



NATIONAL ASSESSMENT PROGRAM – LITERACY AND NUMERACY

Online Assessment Research

Development Study 2014

Cognitive Interviews: Technology
Enhanced Items (Reading)

2014



Online Assessment Research
Development Study 2014
Cognitive Interviews: Technically Enhanced Items (Reading)

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National Assessment and Surveys Online Program

The National Assessment and Surveys Online Program, funded by the Australian Government, is designed to deliver national assessments and surveys online. ACARA is responsible for planning and implementing a clearly defined assessment and reporting research agenda that will allow reporting to the Education Council on issues and options for delivering NAPLAN online. A key aspect of the program is ACARA's expanded assessment and reporting research agenda, incorporating a comprehensive investigation into assessment instruments and programs using online technology.

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Research Report

NAPLAN Online 2014 Development Study Cognitive Interviews Research Activity 3: Technically Enhanced Items (Reading)

Martina Bovell

October 2014

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EXECUTIVE SUMMARY

The Cognitive Interviews Research Activity 3: Technically Enhanced Items (Reading) is a small study to investigate students' cognitive and behavioural engagement when completing online Reading items that incorporate technical enhancements. The study was commissioned by ACARA as part of an extensive research agenda to examine the conditions and requirements for transitioning NAPLAN assessments from paper to online delivery. It was conducted alongside the NAPLAN Online 2014 Development Study.

Six schools in regional and metropolitan schools in WA participated in the study in September 2014. Interviewers presented a total of 31 innovative items that contained a variety of prototype technical enhancement types to 48 students with a range of reading abilities across Years 3, 5, 7 and 9. The items addressed learning outcomes from the Australian Curriculum: English relating to Reading, Viewing, Listening, Writing, Grammar, Punctuation, and Spelling. Students were presented with the items through secure websites on a specially prepared Windows laptop computer.

The study investigations centred on how students' computer literacy, motor skills, reading ability, and motivation and fatigue impacted on their interactions with item layouts, item directions and the technical enhancement types contained in the items. Students' interactions with item content also became the subject of investigation as this was necessarily the medium through which other interactions were observed.

Technical enhancement types

The technical enhancement types applied to items presented to students were:

- multiple choice;
- drop-down menu;
- connect two boxes;
- click, drag and drop sentences, paragraphs or text boxes;
- select text;
- select object;
- change text in a text box;
- type in text box;
- play an audio prompt;
- play a video prompt; and
- click on a link to access a pop-up text.

The basic computer interactions of clicking with a mouse or mouse pad, dragging the screen elements of text and text boxes, and typing, scrolling and/or zooming were required to operate the enhancements.

The study focus

Students' cognitive and behavioural interactions and engagement with the online items are described in this report. The findings go some way to providing insights and answers to the following questions:

- To what extent do students engage with online test items with technical enhancements?
- What facilitates student engagement? What are the barriers that preclude student engagement?

- What computer skills and knowledge do Years 3, 5, 7 and 9 students bring to an online test, and is there a differential across Year groups?
- How do students approach items with technical enhancements, and to what extent do the items and students' interactions with them show construct relevance?
- What does an online Reading test offer that a paper-based test does not?
- What do students need to know about computers in order to efficiently participate in an online test?
- What further research may be useful to ensure the equitable introduction of online testing across Australia?

The small sample of students in this Research Activity does not permit generalisations of findings to the population. However, what the findings do show is that within the small sample, a wide variety of knowledge, skills and experience, and many different approaches were brought to the items by students as they carried out their interaction.

It can be deduced from the findings that at least the variety of interactions and behaviours witnessed within this sample is likely to be found in areas of the wider population.

Findings

Student engagement and confidence and barriers

Students across all Year groups engaged with the test items and the experience of working online, and their interactions with the technical enhancement types and computer tools were motivating for them.

The major facilitators of students' engagement and motivation were levels of computer literacy and Reading ability such that they were able to understand item directions, access Reading texts and use computer tools. Having confidence in their skills and ability also facilitated engagement and motivation.

Interesting and informative content in Reading texts increased engagement and motivation.

Low reading ability was a major catalyst for disengagement. Students became disengaged with items when Reading texts were too difficult or very long, and when instructions regarding the item intent and/or technical enhancement were not clear or not understood.

Fatigue, inability to use computer tools and lack of confidence also impacted negatively on engagement.

Computer skills and knowledge

There was a wide range of computer experience, knowledge, and skills within and across cohorts ranging from high levels to very low levels. Some students demonstrated very low levels of computer literacy.

There was a difference between cohorts, with students in Year 3 and 5 having fewer computer skills than students in Years 7 and 9. There was also a wide range of skills within Year groups, particularly at Year 3, where some students had little computer literacy and others demonstrated proficiency with the available tools and operated all technical enhancement types required by the items and presented to them.

However, all students in all Year groups were able to operate some technical enhancement types: Year 3 students with very low reading ability and few computer literacy skills could click on the mouse or

mouse pad to select text or an object, and they could open a drop down menu (but not always select an option). Most could click and drag a text box, or a small amount of text, a short distance across the screen.

Approaches to items

Students' opinions of the items and the way they approached them onscreen provided evidence of a high level of construct relevance.

Students' views indicated that the style, content and requirements of the items were similar to other tasks they had encountered in their English classes and had completed in school or at home.

Students overwhelmingly read text from left to right and top to bottom with very little skimming and scanning, and they tended to read texts from beginning to end. This was an indication that there is little difference between students' reading techniques on screen compared to on paper, at least in this testing situation.

Most students' interactions on most items were similar to what would be expected on similar tasks at other times and in other situations. They followed directions and completed items in the way intended by test developers. However, reading ability and computer literacy impacted on the pathways that some students took. Students who were weaker readers and had difficulty reading directions tended to omit intended steps, repeat steps unnecessarily, or not interact with the item.

It is unclear to what extent lower levels of computer literacy were the sole contributor to the difficulty some students had in completing items. It was not possible to disentangle interactions between lower levels of computer literacy, lower reading ability and lack of confidence to determine how much these lower levels of computer literacy, in and of themselves, affected the validity of the test for some students, or whether computer literacy skills form part of the measurement construct.

Knowledge required for efficient participation in an online test

It was evident in the Research Activity that there were considerable differences in the computer knowledge, skills and experience that students bring to school. Identifying these differences has been a key aim of this research. In the interests of fair testing and to minimise any confounding variables that may affect the measurement of student performance in online NAPLAN assessments, a reduction in these differences will be an important product of this research.

Based on the technical enhancements that students were required to use with items in this Research, the following is a summary of the computer knowledge and skills identified as being essential to all students' successful participation in future online testing:

- Knowledge of screen elements;
- Knowledge of how the scroll and zoom functions operate and the ability to use them when needed;
- Knowledge of keyboard layout, including the functions of the enter key;
- Ability to click, hover and drag the cursor across the screen;
- Ability to click a small piece of text (word) and drag the cursor over it; and
- Knowledge of icons, such as hyperlinks and video play buttons, that may be incorporated into items, and the ability to use them when needed.

Benefits of online testing in English

There are at least three major benefits of an online test, over paper-based testing, that utilises items with technical enhancement types. All have a positive influence on the construct validity of the test items.

In this study, items that assessed a wider range of Reading skills, knowledge and strategies were presented to students, giving broader coverage of the Reading domain. Further, items assessing skills of the other language modes of Writing, Listening and Reading of Visual Texts were incorporated. The study has also shown that incorporation of items targeting grammar and spelling, within a context provided by a Reading stimulus text, is possible in a standardised online test.

Secondly, the technically enhanced computer interface allows the assessment of a wider variety of Reading skills that cannot easily or economically be assessed in a pen and paper test. Traditionally, multiple choice questions have been used in large scale Reading tests. In contrast, the technically enhanced item types utilise short, constructed responses that do not have the inbuilt supports that multiple choice items, by definition, contain. The technical enhancements in this study allowed the assessment of such skills as classifying, summarising, labelling and organising information, reordering text and adding information to texts.

Thirdly, students were observed in this study using a variety of self-chosen reading processes and strategies, providing evidence of a more authentic reading experience in the test situation. The interactive features of the computer interface and, in some cases, layout of the item, afforded students flexibility in such strategies as positioning text, using the shading and highlighting features of the technical enhancement, and tracking text with the mouse. Another observation was the ease, speed and neatness with which a response could be changed. Students themselves thought this was a major benefit, as they could ‘test out’ their responses more readily. Some Year 7 and 9 students used the technical enhancement and the computer tools to investigate, evaluate and problem-solve the question and information in the text. These interactions were evidence of high levels of cognitive engagement.

More generally, as accessing, using and creating information via computer technologies becomes the norm across the globe, and computer literacy becomes the expectation at school, it seems entirely natural that online assessment be introduced to complement and support learning and teaching in schools. While many of the skills needed to read an electronic text are similar to those needed to read a print text, differences between the print and electronic environment require students to develop new skills to enable them to successfully participate in personal, educational and vocational domains. Assessment of Reading in the mode that utilises these new skills is timely and appropriate.

Further research

A number of recommendations have arisen from this Research Activity. These are:

1. To enhance equitable access to test items, it is recommended that only those technical enhancements that all students, including the weakest, are likely to be able to operate are used in the online assessments.
2. That information is provided to schools on the computer skills and knowledge that students will need to access the online assessments.
3. That identical or similar technical enhancement types be arranged together in a test paper to support students with lower computer literacy.
4. That question directions are written in a clear, concise and standardised manner.

5. That computer drawing tools to assist students to track text as they read, highlight or underline key words be considered for the future.
6. That highlighting on test items be standardised within Year groups.
7. That item layouts and types are investigated for potential to artificially raise item difficulty.
8. That interactions between levels of computer literacy, reading ability and confidence be investigated further.

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CONVENTIONS USED IN THIS REPORT

The phrase technical enhancement is denoted by TE throughout.

Direct quotes from screen capture audio recordings and interviewer written notes are indicated in italics.

Quotes from test items are indicated in single quote marks.

Items from the <http://acara.pacificmetrics.com/> website are referred to by PM followed by the number in which they occur in the sequence of Pacificmetrics items, e.g. PM 1.

Items from the <http://measacara.com/> website are referred to by MI followed by the website identification number, e.g. MI 18712.

1. INTRODUCTION

The NAPLAN Online 2014 Development Study is the third stage of a comprehensive research agenda conducted by the Australian Curriculum, Assessment and Reporting Authority (ACARA), in preparation for the online delivery across Australia of NAPLAN tests that are tailored to the ability levels of students.

The online delivery of tests means that new item formats that incorporate technical enhancements are able to be developed to assess skills and understandings articulated in the Australian Curriculum which are not easily assessed in the pen and paper mode.

The 2014 Development Study, conducted in August – September of 2014 saw students in Years 3, 5, 7 and 9 sit an online assessment incorporating the tailored test design. To run parallel to the Development Study, ACARA commissioned five separate cognitive interview research studies. ACER was contracted to conduct the Cognitive Interviews Research Activity 3: Technically enhanced items (Reading), to investigate and collect information on students' cognitive and behavioural interaction and engagement with a selection of Reading items containing technical enhancements (TEs) proposed for NAPLAN online reading tests.

Suites of items containing a range of TEs and with a range of difficulties were developed by two separate companies. These were made available to ACER to present to students to work through while staff commissioned by ACER used think aloud interview protocols.

An overview of the project is presented at Appendix 1.

2. METHODOLOGY

2.1 Interview sample

Six schools – five metropolitan and one regional school – provided students for the Cognitive Interviews. Characteristics of these schools are listed in Table 1.

Table 1: School characteristics

School label	Location	Sector	Type	ICSEA value	Year range	Enrolments
A	Regional	Govt	Combined	939	K-12	491
B	Metro	Govt	Primary	917	K-7	217
C	Metro	Govt	Primary	1049	K-7	386
D	Metro	Govt	Secondary	1013	8-12	945
E	Metro	Non Govt	Combined	1028	K-10	681
F	Metro	Non Govt	Combined	1016	PP-12	1161

A total of 48 students were interviewed, comprising 12 students from each of Years 3, 5, 7 and 9. Overall, 27 boys and 21 girls were interviewed. Interviews were conducted in the morning over a two and a half week period. Table 1 shows the sample break down by school type, Year level and gender.

Table 2: Sample by school, Year level and gender

School label	Year 3		Year 5		Year 7		Year 9	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
A	1	2	2	1	2	1	2	1
B	2	2	3	0	1	2	0	0
C	2	1	1	2	3	0	0	0
D	0	0	0	0	0	0	3	3
E	1	1	2	1	0	1	0	0
F	0	0	0	0	2	0	0	3
TOTALS	6	6	8	4	8	4	5	7

Detailed information on the sample is shown at Appendix 2, as an attached document, Summary of Interviews.xlsx.

2.2 Interview items

A total of 50 online items with a range of TEs from two development companies were supplied to ACER. The items nominally addressed learning outcomes described in the Australian Curriculum: English for Years 3, 5, 7 and 9. Item difficulties were not known.

The items' TE type was the overarching organiser for the selection of items to use in the Cognitive Interviews. The aim of the selection was to obtain maximum coverage of the different TE types at each Year level and across both item development companies. Items contained one or more TE type, e.g. an item may have been a simple multiple choice where the option is selected by clicking a radio button, or it may be a simple multiple choice followed by a click on a word, phrase, clause or paragraph in a text in order to show a relationship, such as supporting evidence or a definition of a word, between the multiple choice selection and the text.

The range of TE types and their various functions are listed in Table 3.

Table 3: Available TE types and their functions

TE Type	Functions of TE type
Drop-down menu	Select words to complete a sentence or add a word or words to a text Select words to construct an outline Select words to add headings to a text
Connections	Join two boxes
Click drag and drop sentences, paragraphs or text boxes	Reorder information in a table Classify information in a table Label information in a table Reorder text – sentences or paragraphs Add information to a text (headings) Order information in a timeline Organise information in a web graphic Match information to corresponding images
Select text	Highlight a word, phrase, clause or paragraph
Change text in a text box	Correct errors in a text box by typing
Multiple choice	Select option by clicking radio button Select option by clicking text or text box
Select object	Select text in a cell of a table or in a text box
Audio prompt	Operate audio controls
Video prompt	Operate video controls
Type in text box	Write a constructed response
Pop- up text	Access a text by clicking on a link

Usually, one or two items only accompanied each text; however, one unit which contained several items attached to a pair of texts addressing a common theme was preferentially included. Because the focus of the interviews was students' interactions with the various TE types, minimal consideration was given to balancing the skills targeted by the items or the ACE links.

Screen shots of each item are shown in Appendix 5.

2.3 Interviewers and interviewer training

Information on the selection and training of interviewers is given in Appendix 1: Overview of the project.

Training material is provided at Appendix 3, as the following attached documents:

- APPENDIX 3a_Cognitive Interview Questionnaire.docx
- APPENDIX 3b_General notes for interviewers.docx
- APPENDIX 3c_Cognitive Interview Administration Guide.docx
- APPENDIX 3d_Interviewer's Instructions.docx

2.4 The interview protocols

Year –specific protocols, or Interview Record Sheets, provided direction to interviewers in the type of interactions and behaviours to attend to during the interview. Forms contained in the Sheets were

designed so that interviewers could record observations about student interactions and behaviours in a standardised manner. Interviewers recorded data by circling, crossing or ticking words or sets of words on the sheets, allowing the data to be collected in a quick and efficient manner, with little interruption to student observations. Interviewers were encouraged to make notes during interviews at their discretion, taking into account the difficulty of simultaneously observing behaviours, encouraging thinking aloud and writing notes. Interviewers were also encouraged to make extra notes, if needed, after the interviews.

The protocols for each year group are provided at Appendix 4, as the following attached documents:

APPENDIX 4a_Protocols_Generic information.docx

APPENDIX 4b_Protocols_Y3.docx

APPENDIX 4c_Protocols_Y5.docx

APPENDIX 4d_Protocols_Y7.docx

APPENDIX 4e_Protocols_Y9.docx

2.5 Electronic capture of interview data

All audio and screen interactions with the computer were obtained electronically. Interviewers and students used laptop computers loaded with the screen capture software, *Microsoft Expression Encoder 4*, and fitted with a backup USB microphone to ensure that student voices were recorded. The laptops were wireless-enabled so connection to the websites of the item development companies, and access to test items, were independent of school networks.

Each electronic screen capture file is of the type .xesc and is approximately 200 mb in size.

One school (School B) experienced internet failure during the interviews. However, interviewers subsequently returned to the school and completed the interviews. Audio was not captured in four cases (School E).

3. ORGANISATION OF THE FINDINGS

Findings are reported by TE type, and by Year level within each TE type. Where there is more than one item within a Year group discussed in a TE type, items are ordered by position in the interview.

Most items contain more than one TE type. Items are organised by their (nominally assigned) dominant TE type and all TEs within that item are discussed, e.g. the first item discussed, My Shadow, uses an audio prompt and drop down menu. This item is classified under its dominant TE type, Audio prompt and findings on the both Audio prompt and the Drop down menu are discussed. Table 4 shows the order by item and for each item, the Year group, the item ID, the TE type and function, and the number of students who attempted the item.

Table 4: Presentation of findings

Order	Year	Title	Item ID	TE type and function	Cases
1	3	My shadow	PM 4	Audio prompt; drop down menu	12
2	3	Frogs	MI 18711	Select text; Change text in a text box	10
3	3	S'mores	MI 18642	Click, drag and drop text to reorder sentences	6
4	5	Growing tomatoes	MI 18744	Click, drag and drop text to reorder sentences/paragraphs	10
5	3	Lake	PM 1	Click, drag and drop text box to reorder information in table	10
6	5	Kevin Coombs	PM 10	Click, drag and drop text box to order information in a timeline	12
7	5	Venus flytrap	MI 18629	Click, drag and drop text boxes to match information to corresponding images	8
8	5	Get off the couch	MI 18721	Click, drag and drop text box to label information in table	5
9	7	Sticky notes	PM 14	Click, drag and drop text box to classify information in table	12
10	7	Pluto web graphic	PM 13	Click, drag and drop text box to classify information in table	10
11	9	Pip/Colin character	PM 25	Click, drag, drop text box to classify information in table	11
12	9	Animal Emotions	MI 18690	Click, drag, drop text box – organise information in table	9
13	9	Student speech	PM 17	Click, drag, drop text box to classify information in table	5
14	3	Speech on bullying	PM 7	Select text – highlight a word or phrase	10
15	5	Kevin Coombs	PM 8	Select text – highlight a paragraph	12
16	5	Kevin Coombs	PM 9	Select text – highlight a word or phrase	12
17	7	Book review-Sport	PM 15	Select text – highlight a word or phrase	11
18	7	Galileo	MI 18702	Multiple choice – click text to select option; Select text - highlight a word or phrase	10
19	3	Someone	MI 18712	Connections	11
20	7	Rainy Day	MI 18631	Connections	10
21	3	Coach Bradford	PM 6	Select object	10
22	9	Train, Diary	MI 18566	Select object – select text in a cell of a table	11
23	9	Pharaohs	MI 18179	Multiple choice – select option by clicking text	5
24	5	Owl Flight	PM 11	Drop down menu; Type in text box	12
25	7	Letter planner and writing	PM 18	Drop-down menu – select words to construct an outline; Type in text box	12
26	7	Sea simulator	PM 16	Video prompt; Multiple choice – click radio button to select option	12
27	9	Colin Wilson	PM 24	Video prompt; Multiple choice – click radio button to select option	11
28	9	Mystery story	PM 19	Drop down menu – select words to complete a sentence	3
29	9	Dickens	PM 20	Pop-up text; Multiple choice – click radio button to select option	12
30	9	Dickens Parts A and B	PM 21	Pop-up text; Multiple choice – click text to select option	12
31	9	Colin Wilson/Dickens	PM 26	Video prompt; Pop-up text; Type in text box; Multiple choice – select option by clicking radio button	11

For each item within a TE type, a brief description of the interactions required to operate the TE is given and the expected pathway is displayed. Discussion is organised into two broad sections: *Interactions*; and *Confidence and Engagement*. In some items, subheadings have been used to categorise information within those organisers. A concluding section summarises the main findings for that TE type.

Some sections of the protocols were recorded in a type of short Likert scale, with the three points of 1 (Low), 2, and 3 (High). While training was given on the interpretation of this scale, it should be noted that interviewers' responses on these points were not formally standardised. In this report, a score of 1 is referred to as low, a score of 2 as moderate and a score of 3 as high. These words should be interpreted as a generalised impression.

4. FINDINGS

4.1 Audio prompt; Drop down menu

4.1.1 Year 3 PM 4 My Shadow

One item utilising the audio prompt TE was presented to Year 3 students. This item was coupled with the drop down menu TE. In order to reach the text, students needed to recognise the black bar as an audio control. A cue to this is the first word in the stem ('Listen to the poem ...'). The item then required completion of two sentences by clicking on the drop down menu arrows to reveal four options for each sentence. Each option was shaded with a blue band. The word 'select' appears to the left of each drop down menu arrow.

Expected pathway – My shadow
Read direction
Click on audio play button
Listen to audio
Read first sentence
Click on drop down arrow
Click on selection
Repeat pathway for Sentence 2

Interactions

Twelve Year 3 students attempted the item. They used three main approaches.

Five students followed the expected pathway and completed the item. They listened to the audio and used the drop down boxes to make selections. Although these students could read and carry out the directions, some lost meaning and their selection was a guess:

- *I'm confident about the second sentence but not the first. In the second one it tells you the answer in the story but it doesn't really tell you it's sad and scary in the first one.*
- *I'm not sure about the first one. Pretty sure about the jumping into bed.*

One student proceeded to the first sentence before reading the direction at the top of the item. She then went onto complete the item following the expected pathway.

Six students did not listen to the audio and went straight to the sentences, read each aloud and completed their selections using the drop down menus. One of these students read the first direction aloud then asked the interviewer if she had to press the arrow to play, but she did not press it. Another hovered the mouse cursor over the audio control for a short while but did not press the arrow. He then moved to the sentences and using the drop down menus to complete them confidently, despite his answers being guesses. A third student read the direction to listen to the poem first but moved straight to reading the sentences and completed one then the next; however, his confidence dropped when he had difficulty negotiating the words in the second sentence.

For one student, the item presented difficulty. She appeared unable to interact with the TEs, except to click on the drop down arrow in the first sentence and hover the mouse over the options. The interviewer reported that this process took a long time. The blue highlight that displayed as the mouse was hovered over the options appeared not to be of any assistance to her and she did not click an option. It may have been that this student did not click on an option because she did not know that this

was expected, or because she was afraid to click an answer that may have been incorrect, or because she was unwilling to guess.

Students' approaches to the item showed that they did not see the word 'select' as signifying an option they could use to complete the sentences. One student, for example, read the first sentence aloud, followed by select, then each of the options, and another read the last part of the sentence as a lead-in to each option, while the options were in view:

- *The words that best describe the shadow are select, scared and sad, playful and silly, funny and joyful, mean and angry.*
- *... the way it grows, the way it sleeps, the way it goes outside, the way it jumps into bed.*

Students were not recorded using the computer tools of scroll and zoom. One student commented that the writing should be made bigger.

Some students used their own knowledge of shadows. It appeared to be relatively easy for students who had not listened to the audio to guess 'grow' as the answer to the second sentence.

Confidence and engagement

Students showed varying levels of confidence in their approach to this item for different reasons. The biggest negative impact on confidence was the inability to read.

The five students who completed the item using the expected pathway showed confidence when interacting with the two TE types and, in most cases, the item content. Three of these students were highly confident their answers were correct.

Most students were recorded as having moderate confidence that their answers were correct. Some had not listened to the text. For these students, it is likely that, in most cases, drawing on personal experience and prior knowledge of shadows had a positive effect on their confidence.

Students who had difficulty reading some or all of the words were not sure of their attempt at the answers. Two students were recorded as having low confidence. One of these was a non-reader and the other was recorded as showing some frustration. Interestingly, this student guessed his answers accurately ('playful and silly', 'grows') despite not having listened to the audio prompt.

Summary of findings

- There was a general lack of familiarity with the audio prompt TE: about half did not recognise or use the audio control bar to access the text. It may have been that directions on how to operate the audio prompt TE were not obvious or explicit enough for this group of students.
- With the exception of one student, the drop down menus were easily managed.
- Being able to 'do something' by physically engaging in a computer action can impact positively on some students' confidence and their ability to attempt and complete an item. Other students may not derive such confidence.
- Non-readers or very weak readers may be able to physically operate a mouse but did not always understand the purposes for which it might be used.
- Students who can read and students who used one or both TEs tended to experience moderate to high levels of confidence.
- The language in the sentences in the item was difficult for weaker readers.
- Students did not use the computer tools of scroll and zoom.
- It was relatively easy for students to guess the correct options for this item.

4.2 Select text; Change text in a text box

4.2.1 Year 3 MI 18711 Frogs

This item, presented to Year 3, required students to read a short text and then, in sentences taken from the text and located below it, identify and click on errors of spelling, punctuation and grammar. When clicked, the error highlighted in dark green. A dialogue box then appeared and the error displayed in the box. Students needed to move the cursor to the text box, remove the error and type their correction. The correction then appeared in the sentence, with the original error shown in strikethrough font.

Expected pathway – Frogs
Read direction 1
Read text
Read direction 2
Click on error in first statement
Type in text box: insert cursor then use keyboard
Click OK
Repeat for next statement (no need to correct all errors)

Interactions

Ten students attempted this item. Upon opening, the item partially appeared on the screen and to view it in its entirety required students to scroll down the screen.

Two students followed the expected pathway. One completed the item easily, demonstrating the computer skills necessary to do so. The other easily navigated the computer but lacked the spelling and punctuation skills to complete the item correctly.

Three students were able to select text containing (or not containing, in some cases) an error but did not know what to do when the correction box appeared. When their selected words appeared, they clicked OK and did not make any corrections.

One student, who easily scrolled up and down the screen, completed the item in the following way: after identifying and clicking on ‘intresting’ in the first sentence, she was unable to understand the directions in the text box [‘Enter new text for the selected text block (15 characters max)’] and was unsure as to what to do. Nevertheless, she clicked on OK then confidently scrolled down to the second item, where she had trouble identifying an error. She read the sentence several times, running the mouse cursor backwards and forwards over the sentence as she did so, carefully looking for a spelling error in each of the green highlighted words. These green highlights that appeared over each word seemed to assist her to analyse the words for a spelling error. She was so intent on identifying a spelling error that she did not identify the incorrect question mark at the end of the sentence. Eventually she settled on the word ‘colour’, read the direction in the text box (this time more fluently), and clicked OK.

For the third item, a grammar item, she similarly had difficulty finding an error and settled on ‘Many’, read the direction in the text box again and clicked OK. In the fourth item, she was able to easily identify the error (‘Majician’). Again, she read the direction in the text box and clicked OK without making changes to the word. This student was recorded as having high confidence (volunteering the figure of 99% confident) that her answers were correct.

In spite of not appearing to understand the instructions in the text box, it may not have been this student's inability to utilise the text box and keyboard to make corrections; rather, it may have been that she did not correct her selected text in the text box because once they were in the text box, the words did not appear to her to have errors. Similarly, another student, who easily scrolled up and down, was able to understand and follow the directions, but did not make a change to her selected text in the first sentence ('intresting') because, once the word appeared in the text box, she did not then recognise it as having an error. For the second sentence, she selected the word 'be' and successfully changed it to 'have'. She then continued to make changes in the same sentence, apparently in an attempt to rewrite parts to improve it. At one point, the sentence read, 'They can have many bright colours and different'. She finished the sentence 'They can have many colours and sizes' and did not use punctuation to finish the sentence. Significantly, of 10 students, one fifth did not recognise words with errors after they had been moved from their context and into the text box.

Another student did not understand that he had to click on a word in the sentences below the main text in order to make corrections. His interaction time with the item was spent working out how to interpret the instructions in light of the item layout: he read the directions and text, then the first two items (the extent of the item visible on screen – he did not scroll). Then he returned to the text above and clicked on the full stop, question mark and comma in the first line, forming blue highlights. He then returned to the sentences below the text, ran his cursor over the first, causing the green highlight to appear over each word. He did not click on a word. After some time, he appeared to have an idea about how to go about answering but was unable to carry it out. He said:

- *I think it means you have to do it on that (the item sentence).*

A little later he said:

- *I think I have to correct the sentences by doing that (producing green highlighting) on them. I think I have to correct ...*

He did not click on the items and therefore did not answer the question.

Two students clicked on the text rather than on the sentences below the text. They did not scroll down to the items and became frustrated when the words in the text highlighted, but they were unable to do anything with their selections. They did not understand the process involved in correcting them. One found the item extremely difficult.

One student looked at the item and commented:

- *This is too hard.*

The interviewer noted that the student thought he had to highlight but he did not, because he didn't know what to do.

Another attempted to read the text. For this student, the interviewer recorded:

- *Again, the words were too difficult. She did not attempt to read any directions and did not try to use anything on the computer.*

Not all students used the scroll bar to access the entire item, and no student used the zoom. One student commented:

- *the page needs to be bigger so you don't have to scroll.*

Confidence and engagement

Students whose reading capabilities enabled them to interact with the item requirements – either the text or the TEs – were recorded as having high levels of confidence that their answers were correct. They kept a positive demeanour and were engaged and motivated.

Although the item requirements were difficult for two students, they tried hard and kept a positive attitude.

Students who had difficulty reading the text and directions, and interacting with the computer, were recorded as having low levels of confidence and showed signs of disengagement and stress. One student was observed as being very stressed and not confident at all. Another, who realised he couldn't read the text very well and wasn't sure what he was supposed to do, put little or no effort into the item and his general demeanour and motivation began to waiver.

One student commented that the instructions should be made easier.

Summary of findings

- Several issues that impact on students' capacity to interact efficiently with this item were evident. These include:
 - the technical language in the directions;
 - students' unfamiliarity with altering text in text boxes; and
 - the alternation of spelling, punctuation and grammar items.
- The layout of the item presented difficulties for some students. The repetition of the items to be corrected, in the text and below the text, confused some students.
- Some Year 3 students were familiar with, and used, the scroll bar. Others appeared not to be, and did not use it. This may be because these students did not know how to use the computer tools, there was an unwillingness to use the tools to navigate the screen, or that there was an expectation that the item would display on the screen in its entirety and there was no need to use the scroll bar.

4.3 Click, drag and drop text to reorder sentences or paragraphs

4.3.1 Year 3 MI 18642 S'mores

The TE of this item required students to click, drag and drop text so as to reorder sentences. They were required to read a text then, using a summary of the text, reorder sentences by clicking and dragging to a new location. Possible locations were indicated by a small blue static marker. Sentences changed to a light grey when they were clicked on and while they were being dragged.

Expected pathway – S'mores
Read direction 1
Read text
Read direction 2
Click on sentence in text below line
Drag sentence to a blue marker (recognises blue marker is a possible location to drop text)
Repeat click, drag and drop (text can be reordered correctly in 2 moves)

Interactions

Six students were presented with this item and two students completed it by using the expected pathway. One confidently used a few moves before settling on a final order. The other skim read the text and didn't initially understand the instructions. After some experimentation and working out how to re-order the sentences, he completed the item (correctly). However, it was somewhat difficult for him to hold the text still enough for long enough for it to drop into place over the blue marker. Additionally, several times while he was moving items, a dialogue box unrelated to the item (with the menu items 'open link in new tab, open link in new window' etc) appeared on the screen, indicating that while he was in the process of dragging text, another of his fingers hit the right mouse button. It would appear that his finger strength and muscle control of finger movements were not sufficient to use the TE in this item efficiently.

Two students who did not follow the expected pathway initially read direction 1, the text, then direction 2. However, they also had difficulty in moving the sentences. One appeared to be able to 'hang onto' a sentence but not move them far away from their original positions. The interviewer noted:

- *Was able to click and drag but had difficulty dragging to a blue spot. She wasn't able to drop into a new spot because she wasn't placing cursor close enough to the spot.*

Another student who ably scrolled down the page to place the question in the centre of the screen managed to drag a sentence only a short distance from its original position. Her numerous attempts to drag it away from its original position failed.

A further way of approaching this item was used by a student who read the two directions, then the text. He found it very hard to work out how to use the technology but once he did, he answered the question easily.

Students indicated the difficulty of executing the click, drag and drop TE in their comments, suggesting that while they understood the item requirements, it was too hard to carry them out:

- *Make it easier to put the sentences in the right order.*
- *Needs to be clearer on how to drag the sentence to its spot.*

When completing this item, students did not refer back to the text. One student was able to put the sentences in the correct order without reading the text thoroughly.

Students who could move the sentences did not seem to mind, and they did not comment on, the way the initial position of the sentences and the line lengths changed as they moved the sentences around.

Confidence and engagement

Students who attempted this item readily engaged with the subject matter. Students who completed the drag and drop were highly confident their answer was correct.

The engaging subject matter may counterbalance other difficulties. Even though several students had trouble executing the click, drag and drop TE, they generally persevered in doing so.

Summary of findings

- For four of the six students, interactions with the TE impacted negatively on their ability to complete this item, even though they had the reading skills to do so. They were hampered by their ability to execute the TE, as they did not have the muscle control or finger strength to drag sentences across the screen to drop them onto a small marker.
- Without significant practice on dragging and dropping text to a small marker, many Year 3 students would be unlikely to be able to complete this item.
- Some students were able to answer the item without interacting with the text.

4.3.2 Year 5 MI 18744 Growing Tomatoes

Students were required to read a text then rearrange paragraphs by dragging and dropping them into the correct order. When the mouse cursor is hovered over a paragraph, that paragraph becomes highlighted in green. The paragraph must be clicked to be selected for moving. The small blue markers showing where paragraphs can be moved are dynamic, changing to green (identical green to the highlighted text) when text is rolled over them. The paragraph can then be dropped on to the marker.

Expected pathway – Growing Tomatoes
Read direction
Read text
Click on paragraph in text (recognises green highlight as text that is ‘selected’)
Drag paragraph to a blue marker (recognises blue marker is a possible location to drop text)
Repeat click, drag and drop (text can be reordered correctly in 2 moves)

Interactions

Most of the 10 Year 5 students who attempted this question used the expected pathway.

Most used the scroll bar to see the extent of the item. Only one student did not. Upon opening the item her screen showed only the title of the piece and the text. It did not display the direction or the reset button. Consequently, she did not read direction 1 before the text. Interestingly, although she did not scroll up to find a direction, she did scroll down to see if she had read all the text. In her situation, the interviewer pointed her to the direction so she could interact with the TE.

Students generally made many mouse moves, using the cursor as a tool to assist exploring the text.

Several students had some difficulty holding the cursor on the blue marker before dropping it. However, with persistence and experimentation, they were able to move the text successfully. It is likely that the way the colour of the marker changed to match the highlight colour of the text being moved assisted these Year 5 students to interact with this sort of TE more efficiently than Year 3 students, who lacked this brighter, colour-coded visual signal.

Three students commented on the delineation (or lack of) between parts of the text. They thought paragraphs needed more delineation from each other:

- *The green highlights show where it ends but when I first saw it I was confused. It would be really difficult without the green highlights to show where each one begins and ends.*
- *Could be improved if there was a line between different sections.*
- *If each paragraph could start with firstly, secondly and then finally at the end.*

Two students who were weak readers did not engage with the text or the TE. One knew how to click to get to a blue marker but was not motivated to participate. Another had little or no understanding of the text.

As was the case with some Year 3 students, students in Year 5 did not use the zoom. Two remarked that they thought the writing was too small.

Interactions with the text

There were some variations in the way students approached the text.

Some read through, commenting on the content as they went, without using the mouse to highlight. Only when they had an overview of the text did they start to move the paragraphs. One more able student discussed what he would do as he ran the mouse over the text:

- *I saw the word 'First' - that tells you when you should do it. Starting the information, the steps. ... This is the introduction – you see this clearly because it tells you when, what, how and who, well who are the tomatoes (laughs).*

He then went on to make changes to the paragraphs.

Students used both language and textual cues to make their decisions, initially using the word 'first' as a trigger for the first step in the procedure. However, most ended up ordering the first several paragraphs correctly; students were least likely to order the final two paragraphs correctly.

Confidence and engagement

Most students were rated by interviewers as having moderate confidence that their answers to this question were correct.

Summary of findings

- This type of TE is likely to be suitable for the majority of Year 5 students if the distance required to drag is kept to a minimum, the marker (drop spot) is of a reasonable size and there is a visible indicator on the drop spot.
- The lower reading ability of some students impacted negatively on their capacity to interact with the TE.
- Year 5 students seemed less reluctant than Year 3 students to use the scroll bar.
- The font size of the text in this item may be too small; however, there was no evidence of students using the zoom function to increase the size of the text.

4.4 Click, drag and drop text boxes

A total of nine items across all Year groups utilised the click, drag and drop-text box TE type: one at Year 3, three at each of Years 5 and 9, and two at Year 7. Within this type, there were a number of variables, including whether highlighted borders define the drop hot spots, the colour of those borders (pink, green, blue), whether the text in the box turns grey as it is dragged, if it disappears from its original location after it has been dropped, or whether it is self-renewing (also known as tiling).

4.4.1 Year 3 PM 1 Lake

Students were required to click and drag non-renewing text boxes from the left hand side of the screen across to defined areas (text box placeholders) on the right hand side of the screen. A bright green border appears around the placeholder when the text box is moved close to it.

Expected pathway – Lake
Read direction
Read each box in LH column, top to bottom
Click on one box and drag to an empty box in RH column
Repeat for remaining three boxes

Interactions

The ten students who attempted this item were familiar with the TE of dragging and dropping text boxes and most enjoyed interacting with it. Half followed the expected pathway.

Three students did not read the boxes in the left-hand column from top to bottom in consecutive order, instead starting with the second or third box. No obvious reason was observed for this strategy.

Six students enjoyed interacting with the TE whether or not they knew why they were completing the item or what information was on the note cards.

Several students were observed by their interviewers as follows:

- *Follows the expected pathway but guessed the answers to complete the item.*
- *Initially experimenting with the drag and drop. He appears confident working around the text and eventually puts the boxes into what (he thinks) is the correct sequence.*
- *Reads everything first and then seems to ‘play around’ with the boxes, clicking and dragging until she feels she has the right order. I am not sure if she is understanding the information.*

Another student could not read the instruction so the interviewer directed him to the word ‘drag’:

- *Made attempts to read the boxes before moving them over to the RHS. He said during this process, ‘I’m guessing now’. He experimented with the drag and drop, moving boxes in and out and up and down.*

Two students who had trouble reading did not attempt to answer the question or interact with the TE at all. Interviewers reported their reading was slow and laboured and they didn’t understand what they were reading, or what they were supposed to be doing, in the item. One of these students became a little stressed. For the other, the interviewer recorded:

- *Only reads the words in the boxes and then has no idea what to do with these ‘random’ words. He doesn’t attempt to move around the computer with the mouse. When I asked what he is thinking/doing he replies, ‘I don’t know.’*

Interviewers did not observe the students paying particular attention to the green highlights. They did not appear to impact on students' interactions. One interviewer reported:

- *the green highlight doesn't sway his decisions.*

Another asked a student if he could say something about the highlights:

- *[Interviewer] Can you tell me about the green highlights?*
- *[Student] Probably was ... um ... I don't know.*

It is interesting to speculate on the effect of this green highlight. It may be that students receive subtle positive feedback due its association with, for example, 'go' (traffic lights); it may be related to the relatively high numbers of students who interacted positively with the item. Students may be inferring that their work is correct, because each box easily snapped into place, or somehow pleasing.

Confidence and engagement

Students who used and experimented with dragging and dropping the boxes enjoyed doing so, and felt a kind of accomplishment in doing so. Some students felt confident with their answer because they were able to drag and drop (as the item required), however many of these students answered incorrectly. They assumed that if they were able to drag and drop the notecards into a 'place' they had answered correctly, perhaps seeing the TE as an end in itself. One, for example, saw it as learning situation, where he successfully learnt a new skill. He commented that:

- *This question would be better on computer so we just have to read and we're learning how to drag and drop.*

Summary of findings

- Year 3 students who used this drag and drop –text box TE experienced no difficulty. Relative to moving text to a smaller hot spot, as in the S'mores item, students were able to move text boxes to large hot spots much more successfully.
- The high degree of interaction with the computer was enjoyable and engaging for those students who used the TE.
- Lower reading skills impact on the capacity to interact with content; however, this did not always prohibit engagement with the item.
- The text in the direction and in the note cards was too difficult for some students.
- It is unknown whether the green highlights affected students' interactions with this item, but it may have had an influence on their engagement.

4.4.2 Year 5 PM 10 Kevin Coombs time line

In the first Year 5 item with this TE type, students were required to click and drag non-renewing text boxes from the left hand side of the screen to undefined (areas opposite a vertical time line with dates on the right hand side of the screen. The TE contained no highlights.

Expected pathway.– Kevin Coombs time line
Read direction
Read each box on LH side
Select box
Click on one box and drag to location opposite a date on RH side
Repeat for remaining four boxes
Does student refer back to text in Q. 8?

Interactions

Most of the 12 students interviewed on this item followed the expected pathway. Those who didn't either read one box at a time then moved it, moved all boxes then rearranged them once they were on the time line, or did not read any boxes before randomly moving them.

All except one student clicked, dragged and dropped to confidently move the boxes across to the time line. Once the boxes were placed on the timeline, students easily rearranged their positioning to locations that accorded with their understandings.

One student read the direction but could not be persuaded by the interviewer to continue with the item.

Three students understood that the text from PM 8 was important to the question:

- *You have to drag events into a time line. You see one done for you. Elder on Koori council – must be the last, because it is in the last paragraph in the text (relying on memory).*
- *I'll have to remember what happened in no. 8. That'll give me a clue.*
- *Based on the text you have read before, you have to understand what you have read and then put the things in order. You take it and drag and drop.*

However, no students accessed, or tried to access, PM 8. This would have been a relatively easy task as the question numbers were displayed across the top of the item pane. Interestingly, a student commented that:

- *You can't get to the text unless you cheat and go back.*

Interactions with the layout of this item

Most students were familiar with ordering content in a time line. However, some had suggestions to include explicit scaffolding for the ordering of information (presumably referring to strategies used in class):

- *Have a 1st, a middle, an end.*
- *Number the boxes so they are in order.*

These types of supports may be inappropriate for a test situation. Nevertheless, the issue of the layout of the item was foregrounded. It could be that having the dates positioned to the right of the time line is counterintuitive to the process of reading from left to right and some students just may not have easily seen the overarching organiser of information (the dates) for this item readily enough.

Black drag lines – small black lines that appear as a trail behind the boxes as they are moved to the right – were evident during this item, and several students commented on these as superfluous:

- *the drag lines could go.*

To remove them, a click to the side of the screen was required.

Students suggested that, when completing the item, the text from PM 8 should be visible.

Confidence and engagement

Despite not accessing the text, three students were rated as being highly confident. Another 5 were rated moderate and two low. One was not confident because:

- *I can't remember all of the information.*

Summary of findings

- Like Year 3 students, this type of TE was easily operated by Year 5 students.
- The layout and design of the item interacted negatively with some students' completion of the item in two ways:
 - while students engaged and interacted confidently with the TE, their interactions with the content of the item were not fully realised as it was not made explicit in the instructions that accessing the text on which the item was based was permissible; and
 - the position of the dates on the time line may have interfered with some students' interactions.

4.4.3 Year 5 MI 18629 The Venus Flytrap and MI 18721 Get off the Couch!

These items utilise click, drag and drop of text boxes from one area of the screen to other defined areas the same size as the text box.

In The Venus Flytrap, horizontally-arranged text boxes are dragged upwards to defined areas below a row of pictures. The area from where the text is moved becomes grey.

Expected pathway – The Venus Flytrap
Read direction 1
Read text
Read direction 2
Read the text in each of the five boxes
Drag to corresponding location and drop.
Repeat click, drag and drop of text boxes x four.

Get off the Couch! required students to drag text boxes arranged in a 2x3 pattern from one table to another. They are dragged downwards to defined areas. When text boxes are moved, they self-renew with an identical box appearing in their place.

Expected pathway – Get off the Couch!
Read direction 1
Read text
Read direction 2
Locate and read <i>Examples from text</i> in table
Locate boxes naming persuasive techniques
Click on a technique
Drag and drop technique in table
Repeat with remaining 3 techniques

Interactions

These items were at the end of the Year 5 set of items and due to time constraints, fewer students attempted them: eight attempted Venus Flytrap and five attempted Get off the Couch!

The click drag and drop TE was managed easily by all students attempting the items. One student thought that only the correct answers would click into place. She did, however, move the boxes about to get a match to her satisfaction.

Students tended to read the texts completely before attempting to click, drag and drop the boxes.

However, two students did not read the Venus Flytrap text. One said it contained a lot of words and immediately began to place the text boxes under the pictures, moving these around quite easily. Another weaker student took some time to work out how to move the statements under the pictures, then moved them randomly without reading them, or the text above.

In *Get off the Couch!* a student with weaker reading skills attempted to read the text, had some assistance from the interviewer to scroll down to the question area and then quite easily, but randomly, moved four boxes.

No student referred back to the Venus Flytrap text to assist their decision or to confirm their answer, but three of the five who attempted *Get off the Couch!* did. Another guessed his selections.

Some students used the scroll bar to access the entire Venus Flytrap item. Another placed the cursor in the scroll bar area and used the keyboard arrows to move up and down the screen.

Interactions with the text of Get off the Couch!

The *Get off the Couch!* item had more self-renewing options (6) than response text boxes (4). Students' final responses suggested that there was an expectation that four different options would comprise a correct answer. One student identified:

- *There are a lot of options. There are 6 things to go into 4 spaces so I need to read carefully to make sure I'm right.*

Final answers of two students were identical (relevant evidence, catchy opening, counterargument and convincing conclusion, in that order). Both were unsure of their third selection (counterargument) but were possibly drawn to negative sentence 'And you don't have to cook ...' to cover off four different options in their answer. Another student finalised his selection using 'plot, catchy opening, relevant evidence, convincing conclusion'. This student considered changing 'plot' but he realised he had used all options except 'counterargument', 'dialogue' and 'plot'. He discounted 'counterargument' and was therefore left with the two narrative elements of 'dialogue' and 'plot'. Plot appeared to be the least wrong of the two so he stayed with that answer.

Confidence and engagement

Students were confident of their responses to both questions, were happy with the computer presentation and did not have any suggestions for improvements. Referring to *Get off the Couch!*, students commented:

- *It's good. Perfect.*
- *Drag and drop is easy. It's catchy and fun on a computer. Helps you get it better instead of trying to draw a line. If you rub it out, and draw another, the marker might not understand – 'Is it this one, or that one?'*

Summary of findings

- Year 5 students who completed these items readily engaged with them and operated the TE with high levels of expertise.
- Some students found the reading load of *The Venus Flytrap* high.
- The item type of *Get off the Couch!*, where there are a greater number of options than response boxes, appeared to raise the item difficulty. This may have been due to learnt test taking strategies applicable to other item types or classroom activities. Responses of some students indicated they thought four different options would comprise the answer when this may not necessarily be the case.

4.4.4 Year 7 PM 14 Sticky notes and PM 13 Pluto web graphic

Year 7 interviewees were presented with two items containing the click, drag and drop - text box TE type.

The first, Sticky Notes, required the click and drag of a note from the left of the screen into undefined hotspots in one of two columns, headed FACTS/OPINIONS, on the right of the screen. When one note is moved, another, different note appears in its place.

Expected pathway – Sticky notes
Read direction
Read first sticky note
Click, drag and drop first note onto cork
Click, drag and drop subsequent notes

The second item, Pluto web graphic, required students to drag three of six text boxes arranged in a 3x2 table upwards to a web organiser. When a box is close to a hotspot, a green border appears.

Expected pathway – Pluto web graphic
Read direction
Read text boxes
Read (analyse) web graphic
Click below web graphic on first selection
Drag and drop first selection to web graphic
Repeat for two more selections
Does student recognise the relationships in the web graphic?

Interactions

Twelve students were interviewed on Sticky Notes and 10 on Pluto web graphic. No student had trouble clicking, dragging and dropping text boxes.

Interactions with Sticky notes

The Sticky notes item required the organisation of text boxes in two columns. One text box (a note) to be moved was visible at a time. When the top note was moved, the next sticky note appeared (simulating peeling a page from a notepad). All twelve students followed the expected pathway, dragging, dropping and organising the six objects to a location on the corkboard.

Eleven of the 12 students who attempted this item completed the question confidently, quickly and easily. One student initially was hesitant. This was because he reacted to one note being visible before the others appeared. In accordance with the direction, 'Read each sticky note and then drag it over to the cork board under the correct category', he was waiting for all the sticky notes to appear so he could read each of them before he dragged one of them. Eventually he worked out that he had to drag one to the corkboard before another would appear.

Students used a combination of personal knowledge and language features to organise the notes. The use of dates and numbers in the notes suggested to some students that these belonged under 'Facts', while notes with 'all or 'most' suggested 'Opinion'. One student said he judged the difference between fact and opinion as follows:

- *Facts are correct because you've got to see whether it would work in a book. If it's precise, it actually happened. Opinions are something a mum would say.*

Another student was unsure where to put the Australian TV Foundation note because she

- *had never heard of it.*

She opted to put it in the 'Opinions' column.

Some students re-read to confirm their selections.

Three notes fit nicely into each column of the corkboard. A maximum of four notes can be placed in each column, although the fourth note hangs over the lower edge of the board. Two students suggested that the corkboard should be bigger so that all the notes fit. They each placed four notes in one of the columns. Students who tried to second-guess the item design and layout may have been cued by the size of the corkboard to supply three notes in each column, without considering whether a fourth may be an option.

An interesting but minor conundrum was noted with this item: the notes were called 'sticky' notes yet each one had a drawing pin for securing on a corkboard.

Interactions with Pluto web graphic

In this item, students were required to select three ideas that supported a main idea then move them to boxes that connected to the main idea. Nine of the 10 students who completed the item read all text boxes before moving any to the web graphic. One student chose one then moved it immediately. Most students referred back to the instructions when making their decisions.

No students appeared to notice or volunteered their thoughts on the green highlights that appeared as the selected text box was moved close to the hotspot. When prompted by the interviewer to comment on how he was going to put a box in the web, one student explained:

- *It turns green. That's where it wants it to go. It's obvious. Wants you to put it there. Green – it's not correct. It just wants you to put it there. It does it for all of them. Green boxes don't bother me. They could help some people.*

Some students articulated their understandings of web graphics. One thought the item was a good way to look at a certain theme. Others referred to the graphic as a brainstorm:

- *the web is a brainstorm with the idea in the middle and lines going out to ideas.*

One gave a fuller explanation:

- *Webs have different uses. A web is something that starts in one place and stretches out into others. They have in common where they come from. The Jupiter box would come in (be relevant) if the centre box was 'the solar system'. They can be used for reasons for an argument, support an idea, how to show connections. There are no extra boxes in this because it doesn't want you to stretch it.*

Another thought the web was restrictive and could have been a larger, more extended web:

- *You could have more than three ideas. This would make the information stronger. You would believe in it more.*

To assist with sorting and classifying information, one student thought that the provision of another area or spot to put eliminated boxes would be helpful. This student appeared to want to move all boxes, not just those that were correct, to another location.

Confidence and engagement

For both items, most students had high confidence levels about the correctness of their answer: only two doubted their placement of one or two notes.

The following comments underscore the general enthusiasm for this type of item:

- *Add a few more boxes. 3 in each is a bit low. Have a variety of subjects, not just TV. Not on a theme. Have normal questions like 'Did you know the Allstars scored 28 goals? Then you'd know the opinion was 'the Allstars are the best team'.*
- *It's the best so far, because it's better than just like clicking and finding an option. You get to drag and drop rather than clicking, and some people don't like typing.*
- *I enjoy webs. Better than anything else, really."*

Summary of findings

- Overwhelmingly, Year 7 students engaged with this TE type and were confident of their ability to answer.
- The ease of answering and the short time it takes to complete the interaction were attractive features, keeping the students interested and giving them more time to make decisions about the question.

4.4.5 Year 9 PM 25 Pip/Colin Character; MI 18690 Animal Emotions; PM 17 Student Speech

The first Year 9 item with this TE type, Pip/Colin Character, required students to click, drag and drop text boxes from a centre column to an undefined space in the left or right column. The edge (border) of the left or right column turns light blue when the text box touches it. Upon dropping the text box, the blue highlight disappears. Clicking the reset button causes all text boxes to return to the centre column.

Expected pathway – Pip/Colin Character
Read direction
Examine table
Read all boxes in centre column
Click on one box in centre column
Drag and drop first selection to RH or LH side of table
Repeat for remaining centre boxes

The second item, Animal Emotions, required students to read a text, then click drag and drop text boxes left to right across the screen to an argument outline. When a text box is clicked then dragged (two interactions) a grey border appears. When a text box is clicked and dragged in one action, no border appears. When the text box is lifted, the text in the original position remains black; when the text box is dropped onto the outline, it turns light grey. Boxes can be moved to the left and to the right and in and out of the outline.

Expected pathway – Animal Emotions
Read text
Read direction
Read boxes in LH column
Read boxes in RH column
Click on option of choice
Drag and drop boxes from LH to RH column

The third Year 9 item of this TE type, Student Speech, has similar interactions to Pip/Colin Character. Students were required to click and drag text boxes from a left column to the immediate right and far right columns. Borders of the text box and columns turned blue when they were clicked and dragged. The highlight disappeared when the boxes were dropped.

Expected pathway – Student speech
Read direction
Read sentences in LH column
Read (analyse) table – headings and example
Read boxes in LH column
Drag and drop boxes from LH to RH column

Interactions

The Pip/Colin Character, Animal Emotions and Student Speech items were completed by 11, nine and five students respectively.

There was no evidence of the TE in these items interfering with students' cognitive interaction with the item content. In all questions, students were able to use the TEs quickly, easily and confidently, irrespective of whether or not there were highlighted borders on the text boxes to be moved, or on the locations to which boxes were to be moved, or the colour of highlighted borders (brown, blue or green), or whether the original location of the text box became blank or was grayed out. The following is a typical comment from an interviewer:

- *Confidently moved boxes across screen to drop them in their spots.*

Students knew – almost instinctively – what to do. When asked how they would tackle the questions, the following comments are representative.

Pip/Colin Character:

- *drag and drop to get to the right person.*
- *need to move the middle boxes under the character headings.*
- *remember story of Pip and Colin, what they say and did, and what was told about them. Read what I have to do. See what looks good.*

Student Speech:

- *Drag and drop.*
- *Drop different sentences into two different boxes.*
- *You're already given one. I'm guessing you've got to put it in a different column. Just read through the boxes. Guessing there will be 3 in each box. If it sounds and feels persuasive, then I'd put it there.*

Animal Emotions, where the directions followed the text and the drag and drop table was not immediately visible on screen:

- *drag statements to the right place based on information in the text (said as student scrolls to inspect the item).*
- *Read the text.*
- *Same as last one. Scroll down for directions to find out what to do.*

Interactions with Pip/Colin Character

Most students either examined the table and read the first box, then moved it, followed by the second box, etc. *or* examined the table and read all boxes before moving them. One student worked on computing Pip's attributes first and then moved onto Colin's. Yet another approach involved counting the number of boxes and determining that each character needed three sentences moved under their name.

Only one student navigated back to the video in PM 24. He used the slider to go back to the start so he could watch and listen for specific information with the question in mind. He stopped viewing when he felt he had enough.

Some students recognised the notes as opposites and therefore mutually exclusive:

- *Couldn't have Pip as a young and a grown man.*

Others relied on their memory of the texts they had read and viewed in the previous questions:

- *He disliked being an apprentice. Wanted to be someone else.*

Another commented on how the boxes ‘jumped’ around. She was referring to the way the hotspots ‘grabbed’ the boxes very early, i.e. the boxes were quite a distance from the hotspots when they ‘jumped’ into the column. This phenomenon may cause interactions with students’ decision-making processes when completing the item, e.g. some students may want to drag a box from side to side and around the item as they think about their answer.

Interactions with Animal Emotions

Of the nine students who attempted this item, five read the text first, then scrolled down to the direction; three scrolled down to the direction first; and one scanned the text, decided it was too long and did not read it.

Most students (five) understood the question (to construct an outline of an argument), engaged with the TE to form their outline and were able to answer to their own satisfaction, persevering by moving text in and out of the argument scaffold until they were happy with their final response. Some were able to do this more quickly than others.

Students tended to work across the direction and the drag and drop tables below it. They did not refer back to the text.

Cognitive interactions with the item were interesting. Five students recognised the statements ‘Animals seem to experience’ and ‘Animals do not experience’ as thesis statements and placed one of these in the ‘argument’ box. These students also recognised the statements beginning ‘This suggests’ as conclusions.

Some students attempted to construct an argument using the given statements rather than form an argument outline. For example, a student used his own experience of dogs to select a stance:

- *I'm going for dogs have human emotions side as I have one very sick puppy right now.*

He looked for statements that supported this position. He did not use the language features (‘It seems’, ‘This suggests’ etc.) to work out the item intent. He placed text boxes in the ‘supporting details’ section of the outline first, then in the ‘Argument’ section and finally in the ‘Conclusion’ section, about which he said:

- *Would've been better if this was counterargument.*

Another student who had been reading aloud for almost an hour and had become quite fatigued, could not see any explicit directions to drag and drop and did not deduce from the item layout that this was what was required. He said,

- *I can't click on anything. Do I just say it?*

He then checked the direction which still did not help him. Eventually after some prompting by the interviewer he was able to get going. He looked for pieces of supporting evidence and wanted to fill in all spaces with these. He seemed to ignore the headings in the argument outline.

Interactions with Student speech

The five students who attempted this item followed the expected pathway. Students used the language features of the statements to make their selections.

One student examined the item in terms of the number of cards to move to each column:

- *Not all would go in one column. Must be an even number in each. I miscounted because of the example. The number of boxes on each side could be a clue to getting it right.*

This was either a strategy learned in class for organising information, or an attempt to second-guess the test developer.

Confidence and engagement

For a few students, reading ability and fatigue impacted negatively on their capacity to interact, engage and complete the item that had a long text and high reading load. On the other hand, and this was more typical, the action of drag and drop was compelling for students of this age:

- *Drag and drop is interactive. The idea is pretty good - keeps you more entertained. I wouldn't say this is the right word for a test. I'd say more engaged.*

Summary of findings on these items

- As for all other Year groups, the drag and drop TE type is easy to operate, enjoyable and engaging.
- Like younger students, lower reading skills impacted on the capacity to interact with content.
- Unlike some younger students, older students' lack of access to content may inhibit engagement with the TE type and cause loss of confidence.
- If it is too large, the hotspot zone and its interaction with dragged text boxes may be a source of annoyance for some students.
- Drag and drop text box TE types, particularly when boxes require dragging to columns, may be subject to easily learnt strategies that encourage second guessing and therefore may have an effect on the validity of the item.

4.5 Select text

Five items – one at Year 3 and two at each of Years 5 and 7 – required students to select text as a way of showing their answer. In four items, this was the only TE type; in one Year 7 item, it was combined with a MC selection, the response to which students were required to justify by highlighting (selecting) relevant evidence in the text.

4.5.1 Year 3 PM 7 Speech on bullying

In this item, students were instructed to highlight (by clicking on to select a word or phrase) five phrases. An example of the type of answer was provided. The seven options available for selection were embedded in the text. A possible selection turned light blue when the mouse was hovered over it. A click on the blue shading caused it to be selected and it then turned yellow. A second click deselected the option. There was no reset button and students could select all options.

Expected pathway – Speech on Bullying
Read direction
Read text
Use mouse to locate options (recognise each blue highlight is a possible option)
Click within text on first selection
Repeat for remaining selections

Interactions

Three students of the 10 who attempted this item followed the expected pathway. Most had difficulty knowing what was expected in this item.

Less capable students, who had trouble accessing the text and did not attempt to answer, did read the directions but did not understand them: their reading ability impacted on their capacity to complete the question. When they saw the highlighted options, they continued trying to read and did not make any highlighted selection. Interviewer's comments for these students included:

- *After reading the text he said he couldn't remember (understand) anything that he'd read. "I've no idea what this means."*
- *A frustrating experience. He has no understanding of what the directions are asking him to do. I did not pursue this question.*
- *Had difficulty with the word 'general' therefore he didn't really understand what was required.*
- *Unable to read the key words to enable an understanding of what is required. Hovers over the text with the cursor but really doesn't know what to do. Doesn't make a selection. Moved to next item as she was really stuck.*

Students, including the most able, who were able to read beyond the directions, assumed that the blue highlighted text (the possible options) were all correct answers. Interviewer's comments for these students included:

- *Student was able to hover the mouse over the items and find the ones that could be highlighted. Then he clicked all of the items and highlighted them all.*
- *Student clicked on all 'possible options' but didn't select from these.*
- *Student was quite a fluent reader, moved cursor over the text and highlighted all the bits that could be highlighted.*
- *Student clicked on them all.*

- *On the third sentence he noticed the blue highlight and thought he was meant to click on all text that was highlighted so that's what he did. He missed a few at the beginning because he didn't go back and check.*

Confidence and engagement

Two students were moderately confident and two were highly confident that their answers were correct. Those who were aware that they could not read the text well and therefore could not understand the purpose of the item had little confidence that their TE interactions were correct.

However, a high confidence level did not correlate with following the direction and answering correctly. One student, who had high confidence, said:

- *Was easy. I hovered over and there was a blue square.*

Summary of findings

- No student answered this item correctly.
- The item content and directions interacted negatively with the TE type. Whilst the intent of this question may have been beyond this Year 3 group of students, the item format of requiring students to first identify options and then select several of these was not clearly described in the directions. More explicit instructions would benefit this age group.
- In addition, the item design impacted negatively on students' ability to complete the item successfully: students' approach to this item was akin to colouring two or more multiple choice options on a pen and paper text. [An error message alerting students that they have selected more than the specified number of responses may assist in overcoming this issue].

4.5.2 Year 5 PM 8 and PM 9 Kevin Coombs

The first item relating to Kevin Coombs (PM 8) required students to select (by clicking) one response (paragraph) out of a possible four. Each paragraph turned brown when the mouse was hovered over it. A click on the brown shading caused the paragraph to be selected and it turned yellow. A second click deselected the option. Only one paragraph could be highlighted – a second click deselected the paragraph. A reset button cleared a response and an error message appeared if multiple paragraphs were selected.

Expected pathway – PM 8 Kevin Coombs
Read direction
Read text
Use mouse to locate options (recognise each pink highlight is a possible option)
Click within text on selection 2

The second Kevin Coombs item (PM 9) asked students to select (by clicking on a word or phrase) one response out of a possible seven. Options available for selection were embedded in the text. A selection turned light purple when the mouse was hovered over it. A click on the purple shading caused it be selected and it turned yellow. A reset button and a second click deselected the option. An error message appeared if an attempt to select a second option was made.

Expected pathway – PM 9 Kevin Coombs
Read direction
Use mouse to locate options (recognise highlight is a possible selection)
Click on selected option in text

Interactions with PM 8 Kevin Coombs

Twelve students were interviewed on this item. While some students went straight to reading the question, others were able to articulate what they thought the item required before they commenced interacting with it. Most referred to reading skills:

- *You have to find out what information is in each paragraph. Decide which one of these paragraphs describes his culture, background, not how old he is.*
- *I'll look for aspects of culture and background, where he's from, what religion he has, or something.*
- *Need to read the whole thing and then decide which one.*

One referred to the technical interaction:

- *Think I'll have to highlight words.*

Whilst completing the item, some used the mouse to track text and/or to bring up the brown highlights on the paragraphs as they read. Some completed this item quickly and confidently. One read the direction aloud and used the mouse to track when silently reading and skimming the text. Others read each paragraph carefully, summarising and judging before they moved to the next paragraph.

One student who preferred the laptop touch pad was given a direct prompt about how to interact with the item. Initially he wasn't using the cursor over the text but when he finally hovered it over the text he realised it could be highlighted and he clicked on a paragraph. The interviewer described him as perturbed that the question and computer only allowed him to highlight one section only.

One more able student's interaction with the content showed that he was able to summarise the material quite succinctly:

- (1st paragraph) *Doesn't sound like where he was from;* (2nd paragraph) *Kind of like he loved basketball, got hurt in an accident;* (3rd paragraph) *Sounds like achievements;* (4th paragraph) *Sounds a little more like family, background and culture. Yes, that's it.*

Another student read to eliminate paragraphs:

- (1st paragraph) *Don't see anything about culture;* (2nd paragraph) *How he got into basketball;* (3rd paragraph) *How he got famous;* (4th paragraph, before he reads it) *I guess it must this one. The rest say how he got famous, how he got into basketball.*

Commenting on the relationship between the instruction and the text, one student volunteered that the instruction should not include the word 'background':

- *because most of it is about his background.*

Two students found reading this item very difficult and this impacted on their ability to use the TE. They did not read the direction or use the mouse to locate options. They placed so much effort into decoding that they were not able to comprehend the question. One student did not know what to do in order to complete the item and only after prompting did he click an incorrect answer within the text. The other student clicked text, and was confused by the changing highlight colour. This student thought he had to get a pen highlighter to answer the question.

Another student expressed interest, and some confusion, in the function of highlighting in the item. His only experience with highlighting appeared to have been in class to highlight main ideas. After

reading the first paragraph, which he described as an introduction, he said that this was the first time he had seen whole paragraphs highlighted. This type of highlight appeared to be a revelation to him:

- *This is how it has been set up by the computer. There are more ways of highlighting than just the main idea. It means the main idea – the whole paragraph is probably about it (the main idea). My teacher says we highlight the main idea. I see now there are more ways to highlight.*

Interaction with error box

Students did not tend to click on the paragraphs during their reading and therefore the pop-up error box was not utilised to a large degree. However, some students did interact with it, with only one having difficulty. He wanted to change his original response after re-reading the question but the appearance of the error box confused him. After some uncertainty (and looking for direction from the interviewer), he navigated the problem and highlighted his final answer. One who interacted fluently with the TEs clicked on the paragraphs as he read them, thus accidentally selecting each paragraph.

He was easily able to correct this by using the error box, as were other students who wished to change their original choice.

Interactions with PM 9 Kevin Coombs

Eight of the 12 students who completed this item followed the expected pathway and were very aware of what they had to do to complete this item.

Two students read the direction but were unsure of how to proceed. One clarified what he had to do, then highlighted most words, clicked one phrase, and then another (using the pop-up error box) as his final answer. Another, who had been unsure of clicking on her answer in the previous question, was still hesitant. She read the text but remained unsure that she should click on her answer and, without clicking an answer, continued to the next question.

Among those who did complete the item, two students highlighted one phrase, checked for another, then completed the item. Another had learnt the skill of hovering the mouse over the text in the previous question (PM 8) and therefore had clues about what he could select. The interviewer noted:

- *In the last item he was prompted about this strategy so he has remembered and applied it to this item.*

Some children had mixed understandings of what the item required. One student, with low reading skills, was not sure what the question required. One read the question aloud before extracting the positive words from the text. Another commented:

- *It's asking me to outline the positive outlook.*

One who clearly knew the question intent explained:

- *I think it might ask you to highlight the things that – not directly but indirectly – have a positive outlook on life.*

If students highlighted a second phrase, the pop-up error box appeared and students were able to click their way out of it.

One student raised the issue of what he called the limit on words and how this could impact positively on students' test-taking confidence. He said:

- *On the computer it is easy to figure out the limit. In a pen and paper test you have to underline but this doesn't tell you the limit of words to underline. A person might do just 'blessed' but you have to underline 'I've been blessed'.*

Another student had a related concern, and explained that the interacting could interact negatively:

- *the computer wouldn't let me highlight what I wanted. On paper, you can highlight the bits you want. They'll (students) think there's something wrong with the computer.*

Confidence and engagement

Students were recorded with moderate to high confidence that they had clicked the correct paragraph (PM 8) or phrase (PM 9), even if they hadn't.

For PM 8, one student was noted as having a low confidence level.

Summary of findings

- Reading ability impacts on the capacity to understand instructions, access content and use the TE in order to answer the item.
- Some students who could not read the direction or question were not entirely excluded from interacting with the TE.
- Some students whose reading skills allowed them to access some content but who lacked confidence, either generally or with a computer, found it difficult to interact with the TE.
- Knowledge of highlighting on computers was lacking with some students. Having two types of highlights causes confusion with weaker readers and those with less developed computer skills.
- The experience of one student using the pop-up error box would suggest that familiarity with this interaction is not uniform across Year 5: the pop-up error box has the potential to cause confusion.

4.5.3 Year 7 PM 15 Book Review – Sport

The first Year 7 item of this TE type asked students to highlight (by clicking) on two paragraphs in a five-paragraph text.

A light blue border appeared around each paragraph when the mouse was hovered over it. A click on the paragraph (within the blue border) caused the paragraph to be selected and it turned pale yellow. A second click deselected the option. All paragraphs could be highlighted. A reset button cleared the response(s). No error message appeared if more than two paragraphs were selected.

Expected pathway – Book Review-Sport
Read direction
Read text
Use mouse to locate paragraphs (recognises blue box highlight is a possible selection)
Click on paragraph in text (recognises pink highlight as text that is 'selected')
Click on 2 selections

Interactions

Eleven students attempted this question and all followed the expected pathway.

Some of these students re-read the direction and part or all of the text. None had trouble using the mouse to hover over paragraphs or to select their paragraph. Only one student was not confident of his answer because he did not know what the pink highlight meant.

Students recognised that the blue border highlights were those that were possible selections. How much the student moved the mouse over the text (one boy was constantly moving his mouse) determined how often the blue highlights flashed. This flashing did not appear to disturb the students.

One student clicked on the first paragraph and initially assumed the highlighted paragraph was correct, but did not know why this text might have been correct:

- *I don't know if the orange highlight is an opinion or judgement.*

Another student commented that:

- *When they (the paragraphs) turn pink it looks like they're wrong but they're only highlights. – wrong because work is marked in red and pink is closest to red.*

The students did not select and deselect at random, or experiment. All tended to select only when making their selection. Some students used the mouse to track and follow text. Two students were noted as scrolling to see the extent of the question.

Confidence and engagement

Nine of the 11 students who attempted this question were recorded as having high confidence levels. One was recorded with low levels because he did not know what the pink highlight signified.

Engagement and general demeanour levels for all students were reported as high.

Summary of findings

- Students at this Year level had no difficulty using the Select Text TE type.
- Clarity over the function of highlighting would assist students
- As can be seen by the discussion on this item, students and interviewers saw the colour of the highlighted paragraph as yellow, pink or orange.
- Pink highlights have the capacity to signal unintended messages (feedback) to students.

4.5.4 Year 7 MI 18702 Galileo

For this item, students were required to read a text then select a MC option by clicking on a sentence. A blue highlight appeared over the sentence after it was clicked (unlike other items, options do not become shaded when the mouse is hovered over them). Students were then required to click in the text above the MC item to select one of six paragraphs which turned same colour blue when clicked. Only one paragraph could be highlighted – a second click deselected the paragraph. A reset button cleared a selection and an error message appeared if multiple paragraphs were selected.

Expected pathway – Galileo
Read direction 1
Read text
Read direction 2
Read all MC options
Click on option of choice
Refer back to passage
Click on a paragraph

Interactions

Six of the 10 students who attempted this item easily completed it by following the expected pathway. They read and understood the directions. One clarified what was required: when clicking on an option, she asked:

- *So I press this then go onto find a ... ah, so just highlight.*

Some students clicked on each option as they read them, presumably to keep track of their location, or to help them concentrate.

The two-part nature of the question caused problems for three students. One student was prompted to complete part 2, which she did efficiently. Another highlighted the paragraphs as she read through the text and did not initially see the second part of the question. However, she did re-read the direction and eventually completed part 2. A third did not understand that locating supporting information in the text was required and clicked on a multiple choice option only.

It was not beyond Year 7 students to experiment with the TE. One student read both directions, then clicked on the first MC option:

- *to see how it works.*

She then proceeded to click on all the options sequentially to highlight them, dealing with the error message in between. She settled on one, saying

- *it was just a guess.*

Unsurprisingly, she was not confident that her answer was correct.

Students interacted with the TE easily, capably using the computer tools of scrolling and clicking. No student used the zoom function.

Two students suggested that the computer should be programmed to automatically deselect the previous option when a new option is selected, so that selections can be changed without having to reset every time.

One interviewer noted that the fraction used in this text is confusing and should be written with a horizontal line between the numerator and denominator rather than a forward slash.

Confidence and engagement

Engagement with the subject matter was high for one boy. He commented on his own Italian heritage and appeared to enjoy reading the text, apparently seeing some connection.

One student found the text lengthy and began to disengage, saying:

- *-Wow! This is so long.*

His mental and physical fatigue is perhaps captured in his comment that the item would be better on pen and paper because:

- *doing it online you have to scroll back and forth.*

Nevertheless, he completed the question.

Several students said this type of item would be better on computer – where it is easier to select, highlight and change answers, and there is no page to turn.

Summary of findings

There were two main interactions impacting on students' capacity to complete item requirements. Both were related to the two-part nature of this question.

- 1. Technical enhancement interactions. The highlight that appears as the mouse is hovered over the text may have distracted from part 2 of the item.
 - Students who used the mouse to track text may have viewed the highlight merely as an aid to track text. They may have viewed this as the sole purpose of the highlight and consequently overlooked part 2 of the item.
- 2. Item format and two- step instructions. Two instructions within close proximity may cause some students to unintentionally omit the second part of the question:
 - For some students, there is an apparent expectation that there is only one instruction per question.
 - Students who don't easily retain information may 'forget' there is a second part.
 - Some students may miss the second part of an instruction when it is situated in close proximity or contained within the same sentence as the first instruction.
- Overall, Year 7 students operated the TE types efficiently.

4.6 Connections

4.6.1 Year 3 MI 18712 Someone poem and Year 7 MI 18631 Rainy Day poem

Two items – one at each of Years 3 and 7 – required students to form connecting lines between objects (text boxes) displayed in two parallel lists to show that the objects are related in some way.

In both items, clicking an object caused a broken line border to appear around the object. The line signified that the object was selected. When an object in the second list was clicked, the borders disappeared and a dark blue connecting line appeared. Two mouse clicks were required to form the connection.

There were two ways to clear the line, each of which took two mouse clicks. One line could be cleared by clicking on the blue connecting line, then on the clear button. All lines could be cleared simultaneously by clicking on the reset button then following the instructions in the dialogue box, 'Are you sure you want to reset your answer?' to which the options 'OK' and 'Cancel' were available. When the connecting line was clicked multiple times, the colour toggled between blue and red.

Both items had the same expected pathway.

Expected pathway – Someone and Rainy Day poem
Read direction 1
Read poem
Read direction 2
Click on one example in LH side
Click on matching selection in RH side
Repeat with remaining three examples

Interactions with Year 3 MI 18712 Someone poem

Four of the 11 students who attempted this item knew, or worked out, how to form the connection lines. Two used the expected pathway, and after much scrolling and clicking on boxes eventually clicked on one example in the left-hand side. One student initially tried to drag and drop before working out how the connections were made. She made many interactions, changing her mind many times and using the reset button before deciding on her final answers. Another, even though he found the text very hard to read, articulated that he didn't know what example and reason meant but that he had to match them. He made some connecting lines after some time had passed.

Several students tried to drag and drop or draw a line before working out what to do.

A further three students followed the expected pathway up to step 3 (reading direction 1, reading the poem, then reading direction 2). After that, one student read the first box on the left hand side then the first box on the right hand side and continued this process to the end. She did not answer the question but nevertheless expressed high confidence that her answer was correct, presumably because she thought she read aloud well. Two other students did not know what to do after reading the directions and the poem as they were not able to work out what the question required.

Three students attempted steps 1 and 2 only and did so unsuccessfully. One could not read Direction 2 and therefore did not know what the question was; however, he was able to scroll down to see the item in its entirety. Another had little idea and read direction 2 only after being prompted to scroll down to see the question. He tried to drag and drop. He was not aware that the boxes required a mouse click.

A third student scrolled down to read the examples but had no idea how to connect the boxes and didn't experiment with the TE.

Those Year 3 students who could not work out what to do suggested improvements related to making the directions easier and clearer:

- *Explain how to do the matching.*
- *Need clearer instructions on how to do the matching.*
- *Make the question so you can understand it.*

Interactions with Year 7 MI 18631 Rainy Day poem

Four of the 10 students followed the expected pathway. One interviewer, who conducted six of the 10 interviews on this item, commented that only one of these students:

- *had an excellent understanding of process, working out very quickly how to make the two sides match.*

Another interviewer reported one student using the TE fluently.

Another student clarified whether he had to match after the interviewer pointed him to the direction, and a fourth took some time to work out what to do.

Those who didn't follow the expected pathway either read both directions before reading the poem, or read through the poem and the examples and descriptions before commencing the TE interactions.

Four students were observed trying to drag and drop their selections. These students all worked out eventually that clicking on the objects was required to make the connection.

Two students used the reset/clear button with no trouble. However, one student queried their functionality:

- *What happens when the line goes red? When you click on the line it should be removed.*

No student used the zoom function. Scrolling up and down the screen presented no problem.

Students worked on the table with the poem out of view, perhaps using short term memory, or using the examples as these were quotations from the poem. They did not apparently need to go back to the text to see the quotations in context. However, one student thought that the whole poem was needed, commenting:

- *If the poem was taken away, you couldn't answer the question.*

(She may have been referring to no stimulus being presented with the item..)

Year 7 students thought it was easier to draw lines on the computer. One commented that the lines on a computer are neater for a marker to understand as any rubbing out (erasing) would not be evident. Drawing lines on paper for at least two interviewees was problematic, apparently due to motor control. These students commented that:

- *Drawing lines on paper is hard. Getting them straight is hard. If I tried to draw a line it would end up as a zigzag. It's harder than two clicks of a mouse.*
- *Would need to use a ruler.*

Confidence and engagement on these items

Varying levels of confidence and engagement were observed for Year 3 students. One student who followed the expected pathway for the most part sat side on to the screen, looking for reassurance from the interviewer.

Another student read only the poem as her inability to read sufficiently well to understand what the question was asking precluded her from continuing. To avoid further stress and discomfort, the interviewer terminated the interview. She made the comment that it was very difficult for the student to articulate how she felt and how hard the test material was.

On the other hand, students who worked out how to use the TE enjoyed the interactions:

- *It's easy to do straight lines. Perfect as it is. I like the way the lines appear.*
- *You only have to click on the things. With paper you have to draw lines. It's less boring on the computer.*

Interviewers of Year 7 students reported moderate to high levels of confidence, general demeanour and engagement. Students enjoyed working with this TE, in spite of initially not knowing how to form the connections.

Summary of findings

- For both Years 3 and 7 students, clicking on two objects to form a line was a largely unfamiliar way of interacting with the computer. The word 'connect' for this TE activity is perhaps unfamiliar or, in any case, does not communicate well in this context.
- For both Years 3 and 7 students, the lack of clarity in the instructions interacted with students' capacity to understand how to use the TE.
- Reading skills impacted on students' capacity to work out how to use the TE, and to work out how to go about answering the question.
- Computer knowledge and knowledge of the TE impacted on students' capacity to answer the question.
- The purpose and functionality of the reset and clear buttons was not obvious.
- Ease of changing answers is important to students and neatness of presentation is important to some students.

4.7 Select object

Three items are classified under this TE type: one at Year 3; and two at Year 9. One click was required to make a selection which then changed in some way. For these items, borders rather than highlights appeared around the object.

4.7.1 Year 3 PM 6 Coach Bradford

Year 3 students were required to read a text then click on a large coloured object (text box) below the text. A green highlight appeared as a border around the object. Only one object could be selected; when a second was clicked on, the border disappeared on the first and reappeared on the most recently clicked.

Expected pathway – Coach Bradford
Read direction 1
Read text
Read direction 2
Read all options
Click on one selection

Interactions

Two of the 10 students who attempted this item followed the expected pathway. One completed it successfully. She considered all of the options before selecting the correct one. The other selected an incorrect response.

The remaining eight students used a variety of approaches; however, they struggled because they were either not able to read the text (decode words) or not able to read for meaning. This applied to the directions and text and they were therefore not sure of how to complete the question.

One student went straight to trying to read the text without reading direction 1. The interviewer noted that his reading was very slow, lacked fluency and the content was not understood.

Another spent a lot of time segmenting words as he read direction 1, the text, direction 2 and then the first option, which he selected as his correct answer because:

- *Woosh was in the text and that's why it's the answer.*

Most of the students did experiment with clicking on the options and had little trouble operating the mouse to do this.

One boy who could not access meaning in the directions or in the content clicked on the objects. He said it gave him a clue as to how to answer.

Two students did not scroll down to see the extent of the item and therefore were unaware of the coloured answer options. They tried to click on the words in the text. When this could not be achieved, one student kept looking at the keyboard for a 'select' key. The other eventually found the coloured boxes and clicked on one. She tried to move it into the body of the text and didn't recognise that the green outline was the final move.

Students who tried to click on the text rather than the options may have been influenced by the previous item (Speech on bullying), which required them to click on text within a paragraph.

Confidence and engagement

Students who had difficulty reading were not confident they had answered the question correctly. Other students who had some success with reading the text and selected an option showed moderate confidence. One student said she enjoyed the question. She:

- *likes to get to choose the answer and click on the right answer.*

Interviewers reported increased frustration levels if nothing happened when they clicked on the text, reporting:

- *... showing signs of being fed up*
- *He became tired and disappointed in himself.*

Summary of findings

- The ability to scroll was important to access the item.
- Students who could not access the text and direction experienced degrees of frustration.
- Use of the TE is important in students' confidence, whether or not they understand the question and/or answer.
- There was some evidence of transfer of TE type from previous items.

4.7.2 Year 9 MI 18566 Train, Diary

Two related excerpts were presented to students. They were required to read and analyse for mood, and the language used to create the mood. To do this, they needed to click to select individual words or groups of words (quotes) in cells in a table. When the mouse was hovered over a valid word, or quote, a thick, light blue border enclosed the word. Hovering and clicking only on the word or quote (and not anywhere else in the cell) would activate the border. When the word or quote was clicked the border remained, indicating it had been selected. Clicking a second time deselected the text. The error box appeared if more than the correct number were selected.

Expected pathway – Train, Diary
Read direction 1
Read passage
Read passage 2
Read direction 2
Read options in the first table
Click on one mood in each column
Read options in the second table.
Click on two objects in each column

Interactions

Nine of the 11 students who attempted this item followed the expected pathway, which was to read both excerpts before completing the items.

When selecting text in the tables below the texts, students had no trouble using the mouse or, in the case of one student, the touch pad, to click on their chosen text. Students interacted with the reset button and pop-up error box with ease.

Students had different preferences for reading and completing questions. They approached their answers in different ways, with five answering by question (i.e. completing Table 1 (mood) for both texts and then completing Table 2 (language) for both texts. Six of the nine who followed the expected

pathway worked across both tables for each text, completing the mood and language components for one text, then the other. Students scrolled up and down to refer back to the texts and use the information in the texts to make their selections in the tables.

One student did not read both texts before working in the tables. The student read the first text then selected text in the LH columns of both tables, then read the second text and selected text in the RH columns of both tables.

Another became fatigued. He read the first text aloud, commenting:

- *1914: that's like when it was made.*

He then scanned passage 2, and said:

- *I don't really want to read it because it is long and there's only one or two questions.*

Four students selected one, rather than the specified two, objects for each text in Table 2.

No student commented on any literary or substantive connection between the two texts.

Two students commented on the positioning of the texts in relation to the questions. They thought the question would be better if each text and its questions were separated and each text and its question were visible simultaneously:

- *allows you to access the text side by side with the questions rather than have to scroll.*

Another thought the text and questions side by side was not so important; rather, reading texts on screen worked well:

- *because you can look at both texts.*

Confidence and engagement

Most students were reported as having a moderate level of confidence on this item. Two students said they were very sure of their answers to the first text but not with the second. Most students found the second text obscure and abstract. As one boy commented:

- *I think the answer is Mysterious because it doesn't really tell you much.*

Two students were recorded as having low confidence in the correctness of their answers.

Summary of findings

- Students had no difficulty with the TE in this question.
- Having stimulus text available when answering related questions, whether it be simultaneously displayed with the question or accessible by scrolling or some other means, is important to students.
- Answers requiring two objects to be selected is seen as unusual.
- The purpose of the item and the skills assessed were not clear to the students.
- Students use different processes and strategies when analysing texts: they work with different aspects of content, (e.g. mood and language) consecutively or simultaneously.

4.7.3 Year 9 MI 18179 Pharaohs

Pharaohs consisted of three items laid out below a text. The items required students to improve the text by replacing sentences in the text with suitable ones from those available in the options. For each item, the sentence to be replaced was displayed (in a dark blue cell) above two possible replacement sentences (in light blue cells), making a table of nine rows and one column. When the mouse was hovered over a replacement sentence, a grey border appeared on the edge of the cell. Hovering and clicking anywhere in the cell would activate the border. When the cell was clicked, the border turned a dark pink to indicate it had been selected. Clicking a second time deselected the cell. The error box appeared if more than one cell was selected for each sub-item.

Expected pathway –Pharaohs
Read direction 1
Read text [Note if student refers to gloss (nadir)]
Read direction 2
Read first bolded sentence and locate in main text
Read both options in first pair
Select one
Repeat for one further pair. No need to do part 3.

Interactions

Three of the five students who attempted this item followed the expected pathway. They interacted with the TE and computer tools easily. When selecting text in the tables below the text, they had no trouble scrolling or using the mouse to click on their chosen text. They did not comment on, or appear to notice, the borders of the cells (objects) changing colour. It was apparent they understood them as having no special significance other than that they were selections to be made (grey border) or selections that had been made (pink border).

Two students understood how the bolded text in each part of the item related to the main text. The third was eventually able to work this out. As the interviewer noted:

- *she wasn't initially sure what was needed to be done, but then re-read and it was clearer.*

Difficulties experienced with this question related to the clarity and requirements of the question.

Two students had difficulty. The interviewer observed that one:

- *by this stage appeared fatigued. He didn't appear to understand the aim of the task entirely, although he recognised that one of the two sentence choices needed to be highlighted. Was quick to choose an option – moving mouse around the screen and seeing text highlight was an indicator to him of what needed to be done.*

Another student, also a boy, had difficulty working out what the question required, but talked himself through it. He said:

- *Cohesive devices – don't know what these are. Haven't heard this terminology. Not sure what question is about. Sentences have same meaning but are worded differently. 1st option sounds better. You would find it or see it in Wikipedia or a book. Strengthen paragraph – but I don't know what Cohesive Devices means. Cohesive means sticky, so I'm guessing that's what it is.*

He made a selection which he was highly confident with because:

- *It sounds better.*

At times, this student swept the mouse right and left across the screen text in great movements, and sometimes tracked text, but he did not know that locating the bolded sentence in the item in the main text was required. He attempted only one item of the three.

One student suggested that the item could be made clearer by making it look like a multiple choice question with options numbered. As it was, she thought it looked like a block of text with no clear separation between the stem and the two options.

Confidence and engagement

Students who attempted this item had moderate levels of confidence – one student who completed only one item was highly confident his answer was correct because it ‘sounded better’.

Summary of findings

- The TEs in this item presented no problem for students.
- There was some lack of clarity in the directions. Some students were not sure of what to do, particularly in how the questions related to the text.
- Students’ lack of understanding of the item intent interacted with their ability to answer the question.
- The layout of the stem and response options had potential to confuse students.

4.8 Drop down menu; Type in text box

Two items – one each at Years 5 and 7 – utilised the drop down menu TE type combined with a text box entry. Both items' structure was such that the first TE type (drop down menu boxes) supported the construction of the typed response in the second TE type (text box entry).

In Year 5, drop down menu selections were designed to assist students to write a summarising paragraph. In Year 7, the drop down menu boxes provided a support for thinking about and planning an extended writing text (in this case, students were asked to produce a letter).

Four formatting features were available for the text box entry: formatting could be applied to text that had been highlighted by clicking and dragging the mouse over it. Toggling the formatting icon turned on and off the feature.

4.8.1 Year 5 PM 11 Owl Flight

The item required students to read a text containing an introduction and three body paragraphs. They were asked to supply subheadings to each of the body paragraphs, then write a conclusion for each subheading. Three options were supplied in a drop down box with the label 'choose heading'. Students needed to click on the drop down arrow to reveal the three options and one was to be selected from the list. The label 'choose heading' displayed twice as it also appeared as an option. Options (including 'choose heading') were shaded in light blue. The drop down boxes were positioned above the paragraph to which they related. To write the conclusion, students needed to place the cursor in the text box and begin typing.

Expected pathway – Owl Flight
Read direction (top)
Read text (implicit direction) How many times?
Read first body paragraph
Click on 1st drop down menu arrow
Click on chosen option (Three available)
Repeat for remaining two drop downs
Read direction (above text box)
Place cursor in text box and use keyboard (Note if student proofs and edits work)
Note use of formatting: highlight text
Click on one or more formatting buttons

Interactions

Most students (eight of the 12 interviewed on this item) followed the expected pathway.

Students' expectations of the item requirements varied. One student thought he would have to highlight some words. Five identified the drop down menus and only that they would have to supply headings within the drop boxes. One student who almost instinctively scrolled down to see the whole item recognised the item had two parts.

Interactions with the drop down menu

Students operated the drop down menu boxes easily.

One student noted that the 'choose heading' text appeared as an option and commented:

- *This is silly – should take that out.*

Another interpreted 'Choose heading' as the overarching instruction and did not read the actual instruction. She therefore did not understand that she had to write a conclusion. It was not until she was prompted by the interviewer to read the direction that she scrolled down to see the second part of the question.

Four students read the paragraphs but did not use the correct drop down box to supply their headings. They used the dropdown box below each paragraph. One of these students found the location of the drop boxes confusing because he didn't recognise the opening paragraph as the introduction; rather he thought he had to provide a selection for it. In these cases, text knowledge and comprehension of the instructions likely combined to interfere with responses.

Another two students were poor readers where comprehension was lost due to the energy required to decode. These students were only partially engaged with the item. One student became frustrated and disengaged.

Students who approached drop down menus as intended did so in different ways. One skim-read the body paragraphs and quickly chose his headings. Two read the entire text, summarising each paragraph as they went. After they had done this, they opened the drop down boxes and selected subheadings. These students compared and analysed the options in relation to their understandings of the text. Some students did not complete the task in a linear way, instead changing responses a number of times. Another read the direction and selected headings without reading the whole text first.

When the drop down menu was clicked, the options appeared over the left one-third of each paragraph. Whilst students did not comment on this, it would have had the capacity to interfere with students' understanding of the text, if they choose to read across both text and options. No student was recorded as trying to move (drag) the options away from the text.

One student demonstrated the zoom:

- *If you can't see properly you can zoom and make it bigger.*

Interactions with the Text box entry

Three students did not attempt to write a conclusion in the text box because they did not use the scroll bar. This was in spite of at least one reading and (apparently) comprehending the directions. Another did write a conclusion but only after being prompted to do so.

Three students noted the red line appearing under their incorrect spellings and used the right click of the mouse to bring up a Microsoft style spell-check. One student spent much of his time correcting spelling, aiming to eliminate the red line.

A handful of students noted the formatting buttons with one briefly experimenting with the strikethrough. Ultimately, none used any.

Confidence and engagement

There were pockets of very high engagement levels with this item, with students engaged with subject matter. One student commented that she enjoyed it the most:

- *This is a really easy way to have sub-headings. There are multiple questions. And it's fun and interesting.*

Another approached the item thoughtfully and confidently, and he also enjoyed the subject matter and typing his answer. He commented:

- *It's faster to type and more professional to type on the keyboard. Markers would not understand bad handwriting. The computer has red underline to tell you that you've spelt a word wrong and you can use that (right click) to get it right. Errors might lose marks.*

Two students became frustrated and disengaged; one was noted as switching off and becoming increasingly disengaged.

Summary of findings

- Year 5 students easily operated the two TE types in this item.
- There appeared to be an expectation that the whole item would displayed on screen, i.e. that what appeared on the screen upon opening the question constituted the whole item.
- The only student across all year groups who demonstrated the use of the zoom did so on this item.
- The overlay of the drop down boxes over the text to be read and summarised had the capacity to interfere with students' understanding of the text, if they choose to read across both text and options.
- Text knowledge and comprehension of the instructions combined to interfere with some students' capacity to interact with the item.
- Students with poor reading skills became fatigued due to the energy required to decode. One interviewer reported that these students would not be able to complete this type of test on a computer.
- Students were keen to correct spelling errors.

4.8.2 Year 7 PM 18 Letter planner and Writing

The item provided a brief planner for a letter that was to be written in a textbox. The planner allowed students to nominate an issue, a point of view (POV) and an audience for their letter from two options supplied in each of three drop down boxes, labeled with 'select an issue', 'select a point of view' and 'select an audience'. Students needed to click on the drop down arrow to reveal the options and to select one from each to guide their writing. Options, including the labels which also displayed, were shaded in light blue. To write their letter, students needed to place the cursor in the text box and begin typing.

Expected pathway – Letter Planner and Writing
Read direction (top)
Click on 'Issue' drop down menu arrow
Read the two options
Click on selected option
Click on PoV and Aud drop down menu arrows and select preference
Read direction (above text box)
Place cursor in text box and use keyboard (Note if student proofs and edits work)
Note use of formatting: highlight text
Click on one or more formatting buttons

Interactions

All students in the Year 7 sample (12) completed this item. All knew how to use the TEs of drop down menu and type in a text box easily but often did not attend to the detail of the question or understand the requirements.

All but one student selected from the three drop down boxes. The issue concerning skateboards was overwhelmingly chosen by students. The notion of a school board confused one child.

It is evident from the texts produced that about half did relate their selections for audience and POV to their text, if not to the stated text form (letter). Only four of the students wrote in letter format. Two wrote in a type of memo style, one wrote a speech, and the remaining five wrote a position with some supporting evidence for that position.

One student who did write a letter thoughtfully interacted with the question. He read the options for issues, POVs and Aud. He then read the direction and went back to the drop down boxes, viewing the options without making any choices. He referred to them for a third time and consecutively chose one from each, re-read the question then typed his letter. He used paragraph breaks and wrote a text long enough to extend the box (scroll bar appeared). The interviewer noted that this boy had good typing skills.

Another student appeared to make his selection of the issue because he could immediately take a stance and generate a reason:

- *because kids might get hurt would be my main reason.*

For this boy, it was not immediately clear that a letter was required. After reading the direction aloud two or three times, he asked:

- *Do you mean I could write 'Dear...' or 'To the students'?*

He then chose 'Students' for the POV and Aud.

Most texts were brief. On the whole, students did not appear to understand the self-extending feature of the text box and they wrote within the size of the text box. Only two students extended the text box so the scroll bar appeared and they wrote text longer than the text box. It may have been that they had run out of ideas and had nothing more to say, or that interviewers terminated the question because they had enough evidence of the interaction. However, it also may be that some students see the small size of the box as a guide to the amount of writing required. As one student asked:

- *Do I have to write a whole paragraph?*

Possibly, this student expected to have to write only a short constructed response.

Three students utilised the formatting tools. To correct spelling errors, most backspaced and retyped to correct. Three used the Microsoft-style spell checker.

Confidence and engagement

Interviewers reported demeanour and engagement levels as moderate and high. Students did not become fatigued. Among the reasons students cited for enjoying this item were:

- *the ease and speed of typing*
- *the option to format text*
- *easier for markers to read*

One student thought the use of the spell check would allow students to get better marks and therefore provide an unfair advantage:

- *There is auto correct on computer and students can get marks*

Summary of findings

- Year 7 students easily operated the two TE types in this item.
- Knowledge of texts and comprehension of the instructions combined to interfere with some students' capacity to interact fully with the item.
- The capacity to easily and quickly review and change responses is important to students.
- Students appeared keen to correct spelling errors in their writing.

4.9 Video prompt

Two items utilised a short video as prompt, with one each presented to Years 7 and 9 students. The video had a play/pause arrow, a scrub bar, a timer displaying elapsed time in seconds, a volume slider bar and a toggle-to-full-screen icon.

4.9.1 Year 7 PM 16 Sea simulator

The Year 7 item of this TE type, the first item presented to Year 7 students, required viewing a short video text and then answering a multiple choice question with four options by clicking one radio button adjacent to their selection. A key word in the item stem was bolded.

Expected pathway – Sea simulator
Read direction 1
Locate and click play button on video control
View video
Read direction 2
Read all MC options
Click on button next to selected option

Interactions

Eight of the 12 students interviewed followed the expected pathway. The four students who did not either watched the video without reading the directions, or read the question before watching the video. Two students viewed the video more than once.

Students knew automatically how to get the video to play, and had no trouble clicking on a multiple choice option.

There was little interaction with the video controls, probably because once the mouse was moved away from the video frame, the controls disappeared. Students did not use or experiment with the volume control (set at maximum when the item opened), and only one clicked on the full screen icon and viewed the video in that mode; however, the video stayed the same, small size and did not enlarge to full screen mode.

Students made their multiple choice selections in a variety of ways. Some students worked across pairs of multiple choice options, including or eliminating as they made decisions. For example, one student thought options A or C were possible, then thought D or C were better. He then excluded B, and settled on C for the reason that:

- *a month of construction can be viewed in 20 seconds.*

Another student decided A was incorrect, and B and C should be kept in mind, with D a definite no. He then re-read to contrast B and C, and settled on C.

A third student did not read the multiple choice options fully. She scanned them, deciding she had to eliminate those that did not ‘sound right’. When asked for an explanation of what this meant, she responded:

- *It’s not what they are looking for. It’s hard to explain.*

She selected D, matching the lack of volume in the video to the opening phrase of the distracter.

One student spoke about what was happening during the viewing, analysing it before going to the question.

Confidence and Engagement

Interviewers noted that about two-thirds of students were highly confident their answers were likely to be correct. Only one student, who said he guessed his answer because he wasn't sure about any of the options, was recorded as having low confidence.

High levels of engagement were reported for all but two students who were recorded as having moderate levels.

4.9.2 Year 9 PM 24 Colin Wilson

The Colin Wilson video was the second text in a pair of thematically related texts. A total of five items from the set were presented to the students. As with Sea Simulator, it required viewing a short video text and then answering a multiple choice question containing four options by clicking one radio button adjacent to their selection. A key word in the item stem was underlined.

Expected pathway – Colin Wilson
Read direction 1
Locate and click play button on video control
View video
Read direction 2
Read all MC options
Click on button next to selected option

Interactions

Seven of the 11 students who attempted this item followed the expected pathway.

Of those who did not, one stopped reading the multiple choice options when she found the answer she wanted.

Another worked across the options as she viewed the video. She read the question first then played sections of video before going back to make her selection.

A third student read directions 1 and 2 first and identified the underlined text as the key part of the question. It was this detail ('take the plunge') that he listened for when viewing the video.

Another student did not watch the entire video. While he was viewing the video, it inexplicably stopped after the spoken text 'I decided to take the plunge and do an apprenticeship'. This occurred just after the student had adjusted the volume downwards then moved the cursor off the video play area. He was able to rationalise this apparent technical hitch:

- *It makes sense to stop video at this place because that was what the question was about.*

In two cases, the screen appeared to freeze upon opening the item. One student was able to get the video to play by refreshing the screen. The interviewer intervened to restore the page for the other.

Two students replayed the video, both to re-watch the relevant part to confirm their answers.

Interviewers observed three students were using an elimination strategy when selecting their response from the four options. Two students articulated why they had chosen their particular answer. One explained his response by drawing on information in the video:

- *He was doing something and decided to change. Some risk deciding what he wanted to do. Something he hadn't really done.*

Another used his own knowledge to connect the words 'take the plunge' to 'risk taking'.

Interactions with video controls

All students automatically knew how to play the video. Most students interacted in some way with the other video controls and most knew how to pause. One student commented that to improve the item, a pause button should be included. She didn't appear to understand that pause and play were activated by the same button.

All but two students interacted with the full screen mode icon. Some opened then closed full screen mode by toggling the icon, and others used the 'close full screen' dialogue box. However, only one student watched the entire video in full screen mode. All other students who interacted with the full screen mode icon returned to item view mode as they saw that the video did not enlarge to full screen size. Students commented that:

- *it is pointless having full screen as it doesn't get any bigger.*
- *the screen should get bigger if the full screen button is clicked.*

The varying visibility of the video controls did not appear to affect students' interactions. In item view mode, the video controls appeared when the cursor was resting on the video panel. When the cursor was moved off the panel, the controls disappeared. In full screen mode during video play time, the controls were not visible regardless of the cursor position; they appeared only when video had finished.

Four students used the volume slider to adjust the volume downwards (the video opened with the volume set to maximum). One student commented that the video was overly loud. Two were concerned that using video with volume would be annoying and confusing to a whole class:

- *I'm not sure how this would go in a class? Would the teacher show the video, or would the students have headphones?*
- *Could be a problem in class, if everyone had it on at the same time ...*

Confidence and Engagement

Interviewers noted that all but one student had high confidence levels that their answers were likely to be correct. The one who expressed reservation said he was:

- *about 2.5 out of 3 – I used information in the video.*

Students were reported as having moderate to high levels of engagement. Two students commented positively that the question format was new and different.

Another two thought the video quality was suboptimal and offered a critique:

- *the video is too long. Looks a bit like an advertisement, like trying to encourage people to do an apprenticeship.*
- *the video could have been made better ... The background sounds were distracting ... Didn't need to repeat the whole sentence in the direction.*

Summary of findings

- Students in both Years 7 and 9 were engaged and motivated when interacting with the video prompt TE type.

- Students in both Years operated the multiple choice TE easily.
- Year 9 students were more likely than Year 7 students to use the video controls.
- Underlined text can assist students to focus on the item requirements.
- Year 7 students who are unfamiliar with content or have lower reading skills have lower confidence levels.
- Students in Year 9 expressed reservations about using audio-visual texts during a testing situation.

4.10 Drop down menu

4.10.1 Year 9 PM 19 Mystery Story

The final item presented to Year 9 students was Mystery Story. Three students completed this item. They were asked to supply four missing words to a brief story by selecting an option in a drop down box with the label 'select'. Students needed to click on the drop down arrow to reveal the three options (shaded in light blue when the mouse was hovered) and click on one to select their choice. The label 'Select' displayed twice, appearing as a label as well as an option. The drop down boxes were positioned within the story.

Expected pathway – Mystery Story
Read direction
Read text (implicit instruction)
Click on drop down arrow of first box
Click on selection
Repeat if time permits for next 3 drop downs

Interactions

The three students who completed the item did so with ease. They managed the drop down boxes automatically, and completed the sentences as instructed. They did not read through the text first; rather, they completed each question as their reading of the story progressed.

One student noted 'best' was bolded, and that this would be important. She was able to clearly talk through her selections in relation to the text and text type as she made them. Another explained her choice as she made her selection, commenting that her selected words added 'some suspense' and 'created tension'.

Two students selected 'crept, peered, pounding, leaped' for the four questions, in that order, and one selected 'crept, stared, pounding, leaped'.

Confidence and engagement

All students had high confidence that their choices were correct. One noted:

- *It was easy. You are told the options and you just have to read them and see what sounds better.*

Interviewers recorded two students with high engagement and general demeanour levels. One was recorded with moderate levels.

Summary of findings

- Year 9 students found drop down menu TE types easy to use.
- Bolding of important words in the stem can assist students to focus on the item requirements.

4.11 Pop-up text

Three items utilise the TE type of pop-up text, with each item containing at least one other TE type to give purpose to students' interactions with the pop-up text content. The other TEs involve multiple choice item types (click to select of one of four options) and a constructed response item (typed response in a text box).

The pop-up text was the first in a pair of thematically-related texts to which a total of five items were presented. Three of these utilise the pop-up text and are discussed here. The other two (PM 24 and PM 25) are discussed elsewhere: in the Drag and drop – text box TE type and Video prompt TE type.

4.11.1 Year 9 PM 20 Dickens

The first item, Dickens, was the first of the five items related to the pair of thematically-linked texts and required students to access a text by clicking on a link button labeled 'Passage', then answer two multiple choice questions by clicking on a radio button next to a selection. The pop-up text displayed as overlapping the directions and items. It could not be resized but could be moved by clicking on the black title bar and dragging it within the question pane.

Expected pathway – Dickens
Read direction
Click on button link to passage
Read passage
Close passage to read items
Read all MC options – Item 1
Click on item 1 selection
Read all MC options – Item 2
Click on item 2 selection

Interactions

All students in the Year 9 sample were interviewed on this question and all were able to click on the link to the passage (although one probably did not initially see the link), use the scroll bar to move the text up and down, and close the text box by clicking in the square in the top right hand corner of the text window. The usual convention of a cross or X in this square was not present in this item but this was of no consequence to this group of students.

Not all students used their mouse to mark their place or to track text as they were reading. Five were noted by interviewers as doing so.

The ability to highlight text with the mouse was of benefit to some students. One student highlighted paragraphs as she read, commenting that the highlighting made the text easier to read.

Of the twelve interviewed students, seven followed the expected pathway. Of those who did not, one opened the passage before reading the directions. Two read directions 1 and 2 together, then read the multiple choice questions before opening the passage. This was a deliberate strategy so that they could adjust their reading to the information necessary to answer the questions.

Two other students did not read the directions initially and went straight to the multiple choice questions. One skim-read direction 1 then moved to the first multiple choice question but quickly realised she had to read the passage. The other either did not see, or chose to ignore, direction 1 and

the pop-up link. She began the item by reading the stem and the options of the first multiple choice item. She became confused and re-read the stem, saying,

- *I don't understand what it wants me to do.*

She was then prompted by the interviewer to go to direction 1 and was able to complete item. This student, in other items commented on the quality of the highlighting, and the interviewer queried with her if she had vision problems. It may have been that the directions and link to the pop-up text were not prominent enough for this student to see.

Three students moved the passage to another area of the screen. However, one student, on discovering that the text wouldn't move out of the way of the questions, closed it so she could read the questions. Another commented that:

- *You can't move it very far*

And manipulated its position so he could see question as best as he could. A third tried to shift the passage over to reveal the questions, but finding this wasn't possible, he continued with his reading.

All but one student opened and closed the pop-up text multiple times to find information. Two students referred back to the text after they had completed the items to confirm their selections.

One student commented on the stem word, 'best', presumably because it was bolded. She said,

- *best is important so ...*

Half the students who attempted this item remarked that having the text and the questions visible simultaneously would have improved the item. The following were typical comments:

- *Have text in one half and questions in the other half.*
- *Separate text and questions. Text covers up question. They're not side by side.*
- *You need to keep going back to the text. Put passage with questions.*
- *I would have preferred text to be visible rather than as a pop-up box.*
- *Change the size of the passage and allow it to go off the part of the screen that contains the questions.*

One student took nearly nine minutes to answer the two questions as he was continually opening and closing the text to try to link the question to the text.

However, other students commented that:

- *It is easy to scroll down to access the passage.*
- *It's better on computer – you just click on the button to get the passage. I can also read better on screen.*

Confidence and engagement

Most students were recorded as having a moderate level of confidence that their answers were correct. One said she was highly confident because:

- *I read the question then went back to passage. The answers are in the passage.*

Three students had low confidence that their answers were correct. One said this was because:

- *I couldn't read the text and had to close it all the time and I kinda forgot what was in between.*

Students were reported as showing moderate and high engagement with the item.

4.11.2 Year 9 PM 21 Dickens Part A and B

The Dickens Parts A and B was the second of the five items related to the pair of thematically linked texts. It required students to select a multiple choice option then highlight information that supported this selection in the text positioned below the question. The text was a repeated section of the pop-up text located in the previous item, PM 20.

The text contained six sentences and students could highlight (by clicking) all of these. Each sentence turned light blue when the mouse was hovered over it. A click on the blue shading caused the sentence to be selected and it turned dark yellow. A second click deselected the option. Only one paragraph could be highlighted as a second click deselected the paragraph. An error message appeared if multiple paragraphs were selected.

Expected pathway – Dickens Parts A and B
Read Part A item stem
Read all MC options
Click on option in Part A
Read Part B item stem
Select sentence to highlight in Part B
Clicks on chosen sentence

Interactions

All students interviewed (12) attempted this item and all used the expected pathway to interact with the question.

Despite the relevant text for Part B being positioned below the text, seven of the 12 students returned to PM 20 Dickens to open the pop-up text to find information that would help them answer Part A. They did this by easily using the PM item bar above the item. It was clear to these students that use of the text in PM 20 would assist them to answer question, and their strategy was to check the text. One of these students, after having gone back to PM 20, said she didn't realise there was a Part B, and said she could have just looked at the part of the text in Part B to answer Part A.

Students who did not navigate to PM 20 relied on their memory of the text when making their selection for Part A. Three of these students completed Part A then went to Part B, upon which they understood the relationship between the two parts. Two students did not understand the relationship between Parts A and B.

One student who did not go back to PM 20 thought about going back to the text, but decided she couldn't:

- *I can't really do that ... I don't know ...*

When selecting her answer for Part A, this student initially clicked option D, then moved to the text below (Part B), hovered her mouse over each sentence to bring up the blue highlight. She changed her Part A answer to option C, then went back to the text. When she came to the second sentence in the second paragraph ('... that I never ran away and went for a soldier or a sailor. '), she word-matched this with option D and changed her answer again to reflect this.

Another was initially uncertain about what the item required. After making her selection for Part A, and scrolling down to Part B, she said:

- *I'm not sure what B wants me to do*

She then commenced analysing the options in Part A in conjunction with the text in Part B, working across both parts of the question. Upon completion, she comments:

- *I didn't really understand at first and then I had to change my answer.*

Students identified early that the blue highlights in Part B were possible answers that could be clicked to select. They also easily navigated away from the error message that appeared when two sentences were highlighted in Part B. However, one student commented on the blue highlighted text:

- *Blue is really hard to see.*

Two students commented on the layout of the item. One suggested that the passage excerpt should be placed first in the item. Another said more instruction about the location of the text would be appropriate.

Confidence and engagement

Two students were recorded as having low confidence their answers were correct. Others were recorded evenly across moderate and high.

All students were recorded as having either moderate or high engagement, with most recorded as high.

4.11.3 Year 9 PM 26 Colin Wilson/Dickens

The item, PM 26 Colin Wilson/Dickens, was the final of the five related to the pair of thematically-linked texts. It required them to complete a constructed response question then answer a multiple choice question. Students could refer to the video or pop-up text already viewed in previous items. As with item PM 20, the pop-up text displayed over the item. The text box was identical to that described in the Drop down menus and text box entry section.

Expected pathway – Colin Wilson/Dickens
Read direction 1
Click play button to view video
Place cursor in text box and use keyboard
Read direction 2
Read all MC options
Click on button matching selection

Interactions

None of the 11 students interviewed had problems operating the TEs for this item.

Six of the 11 students were observed using the expected pathway.

All but one student replayed the video text: some to pick up pieces of information they wanted to use: four to replay the whole video (this was particularly useful to the student for whom the video stopped unexpectedly in PM 24 as he could listen to the text and review his responses to PM 25). Interestingly, although one student realised the video would be the same as in previous items, she was unsure whether she could watch it again. She did decide to watch part of it.

Most students used the video control slider to either move through the video faster, or to locate specific information for their answer. This is in contrast to observations of Year 7 students on the

Video prompt TE. On finding relevant sections of video, some paused to type part or all of their answer. Several students multitasked, typing as the video was playing.

One student navigated to the full screen mode icon almost instantly, saying as he did so:

- *hope it gets bigger.*

When it did not, he went back to the item view mode.

Five students re-opened the pop-up text, mostly to confirm that it was the same text from previous items. They did not re-read the text in full; rather they skimmed and scanned to, as one student put it:

- *quickly check Pip's story.*

The availability and positioning of the pop-up text caused problems. Students said:

- *The passage pop-up that covered everything was inconvenient.*
- *Show whole passage.*
- *Have the passage available.*
- *Have passage already there so you don't have to open it – it would make things easier to navigate.*

Students' typing competency varied. Most believed it was possible to produce written responses more quickly on the computer. One thought a handwritten response would be faster to produce.

One student was noted re-reading and editing her work after she had finished writing, but most corrected spelling errors as they went, usually by backspacing to the point of error but also by inserting the mouse cursor, then retyping. One student used the home button instead of backspacing and the interviewer observed that this was time consuming.

One student was noted using the bold/unbold formatting button.

Confidence and engagement

There was a roughly even division of students who were recorded as showing either moderate or high confidence that their answers were correct. Only one student was seen as being less confident.

As with PM 24, all students were recorded as having either moderate or high engagement, with most recorded as having high engagement. One interviewer noted that the Year 9 students she interviewed tended to have somewhat flat and unchanging demeanours but this did not impact on their pleasant manners and compliance with completing their interview.

Summary of findings

- Directions and link to the pop-up text may not have been prominent enough for at least one reader.
- The colour of the highlighting (light blue) may hinder some students' reading of the text.
- In PM 20 and 26, interactions with the pop-up text, and the way its position on the screen overlaps the questions, caused difficulties for some students as moving to and from the text interfered with tracking and retention of information.
- The layout and arrangement of item PM 21 was problematic, specifically in how it determined the relationship between Part A and Part B. It was not immediately obvious, and probably counterintuitive to most students, that the text in Part B related to the question preceding it (Part A).

- Some students did not, or were hesitant to, return to the text displayed in previous items. (Clear instructions that this is permissible may be necessary.)
- Year 9 students, like Years 5 and 7 students, make corrections to their spelling as they proceed with their typing.
- There appeared to be a progression from Year 7 to Year 9 in students' use of the video controls: Year 9 students used the controls more than Year 7 students.

5. FURTHER FINDINGS

5.1 Student Reading Techniques

Interviewers were asked to observe and note the way the students approached reading text on screen. A number of questions were also developed to probe students' own thoughts on their experiences when reading on screen and on paper.

Interviewers observed that students overwhelmingly read text from left to right and top to bottom with very little skimming and scanning.

Those students who were able to read, overwhelmingly read the Reading texts in their entirety. Some read by paragraph, stopping and summarising each paragraph as they proceeded through the text. In the majority of cases, students used information from the text to arrive at their answers.

Students appeared to enjoy reading most texts. Those which seemed to be the most appealing were Owl flight, Kevin Coombs, Galileo, Sticky Notes, the Colin Wilson/Dickens set, and Animal Emotions.

Some students who were interviewed were of low reading ability. The Reading texts and items in this Research Activity were not suited to these students and consequently they had difficulty when attempting to respond.

Students overwhelmingly commented that they read in the same way whether on screen or on paper. Some noted differences such as tracking text with a mouse rather than a finger or highlighter, and scrolling rather than turning a page. Some thought they read faster on a computer; others faster on paper.

These findings may have implications for understandings of ICT literacy skills. It would appear from this Research Activity that students' reading techniques on screen are little different to those on paper. It may have been that this was because this Research Activity was related to on screen testing and students' experience of this to date has been with relatively static on screen items. However, students' lack of interactions with computer tools such as the scroll and zoom would seem to indicate otherwise. Students appeared to approach the computer screen as a fixed, linear space rather than one that has the capacity for multidirectional extension and stretch. This was particularly the case for younger students but was not restricted to that group and may be related to development of more conceptual and abstract thought.

5.2 Item Authenticity

To obtain a gauge of construct relevance of the test items, students were asked to comment about the similarity of the items they were presented with in the Research Activity to those they were asked to complete at school or for homework. Students' comments overwhelmingly indicate that the items were similar to tasks undertaken in the classroom.

Students in Year 3 were able to comment that at least some of the items were similar to those that they do in class or at home.

Similarly, students in Year 5 thought the items were similar to work they completed in other situations. Worksheets, NAPLAN tests, reading tasks were offered by students as similar tasks. One commented:

- *we're given text and we need to find the answers.*

Most Year 7s volunteered an opinion. They thought the items were like real reading tasks, or tests done on computers. Comprehension and highlighting text were tasks that were mentioned.

All Year 9 students who were asked volunteered that the items were similar to class work. They said:

- *Look at things in an indepth way and these are similar.*
- *Like reading passages and answering questions.*
- *Similar to NAPLAN tests.*
- *Reading and comparing and changing words.*

6. CONCLUSIONS

The information on cognitive and behavioural interactions with TE Reading items from the small sample of students in this Research Activity does not permit generalisations to the population. However, what the findings do show is that within this small sample there was a wide variety of knowledge, skills and experience, as well as many different approaches, brought by students to the items. It can be deduced from the findings that **at least** the variety of interactions and behaviours witnessed within this sample is likely to be found in areas of the wider population.

Interviewers found in the course of talking to students and making observations of their interactions that there was uneven computer experience, knowledge, and skills within and across cohorts.

A major finding of this Research Activity is the way that computer knowledge, skills and experience, Reading ability, and confidence interact with one another.

An intuitive finding was that students with little knowledge of and experience with computers were not able to carry out the computer operations necessary for completing items to the same degree that students who had a higher level of knowledge and experience with computers were able to. However, students with lower reading abilities were at an additional disadvantage as they were often unable to read instructions about how to operate the computer functions, an example of an interaction between reading ability and computer skills.

It was unclear to what extent low levels of computer literacy were the sole contributor to the difficulty some students had in completing items. It was not possible to disentangle interactions between low levels of computer literacy, low reading ability and lack of confidence to determine whether these low levels of computer literacy do, in and of themselves, affected students' performance.

There was a marked difference between cohorts, with students in Year 3 and 5 having fewer computer skills than students in Years 7 and 9. There was also a wide range of skills within Year groups, particularly at Year 3, where some students had little computer literacy. A difference was also observed within Year 9, where some students did not use particular functions available to them.

However, students with lower knowledge of and experience with computers but who had higher reading abilities were often able to work out how to use the computer operation to answer the question.

Conversely, students who had higher levels of computer literacy and more computer experience used the TEs and computer tools to demonstrate a variety of self-chosen reading processes and strategies to help them investigate, evaluate and problem-solve the question and information in texts. They used the interactive features of the computer interface to, for example, position text, use the mouse to track text, use highlighting to assist them to answer the item and change answers. These interactions were evidence of high levels of cognitive engagement. However, it was not possible to disentangle interactions between higher levels of computer literacy, higher reading ability and confidence to determine whether higher levels of computer literacy (and/or more experience), in and of themselves, do affect performance and the extent to which higher levels of computer literacy provide an additional advantage.

6.1 General conclusions

Engagement

- On the whole, students enjoyed the experience and engaged with the test items.
 - Students across all Year groups were highly motivated to interact with the TEs.
 - Some students, particularly Years 7 and 9 students, showed high levels of cognitive engagement when using the TE and computer tools as a problem-solving tool. When they did not know how the TE interacted with item content, they enjoyed the experience of using the TE and other computer tools to work it out.
 - Students' enjoyment and engagement increased when they found the content of texts informative and interesting.
- Disengagement was brought on by fatigue, confusion about what to do, inability to access text and inability to use computer tools. For some students, including Year 9 students, the presentation of longer texts also caused disengagement.
- Fatigue was brought about by decoding difficult words, intense concentration, reading aloud and thinking aloud.

Confidence

- The interaction of confidence and use of the TE was uneven for students with few computer skills and low reading abilities.
 - More confident students with few computer skills and low reading abilities tended to interact with the TE and felt they had accomplished something, regardless of whether they had read the instructions, question or text.
 - Some students with low confidence, few computer skills and low reading abilities who were unable to access the text or item directions had raised confidence levels when they made computer interactions such as a click to raise a highlight or select an answer.
 - Students with very low confidence levels did not attempt to make interactions and therefore did not have increased confidence.
- Students with higher computer skills who were able to access the text and item directions had increased confidence when they answered a question, even if they had guessed their answer.
- Older students' facility with the computer did not compensate for inability to access more difficult texts and questions. When older students had trouble understanding a text, they disengaged and lost confidence, despite being able to use the TE. Unlike the younger more confident students, the use of a TE or computer tool in itself does not increase confidence.
- Fatigue in older students impacted on confidence.

Reading

- There appeared to be little change between students' reading techniques on screen compared to on paper. Interviewers observed that students overwhelmingly read text from left to right and top to bottom with very little skimming and scanning. Students tended to read texts from beginning to end and to read texts in their entirety.

Interactions with item directions

- Some items had convoluted directions relating to the item intent and to the operation of the TE.

- Unclear directions relating to the item intent and/or operation of the TE added an extra cognitive load and artificially increased the difficulty level of the question.
- In some cases, lack of clarity of directions interacted with students' ability to proceed with an item.
- Items that contained two directions were in many cases problematic for students. In some cases, students unintentionally omitted questions.
 - For some students, it was apparent that they had the expectation of only one instruction per question.
 - Students who don't easily retain information may 'forget' there is a second part.
 - Some students missed the second part of an instruction in items in which it was written close to the first part.
 - In items with directions above and below the text or question, i.e. where the full item is not visible on the screen, students tended to answer the first part without 'seeing' the second part.
- In some items, the directions did not make it clear to students that they could return to previous items to view reading texts.

Transitions between TE types

- In a small number of cases, transitioning from one TE type to another across items may have been the cause of some confusion, particularly with younger students. There was evidence of some students attempting to use a TE that they had used in the previous item, where it was not available in the current item.
- The same TE type across consecutive items was observed to assist students, particularly weaker students.

Interaction with the TE types and computer interface

- All students in all Year groups were proficient with at least some computer TE types. They could:
 - click on the mouse or mouse pad;
 - operate the dropdown menu TE; and
 - operate the drag and drop – text box TE.
- Students overwhelmingly preferred to use the computer over pen and paper for assessment.
 - It was easier and quicker for them to answer on computer.
 - The computer was more interactive, had more things happening and kept up interest.
- Familiarity with a TE type gave students more time to focus on the substantive item requirements.
 - Some students who were familiar with a particular TE used it to assist their understanding (work out) the item's intent.
- Students overwhelmingly regarded having the reading text and item readily available as essential.
 - Text that overlapped all or part of an item interfered with students' capacity to complete items.
 - The requirement to return to a previous item to view text was a distraction and students were reluctant to do this, either to review answers or to access a text. Some students did not think they were allowed to return to a question.
 - There seemed to be some interaction between students' willingness and their ability to arrange screen elements (pop-up text).

- There was almost no evidence of students using the zoom function.
- Most students could scroll, although not all did. Younger students tended not to.
- There was some evidence in Year 9 of students having less control of the drag and drop text boxes than they would have liked, particularly when there was a large hot spot zone.
- The use of the mouse and of highlights to track text while reading was of use to some students to assist understanding as they read.
- Students liked the way the TE could assist in providing work that is clear and clean. Some anticipated how a response could be misread by a marker when written by hand. Providing a response that afforded no ambiguity to markers was important, and the ability to change an answer neatly and cleanly was seen as a benefit to computer testing.
- Interviewers thought that test items that require students to use the sorts of TEs and computer tools required by the items used in these interviews were not suitable for Year 3 students and for a significant majority of Year 5 students.

Highlighting

- The multiple purposes of highlighting and the various colours of highlighting were confusing for some students in all Year groups. Whilst students could select text for highlighting, they often could not distinguish between the different meanings of highlights.
 - Blue shading on drop down boxes did not appear to assist a Year 3 student of low ability
 - Weaker Year 5 readers were confused by different types of highlights.
- The colour of text highlights mattered to some children.
 - For at least one student, the pale blue highlight was problematic.
 - Pink had connotations of the item being wrong for another.
- There is the possibility that highlight colours may give unintended positive feedback to students.
- When hotspots for drag and drop TE items and possible options in Select text TEs are highlighted, some students (particularly younger ones) thought all the interactions were correct.
- On some screens, the colours appeared differently, e.g. pink/brown/orange and were identified as such by students and interviewers.

Fine motor and muscle strength of the hand

- Years 3 and 5 students could not always hold dragged text over the area they where wanted to drop it and they found holding down a mouse button for the length of time required to drag and drop a text box was difficult.

Screen display

- The size of the screen determined how much of an item is displayed on screen; this in turn impacts on students' expectations of item requirements, particularly younger students who have less experience with computers.
- To see an entire item, in most cases students needed to scroll or zoom. Many did not and they did not see the whole question before reading a text. This led to inefficient test-taking practices, such as:
 - re-reading a whole text more purposefully, once they had seen the question; and
 - omission of parts of a question.

6.2 Year group conclusions

Year 3

- Many Year 3 students could operate:
 - select object TE;
 - select text TE;
 - drop down menu TE;
 - drag and drop – text box TE; and
 - highlight text (a small amount, e.g. one word, using click and drag the cursor).
- Many Year 3 students had difficulty operating:
 - drag and drop – text TE.
- Many Year 3 students appeared not to know how to:
 - use an audio control bar;
 - use the scroll bar to access all of an item (they tended to view the screen area a fixed space);
 - click on two objects to form a connecting line (they usually tried to drag and drop one box onto another, or draw a line); or
 - change text in a text box.
- The cognitive demand of working out a TE strategy interfered with the cognitive demand of working out the substantive requirements of the question.
- The inability to hold recently-read information over a long text interacted with students' ability to remember item directions.

Year 5

- Year 5 students could proficiently operate:
 - drag and drop – text box TE;
 - drag and drop – text TE;
 - select text TE;
 - drop down menu TE; and
 - the keyboard to type a text box entry, paying particular attention to the correction of spelling errors.
- Some Year 5 readers were confused by the function of some highlights.

Year 7

- Year 7 students could proficiently operate:
 - select text TE;
 - drop down menu TE;.
 - drag and drop – text box TE; and
 - the keyboard to type a text box entry, paying particular attention to the correction of spelling errors.
- Many Year 7 students appeared not to know how to click on two objects to form a connecting line (they usually tried to drag and drop one box onto another, or draw a line).
- Year 7 students did not appear to use video controls as much as Year 9 students and very few students used the full screen mode.

Year 9

- Year 9 students could proficiently operate all TEs presented to them.
- Most Year 9 students used video controls more than Year 7 students; however, very few used the full screen mode.
- Some Year 9 students found the pop-up text boxes interfered with their completion of items.
- Difficult item content and long reading texts tended to interact with students' success in completion of the items.

6.3 Further conclusions

- Items with innovative TEs may not be immune from formulaic test preparation practices. In this Research Activity, this conclusion is related to the item intention of classifying information in a table (two columns) using the drag and drop – text boxes TE. Some older students appeared to ‘second guess’ the item requirements by their desire to put equal numbers of boxes in each column. It may be that this is the trade off for providing advice guidelines for preparation (see Recommendations).
- The suitability of audio and/or audio/visual texts in an online test video maybe problematic in a classroom assessment situation without individual headphones, student knowledge of how to operate them, and robust test administration practices.

7. RECOMMENDATIONS

Recommendation 1: To enhance equitable access to test items, it is recommended that only those technical enhancements that all students, including the weakest, are likely to be able to operate are used in the online assessments.

This Research Activity has found that across and within Year groups, there was uneven computer knowledge, skills and experience among students which impacted on their ability to complete test items. While lower confidence and weaker reading ability also contributed to the unwillingness of some students to attempt items, students with less familiarity with computers had less success fulfilling item requirements than those who had greater familiarity. Physical factors, such as hand muscle strength and fine motor control, and sometimes vision issues, also impacted on students' access to items.

For equitable access to NAPLAN online assessments, a list of computer skills and knowledge that students across Years 3 to 9 require has been compiled from the evidence collected during the research.

Although students used laptops loaded with Windows operating systems exclusively in the Research activity, schools across Australia use a variety of device types. This list takes into account this variety.

- Screen knowledge and ways to read around the screen to locate screen elements rather than focusing on the content in the centre of the screen.
- Awareness of and experience in the NAPLAN test environment, including screen real estate, device to be used.
- Knowledge of how to use the scroll and zoom, and other navigation tools, where they are incorporated into an item, and the circumstances in which they should be used.
- Knowledge of keyboard layout, including the functions of the enter key.
- Ability to click, hover and drag the cursor, either by mouse or by finger.
- Efficient use of the mouse, touch pad or finger in order to highlight text by dragging the cursor over it, so selecting, highlighting, and drag and drop can be carried out.
- Knowledge of icons such as hyperlinks and video play buttons that may be incorporated into items, and the ability to use them when needed.

The following chart shows the computer knowledge and skills suitable for students in each Year level, based on findings in the Research Activity. The skills are organised by increasing difficulty and are cumulative across the Year groups.

For each Year level, the chart shows those technical enhancements that were operated easily by all students in the Research Activity and that could be used in the initial online testing (under 'Initial skills'). Those enhancements that could be phased in as online testing becomes more established and students gain more computer exposure are also shown (under 'Phase in skills').

Year	Initial skills	Phase in skills
3	Select an object (one click)	Drag and drop text (larger pieces of text over longer distances across the screen; large hot spot zone; bright coloured and colour-coded highlights)
3	Drop down menu (two clicks)	Draw connecting lines
3	Drag and drop text box (large object over a short distance)	Make corrections in text box
3	Highlight short pieces of text (one word) by dragging cursor over text	Audio prompt (classroom headphone management would be required) and use of video controls
5	Text box entry	Use of basic formatting buttons
5	Select text (smaller or larger amounts) by hovering cursor to highlight options and making one click	Drag and drop text (smaller pieces of text over longer distances across the screen; large hot spot zone; bright coloured and colour-coded highlights)
7	Drag and drop text boxes into undefined areas	Use of video prompt
7	Connecting two objects	Use of a drawing tool – to highlight text (key words)
9	Access pop-up text – click on hyperlink to locate information; close text	Reposition screen elements, e.g. by clicking and dragging pop-up text to another part of the screen

Recommendation 2: That information is provided to schools on the computer skills and knowledge that students will need to access the online assessments.

A checklist of the essential computer skills should be provided by Year level to schools. This should contain details of all elements of the interface and TE that students will be required to interact with, including those that may appear to be basic, e.g. the various functionalities of clicking or touching elements, the meaning and functionality of the words in error boxes (e.g. cancel, ok), how to zoom and scroll, closing a pop-box, and the meanings of different highlights.

This is particularly important for Year 3 students and new arrivals to Australia who may have had little or no schooling.

Information should take into account the range of devices that students might use in the online assessment.

Research to investigate the types of devices that students may use in the initial and future rounds of testing may be required to anticipate new technology and schools' preferences when purchasing technology.

Recommendation 3: That identical or similar technical enhancement types be arranged together in a test paper to support students with lower computer literacy.

While test developers' should be free to use the most appropriate and authentic technical enhancement type for items, grouping types, where possible, may help to support those students who have little knowledge of and experience with computers to build strategies that will assist them to make more efficient interactions with subsequent questions. This may overcome problems associated with transitioning between different types.

Recommendation 4: That question directions are written in a clear, concise and standardised manner.

To provide clarity in item intent as well as a way for students to easily judge what technical enhancement is to be used, directions should be written in clear, concise and standardised language.

Recommendation 5: That computer drawing tools to assist students to track text as they read, highlight or underline key words be considered for the future.

The incorporation of a drawing tool that highlights, circles or underlines text may be beneficial to many students and would draw on the flexibility of computers to take into account different Reading processes and strategies and preferred ways of interacting with text.

Recommendation 6: That highlighting on test items be standardised within Year groups.

Consistency of the colour and purpose of highlighting and shading of text, and the borders of active objects and hot spots, should be standardised to avoid confusion amongst students. Explanations on how they operate and their purpose should be drawn up for schools' information.

Investigation of the effects of highlighting and shading colours may assist to determine optimal colours, as well as any unintended positive or negative feedback that students may receive during the assessment.

Recommendation 7: That item layouts and types are investigated for potential to artificially raise item difficulty.

Item formats should be investigated for features that might artificially raise the level of difficulty. Based on this Research Activity, two step questions, items with unclear directions, lack of an error box where more than one selection is required, and unsuitable technical enhancements such as drag and drop text for Year 3 students are such items.

Recommendation 8: That interactions between levels of computer literacy, reading ability and confidence be investigated further.

In order to determine whether levels of computer literacy have an added effect on Reading performance, over and above student reading ability and confidence levels, further investigations into the interactions between computer literacy, reading ability and confidence may be useful. Such research may give information on the validity of the test for some groups of students.

8. APPENDICES

APPENDIX 1

Project Overview, as attachment to this document (APPENDIX 1_Overview of Project.docx)

APPENDIX 2

Detailed interview information, as attachment to this document (APPENDIX 2_Summary of Interviews.xlsx)

APPENDIX 3

APPENDIX 3a_Cognitive Interview Questionnaire.docx

APPENDIX 3b_General notes for interviewers.docx

APPENDIX 3c_Cognitive Interview Administration Guide.docx

APPENDIX 3d_Interviewer's Instructions.docx

APPENDIX 4

APPENDIX 4a_Protocols_Generic information.docx

APPENDIX 4b_Protocols_Y3.docx

APPENDIX 4c_Protocols_Y5.docx

APPENDIX 4d_Protocols_Y7.docx

APPENDIX 4e_Protocols_Y9.docx

APPENDIX 5

Interview item images copied as screen shots from item developer websites, as attachment to this document (APPENDIX 5_ Screenshots of Items.docx).