 demonstrated that they can:

- convert to and from 24 hour system
- order time

Most learners can convert from 12 to 24 hours and from 24 to 12 hour.

For example, write 6.00 pm as it appears on a 24 hour clock.

The majority of learners at P7 were able to provide the correct response to questions about ordering timings, including those with hundredths of seconds.

Here are five times for a school 1000 metre race.

5:41.36  5:42.76  5:41.77  5:42.21  5:39.72 minutes

What is the fastest time?

Answer: _______________________ minutes
Area for improvement

At P7, learners perform less well in this area:

- using knowledge of fractions within the concept of time

Within the organiser of fractions, decimal fractions and percentages learners demonstrated that they are more confident in calculating fractional amounts of time involving simple fractions such as a half. However, the level of correct response was substantially lower when learners were asked to calculate fractional amounts of time using $\frac{2}{3}$ and $\frac{1}{3}$. This was also the case within the context of time as illustrated below.

How many hours are there in $2\frac{1}{3}$ days?

Answer ________________ hours

Less than half answered correctly.

Reflective question:

- What opportunities do learners have to discuss the relevance and appropriateness of converting between units of time?

Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

T&L: BBC Bitesize: KS3 – Measure, Time, Units
http://www.bbc.co.uk/bitesize/ks3/maths/measures/time/revision/2/

CLPL: Scholastic Study Jams: Convert Units of Time
Activity to help reflect on what numeracy experiences and outcomes impact upon learners’ ability to convert units of measure.
http://studyjams.scholastic.com/studyjams/jams/math/measurement/converts-units-time.htm
Strength

Learners in P7 were able to:

- calculate simple time durations
- calculate time intervals between two given times*

Almost all P7 learners could calculate time durations involving counting forwards and back in hours and minutes, including bridging the hour.

A party starts at 5.45 pm.
It lasts one hour and thirty minutes.
When does it finish?
Answer: _______________ pm

Most learners could work out time intervals using the 24 hour system when working with complete hours.

A plane leaves an airport at 1015 and arrives at its destination at 1415
How long does the flight last?
Answer ________________________ hours
Most learners were able to work out the time in questions similar to this when the time was relatively close together and was in 12 hour time.

A TV programme starts at 6.25 pm and ends at 8.40 pm.
How long does it last?

Answer ___________ hours _________________ minutes

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Area for improvement

Learners’ responses at P7 indicate the need to improve their knowledge, understanding and skills within the concept of time calculations in the following areas:

- calculate time intervals between two given times
- calculate time intervals between two given times bridging 24 hours
- calculations with time using hundredths of a second
- work in 24 hour time
- apply knowledge of the link between distance speed and time

Learners are most successful when the start and end times are relatively close. Their success decreased when the start and end times are much further apart but still within a day. Working in 24 hour time and bridging 24 hour resulted in an even lower number of correct responses.

Start and end times are relatively close together.

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The Smith family are going on holiday to Inverness from their home in England. They left home at 9.55 am and arrived at the hotel at 2.30 pm.

How long did the journey last?

Answer________________hours________________minutes

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Working in 24 hour time.

Learners are less successful in calculating time durations involving 24 hour as illustrated below.

**Bridging 24 hours.**

A school disco started at 1830 and ended at 2215.

How long did it last?

Answer: ______________ hours ______________ minutes

Less than half got this type of question correct.

**Apply knowledge of the link between distance speed and time.**

Learners are not confident in applying their knowledge of distance speed time to questions, as illustrated below.

How long does the 2150 train from Glasgow take to travel to Edinburgh if it arrives at 0004?

Answer ______________ hours ______________ minutes

Less than half got this type of question correct.

During a swimming session Jenny swam 5 km. She swam at an average speed of 15 km per hour

How long does she take to swim the 5 km?

Answer _________________________________

One third of learners answered a question like this correctly.
Learners are having difficulty in working with minutes and seconds, including hundredths of seconds. They are confusing how to set out calculations involving a context outwith time eg. money, combined with calculating time differences.

In particular in working with minutes, seconds and, hundredths of seconds, they are unable to determine how to set out the calculation.

Pat came second in the 400 metres race. The time was 2:25.47 minutes.

The winner was 2.50 seconds faster

What was the winning time?

Answer ________________ minutes

Reflective Question:

- How are you teaching appropriate strategies for calculating time durations which include bridging?

Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

**T&L: BGFL: Difference between Two Times**
Interactive whiteboard resource: Analogue clocks and digital display timetables with visual timeline to support learners with calculating intervals.

**T&L: BBC Class Clips: Clip 13586: The development of Number Bases.**
Short animated video explaining different number bases. This will spark discussion around why written algorithms do not work for calculating time intervals/durations.
http://www.bbc.co.uk/learningzone/clips/the-development-of-number-bases/13586.html

**CLPL: Victoria Department of Education and early Childhood Development: Time Intervals Level 3**
Webpage providing some support, ideas and activities on teaching learners how to calculate time intervals.
**Strength**

There is evidence that learners in P7 can:

- extract simple information to work backwards (one step)

Given a start or end time, the majority of learners can follow a stepped out question to carry out simple calculations.

**Areas for improvement**

At P7, learners perform less well in these areas:

- impact of knowledge, understanding and skills in other organisers
- select an appropriate strategy

Learners were unable to reason out what to do with part hours or minutes within the given context, as illustrated below.

**Applying time in familiar and unfamiliar situation and contexts**

Two friends are going to the shopping centre:

- it takes 15 minutes to get to walk to the bus stop and get on the bus
- the bus takes 35 minutes to get to the bus station
- it takes 20 minutes to walk from the bus station to the shopping centre
- they arrive at the shopping centre at 2.45 pm

What time did they start out?

Answer: ________________

A quarter of learners answered questions like this correctly.
Learners had difficulty in selecting a strategy to questions within a given context as illustrated below.

A show finishes at 10.45 pm.

A family takes 15 minutes to get from the show to the bus station.

<table>
<thead>
<tr>
<th>BUS TIMETABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buses leave at 9.00 am and every 15 minutes until 7.30 pm</td>
</tr>
<tr>
<td>From 7.30 pm buses run every 45 mins.</td>
</tr>
</tbody>
</table>

Use the table to work out how long they will have to wait for a bus.

Answer: ________________________ minutes

Further guidance and advice on supporting learners can be found in previous professional learning resources.

Reflective Question:

- What approaches do you use to provide learners with an appropriate balance between learning about number and number processes and applying this learning to real-life, relevant contexts?
Strength

Learners in P7 were able to:

• interpret basic timetables

Most learners can read and interpret basic timetables to answer questions such as this one.

Areas for improvement

Learners’ responses in P7 showed that learners need to develop their skills to:

• extract a range of information

Learners had difficulty extracting a range of information from the timetable and requiring to use this to undertake one calculation and communicate their solution.

For example, given a triathlon’s weekly training timetable, learners have to calculate how much more time the triathlon spent training for the swimming event than the cycling event for the whole week.
Reflective Question:

- How do you support learners to use timetables that are relevant to your area / context (i.e. trains, buses, ferries, cinema, and swimming pool)?

Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

Article exploring learners’ difficulties when learning time concepts.

Reflective Questions:

Within your establishment, how often do you plan effective learning, teaching and assessment that:

- develops learners’ competence and confidence in working with time in real-life, relevant situations?
- integrates learning across the numeracy organisers?
- supports learners to look carefully at a question and work out the steps that are required to provide a solution?
- encourages learners to use known facts to reason and work out the unfamiliar?
- builds in opportunities to discuss the relevance and appropriateness of converting between units of time?
- builds in opportunities for learners to convert timetables themselves / real life contexts.
- encourages learners to verbalise their thinking when they demonstrate calculating a time interval involving bridging?
The main area impacting on S2 learners' performance in time was their ability to use basic knowledge and understanding of time in simple situations.

However, aspects which impacted on performance at this level included:
- more complex situations which involved a number of steps in their solution
- situations involving parts of an hour or minutes, especially where these were written as decimals.

<table>
<thead>
<tr>
<th>Second level</th>
<th>Third level</th>
<th>Fourth level</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning.</td>
<td>Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.</td>
<td>I can research, compare and contrast aspects of time and time management as they impact on me.</td>
</tr>
<tr>
<td>I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use.</td>
<td></td>
<td>I can use the link between time speed and distance to carry out related calculations.</td>
</tr>
<tr>
<td>Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Areas for improvement

Using calendars to compare time events and calculate duration was not extensively assessed within the S2 survey. However, the very low correct response to simple questions involving the use of calendars is a concern, particularly given that this is a vital life skill.

- number of days in a given month
- use start and end of a month accurately

A substantial number of learners at S2 did not seem to know the number of days in each month, or to be able to take account of whether first and last dates were to be included in a calculation.

Reflective question:

- Beyond rote learning of the days in a month, and the order of months, how can we develop learners' skills and make the learning more interesting?

A holiday package company ‘Special Tours’ operate from 20\textsuperscript{th} April to 27\textsuperscript{th} August.

What is the total number of days they operate?
Include the start and end dates.

Answer: ____________________________ days

Only 5\% of learners got this correct.
Strengths

Analysis of S2 learners' responses showed that most of them were able to:

- extract simple information from a timetable
- interpret a key on a timetable

At S2, most learners were able to identify start and end times given in a timetable. They could recognise and interpret keys in timetables, which qualified when particular services were available or had restrictions, and give possible reasons why journey times varied between services. The majority were able to extract information from more than one timetable e.g. buses and trains to compare journey times (Example A) and explain why one service was quicker or slower than another (Example B).

Example A

The 0720 ferry from Dunoon has a letter B beside it on the timetable extract. What does this mean?

Answer: __________________

Example B

Why does the 1118 train from Glasgow take less time to get to Pitlochry than the 1235 train?

Answer: __________________

<table>
<thead>
<tr>
<th>Depart</th>
<th>Arrive</th>
</tr>
</thead>
<tbody>
<tr>
<td>0650B</td>
<td>0713B</td>
</tr>
<tr>
<td>0720AC</td>
<td>0743AC</td>
</tr>
<tr>
<td>0750B</td>
<td>0813B</td>
</tr>
<tr>
<td>0820BC</td>
<td>0843BC</td>
</tr>
<tr>
<td>0850</td>
<td>0913</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Not Sundays</td>
</tr>
<tr>
<td>B</td>
<td>Not Saturdays or Sundays</td>
</tr>
<tr>
<td>C</td>
<td>Passenger only Monday to Friday</td>
</tr>
</tbody>
</table>
The majority of learners were able to extract information from a simple timetable and use this to complete a simple time calculations, eg one hour ahead or one hour behind a selected time. However it should be noted that the performance in P7 on an identical question was stronger than in S2.

Joe wants to travel from Perth to Inverness using “Fast coach”

Give the times of the buses he could catch from Perth

Answer __________________________

<table>
<thead>
<tr>
<th>“Fast coach” bus timetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glasgow 0900 1030 1200 1330</td>
</tr>
<tr>
<td>Stirling --- 1115 --- 1410</td>
</tr>
<tr>
<td>Perth 1015 --- 1320 ---</td>
</tr>
<tr>
<td>Pitlochry 1100 --- --- 1550</td>
</tr>
<tr>
<td>Aviemore 1210 1315 1500 1709</td>
</tr>
<tr>
<td>Inverness 1250 1145 1540 1750</td>
</tr>
</tbody>
</table>

Areas for improvement

At S2, learners perform less well in this area:

- extract and use a range of information in context

Less than half of learners were able to work with a greater range of information extracted from timetables to calculate journey lengths and make comparisons.
One third of learners got the correct answer to a question similar to the one below.

**Reflective question:**

- In what ways do you expose learners to real-life examples of timetables, where there is a lot of data to sift for the required answer?
Converting units of time

Strengths

Most learners in S2 were able to:

- convert to and from 24 hour time

At S2, most learners could convert between 12 and 24 hour times in straightforward situations.

Areas for improvement

Learners in S2 performed less well in the area of:

- use decimal parts of an hour

Learners at S2 had difficulties in working with decimal parts of an hour, in appreciating that notations varied, and that there was a need to convert between hours and minutes before carrying out calculations.

In the example below, the time is given as a decimal fraction. Just under a tenth of learners got the correct answer and nearly half did not attempt it.

This correlates with performance at P7 which show that learners find using the knowledge of fractions within the concept of time more of a challenge.

A cyclist travels 54km in 2.25 hours.

Calculate the cyclist’s average speed in kilometres per hour.

Answer: ________________ km/h
Reflective question:

• what strategies do you use to develop learners’ confidence in working between normal time notation and time in decimal form (e.g. 2.25hrs and 2hr 15mins, which may be written as 2:15)?

Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

T&L: Nrich: Distance speed time
Speed-time problems at the Olympics
http://nrich.maths.org/7322

T&L: Superteacher: Elapsed time durations

CLPL: You tube: Distance speed time
Video – distance speed time calculations in context of moving vehicles.
http://www.youtube.com/watch?v=Sn5bQdZsbA

Strengths

Learners in S2 demonstrated they were more successful in these areas:

• calculate simple time durations
• calculate time intervals between two given times *

At S2, learners could calculate time intervals in situations where times were within the same hour or day. Almost three quarters of learners answered questions like this correctly.

How long does the ferry take to sail from Dunoon to Gourock?

Answer: _________________ minutes

<table>
<thead>
<tr>
<th>DUNOON</th>
<th>GOROCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depart</td>
<td>Arrive</td>
</tr>
<tr>
<td>0650B</td>
<td>0713B</td>
</tr>
<tr>
<td>0720AC</td>
<td>0743AC</td>
</tr>
<tr>
<td>0750B</td>
<td>0813B</td>
</tr>
<tr>
<td>0820BC</td>
<td>0843BC</td>
</tr>
<tr>
<td>0850</td>
<td>0913</td>
</tr>
</tbody>
</table>
Areas for improvement

Learners at S2 found the following areas challenging:

- calculate time intervals between two given times
- calculate time intervals between two given times bridging 24 hours
- calculations using hundredths of seconds

Learners are most successful when the start and end times are relatively close. Their success decreased when the start and end time are much further apart and bridge the hour, particularly if they bridge more than 24 hours.

This was identified as an area for improvement at second level and does not improve at S2 and in some instances, performance is weaker at S2.

Pat set off on holiday at 7.30 am on Monday. His flight is delayed and he does not arrive at his hotel until 1.15 pm on Wednesday.

How long did his journey take?

Answer _______________ hours _______________ minutes

One fifth of learners answered a similar question correctly.

Learners are having difficulty making accurate time calculations. They are confusing how to set out decimal fraction calculations with calculations involving units of time.

Many learners used a standard algorithm to solve the following type of problems and did not realise that this is not the most efficient method for time calculations.

eg A top costs £14.56 and another top costs £23.31, what is the difference in price?

eg The 1141 train from Glasgow arrives in Pitlochry at 1319? How long does the journey take in hours and minutes?

Less than around a third of learners got this type of question correct.

This highlights the need to emphasise developing a range of mental and written strategies.

Similar to P7 learners, those at S2 find working with minutes, seconds and, hundredths of seconds to be more challenging. Overall within time calculations they are unable to select an appropriate strategy to undertake the calculation.
John came second in the 800 metres race. His time was 4.26.49 minutes.

The winner was 2.50 seconds faster.

What was the winning time?
Answer __________ minutes

With a similar question, just under one fifth of P7 learners got the correct answer.

**Reflective question:**
- In what way do you routinely challenge misunderstandings about time in classroom situations, or do you too often treat them as casual errors?

**Distance speed time**

**Strengths**

Learners in S2 were more successful in these areas:

- straightforward calculations
- simple extraction of information from a distance/time graph

At S2, the majority of learners could carry out straightforward calculations, where knowledge of the relationship between distance, speed and time is required.

In questions similar to these, learners did not necessarily need to use the distance speed time formula to work out the answer. Learners are using their knowledge of proportion and there is no conversion of units.

It is 60 miles from Perth to Aviemore. How long does it take to drive this distance at an average speed of 30 miles per hour?

Answer: _____________________ hours
S2 learners are able to extract simple information which is from a distance/time graph that requires no further interpretation calculation, similar to the one above.

**Areas for improvement**

- conversion of units of measure
- select and use an appropriate strategy
- features of a distance/time graph
- scale
- extract information to calculate average speed
- use information to complete a distance/time graph

Learners are less able to accurately answer questions that involve conversion of units of time and part hours, such as the example below.

**MNU 3-10a**

Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.

This graph shows how far a cyclist travelled and the time he took to get there.

**Question:** How many kilometres did he cycle altogether?

**Answer:** _________________ km

**Example:**

At a speed of 60 miles per hour how long would it take a car to travel 140 miles?

**Answer:** ____________________ hours
Learners are not able to apply and select an appropriate strategy to solve distance, speed and time problems by using either proportion or a formula if given two pieces of information where the answer requires a conversion of time.

A horse and rider travels at 30 km in 1.25 hours

Calculate their average speed in kilometres per hour

Answer _______________ km/h

9% of S2 learners were able to answer a question similar to this.

Learners at S2 have difficulty in interpreting distance/time graphs.

In the question below just over a tenth correctly interpreted the horizontal portion of the following graph as representing a speed of zero. A third only took account of the start of the time interval and read the distance as being the speed (6km/h). This was a common error.

Similar to the learner responses within the organiser of measurement, interpreting the scale on the distance and time axes was not an area of strength. For example, in the question below, learners did not work out the value of the graduations on the scale correctly.

This journey shows a journey into town.

What was the speed between
A 8 am and 8.30 am?
B 8.30 am and 8.48 am?

Answer: ________________________

Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance

MNU 3-10a
Learners had significant difficulties in completing a distance/time graph from the given data. Less than 10% of learners were able to complete the distance/time graph similar to the question below.

A lorry travels from Aberdeen to Dundee on the A90.

<table>
<thead>
<tr>
<th>Event</th>
<th>Time taken</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>getting out of Aberdeen</td>
<td>20 minutes</td>
<td>5 miles</td>
</tr>
<tr>
<td>on A90</td>
<td>40 minutes</td>
<td>50 miles</td>
</tr>
<tr>
<td>into Dundee city centre</td>
<td>15 minutes</td>
<td>5 miles</td>
</tr>
</tbody>
</table>

Complete the distance/time graph on the grid below to show the journey.

**Reflective question:**

- Do what extent do you carry out practical work with learners, for example in science, to show how real situations give rise to these graphs?
Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

**T&L: National STEM centre: Graph shots**
An interactive game that develops learners’ understanding of distance-time graphs in the context of a football match.
http://www.nationalstemcentre.org.uk/elibrary/resource/473/graph-shots

**CLPL: Google images: Distance speed time graphs**
Distance speed time graphs to promote discussion with learners
https://www.google.co.uk/search?q=distance+speed+time+graphs&biw=1024&bih=673&tbo=u&source=univ&sa=X&ei=J58aVP6WKI6i7AAalv4DIDA&sqi=2&ved=0CCsQ7Ak

**Reflective questions:**

Within your establishment, how often do you plan effective learning, teaching and assessment that:

- integrates techniques rather than setting tasks that require individual steps?
- supports learners to develop a range of strategies for solving word questions?
- encourages learners to use known facts to reason and work out the unfamiliar?
- provides increasingly complex questions including those set within real-life, relevant situations?
- develops learners’ resilience and capacity to stick to a task?
- provide appropriate opportunities for learners to apply their numeracy skills?

Teaching and Learning (T&L) and Career-Long Professional Learning (CLPL) resources:

**T&L: TES: Distance-time graphs**
Activity to decide which statements about distance-time graphs are true, which will support understanding of moving and stationary sections of journeys. (Free registration and login required)
http://www.tes.co.uk/teaching-resource/Interpreting-distance-time-graphs-true-false-6258993/

**CLPL: National STEM centre: Distance-time graph inquiry**
Article providing some support and ideas on teaching learners how to interpret and create distance-time graphs.
https://www.stem.org.uk/resources/elibrary/resource/34098/distance-time-graph-inquiry
Appendix
Performance overview in Time
From the more detailed analysis of children’s and young people’s performance within **time**, the following strengths and areas for improvement were identified in the 2013 Scottish survey of Literacy and Numeracy:

<table>
<thead>
<tr>
<th>Strengths</th>
<th>First level</th>
<th>Second level</th>
<th>Third level</th>
</tr>
</thead>
</table>
| **Clocks** | - read times involving o’clock, half past, quarter past and quarter to on an analogue clock face.  
- recognise quarter to and quarter past  
- match analogue to digital time* | **Converting units of time**  
- convert to and from 24 hour system  
- order time  

**Time calculations**  
- calculate simple time durations  
- calculate time intervals between two given times*  

**Applying time in familiar and unfamiliar situations**  
- extract simple information to work backwards (one step)  

**Timetables**  
- interpret basic timetables | **Timetables**  
- extract simple information from a timetable  
- interpret a key on a timetable  

**Converting units of time**  
- convert to and from 24 hour  

**Time calculations**  
- calculate simple time durations  
- calculate time intervals between two given times.*  

**Distance speed time**  
- straight forward calculations  
- simple extraction of information from a distance/time graph |
<table>
<thead>
<tr>
<th>Areas for improvement</th>
<th>Clocks</th>
<th>Converting units of time</th>
<th>Calendars</th>
<th>Timetables</th>
<th>Converting units of time</th>
<th>Time calculations</th>
<th>Applying time in familiar and unfamiliar situations</th>
<th>Distance speed time</th>
</tr>
</thead>
</table>
|                       | • confidently reading times beyond o’clock and half past  
|                       | • match digital to analogue  
| Language of time and representing time | convert from 24 hour to 12 hour  
| | represent time on a clock face  
| Time calculations | time ahead and time behind  
| | calculations using hours and minutes  
| Calendars | number of days in a month  
| | using a range of information along with calendars  
| | using knowledge of fractions within the concept of time  
| | calculate time intervals between two given times  
| | calculate time intervals between two given times bridging 24 hours  
| | calculations with time using hundredths of a second  
| | work in 24 hour time  
| | apply knowledge of the link between distance speed and time  
| Time calculations | calculate time intervals between two given times bridging 24 hours  
| | calculations using hundredths of seconds  
| | select and use an appropriate strategy  
| | conversion of units of measure  
| | features of a distance/time graph  
| | scale  
| | extract information to calculate average speed  
| | use information to complete a distance/time graph  
| | extract and use a range of information in context  
| | number of days in a given month  
| | use start and end of a month accurately  
| | extract and use a range of information in context  
| | use decimal parts of an hour  
| | calculate time intervals between two given times.  
| | calculate time intervals between two given times bridging 24 hours  
| | calculations using hundredths of seconds  
| | extract and use a range of information in context  
| | number of days in a given month  
| | use start and end of a month accurately  
| | extract and use a range of information in context  
| | use decimal parts of an hour  
| | calculate time intervals between two given times  
| | calculate time intervals between two given times bridging 24 hours  
| | calculations using hundredths of seconds  
| | select and use an appropriate strategy  
| | conversion of units of measure  
| | features of a distance/time graph  
| | scale  
| | extract information to calculate average speed  
| | use information to complete a distance/time graph  
| | extract and use a range of information in context  
| | number of days in a given month  
| | use start and end of a month accurately  
| | extract and use a range of information in context  
| | use decimal parts of an hour  
| | calculate time intervals between two given times  
| | calculate time intervals between two given times bridging 24 hours  
| | calculations using hundredths of seconds  
| | select and use an appropriate strategy  
| | conversion of units of measure  
| | features of a distance/time graph  
| | scale  
| | extract information to calculate average speed  
| | use information to complete a distance/time graph |