Chapter 1

THE ROLE OF NUMERACY IN NURSING AND HEALTHCARE PRACTICE

Numeracy in Children's Nursing, First Edition. Arija Parker

LEARNING FOCUS

The Role of Numeracy in Nursing

The broad focus of this chapter is to define what numeracy is and where numeracy skills are needed in healthcare settings. There will be a particular focus on nursing practice and, more specifically, on numeracy skills to support children and young people's nursing.

LEARNING OUTCOMES

By the end of this chapter you should be able to:

- Identify why you need to read this book and why it is important to your practice
- Define what numeracy/mathematics are
- Have a conceptual understanding of the problems that adults, and so by default nurses have in relation to the use of number
- Use place value and the denary system
- Reflect on what you would like to achieve by working through this book and companion website having completed the diagnostic assessment which precedes this chapter

CASE SCENARIO 1

Una Venn (Age 4) is visiting the hospital for a preoperative visit and assessment prior to admission for day case surgery in the following week for ENT surgery (tonsillectomy, adenoidectomy and insertion of grommets). She is accompanied by her mother, Mrs. Venn and little brother, Jack (1 year).

Una gets to visit ENT theatre 1 together with other children who will be coming into hospital for various day case surgical

procedures over the coming week. Both Mrs. Venn and Una have the documentation explained to them, including a Pain Assessment Chart. The nurse, who will be caring for Una, carries out a set of baseline observations and weighs Una and then gives them both a chance to ask questions. Mrs. Venn is also advised about pain management in hospital, postoperatively and on discharge. The nursing staff on Gamma Ward use the Arch Mede Hospital Pain Assessment Tool for children. (The Arch Mede Pain assessment too is a fictitious tool just for use to illustrate numeracy issues in this book. It is adapted from Baker and Wong (1983; 1988) and numerous other numerical, visual and colour analogue scales and has a number focused theme.)

She had some blood tests, including a full blood count (FBC), performed in clinic the week before and the results are included in the table below. Mum is informed of the result and reassured that all is fine in preparation for admission to hospital and theatre next week.

Una had a FBC performed because she has been unwell recently and looked pale and anaemic when seen by the ENT doctor in clinic. A FBC is not routinely performed as part of a preoperative assessment.

Hospital number	**AMH2014-01**
Ward name/number	**Gamma Ward 3 (children's day case surgical unit)**

Temperature	Pulse	Blood pressure	Respirations	CRT	Pain score	PEWS score
37°C	106 bpm	Not recorded	26 per minute	1–2 seconds	0	0

Full blood count	Una's result	Normal range
Haemoglobin	13.3 g/dL	13.8 g/dL
White cell count	7×10^9/L	4–12 $\times 10^9$/L
Platelets	255 $\times 10^9$/L	100–300 $\times 10^9$/L

INTRODUCTION

This chapter will explore the context of numeracy practice in nursing in general and children and young people's nursing more specifically, define what is numeracy/mathematics and introduce the beginnings and basics of numeracy language including place value and the use of zero.

Why read this book?

The first question to ask is why are you reading this book and why do we need yet another book on numeracy for healthcare, nursing and children's nursing in particular, especially when there are already many other very good numeracy text books available.

You only need to look at the unfortunately regular news headlines lambasting nurses for their poor numerical abilities, which lead to serious prescription and drug administration errors. As a result we need to sit up and take note of the fact that we need to be constantly updating and developing our numeracy skills however numeracy competent we may feel we are. Whilst competence is needed for all fields of nursing, with the nursing of children and young people – where we care for neonates to adolescent patients – being accurate, safe and competent in numeracy practice is of vital importance. In addition, the

numeracy subset of skills for this particular group of patients also serves to offer more challenges to numerical ability.

So, to delve a bit more deeply beyond media headlines alone to more research-based evidence, the National Patient Safety Agency (2007a) found that the most serious errors were caused by errors in medicine administration (41%) and prescribing (32%). Medication errors with children were reported from all stages of the medication process though the majority were from the part involving administration of the medicine itself (56%). The main causes are listed below:

- **Prescribing errors** – where medicines prescribed as volume of liquid rather than actual dose and also calculation errors, that is, 5 mL instead of 250 mg
- **Dispensing errors** – due to labelling errors
- **Administration** – involving, most commonly, intravenous drug errors though also giving a drug like paracetamol when previous dose given was not recorded, a drug being given to the wrong patient or giving the wrong amount, that is, millilitre instead of milligram

Additionally, there is a whole list of errors including wrong dose, strength or frequency errors, weighing scale errors and weight in pounds not kilograms. This is why this book has a focus on **all** aspects of numeracy, not just that related to medication administration. The most common medicines involved are paracetamol, gentamicin and morphine, which are all medicines that are commonly given to children and young people and are used as examples in Chapter 6, when focusing in on the needs of our neonatal patients. Here is the justification for reading and learning from a book that has a focus on the whole range of basic numeracy skills with a focus on the particular needs of children and young people.

So why do nurses who care for children make numerical mistakes? Whilst a lack of understanding of the basics could be one reason for the poor numeracy skills of nursing students, registered children's nurses and the nursing population in general, there are other issues that might explain why there is a deficit in these skills. There

is a commonly held perception, that is common in British people, not only nurses, of 'I can't do maths', which may be a cultural factor though could also be due to lack of confidence, dyscalculia and maths anxiety. This is well reported in the literature including Pozehl (1996) who found that nursing students demonstrated higher levels of maths anxiety than other students. Whilst, anecdotally, it would appear that we do not have nurses who have dyscalculia working in clinical areas, probably because of a Grade C pass in maths GSCE as an entry gate to programmes of nurse training, there are many prospective nursing students who spend many years attempting to meet this entry gate to the profession by repeating courses and redoing the examinations until they pass and meet the entry criteria. Whilst they have the 'certificate' this does not mean that they have confidence in their numerical ability. They then spend the next 3 years of the course and beyond worrying about every numeracy test and assessment that comes their way. Increasingly now students have to pass a numeracy assessment as part of the recruitment process both to get entry onto a nursing programme and then to gain employment on registration. From a professional perspective there are also the ethical and moral issues to think about if you are practising without numerical proficiency.

It could also be argued that even the most proficient nurse mathematician still has these feelings of anxiety when faced with tests, so for all who are reading and utilising this book to improve their numeracy skills, the message of 'practice, practice, practice' will form the basis of advice offered. Whilst the message so far has been very serious, it is really important to emphasise that having some fun with numbers is the best way to learn, which is the approach this book would like to take by also looking at how children learn about numbers.

How do we know if we are numerate?

Numeracy is 'of or relating to numbers', where to be numerate 'is the ability to use numbers especially in arithmetical operations'. The ability to be numerate is clearly linked to literacy which is the 'ability to read and write and the ability to use language proficiently' (Collins

English Dictionary, 1999). This is reflected in the famous quotation as below:

> [The universe] cannot be read until we have learnt the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word.
>
> (Galileo Galilei, *Opere Il Saggiatore*, p. 171)

Goldbeck (1999) (cited in Rothman et al., 2008) states that numeracy consists of four main skills:

1. Basic – identifying numbers
2. Computational – simple manipulation of numbers
3. Analytical – inference, estimation, proportions
4. Statistical

Rothman et al. (2008) basically define numeracy as the ability to understand and use numbers in daily life, so we could conclude by stating that numeracy for nurses is all about the ability to identify, compute, analyse numbers that relate to nursing practice and utilise them effectively to ensure safe practice.

The fact that literacy and numeracy walk together hand in hand cannot be overemphasised where you have probably already realised that how a nursing numeracy question is written and phrased has a major impact on your comprehension. It can often be difficult to actually unpick the written language with respect to what have you been asked to do. Once this is done the numeracy problem is usually easy to solve.

The teaching of numeracy skills in pre- and post-registration nursing curricula

So if we acknowledge that we have a need for further numeracy education for nurses why are we not doing anything about it? How are we teaching numeracy skills in practice and in education settings? Why are we, as professional nurses, not acknowledging that there are

deficits in knowledge via reflective practice and doing something about it?

From a brief overview of the research into nursing ability or disability as may be the case, Goldin (1990) found that overemphasis on the use of formulae in nurse education is potentially damaging to students because it involves rote learning what they may perceive to be meaningless information. This is reflected in the way children learn and are taught mathematics (see Chapter 7). Baroody and Ginsburg (1990) go on to say that systematic calculation errors or 'bugs' learnt in this way ensure that student cannot see any sense in what they do and blindly accept the results of what they do. Gillies (2004) emphasises the importance of learning mathematics with understanding so that processes, when performing drug calculations, are understood, more easily remembered and more easily transferred to other situations.

Do you recognise any of these characteristics in yourself?

Needless to say, there is a much greater emphasis on numeracy in nursing curricula and moving beyond rote learning practices to teach about number in Higher Education settings though the degree to which we should teach these skills is debatable and too big a topic area for this little book.

From this introductory discussion it is clear that we need to start at the beginning in developing and building on our existing numeracy knowledge and so need to introduce the concept of 'place value' into this chapter. This will then correct any initial misconceptions that there may be about numbers including:

- conceptions of how numbers behave (particularly in relation to fractions which is an area that is frequently highlighted as that of worry and anxiety from work with pre-registration nursing students – see Chapter 4),
- trying to ensure that the vocabulary used is clear in terms of how we use language – literacy and

oracy, including nursing jargon, as well as the use of mathematics language,

- focusing in on correct procedures and methods, which will then help problem solving with respect to choosing the correct operation to use. This should then stop the frequent behaviour of guessing that students may use as a strategy, especially when being tested using multiple choice questions.

This does not mean that we stop using the classic nursing rule/formula, that many of us have learned, which works well for many nurses. We need to ensure that all appreciate and understand the numeracy/mathematics that underpins the formula – in this case the children's nursing formula. In fact we look at this in much greater detail in Chapter 5.

From a numeracy perspective the following quotation is the Gold Standard in relation to nursing with numbers in this book and is as follows:

> To be numerate means to be competent, confident and comfortable with one's own judgements on how to use mathematics in a particular situation and if so what mathematics to use, how to do it, what degree of accuracy is appropriate and what the answer means in relation to the context.
>
> (Coben, 2000, p.35)

This is included as part of the NMC Standards for Pre-registration Nurse Education – Annexe 3 Essential Skills Clusters (2010) adapted and written as 'The focus should be on demonstration of competence and confidence with regard to judgements on whether to use calculations in a particular situation and, if so, what calculations to use, how to do it, what degree of accuracy is appropriate, and what the answer means in relation to the context'.

This statement is the pillar of this book with respect to looking at the three numeracy (or calculation) C's of competence, confidence and comfort!

'Calculate competently, confidently and comfortably' could be the motto for this book!

Clarifying our understanding of what dyscalculia is

Whilst most nurses who have a perception that they are not good at mathematics have a problem with competence, confidence and/or comfort, there are a group of adults, including nurses, whose problems with numbers are more complex. Dyscalculia is a 'condition that affects the ability to acquire arithmetical skills, where those affected have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning facts' (Dfes, 2001). The Royal College of Nursing has explored the issue of dyslexia, dyscalculia and dyspraxia amongst the nursing population to identify the scale of the 'problem' so as to develop a strategy for how to deal with the needs these nurses have. Anecdotally, from many years of experience in nursing practice and contradicting the statement made in the previous paragraph, there is no doubt that there are registered nurses with dyscalculia in practice! The following materials will help you develop some insight into the problems some people have with numeracy and the strategies they develop to manage their dyscalculia. The focus of this book goes beyond just improving your own skills to also thinking about how to assess numerical ability in others and gain more understanding in how to teach numeracy skills within a nursing context to children and their parents/carers who may also struggle with numbers and how to use them.

Access the following online resources to find out more.

Dyslexia, dyspraxia and dyscalculia – guide for managers and practitioners (RCN, 2010)
http://www.rcn.org.uk/__data/assets/pdf_file/0006/333537/003833.pdf

Dyslexia, dyspraxia and dyscalculia – toolkit for nursing staff (RCN, 2010)
http://www.rcn.org.uk/__data/assets/pdf_file/0003/333534/003835.pdf

Dyslexia, dyspraxia and dyscalculia – a pocket guide (RCN, 2011)
http://www.rcn.org.uk/__data/assets/pdf_file/0007/372994/003851.pdf

Learning theories and social context

Whilst it seems obvious to say that a context is essential to the learning of skills such as numeracy why is this so? Hansman (2001) argues that social context is central to learning, particularly to learning in adulthood. She goes on to explore issues around social learning theories focusing in on the fact that the setting provides the tools and mechanisms that aid and structure the learning process and the social setting itself provides a learning context that determines the learning that takes place. Clearly it is vital, for a nurse learning numeracy skills, to do so within a nursing setting and context, within a framework of nursing skills and competences, using nursing tools and theory, thus enhancing the numeracy learning experience for children's nurses. This book aims to set all the numeracy activities within a children's nursing context to aid the learning process. This is the reason why case scenarios are included in all the chapters of this book. We could add 'Context' to our calculation motto.

This book does not stand alone in numeracy for nursing learning and teaching. As already demonstrated, this book will make reference to other numeracy-related texts. There is a rich tapestry of books and resources that already exist and thus enhances this text book and resources also. We cannot use a 'one size fits all approach'.

THE LANGUAGE OF MATHEMATICS AND NUMERACY

Mathematics versus numeracy – the same or different?

For the purposes of this book, as reflected in the title, the word numeracy will be used as the core term to define common understanding, though, in theory, there is no difference between the words mathematics or numeracy as used and they can be used interchangeably. The word mathematics will appear here and there because it could be argued that it is the more commonly recognised word.

The Collins English Dictionary (1999) defines mathematics as 'a group of sciences including algebra, geometry and calculus concerned with the study of number, quantity, shape and space and their interrelationship by using a specialised notation' and numeracy as 'of or relating to numbers' which does appear to suggest that numeracy is something less scientific or rigorous than what mathematics is, that is, mathematics is a science and numeracy has a more practical perspective. What do you think?

It is worth reflecting on your definition of the words mathematics and numeracy at this point:

- Use the PDP template to explore what the words mean to you – are they different or the same? Does this matter?
- Which word will you use when discussing number-related activity with children in clinical practice?

Introducing numerical concepts and ideas

Five important areas of numeracy language will be covered in this section – that is defining numbers, place value, number bases, the value of zero and prime numbers.

1. What are numbers?

What follows is a definition of 'number'

- An arithmetical value, expressed by a word, symbol or figure, representing a particular quantity and used in counting and making calculations and for showing order in a series or for identification.

This can then be subdivided down into defining a numeral and then cardinal, ordinal and nominal numbers.

- A **numeral** is a symbol for the idea of what we call a number.
- A **cardinal number** is how many there are of a thing and can also be called counting numbers because they define quantity.

- **Ordinal numbers** tell the order of things in a set – first, second, third, etc. Ordinal numbers do not show quantity. They only show rank or position, that is, like the chapters in this book which place skills learned in a certain order.
- A **nominal number** names something – a telephone number, a player on a team. Nominal numbers do not show quantity or rank. They are used only to identify something such as Una and her hospital number.

We give a number a symbol though it also has a word associated with it. The English language does not help in relation to how syllables are used to construct words which reflect a numerical value. For example there are three forms in relation to 'three' as a unit, which as a unit of ten becomes 'thirteen' though with the addition of twenty becomes 'thirty'. Only as a unit in hundreds does the relationship become clear, that is, three hundred. Where is the sense here when trying to understand how to count numbers? (Sousa, 2008)

Interestingly, it has been found that Asian children learn to count earlier than Western children partly due to the simplicity of their number syntax, which again reflects the close relationship between literacy and numeracy.

2. Everything in its place and a place for everything

Place value is all about number representation systems and the meaning applied to numbers, which within the denary system that we use here involves the use of number in relation to 100s, 10s and units (of one). Sharma (1993) states that not only do students (children in his situation and context) need to understand the value of digits/numbers they also need to have spatial awareness in terms of orientation and space organisation. This is where problems arise in adult learners as well as children. According to Sharma (1993) place value is the language of mathematics – 'a true symbol system'. He sees the development of place value system as a 'truly great achievement of human ingenuity'. He goes on to state that place value is a demonstration of the key characteristics of maths thinking: efficiency, elegance and exactness, which clearly underpins learner understanding and progression in their numeracy learning. Place value forms the basis of all that follows number wise in numeracy

education, so without a command and understanding of why we need to value 'place' people will struggle with numeracy. This is clearly demonstrated in numeracy teaching practice where errors in 'exactness' mean that numbers get mixed up and you end up with an incorrect answer.

MILLIONS	HUNDRED THOUSANDS	TEN THOUSANDS	THOUSANDS	HUNDREDS	TENS	UNITS	DECIMAL POINT	TENTHS	HUNDREDTHS	THOUSANDTHS
1 000 000	100 000	10 000	1000	100	10	1	.	0.1	0.01	0.001
8	6	5	4	3	2	1	.	1	2	3
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Definition of place value.

Practice adding the following numbers to the chart above or on the online version. Also write in your own numbers and then say them aloud!

- Sixty-five and three-tenths
- Seven thousand and seventy-seven
- Eight million, nine hundred and eighty-five thousand, five hundred and twenty-two

To sum up this section on place value Sharma (1993) does argue that 'mastery' of the place value system is an important milestone for children and if this is not understood they cannot proceed to understand other mathematical concepts and principles. This has not been mastered by many nurses so it is worth spending time ensuring that you understand place value so please complete some of the activities before moving on.

Using graph or squared paper allows you to offer due respect to the place value of a number and will reduce the chance of making mistakes! See Section 3 on ONE to print off some squared graph paper.

Within nursing practice we tend to proceed to more complex numerical problems (by using a formula), where multiple steps with regard to manipulation of numbers need to be taken, using a problem-solving approach, without checking out whether we understand the meaning of place value.

When working with really big numbers it is useful to use the exponential form by use of the 'power' of a number. You will encounter this way of writing large numbers when looking at blood results. So for example $10 \times 10 \times 10 \times 10 = 10{,}000$ (ten thousand) though this could be written 10^4.

So if we look at Una's FBC result you can see that both white cell and platelet counts are recorded in units of $\times 10^9$/L, which makes the numbers much more manageable, even though they are unbelievably big numbers.

3. Number bases

The denary system is the number base that we use to work with numbers, that is, base 10. The denary (or decimal) numbering system is the most widely used in the world. It has a base of 10 and uses the numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Working in tens is much easier than any number which explains why this system is so widely used. We use the denary system in nursing practice and calculations,

which should become apparent when we look at other bases that could be used.

In nursing practice it would be uncommon to explore other number bases, though it is worth introducing this idea of base into this chapter for the very fact that it is an interesting topic area, which also offers us a greater understanding of what place value actually means. The historical context is particularly meaningful when we used pounds, shilling and pence as used prior to 1970, pre-decimalisation, and in very complex calculations when calculating insulin dosages, which did not always follow the metric system in terms of the now accepted standard 100 units per millilitre formulation that we use now. This can still be remembered by many nurses. The pre-decimal system did not use a standardised system of units in relation to different formulations of insulin and this caused great confusion to healthcare professionals and patients' alike, that is, with differing amounts in different volumes depending on the type of insulin used, which meant that nurses had to work in a different base system for each calculation.[1]

Interestingly, the old USP unit of insulin was arbitrarily set to the amount required to reduce the concentration of blood glucose in a fasting rabbit to 45 mg/dL[2]. It is clear that the decision to rationalise the situation in the 1970s was a very wise move to reduce prescribing errors made by medical staff and administration errors made by nurses and patients themselves. To add some confusion to the present situation though, in some veterinary care setting and in other countries the usage of a 40 unit/mL concentration of insulin is common (Hanas, 2010). This has an impact when giving advice to children and

[1]That is not to say that the present system is easy to use and understand. The present system of 100 units per millilitre can still be confusing because of the small volumes of insulin administered (in relation to small children particularly) and the different sizes of insulin syringe that are available, that is, 0.3, 0.5 and 1 mL, though it has to be noted that most children are now using pens to administer insulin thus avoiding confusion with syringe choice. Even now the situation is not straightforward because international units do not follow the usual convention of SI units, that is, one international unit of insulin is the biological equivalent of 45.5 micrograms of pure crystalline insulin. Administration of insulin will be discussed further in Chapter 7.

[2]A decilitre is equal to 100 mL or one-tenth of a litre.

families when travelling overseas should their supplies of U-100 insulin run out or expire. This advice will be offered by nurses who need to give advice based on assessment of numeracy ability of their clients (child and family) as well as have the skills to ensure accurate conversions and safe practice.

This could then lead us on to explore other bases out of interest, that is, binary systems (which are used routinely in the computing world) and we will look at base 6 in relation to time in the next chapter. It is also interesting to explore other number systems such as the use of Roman numerals which are used frequently when teaching subjects like anatomy and physiology, that is, naming of cranial nerves and whilst we have no need to learn how to add, subtract, multiply and divide using different number bases, some examples are offered on ONE for you to practice and play with if this topic area interests and fascinates you. Also of interest is that the Romans did not develop the idea of place value at all from what had gone before historically in the development of mathematical knowledge – it was already in existence in other countries. This allows us to explore numeral systems in terms of whether they are positional and how they use zero, which leads us on to another important discussion around zero as a 'place holder'.

From observation it is clear that children's nurses use their fingers a lot to count so we have to think about the Roman system again. The word 'digit' as used for numbers comes from the Latin word for finger and numeral and Roman numerals originally represented fingers.

The greatest brain activity is in the left parietal lobe and also in the region of the motor cortex that controls the fingers – is this a coincidence? (Dehaene et al., 2004)

4. The value of zero

You have probably not thought about it before but why is the digit zero so important?

Connor and Robertson (2000) state what is commonly held in that there are two uses of zero which are very important though very different. One use is as an empty place indicator in our place value number system, as already discussed, so that in a number like 5505 the zero is used so that the positions of the 5 and 500 are correct. If we miss out the zero the number is completely different, that is, 555. The second use of zero is as a number in itself. Connor and Robertson (2000) talk about the history of zero and about the differing aspects of zero – the concept, the notation and the name where the name comes from the Arabic 'sifr' meaning 'cipher'.

Access ONE to find out more if you are interested!

As you will have gathered this is a difficult concept to understand particularly when we think of the value of zero as 'nought' or 'nothing'. When it is a label on a graph you can clearly see it does have value though if you want to quantify it as an object in your hand then clearly there is nothing there. No other numbers have more than one name which either identifies it as something special or something that is different maybe.

With respect to our work with zeros, they are extremely valuable as a position holder (see Chapter 3 when working with long division), though sometimes are not helpful, that is, when they appear after a decimal point and do not hold the position of numbers after a decimal point, that is, 5.05 the zero is needed. When looking at 5.50 the zero is not needed – it is five point five (or five and five-tenths) not five point fifty (which is an error that many children make when talking about numbers not realising that they should be thinking about fifty-hundredths which is the same as five-tenths). So if you have a drug prescribed as 100 mg do not be tempted to add a decimal point and lots of trailing zeroes at the end, that is, 100.00 mg – you can immediately see why errors could occur! Trailing zeroes have been identified as a potential source of serious drug errors (DH, 2004).

5. Prime numbers

A prime number can only be divided by 1 and the number itself with no remainder. Why is this important to know and why are these numbers so interesting?

Enzensberger (2006) calls prime numbers prima donna[3] numbers which is a great way of describing numbers that do stand out as being different. Why do we need to appreciate this difference and how does it help us appreciate and solve nursing-related number problems?

Here are some prime numbers with some of them missing – can you identify the missing numbers?

2		5	7		13
17	19		29	31	
41	43	47		59	61
	71	73	79	83	
	101		107		113

Also answer the question: Why does 1 not count?

Why is it useful to know your prime numbers?

This helps you understand when you can cancel down and simplify particularly fractions where speed is of the essence, that is, in timed numeracy tests and in some emergency situations. Prime numbers cannot be made any simpler which is why they behave like prima donnas.

Numbers and patterns

The Fibonacci series (created by Leonardo Fibonacci in 1202) is a series of numbers that famously originated

[3]A prima donna is literally translated as 'first lady'. The term is used to describe the female lead in an opera or opera company and can also be used when describing a very temperamental person with an inflated view of their own talent or importance (OED). A diva could be another term for prima donna though this term is usually applied to a lady who is talented though knows that she is temperamental or haughty. A prime number could be a prima donna and a diva.

around the mating patterns of rabbits where you start with 1 + 1 and then chart how they multiply which generates the number sequence. The first two numbers in the series are one and one. To obtain each number of the series, you simply add the two numbers that came before it. In other words, each number of the series is the sum of the two numbers preceding it. 1 + 1 = 2; 2 + 1 = 3; 3 + 2 = 5; 5 + 3 = 8 and so on to infinity. Fibonacci (and those who have come after him to study this branch of mathematics) then found that this identifies patterns in nature, that is, shells (the Fibonacci spiral) and flowers (with the arrangement of petals) and the way trees grow from one trunk to branches. The tree illustration in Chapter 7 will also form the same principles in the way it grows from a single trunk, to branches and sub-branches.

This demonstrates why numeracy is so interesting and how it applies to the world around us. Children also find this fascinating so it is a good discussion point as well as play activity in generating the series. The numbers and patterns create a good play and distraction activity whereby generating the series is good fun for children. The pattern starts with 1, 1, 2, 3, 5, 8, 13, 21 and then carries on to infinity.[4]

A Daisy's petals show the Fibonacci pattern.

[4]Infinity is a number greater than any assignable quantity or countable number (symbol = ∞).

When looking at Una's medical notes, what are the issues that may arise when using her hospital number?

From this brief introduction to numbers and, in conclusion, we will return to nurses and numeracy practice by identifying some of the common errors that occur when working with numbers.

ERRORS IN NUMERACY PRACTICE

Identified in the table below are some common reasons for errors and misconceptions in numeracy. Can you relate to any of these? In addition to completing the pretest it is worth identifying some of the common errors you make as part of your personal and professional development activity that could form part of your journey through this book.

Error	Reason and examples
Conceptual error	Not understanding the concept e.g ½ is one whole one divided into two equal parts
Vocabulary	Unfamiliar vocabulary (product, divisibility, factor, etc.), misunderstood vocabulary, which applies if your first language is not English and also when you first learned to 'do' maths
Wrong operation	Chooses the wrong operation
Defective procedure/ method	Errors in carrying out the steps in a correctly chosen operation
Overgeneralisation	Rules learned, then applied where they do not work i.e. × 100 means add 2 zeros, so 1.3 × 100 must be 1.300
Undergeneralisation	E.g. 'since 5 × 7 = 7 × 5, then 24 ÷ 4 must equal 4 ÷ 24', or '8 + 2 = 2 + 8, so 8 – 2 must be equal to 2 – 8'
Random response	A guess!

So what are the common errors and misconceptions that occur with nurses and adults in general and why do they occur? Some observations made include the way a nurse

may actually write down numbers and sums with total nonregard for place value, using tiny numbers, in the corner of a page that also is usually full of other information. This appears to be done in a secretive way as if they do not want others to see what they are doing, that is, like children who cover up their work so others cannot see what they are doing. Many of us try to hide away when wanting to be able to concentrate on working something out which in the context of needing peace and quiet to calculate medication dosages is a good thing though we need to be open about how we are doing the calculations and share good practice.

The following may seem overly simplistic; though it is a very effective advice, that is, write numbers clearly in large letters/numbers on a blank piece of paper with a clear respect for place value – see ONE for downloadable square/graph paper.

APPLICATION OF NUMBER TO CASE SCENARIO

And finally, to return to Una and her family whilst visiting the ward on a preoperative assessment. In relation to the use of number we will focus on her observations and the use and explanation of a pain assessment tool.

- The normal ranges of observations for different ages appear in ONE and in the next Chapter 2 – do Una's baseline observations fit within the normal range?
- How would you explain what the smiley faces mean to a 4-year-old child, like Una and would you expect her to understand the numerical meanings attached to the chart as it appears below, which consists of a visual scale, a numerical scale, a colour scale (on ONE) and a pain descriptor scale?

  The conclusive answer to this question appears in Chapter 7 where the focus is on looking at how children make meaning of and from number though what follows is some explanation.

0	1	2	3	4
No pain	A little bit of pain	More than a little pain	Lots of pain	The worst pain

Arch Mede Faces Pain Scale.

Source: Adapted into the Arch Mede Hospital Children's Shape Pain Assessment tool from multiple sources including Wong–Baker FACES™ Pain Rating Scale (1983)

Note: Replace the word 'pain' with the words for pain used by the child and family.

See ONE Section 1 for a colour version of pain scale incorporating a colour analogue scale.

Assessing pain in children and young people

Una will be in pain following surgery so it is really important to help prepare both Una and her mum for what is going to happen when she comes into hospital which includes an explanation of the pain assessment chart used on Gamma Ward. This includes a numerical element which will also be discussed in the next chapter.

Refer to the RCN (2009) Recognition and Assessment of Acute Pain in Children for more information about pain management.
http://www.rcn.org.uk/development/practice/clinicalguidelines/pain

Which pain assessment tool for which age group?

The suggestion is that we use different tools for different ages as follows:

- 0–3 years observer scores (with parent or nurse recording the pain score)

- 3–8 years faces pain scale
- >8 years faces/numerical scales

It makes sense to combine all the available tools so the Arch Mede version incorporates a faces pain scale with pain descriptors, numerical scale (0–4) and colour analogue scale (green–red: see the ONE resource) as well as the facility to individualise a tool to a child's needs.

Will Una be able to understand how to use the tool? It is really important that there is a qualitative element as well as a quantitative element thus combining literacy and numeracy aspects of this pain assessment.

There is a large body of research and knowledge with regard to validity and reliability of these tools. Stanford et al. (2006) study looked at 3–6 year olds and their abilities in using self-report scales using 112 children in equal proportion of male and female, placed in 3, 4, 5, 6 year age groups using vignettes (i.e. pain pictures of cartoons depicting various scenarios, i.e. reading a book, to scraping knee, etc.) to assess varying levels of pain. They used the Faces Pain Scales Revised (FPS-R) (Bieri et al., 1990) in order to make it possible to score on a 0–10 metric. The absence of smiles and tears (as used in the Baker and Wong (1983) scale) was seen as being advantageous in that it assessed how children feel inside, not just how the face looks. They recommend that you avoid using words ' happy' and 'sad' (which have an affective element as opposed to a sensory element of the pain experience). They found that older children were able to use FPS-R better than younger children, where 40% of 5–6 year olds really struggled to understand and use it. Whilst this study is not without its criticisms in terms of validity and reliability it offers a useful guide in terms of how children of different ages understand scales and how to explain them to children thus attending to quantitative and qualitative aspects of pain assessment and the pain experience in general. Use of number in research will be discussed in Chapter 8 in greater depth and detail.

Una appeared to understand and managed to use Arch Mede pain scale well and both she and mum were well prepared for surgery the following week, which led to an uneventful admission and postoperative recovery following surgery. Una's discharge prescription of analgesics will be discussed in other chapters.

CONCLUSION

This chapter has offered a rationale with regard to why we, as nurses, might have anxieties about our numeracy skills and has also identified where we are likely to make errors when working with number. Having defined these potential misconceptions and by developing our knowledge of number by starting from the basics, we can now start improving our skill in application of numbers as part of nursing activity. This will also help us work with children, young people and parents/carers who may have problems with numeracy skills themselves.

It is now time to reflect on your action plan before proceeding to the next chapter, which focuses on the use of numbers in counting and measuring in children and young people's nursing practice.