



THE UNIVERSITY of EDINBURGH Moray House School of Education and Sport

# A guide to word prediction



A guide to using word prediction with learners who experience difficulties with literacy

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This guide focuses on the needs of learners who experience difficulties with literacy (particularly dyslexia and/or dysgraphia) who may benefit from using an assistive technology, i.e. word prediction to overcome difficulties with spelling, forming letters incorrectly, expressive writing, legibility and general speed and accuracy of text production.

If you are a teacher, or a parent concerned about the writing progress of your pupil or child, please take time to read through the guide and learn about the different tools that are available to meet the needs of learners.

Anecdotal feedback from teachers and parents suggest that word prediction can help learners to overcome difficulties with writing; improve spelling, increase accuracy and writing speed and help them to feel more confident.

The quote below is from the mother of a dyslexic son. 'David' is in P6, he is a keen reader but experiences difficulties with writing and is falling behind his peers. After introducing him to a word prediction program and providing basic training to David, his teacher and parents, his writing began to improve:

"the technology has made such a difference to allow him to take ownership of his own learning and also there have been noticeable improvements in David's reading, writing - we can't begin to tell you the difference having the software and laptop has made."

Finding the right word prediction program to meet her son's needs involved a 'needs assessment' - discussion with a CALL member of staff, involvement with teachers, parents and other professionals – a process of enquiry and trialling various software programs and strategies; what specific learning tasks are essential to the pupil's achievement, what tools are currently being used to support the student – in a nutshell, what do you want the technology to do and how can it help?

"What do you want the technology to do" and "how can it help" is the focus of this guide; to outline the various features and accommodations of word prediction programs and apps to hopefully help you make an informed decision before purchasing.

As a parent, you may not have the luxury of trialling different software programs - which one works, and which one doesn't, and which is best suited to my child?

I hope this guide goes some way to help.

Craig Mill - Assistive Technology Advisor, CALL Scotland.

Please note that Word prediction programs can also help people who have communication difficulties who use augmentative and alternative means of communication (AAC) such as a communication device with speech output, often supported with symbols or images – if you require something to support communication please contact your local Speech and Language Therapist or get in touch with CALL Scotland or alternatively download the 'iPad Apps for Complex Communication Support Needs ' wheel of apps and see the 'Text-based AAC' section: http://bit.ly/apps-complex-com-support

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# Introduction

# What is word prediction?

If you have sent messages with your phone or tablet the chances are you have used word prediction, or as it is more commonly known, predictive text.

Predictive text offers suggested words and phrases which closely match the first few letters that have been typed. It can help to reduce the number of required keystrokes, by predicting the word you are typing, and the next word based on word frequency and context of what is being typed.

For example, in the illustration below, predictive text on an iPhone has offered 'meet' after typing 'm' as a potential word completion.



Although predictive text on tablet devices can help to improve typing speed, particularly when using the on-screen keyboard, it has limited functionality. Recent updates to predictive text allow you to 'tap and hear the word' before entering it into a message or document.

Predictive text is not new. It has been around since the 1980s as an assistive technology writing support tool – known as **word prediction**. Word prediction was originally designed as a writing aid to help people with physical disabilities to improve keyboard access, minimising the number of keystrokes required to type.

Increasingly, word prediction is used as a tool to support learners with literacy difficulties, particularly spelling and grammar.

Word prediction programs offer a list of words in a 'prediction window' which can either follow the mouse cursor as it moves across the document or as a static window placed in a convenient location on the desktop.



# Why use word prediction?

Word prediction has many benefits, such as making the writing process easier, for example:

- It can help learners with a physical disability to type some word prediction programs allow the user to type using a mouse by hovering over a letter or word using an on-screen keyboard.
- ✓ It can help learners who experience difficulties with spelling and grammar.
- It can help learners to focus on the writing task rather than worry about making spelling mistakes.
- It can help learners to be more creative and expand their ideas, rather than avoiding words they can't spell.
- It can help to increase text production (and accuracy).
- It can help to boost confidence.

Word prediction is also beneficial to people who experience fatigue or have limited motor skills as it requires less effort to type, requiring only one or two keys to complete longer words and sentences.

### Are all word prediction programs the same?

At a basic level word prediction makes suggestions for words it thinks you are trying to write.

Although the main aim of a word prediction program is to 'predict words' they differ in their approaches and characteristics, for example, word prediction can appear in a vertical list and/or in a horizontal row of words or as mentioned earlier, on the top row of an on-screen keyboard.

1	suaaest 🔹	2 suggested 🔹	3 sugar 🏼	4 suggestions
•	Juggeot	- ouggoolou	o ougui	, ouggoodono

Most word prediction programs have options to change the font style, size and colour as well as the background colour of the word prediction window. Some word prediction programs are stand-alone or come as part of a larger software package.

Word prediction programs offer various accommodations to support the writing process, although include the following features:

- Text-to-speech support words are read aloud in the prediction window. This can help the learner to see and hear the predicted word to aid accuracy. Typed words and sentences can also be read aloud in a document such as Microsoft Word.
- Homophone support this can help to clarify similar sounding words (confusables) such as 'their' or 'there'. The word prediction program supplies a list of possible contextual words.
- Flexible, creative or phonetic spelling words are suggested when spelt incorrectly or with missing letters.
- Create topic dictionaries topic specific lexicons to help vocabulary when writing specific projects or curriculum subjects, e.g. topics are often located with a category, e.g. History > The Celts, The Romans etc.

- Images or symbols which match the predicted words.
- Abbreviation expansion type a combination of two or more letters to produce sentences or paragraphs.

# Types of word prediction programs

Although word prediction programs have one main objective, i.e. to suggest words as you type, they differ greatly in terms of the features and tools they offer.

Some are stand-alone word prediction programs, e.g. Penfriend, Co:Writer and WordQ, while others are included as a component of a comprehensive literacy support program such as Clicker 7, Texthelp Read&Write, ClaroRead and Ghotit.

Increasingly word prediction also appears as a built-in component of operating systems such as Windows 10, iOS, Android, Chromebook and MacOS.

### Word prediction at Operating System level

Word prediction is freely available on a range of different devices via the operating systems, including iOS, Google Android/Chrome, Windows and MacOS.

### Windows 10 – text suggestions

cursor in a vertical row with a maximum of 3 words to choose from.

Word prediction or 'Text Suggestions' is available in Windows 10 (version 9013 and above) is available on both the 'software keyboard' (on-screen) and a hardware keyboard.

### To turn on 'text suggestions' go to:

 Windows Start Menu > Settings (cog icon) > Typing (or type 'Typing' in the Windows Search box).

Typing	
Show text suggestions as I type on th	<sup>e sor</sup> Hardware keyboard
On On	Text suggestions for the hardware keyboard aren't available in some languages
Add a space after I choose a text sugg	Show text suggestions as I type
Add a full stop after I double-tap the	spac On
Off Off	Autocorrect misspelt words I type
	Off Off
When the Hardware	
keyboard is turned on 'text suggestions'	Windows Wiltshire Windsor
appears above the Usin	ng text prediction in Wi

Text is entered with a mouse click or with the keyboard arrow keys.

# Summary

Although 'text suggestions' is a welcome addition to Windows 10, it does not currently have an option to listen to each word using text-to-speech. A simple rightclick with an option to hear each word would be a useful feature ensuring learners can hear each word before choosing.

Overall, text suggestion is very accurate and works on a range of Microsoft applications such as Word, Notepad, Outlook and PowerPoint.

Text suggestions is also keyboard accessible: Up arrow key to highlight a word, Left/Right arrow keys to move between words, Enter key to select the word.

Using word pre

prediction

The **Windows On-Screen Keyboard (Accessibility Keyboard)** also includes 'Text Prediction' and could be helpful for those who can only use a mouse, e.g. a trackball or even switch access.

# To turn on Accessibility keyboard go to:

# System Preferences > Accessibility > Keyboard > Accessibility Keyboard<sup>1</sup>

To turn on 'Text Prediction' on the Accessibility Keyboard select 'Options' and check the 'Use Text Prediction' box.



# Find out how you can predict with Emojis using the Windows 10 'Emoji Panel'. 🙂 者

# MacOS – Word Completion

To help with vocabulary and word-building skills, MacOS provides Word Completion, which works in OS Apps such as Pages, TextEdit and Keynote.

To use Word Completion, open a text editing app such as Pages, Keynote or Notes. Type the start of a word and press the F5 key to bring up a list of words.



You can choose the word you want by either clicking on the word or by pressing the Enter key on the keyboard (use the up and down arrows to navigate through the list).

<sup>1: &</sup>lt;u>www.techrepublic.com/article/how-to-add-emoji-to-your-documents-using-the-built-in-windows-10-emoji-panel/</u>

# Summary

Word Completion is limited to MacOS Apps such as Pages and Notes. It is not compatible with the Mac version of Microsoft Word. The option to navigate through a list of words is a benefit, although an option to hear each word spoken aloud would be an improvement.

However, it is possible to use the **Accessibility Keyboard** (similar to Windows 10) which can be used in conjunction with an external keyboard or as a stand-alone onscreen keyboard (use with a mouse to click, dwell – or with switch access) to input predicted words.

# To turn on Accessibility Keyboard go to:

System Preferences > Accessibility > Keyboard > Accessibility Keyboard.



# Android - Predictive Text

Predictive text is available in the Android operating system although the features will vary depending on the version of Android you have installed, e.g. Kit Kat, Marshmallow, Pie etc.



### Summary

Text prediction is set as default on the on-screen keyboard and works straight out of the box. Depending on the version of Google Android (and the on-screen keyboard) there are additional features such as 'Next word suggestion' and 'Personalised suggestions' – Google learns from your communications and typed data to improve suggestions.

### **Chromebook – Predictive Text**

Predictive text is available on a Chromebook. It works in a similar way to Android prediction and is designed to work on a touchscreen and hardware keyboard. If you don't have a touchscreen device, you can also use the mouse pointer to click (and/or dwell) on the on-screen keyboard.

# To turn on Predictive Text go to: Settings > Device > Keyboard > Change Language and Input. Choose the UK keyboard to get started.

# iOS iPad/iPhone – QuickType (Predictive)

QuickType or Predictive is the iOS equivalent of Android's predictive text. Like Android, QuickType is a contextual word (and phrase) completion tool that learns what you type, i.e. based on past conversations, writing style and even browsing history from websites such as Safari.

### To turn on QuickType/Predictive go to: Settings > General > Keyboard > Predictive



#### Summary

A benefit that iOS has over Windows, Android and Chromebook is the ability to hear predictions spoken aloud using 'Hold to Speak Predictions – particularly useful for those learners who can hear



the word but are unsure which word to choose.

#### To turn on 'Hold to speak predictions' go to:

Settings > General > Accessibility > Speech > Hold to speak predictions

An additional benefit of iOS is the ability to 'undock' the on-screen keyboard so it can be aligned directly under the text, aiding focus.

1	I can use Predi									
ភ	⊞ Aa		"Predi"		Predie	ctive	1	Predict	6	⊘ ⊕ ⊗
1 <b>q</b>	2 W	з е	4 <b>r</b>	5 t	6 <b>y</b>	7 u	8 i	9 0	° p	$\bigotimes$
	@ a	# S	f d	& f	* g	( h	) j	, k	" 	Ł
¢	% Z	×	+ C	= V	/ b	; n	: m	! ,	?	Ŷ
.?123		Q						.?	12	, U

Tap and hold the 'keyboard' icon (bottom right) to 'undock' and 'dock'.

QuickType also works with an external keyboard – the prediction bar defaults to the bottom of the screen.



Most built-in prediction systems also predict using Emoji suggestions, e.g. Windows and iOS.

# Word prediction software programs (Windows and MacOS)

There are several literacy software programs for Windows and Mac computers. As mentioned previously, some are stand-alone word prediction programs, e.g. Penfriend, Co:Writer and WordQ. In programs such as Clicker 7, DocsPlus, Texthelp Read&Write, ClaroRead and Ghotit, word prediction is offered as one component of a suite of literacy support tools.

### Choosing a word prediction program

With so many literacy support and word prediction programs to choose from, deciding on a 'solution' to support a learner with literacy difficulties can be a difficult process.

Preferably, the process of deciding on appropriate technology that suits the needs of a learner should be realised through an **assessment process**, a collaborative approach with appropriate colleagues, for example, the SETT Framework<sup>2</sup> (Student, Environments, Tasks and Tools).

Comprehensive literacy support programs such as Texthelp Read&Write<sup>3</sup> may initially require a steep learning curve for both the teacher and learner. Something more basic, such as a simple word prediction with text to speech is often overlooked, even for those learners who are proficient typists.

But even a 'simple' word prediction program can include numerous tools which are intended to enhance accessibility and improve literacy support.

This section will explore features of different word prediction programs, some of which are similar across the board, others are unique to individual programs. It is hoped the following overview will act as a guide when choosing the most appropriate word prediction program to support a learner.

The table below represents popular literacy support programs and word prediction programs. They are ordered alphabetically to avoid bias.

Program	Overview	Website
*ClaroRead	A floating toolbar with a range of support tools.	www.clarosoftware.com/portfolio/claroread/ For Windows, Mac, iPad, Android and Chrome browser.
*Clicker 7	A child-friendly interface aimed at primary pupils.	www.cricksoft.com/uk/clicker For Windows, Mac, Chromebook and iPad.
Co:Writer	Word prediction program with numerous topic dictionaries.	https://learningtools.donjohnston.com/product/cowriter/ No longer available to buy in the UK, but many schools and pupils still use it.

\* Indicates word prediction is integrated as one part of the program.

<sup>&</sup>lt;sup>2</sup> <u>https://assistedtechnology.weebly.com/sett-framework.html</u>

<sup>&</sup>lt;sup>3</sup> <u>https://www.texthelp.com/en-gb/products/read-write/</u>

*DocsPlus	Similar to Clicker 7 but aimed at secondary pupils.	www.cricksoft.com/uk/docsplus For Windows, Mac, Chromebook and iPad.
*Ghotit Real Writer & Reader	Comprehensive literacy support program.	www.ghotit.com/ For Windows, Mac, Chromebook and iPad.
Penfriend	Stand-alone word prediction with topic dictionaries.	Windows only. Available in 2 versions, XP and XL – which includes prediction/dictionaries in European languages. Also available on a USB pendrive.
*Read&Write	Comprehensive literacy support program.	www.texthelp.com/en-gb/products/read-write/ For Windows, Mac, iPad, Android, Chrome and Edge browsers.
WordQ	Comprehensive word Prediction program.	For Windows, Mac, iPad, Chromebook and Chrome browser.

# Features of word prediction programs

As word prediction programs have evolved over the years, so too has the development of different tools and features that are included in word prediction programs.

# Word prediction and accuracy

The most important aspect of a word prediction program is its ability to predict accurately and in context after only 1, 2 or more key presses.

Predictions are based on the context and spelling, as well as frequency, redundancy and words which have been recently used. Most word prediction programs operate in the following way:

- 1. As the first letter of a word is typed, the program offers a list of words in a prediction window beginning with that letter.
- 2. If the required word appears in the list, the learner can then choose the word (by pressing a corresponding number or pointing and clicking) and the word will automatically be inserted into the sentence.
- 3. If the required word does not appear, a second letter of the word is typed, and a new list appears with relevant words beginning with the two letters.
- 4. The learner continues this process until the required word appears or is offered in the prediction window.

If the word is not included in the program's predictor database, it can be added for future use.

Some programs offer different 'levels' of prediction and quantity of words in their database – 'kids 500', 'teens 10k', 'youth 30k' etc, - basic to more complex words, depending on the age and ability of the learner. See the Research section for more on the importance of 'dictionary size and level'.

In the experiment below, the letters '**sug**' were used to prompt each word prediction program to complete the word '**suggest**' demonstrating the differences (and similarities) between each word prediction program.

The letters were typed in isolation without any context and without any sentence structure. This is a slightly ambiguous experiment as word prediction programs tend to respond best when words are used in context as part of a sentence.



Although most of the word predictors offer 'suggest' or 'suggested' as a top of the list choice, there are discrepancies (suggest/suggested etc). While this is normal for a 'first' or 'single' word prediction, accuracy is greatly improved when used within a contextual sentence.

Using Ghotit and WordQ as examples, 'suggest' appears at the top of the list.



# Customising the prediction window

An important feature of word prediction programs is to customise the word prediction window, to suit different learning needs. For example:

- Changing the font style, colour and size
- Changing the background colour
- Option to have prediction list with numbers or 'F' keys, i.e. F1, F2, F3, etc., which can be either accessed from the keyboard or by a mouse click.

In the examples below, both Penfriend and ClaroRead include options to customise the prediction window. Penfriend also has a 'Style' dropdown box with different styles including horizontal.

Programs which have customisation options			
ClaroRead	$\checkmark$		
Clicker 7	$\checkmark$		
Co:Writer	$\checkmark$		
DocsPlus	$\checkmark$		
Ghotit	$\checkmark$		
Penfriend	$\checkmark$		
Read&Write	X		
WordQ	$\checkmark$		

#### Next word prediction

This is vital feature of any word prediction program. The word predictor predicts what it thinks is the next word within the context of a sentence. This acts as a prompt, encouraging the learner to choose the appropriate word and focus on the writing task.

This is not always switched on by default, so it is worth checking in either the 'Preferences' or 'Settings' menu. The example on the right is DocsPlus. All word prediction programs in this guide include 'next word' prediction.



# Topic dictionaries/lexicons

Creating and saving subject or curriculum specific lexicons/topic dictionaries', i.e. words which are related to a topic appear in the prediction, greatly enhances a word prediction program.

Topic dictionaries can improve the accuracy of predicted words, as opposed to using a 'generic' dictionary.

Increased frequency of words related to a topic can also improve typing speed, by cutting down the amount of 'generic' words appearing in the list.

For example, if a learner is working on an activity, e.g. 'Global Warming' using a Global Warming topic dictionary or lexicon, words related to Global Warming, will appear with increased frequency when letters such as 'g' for 'greenhouse' or 'a' for 'atmosphere', are typed.

Similarly, if a learner is studying biology and is required to write words such as 'photosynthesis' or 'photosynthetic' a Biology topic lexicon will push these words to the top of the prediction list, reducing the number of prediction guesses.

In the example below, topic dictionaries for William Shakespeare and Macbeth have been selected for an English writing activity.

🦃 Co:Writer - Default Student	In English I am writing about Will	ia	
Topics Word Bank Vocabulary Recent Topics Macbeth Global Warming Albert Einstein William Shakespeare		1: Wi 2: Wi 3: We 4: Wi 5: Wi	illiam Shakespeare illing ellies hile hole
Compare and Contrast  Tsunamis & Tidal Way	Tategories		On Topic Dictionary
More Topics	Active Topics _Active Topics _Not Filed Arts _Citizenship / PHSE		A Curious Dream SIF     A Midsummer Night STF     Abraham Lincoln     Adaptation Change STF     Afahanistan
Co:Writer includes a	English / Literacy Famous People		Albert Einstein     Alcatraz STF
wide-range of	Geography & Travel		Alexander Graham Bell
curriculum-related	Maths		Ali the Greatest STF
topic dictionaries,	Newest Topics Religious Education		Alice in Wonderland     Amazing Creatures STF
and has an option	Science		Amelia Earhart
to create your own	Types of Writing		Amer Revolution     Ancient Assyria
personalised topic			

# **Clicker Grids**

dictionaries.

Clicker 7 and DocsPlus take a different approach. Topical gridsets, such as word banks can be downloaded from Learning Grids <u>www.learninggrids.com/uk/</u> or custom grids can be created from within Clicker 7 and DocsPlus. Gridsets such as wordbanks or sentence sets automatically generate topics to be used with word prediction, offering enhanced support, i.e. point and click access to word banks, sentence sets (writing frames) and word prediction.

In the illustration below, word prediction is used in combination with a Sentence Set to provide additional scaffolding. If required, learners can switch between either word prediction alongside the sentence set, or minimise the sentence set, and use word prediction in isolation.

In Clicker 7 and DocsPlus 'Predict words from Clicker set' is turned on as default: **Options** > **Preferences** > **Predictor** > **Custom Level.** 



Programs which have topic dictionaries/lexicons				
ClaroRead	$\checkmark$	Extensive selection of topic dictionaries.		
Clicker 7	$\checkmark$	Learning Grids and option to create new topics.		
Co:Writer	$\checkmark$	Extensive selection of topic dictionaries.		
DocsPlus	$\checkmark$	Learning Grids and option to create new topics.		
Ghotit		No built-in topic dictionaries, but option to create new topics.		
Penfriend		No built-in topic dictionaries, but option to create new topics.		
Read&Write	$\checkmark$	Extensive selection of topic 'Word Banks'.		
WordQ	$\checkmark$	'Dynamic topics' (online) and option to create new topics.		

#### Learn new words

As well as Topic Dictionaries word prediction programs include a 'Learn new words' feature. Although this is useful for words which are not in the predictions database, there is a risk that misspellings can be unknowingly stored in the database and consequently appear in the prediction list – the learner then wrongly assumes it is a correct word – treat with caution!

# Flexible/Phonetic spelling

Arguably one of the most important features of word prediction is the software's ability to recognise and correct phonetic spelling mistakes as word prediction software uses spelling and grammatical rules to predict words.

Simply put, phonetic spelling is spelling words the way they sound, for example, elefant (elephant), telefone (telephone), rong (wrong), u (you) etc.



As well as identifying a phonetic spelling mistake some programs have a feature that allows you to click into different parts of the word – with different but related words appearing in the list.

This is useful to help identify both phonetic and unintended spelling mistakes.

Programs which have phonetic/flexible spelling			
ClaroRead	$\checkmark$	Not by default – use Phonetic spelling option.	
Clicker 7	$\checkmark$		
Co:Writer	$\checkmark$		
DocsPlus	$\checkmark$		
Ghotit	$\checkmark$		
Penfriend	X		
Read&Write	$\checkmark$		
WordQ	$\checkmark$		

# Text-to-speech

For learners who experience difficulty recognising words, even though they appear in the prediction window, being able to 'see' and 'hear' the word spoken aloud can make a big difference, helping to reinforce what is seen on the screen and aiding comprehension, sometimes referred to as dual modality<sup>4</sup>.

Most modern word prediction programs include text-to-speech although it is not always turned on as default. Programs such as Penfriend, Ghotit, WordQ, Read&Write and ClaroRead have a 'roll or hover over' the word feature – so the learner can work their way down each word in the prediction list until he/she hears the word.

<sup>&</sup>lt;sup>4</sup> <u>https://journals.sagepub.com/doi/pdf/10.1177/2158244016669550</u>

The advantage of this feature is that it supports 'auditory-visual shape matching', where the user can associate the sound of the word with the 'shape of the word', which promotes faster recognition without decoding the letters of the word<sup>5</sup>. Speaking words in the prediction window/list also helps the learner to hear if they have made the right word selection.

Clicker 7 and DocsPlus require a 'right mouse click' on each word to hear it read aloud. In some cases, the text-to-speech may require an initial set-up, e.g. type of voice, speed of the voice.

As well as having 'hover over the word' to hear it read aloud, all the programs below can also read text, either within its own environment (Clicker 7 and DocsPlus) or from within a document, such as Microsoft Word – ClaroRead, Co:Writer, Ghotit, Penfriend, Read&Write and WordQ.

Programs which have text-to-speech				
ClaroRead	$\checkmark$			
Clicker 7	$\checkmark$	Right mouse click on the word to hear it spoken aloud.		
Co:Writer	$\checkmark$			
DocsPlus	$\checkmark$	Right mouse click on the word to hear it spoken aloud.		
Ghotit	$\checkmark$			
Penfriend	$\checkmark$			
Read&Write	$\checkmark$			
WordQ	$\checkmark$			

All these Windows OS programs can speak with the free Scottish computer voices available free for Scottish schools. Colleges and Universities: <u>www.thescottishvoice.org.uk/home/</u>

Another feature of word prediction programs and text-to-speech is 'typing echo' which speaks back letters, words, and sentences as a learner types into a document. By listening to the flow of words a learner can hear whether the word or sentence makes sense helping to detect potential mistakes. For more on text-to-speech, see 'Text-to-Speech Technology as Inclusive Reading Practice' by Michelann Parr (2013)<sup>6</sup>.

# Picture or symbol support in the prediction window

As mentioned above, seeing a word and hearing it read aloud in the prediction windows can be beneficial for providing additional support.

However, having a picture or symbol representation can enhance the learning experience, particularly as pictures and/or



symbols in the predictor and document can be useful tools for supporting comprehension of text, particularly key information carrying words in a sentence. Only Clicker 7 and Read&Write has picture or symbol support in the prediction window. (Read&Write – use the Prediction and Picture Dictionary in tandem.

<sup>&</sup>lt;sup>5</sup> Shein, F. (2019) Quillsoft : <u>https://www.quillsoft.ca/ourteam</u>

<sup>&</sup>lt;sup>6</sup> Parr, M (2013) Text-to-Speech Technology as Inclusive Reading Practice: <u>http://bit.ly/2LnzHE2</u>

# Homophone/confusable word support

Homophones, sometimes known as 'confusables' are words which have a similar sound but differ in spelling and meaning. Examples of homophones include 'there' and 'their', 'where' and 'were' and so on.

With over 400 homophones in the English language, similar sounding words add depth to a language, but they can also be the cause of great frustration.

Homophones can be particularly problematic for dyslexic learners who have difficulty distinguishing between homophones such as 'their' and 'there'.

For example, if the words 'be' and 'bee' appear in the prediction list, how would a dyslexic learner know which word to choose? In the case of 'be' and 'bee' text-to-speech probably wouldn't help as both words sound similar.

Picture or symbol support would help to distinguish between the words, but this feature is limited to one-word prediction program.

Another method employed by word prediction programs is to include a talking dictionary (meanings, explanations for predicted words) to help distinguish between homophones. This is normally accessed by either clicking or rolling the mouse over the confusable word to reveal/hear the dictionary meaning – see illustrations below (in order - Penfriend, Ghotit and WordQ):

Tł	The ball is over ther										
					Di	Did you know their					
0	_		$\times$		I				1		
File	View			means:		_		$\times$			
f1.	there		>	Place	File	View			means:		
f2.	there	fore		for example:	f1.	their		>	Belonging		
f3	there	ofter		The town is over	f2.	theirs	\$		for example:		
10.	uiere	anci		there					We went to their		
†4.	there	by		uicic.	-				house.		
f5.	thera	ру		their means: Belonging					there means: Place		

This	is to		
0	ihotit - Predict Anywl	here X	
F1	too	<b>»</b>	1) In addition. 2) Over-much, unnecessary. 3) Ways.
		1	

lt cost to	o m	uch money.
1 to		
2 to the		
3 to you		
4 too		I've got too much work.

## Free word prediction programs

Free word prediction programs are also available, but they lack important features such as text-to-speech, next word prediction etc.

### Lightkey

Instead of predicting words from a drop-down list, Lightkey predicts the word after two or more keystrokes – the suggested word appears in light grey. Words are completed by pressing the 'Tab' key.



# Press the Tab key to complete

M

1

1

0

0

• • Technology

Lightkey operates in a slightly unorthodox way compared to the 'traditional' list style of prediction. There is no way of knowing if the word is correct unless a separate textto-speech program is used to hear the text spoken aloud.

Lightkey also struggled to recognise homophones and did not offer an alternative to 'to' or 'too'.

However, Lightkey includes a range of topic dictionaries, including an Academic with a range of subjects such as History, Geography, Biology etc.

Download the basic version of Lightkey from: www.lightkey.io/basic-edition

Industries	Mathematics	, Line nemy	Siciegy.
Business & Finance	Chemistry	Civil Engineering	Computer
Law & Government			Science
Academic	Earth Science	Education	Electrical Engineering
Art & Entertainment			
Sports	Geography	History	Linguistics
Medical & Health			
Custom Categories	Literature	Materials Science	Mathematics

Select Your Prediction Categories (0/68 Selected)

Applied

# **Dicom Portable**

Dicom Portable is a free (but very basic) word prediction program that runs from a USB pendrive, i.e. no installation required.

It is possible to customise the background and font colours of the prediction window and add new words to the prediction database, but otherwise, Dicom is very limited, e.g. **no next word prediction, phonetic/flexible spelling, text-to-speech etc.** 

Words in the prediction list can be enlarged by clicking and dragging one of the corners of the prediction window.

Dicom Portable is a free word pred	DICOM Portable ×
	F1: predict F2: predictable
	F3: predicted
	F4: predator
	F5: predicament
	F6: predators
	F7: prediction

**Please note:** the original Dicom is available from the website Portable Apps but this version contains **offensive (swear) words** which are unsuitable for learners.

However, you can download a 'clean' version (all swear words have been removed from the database) from the following OneDrive account: www.callscotland.org.uk/bit/?aOeZPxb

#### Which one is best?

It is difficult to recommend a 'best' word prediction program as there are many factors to consider, each has its own set of characteristics. Rather the question should be rephrased; which word prediction program best suits the needs of an individual learner?

If you work as part of a team, in a school for example, then the SETT Framework should be taken into account, i.e. what are the needs of the **student**?, what kind of **environment** will the student be in, a classroom?, what **tasks** or activities will the learner be doing (writing, reading) and what **tools** (including devices and services) are currently being used and what strategies are in place to support the learner?

Some possible scenarios could include:

#### Case Study 1

The student is in primary school and has significant difficulties with writing sentences. Spelling is also poor. The student finds Microsoft Word overwhelming and requires a simpler interface. After observation, it appears the student can identify words by seeing and hearing the word but requires help to construct a sentence.

#### **Possible solution**

It is unlikely that a student would benefit from having only word prediction, but rather access to enhanced tools to provide additional scaffolding and reinforcement, for example, a simplified interface, additional word banks/writing frames, built-in text-to-speech and image support.

**Software:** Clicker 7 – sentence sets and/or word banks (and possibly DocsPlus with word banks).

#### Case study 2

The student (secondary school) has a physical difficulty and finds a keyboard difficult to use. Ideally, he/she requires a tool to help cut down the amount of keystrokes type words. He/she does not have literacy difficulties. Speech recognition has been trialled but was unsuccessful.

#### Possible solution

A stand-alone word prediction could be a possibility, one that has 'number' or 'F' keys for selecting and inputting words and/or a mouse option hover/click input word by using a mouse click or dwell.

**Software:** Penfriend has a built-in on-screen keyboard with 'mouse hover' and 'dwell click' accommodations. Clicker 7 includes alternative access such as Switch Access and Eye Gaze: <u>http://bit.ly/clicker-accessibility</u> ClaroRead, Ghotit, Read&Write and WordQ have options for inputting predictions by either the 'F' keys and/or number keys.

#### Case Study 3

The student has problems with spelling. He/she can identify the first letter, sometimes the second letter, but is unable to complete the word without any additional

support. He/she spells phonetically and is unaware that the word has been misspelt. He/she also has sight difficulties and requires large fonts on a high contrast background.

#### **Possible solution**

This would require a word prediction program that offers extensive support – options to customise the font style, colour and background in the prediction window, topic dictionaries with access to specific words, flexible/phonetic spelling, text-to-speech to see and hear the words and help with confusable words.

**Software:** all word prediction programs except for Penfriend have flexible/phonetic spelling support.

#### Case Study 4

The student has Gaelic as a first language and requires word prediction to support his/her writing and prefers to hear the words in the prediction list read aloud.

#### **Possible solution**

Penfriend includes a Gaelic Syntax and Gaelic lexicons. It can be used in combination with the free Gaelic voice, Ceitidh: <u>www.thescottishvoice.org.uk/home/</u>

#### Summary

While each word prediction system has its unique handling of prediction, virtually all modern word prediction systems are comparable in terms of accuracy.

A priority should be whether the system is easy-to-use and has the needed and desirable features, i.e. what does the student actually need? The focus should always be on writing and editing. Generally, few students need or use word prediction with every word. It should be available when needed and hidden or off to the side when not needed<sup>7</sup>.

If all that is required is accurate word prediction, text-to-speech, topic dictionaries, next word prediction and a program that is easy-to-use, then most modern word predictions will suffice. The final decision may come down to factors such as cost, what the school can support in terms of staff training and technical support.

<sup>&</sup>lt;sup>7</sup> Shein, F. (2019) Quillsoft : <u>https://www.quillsoft.ca/ourteam</u>

# Word Prediction Apps for iPad, Android and Chromebook

In April 2010 the first iPad was released. Since then, other tablet devices such as Androids and Chromebooks have also appeared and evolved over time.

As the operating systems of these devices continue to offer improved built-in Accessibility settings, such as Predictive Text, so too has the development and choice of word prediction apps.

One possible reason for this is that original on-screen keyboards were tricky for writing long word processing tasks, require numerous taps and double taps (for capitalisation) etc. Word prediction apps helped to cut down the number of keystrokes required for extended writing activities.

Increasingly external keyboards, such as Bluetooth keyboards helped to overcome difficulties associated with the on-screen keyboard.

Consequently, as word prediction apps have evolved, they are used to support a range of additional support needs such as dyslexia, physical difficulties and communication access.

Developers of Windows and Mac word prediction programs have used this opportunity to create apps, building on years of experience and expertise, moving from the desktop to the portable, for example:

Developer	Арр	Features
Claro Software	<b>ClaroSpeak</b> – compatibility: Android Chromebook iPad	<ul> <li>On-screen (and external keyboard) prediction </li> <li>Customise word prediction/on-screen keyboard x</li> <li>Customise document font/style/colour </li> <li>Prediction in a list x</li> <li>Predict next word </li> <li>Text-to-speech </li> <li>Topic Dictionaries (create custom only) </li> <li>Learn as you type </li> <li>Tap to hear the word x</li> <li>Phonetic spelling x</li> <li>Homophone support x</li> </ul>
		ClaroSpeak
The R	ussian Revolutio	n
The R	ussian revo	
revol	ution <u>revolution</u>	nary <u>revolutionary</u>
$\rightarrow$	B I ⊻	

Crick Software	<b>Clicker Docs</b> – compatibility: iPad Clicker 7 available for Chromebook	<ul> <li>On-screen (and external keyboard) prediction </li> <li>Customise word prediction/on-screen keyboard x</li> <li>Customise document font/style/colour </li> <li>Prediction in a list (Chromebook only) x</li> <li>Predict next word </li> <li>Text-to-speech </li> <li>Topic Dictionaries (Learning Grids &amp; Custom) </li> <li>Learn as you type </li> <li>Tap to hear the word (Sound shift) </li> <li>Phonetic spelling </li> <li>Homophone support </li> </ul>
☐ ☆ I I am leo race	arning about	Document 2 ? ? ? IF
Don Johnston inc	<b>Co:Writer</b> (Universal)- compatibility: iPad Chrome browser.	<ul> <li>On-screen (and external keyboard) prediction </li> <li>Customise word prediction/on-screen keyboard x</li> <li>Customise document font/style/colour </li> <li>Prediction in a list x</li> <li>Predict next word </li> <li>Text-to-speech </li> <li>Topic Dictionaries (requires online access) </li> <li>Learn as you type </li> <li>Tap to hear the word </li> <li>Phonetic spelling </li> <li>Homophone support </li> </ul>
د G	Iobal Warming is o <u>careful</u> <u>carbon</u>	aused by car caused by car dioxide car carcinogenic caring. B I ⊻ ∧ ∨

Cric Soft	Crick Software       DocsPlus - compatibility: Chromebook iPad       • On-screen (and external keyboard) prediction ✓         • Customise word prediction/keyboard (font only)       • Customise document font/style/colour ✓         • Prediction in a list ✓       • Predict next word ✓         • Topic Dictionaries (Learning Grids & Custom) ✓       • Learn as you type ✓         • Tap to hear the word (Sound shift) ✓       • Phonetic spelling ✓									✓ /)		
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Gho	otit		<b>Ghotit R</b> compat iPad	e <b>alWriter</b> ibility:		Extern Custo Predio Predio Text-t Topic Learn Tap to Phone Homo	nal k mis ction ct n o-sp Dic as o he etic	e word p e docur n in a list ext word beech tionaries you type ar the w spelling one supp	d predored ment  d $$ s (cre $\approx $ vord  oort	ediction/o iction/o font/sty eate cu: ✓	✓ n-screen keyboar /le/colour ✓	d x
F	River p as the Soil er	A <sup>™</sup> E     DrOC     rive     erosion     error     error     error     era	esses sl r moves	nape th from it	⊧ e la s so	nd in c urce to		their	Ø Iys I.	Homo in the windo	phone support prediction w. f something belongs to th 'their" thing.	em it is

Penfriend	Not available as an app.								
Texthelp	Read&Write for iPad	Only ave section c	nilable as	a 'thirc oarty ke	d-party' eyboard	keyboc ls'	ard ap	p – see t	the
Quillsoft	iWordQ	<ul> <li>Extern</li> <li>Custo</li> <li>Custo</li> <li>Predia</li> <li>Predia</li> <li>Text-t</li> <li>Topic</li> <li>Learn</li> <li>Tap ta</li> <li>Phona</li> <li>Homo</li> </ul>	Customise word prediction (font size only) Customise document font/style/colour Prediction in a list Predict next word Text-to-speech Topic Dictionaries (add new words) Learn as you type Tap to hear the word Phonetic spelling Homophone support						
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Predictions	word Prediction		predict						
Usage Examp	es		predictin	g					
Creative Spell	ing		predator	5					
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Position	Position Above keyboar								
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#### Inku

Unlike the previously mentioned apps, Inku also includes speech recognition providing a combination of writing/prediction and speech.

When you use speech recognition to say a word or sentence, your speech appears in the prediction



window. You can check if it is correct by tapping the 'speaker' icon to hear it read aloud. Inku also has many other features including:

- On-screen (and external keyboard) prediction ✓
- Customise word prediction/on-screen keyboard ✓
- Customise document font/style/colour ✓
- Prediction in a list two columns
- Text-to-Speech ✓
- Topic Dictionaries x
- Learn as you type
- Tap to hear the word x
- Different levels of support  $\checkmark$
- Speech recognition ✓
- Spellchecker
- Select dictionary size ✓
- Multiple languages
- Customise pronunciation  $\checkmark$

# Third-party keyboard apps with prediction for iPad

A third-party keyboard allows you to replace the default or built-in keyboard with a third-party alternative. While this can be an inexpensive substitute for a dedicated word prediction app, there is some concern that third-party keyboard apps can potentially capture and store data<sup>8</sup> - always check with the supplier before installing.

# The benefits of third-party keyboard app include:

- ✓ More font style and colour options compared to the default keyboard.
- ✓ Works across different apps, Notes, Pages, MS Word etc.
- Keyboard apps are often less expensive.
- ✓ Different keyboard layouts are available, e.g. 'abc', lowercase, clusters.
- Improved word prediction, including topic dictionaries.



<sup>&</sup>lt;sup>8</sup> <u>https://zeltser.com/third-party-keyboards-security/</u>

#### Third party word prediction keyboard apps



**Keedogo** is an iPad keyboard designed for children and young students who have just started to read, write and type. The keyboard provides a simplified layout with just the essential keys so early writers can focus on developing their skills rather than being distracted by symbols and functions they don't yet need. (Text from App Store).

For more information: https://apple.co/2YJ7nPl



asc

**SuperKeys** is a simple colourful and uncluttered keyboard with word prediction. Keys are grouped into clusters, tap on a cluster to display the letter and predicted word (displays in a large font).

For more information: <u>https://apple.co/2S3P4Ca</u>





**Read&Write for iPad** helps with reading and writing and provides customisable text to speech - including continuous reading and dual colour highlighting in a quick tap. (*Text edited from App Store*).

For more information: App Store: <u>https://apple.co/2YHo7qn</u> Google Play Store: <u>http://bit.ly/2LJNwMj</u>

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**Dyslexia Keyboard** predicts words by using Ghotit Quick Spell Word-Prediction, the technology designed for writers with typing issues and phonetic writers. (*Text edited from App Store*).

For more information: <u>https://apple.co/2Xzlg0f</u>

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**Co:Writer** predicts the intended word with a selection of word suggestions using powerful grammar-smart word prediction. These suggestions can be read aloud with a swipe. (Text edited from App Store).

For more information and screenshots: App Store: <u>https://apple.co/2XxQkn3</u> Chrome Browser: <u>http://bit.ly/2G1X4yM</u>

### Word prediction - what the research says

A literature review was conducted over a three-day period to identify appropriate 'word prediction' research articles. The aim of the review was to investigate whether word prediction was effective in improving the writing skills of learners with literacy difficulties, e.g. improves spelling, rate of writing, expressive writing and general text production.

The review identified a lack of current research in the field of word prediction. Most of the papers cited here were written between the late 1990s – 2006 when word prediction programs were still in early development. Arguably not a great deal has changed in the fundamentals of word prediction software; as the first letter of a word is typed, the 'program' offers a list of words beginning with that letter. If the desired word appears in the list, the user can then choose the word by pressing a corresponding number or pointing and clicking and the desired word will automatically be inserted into the sentence. If the desired word is not displayed, the users enters the second letter of the word and a new list appears with words beginning with those two letters (Marshall & Powers, 1998).

However, although the basics of word prediction have remained the same, modern word prediction software includes enhanced features such as text-to-speech, topic dictionaries, phonetic spelling and homophone/confusable etc. Predictive text has evolved in mobile technologies in recent years, making it more widely available and recognised as a mainstream technology.

Despite advances in technology, evidence suggests that in most school classrooms, students spend an average of 43% of their day doing fine motor tasks and 85% of those tasks are paper and pencil activities (McHale & Cermak, 1992). For those pupils who experience handwriting difficulties, it can interfere with related writing processes such as planning and generating ideas (Graham 1992). Benbow, Hanft, and Marsh (1992) argue that "one of the most serious effects of poor handwriting occurs when the quality of handwriting detracts from the student's ability to convey information and ideas" (p. 33).

An additional consequence of handwriting and spelling difficulties for learners is that assignments typically take longer to complete, and it may be difficult to keep up when taking notes in class (Graham 1999). In a study by Weintraub and Graham (1998) students with additional support needs required an additional 50 minutes to complete a task that would regularly take achieving students just 30 minutes to finish.

For those learners who experience difficulties with the mechanics of handwriting, word processing has many characteristics for addressing the needs of children who have deficits related to poor handwriting (Handly-More, Deitz, Billingsley & Coggins, 2003). Word processing ensures a neat finished product, allows editing without recopying and simplifies the production of text from manipulating a pencil in handwriting to pressing keys in keyboarding.

#### Word processing - an important prerequisite for word prediction

Effective word processing is dependent on navigating through and being familiar with the keyboard QWERTY layout, which can also be problematic for learners who are unfamiliar with both the keyboard and word processor interface.

Students may need to learn the basics of keyboarding and have experience of a word processor before being introduced to word prediction, particularly if the school is using the 'traditional' Windows desktop computer or laptop. Studies which have addressed the effectiveness of word processing and keyboarding (Collis, 1988; Dalton & Hannafin, 1987) suggest there has been a failing to teach students effective keyboarding skills.

Portable devices such as the iPad and Android are more intuitive and easier to use, particularly for those children who have access to a tablet at home and are familiar with the on-screen keyboard (with predictive text) for text production in its various forms.

### Word prediction

According to Buekelman (1994) and McArthur (1996) research on the use of word prediction has been limited. Even today, research on word prediction is inadequate, and existing literature on the benefits of word prediction is mixed.

In a study by MacArthur (1999) with 3 primary pupils (identified as having additional support needs) he found mixed results in terms of word processing speed and composing rates when using word prediction. All students were familiar with word processing and had received some keyboard instruction. Overall, word prediction had little impact on the legibility and spelling of students' writing, although one student, 'Ralph' had noticeable improvement in his spelling.

A possible explanation of varied results could be attributed to the way the students used word prediction features. For example, compared to 'Mary' and 'Sam', Ralph selected words from the list of "predictions on average of 13.6 times per session, for about 70% of his words." (p. 164) compared to Mary and Sam, who used less. The study also revealed that Sam and Mary made repeated attempts to figure out a word using the prediction list without success and as a result expressed negative opinions of the software.

One explanation, according to MacArthur for the negative results of the study was that the software was difficult to use because the large dictionary and complex word prediction capabilities and the writing task did not 'take advantage of the power of the software' (p. 167) i.e. the modest vocabulary demands did not take advantage of the large/complex dictionary.

This is a good example of Zabala's SETT Framework, which recognises the interplaying factors of matching the 'Task' and 'Tool' – today's software allows the word prediction dictionary to be easily changed from a smaller word database to a larger and/or creating a topic word dictionary – thereby matching the 'tool' with the 'task'.

Another explanation for the negative results is related to the student's poor spelling accuracy. Word prediction requires the user to spell the initial letters of a word correctly without any allowance for phonetic substitutions or other errors. About 60% of the errors made by the students were on words that never appeared in the list of predicted words because the initial letters were incorrect (MacArthur 1999).

In contrast to MacArthur's study, research by Lewis, Graves, Ashton, and Kieley (1998) found positive effects of word prediction with text-to-speech on text entry

(spelling, mechanical errors, and syntax) of students with LD [sic] additional support needs, when compared to handwriting and other technologies. Similarly, Cullen, Richards, & Frank (2008) reported positive effects on students' composition-writing skills and spelling accuracy.

Furthermore, research by Arcon (2015), Evmenova, Graff, Jerome, & Behrmann (2010) has suggested that word prediction software may have a positive effect on users' typing speed, accuracy, and productivity, while also reducing the number of grammatical and spelling errors and the amount of cognitive load taken to produce written text.

And in a recent study by Moore, K. A., Rutherford, C., & Crawford, K. A. (2016) when students were asked about the benefits of using the word prediction software to support their writing, the participants noted its convenience and appreciated that they could customise the software to meet their needs thereby helping them to save time during the writing process.

#### Conclusion

Over the years, and based on user feedback, modern word prediction software has developed greatly and now offers new and improved features including more accurate and responsive prediction, topic dictionaries, phonetic/flexible spelling, homophone/confusable options as well as picture/symbol support with integrated writing frames. In addition, speech synthesis and text-to-speech have significantly improved with realistic voices. Coupled together, and if used within a SETT Framework and appropriate support, word prediction has the potential to support a range of literacy difficulties.

To conclude, on a cautionary note, Batorowicz et al., (2012) suggests there are multiple challenges in evaluating and comparing word prediction software due to the "variability of methods used for word prediction, dictionary size (size, type, vocabulary), visual cues and auditory feedback" (p. 221). Batorowicz et al. (2012) argue that the state of evidence is such that a direct link cannot yet be made between specific writing difficulties and the effectiveness of a particular technological solution. Yet they recognise that children with additional support needs appear to have positive experiences while using technology, which may motivate them to write and become more confident and independent writers. This reflects the experiences of David, (see beginning of this guide) whose mum states "we can't begin to tell you the difference having the software (word prediction) and laptop has made".

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For more on technology to support literacy difficulties visit: <u>www.callscotland.org.uk/information/dyslexia/</u>