Inking Your Thinking
Case studies in innovation with Microsoft Surface
The use of Microsoft’s 2-in-1 Surface device in schools has the potential to promote new learning for students and the use of innovative pedagogies by teachers.

With the introduction of the first-generation Surface devices in October 2012, enhanced and dynamic ways of learning in our schools became possible. These included the ability to interact via a pressure-sensitive Surface Pen (stylus), and the use of touch or keyboard interactions with digital texts, images and videos, as well as the ability for students to share ideas and collaborate on investigations in real time using Office 365 software on the devices.

While sometimes referred to as a ‘tablet’, Microsoft Surface is in fact a "2-in-1" device – a hybrid of a computer and a portable device. It is unique in the current market with its capacity to function independently as a tablet that can also be magnetically "docked" to a full-size keyboard, allowing it to function as a regular Windows laptop. This enables it to run full versions of software, while still accessing Windows apps and touch screen, as well as the additional advantage of Surface Pen.

The use of a stylus for interacting with digital content has been the subject of research in recent years. A leader in the field, Sharon Oviatt (2013) summarised her findings:

“Over the last decade, our studies and those of others have repeatedly shown that when students solved science and maths problems, performance improved significantly when they used a stylus interface rather than a keyboard”

(Oviatt, 2013, p.4)

The “Inking Your Thinking” project was conducted in 2014, in partnership with the Victorian Department of Education and Training (DET), Victoria University and Microsoft. This study took place in three Victorian government schools where students in Kindergarten, Year 2 and Years 7 and 8 were provided with access to Surface devices.

Each setting was unique in its educational setting, socio-demographics and in the number of devices to which students had access.
Introduction

New technologies are evolving at an ever-increasing rate. Most recently, the introduction of Microsoft Surface created a new category – the “2-in-1” device – that incorporate the benefits of both tablet and laptop technologies. As such it affords new opportunities and contexts for learning with new technologies in schools.

This report presents case studies of classrooms using Microsoft’s Surface and Asus VivoTab Note 8 devices as part of their curriculum program. The project was part of a long-standing partnership between Microsoft and the Department of Education and Training (DET) in Victoria.

The case studies in this report were designed to explore the potential of the new technology and document the innovative ways in which Surface could be integrated in classroom across four levels of schooling. The questions underpinning this research were:

1. How can Microsoft Surface, a 2-in-1 device, be integrated into Kindergarten, Primary and Secondary school settings in order to maximise learning in the 21st century?
2. In what ways does a 2-in-1 device that has a stylus – like the Surface Pen – impact on learning scenarios in educational contexts?
3. Do teachers and students think that learning with 2-in-1 devices, such as Surface, impacts on the quality of their learning and the ways in which they are able to represent their learning?

Using Surface in classrooms provided contexts for deep learning and the application of 21st century skills in a variety of ways. The case studies illustrate the ways students are engaging in being creative, using critical thinking skills, collaborating and communicating their ideas to an audience. These essential elements of 21st century schooling are enacted in the context of curriculum frameworks, which support knowledge creation as well as the exploration of existing knowledge.

The findings from the research indicated that:

- The Surface Pen was a key point of difference with existing devices and students found the desktop easy to navigate with a stylus, thus enabling them to create more thoughtful work.
- Students adapted quickly to using Surface, were actively engaged in their learning and valued the device.
- Teachers used Surface as a resource to plan and introduce learning activities focusing on both creative and skill building, knowledge acquisition learning activities.
- The versatility of Surface supported a variety of new learning experiences for students across year levels.
- Students demonstrated responsible behaviour and then beyond the classroom.
- Early years literacy skills were enhanced by maximising the multimodal nature of Surface. Students wrote, drew and discussed their learning (Sheppard, 2011).
- The built-in camera and microphone enabled students to take photographs and make videos to explain their ideas, clarify their thinking and extend their vocabulary.
- Using the built-in camera and software like OneNote enabled teachers to annotate and collate artefacts that captured evidence of students’ learning.
- By producing eBooks, students created content and enhanced their understanding of their learning (Hattie, 2009). The Surface Pen appeared significant in expanding these learning choices.

Furthermore, the eduSTAR software image can be used in ways that other 2-in-1 devices cannot at this point. DET provides schools with eduSTAR, 80 pieces of educational software including the Microsoft Office Suite and software for video, image and music creation, thinking skills, literacy, mathematics and science.

Unique features of Surface that promoted new learning in this project included:

- Mobility, portability and versatility of a tablet with the power of a laptop.
- Device and laptop use was made possible within a single 2-in-1 device.
- Surface’s digital pressure-sensitive stylus (pen) assisted in note-taking.
- Windows operating system familiar to students in the school system.
- Ability to run apps and programs such as Microsoft Office and the Adobe suite.
- Ease of connecting to the school network for traditional files sharing and printing.
- Buttons on the Microsoft Surface Pen enhance functionality of use.
- USB ports and the ability to interact with peripheral hardware extended the potential of the device.
- Long battery life enabled usage for extended periods of time.

The project was part of a long-standing partnership between Microsoft and the Department of Education and Training (DET) in Victoria, with a total of 180 students across four Year levels: Kindergarten, Year Two, Year Seven and Year Eight.

It focuses on children’s learning across subject areas and learning 21st century skills using Microsoft’s Surface, specifically in context of the use of a digital stylus working in concert with a touchscreen and a keyboard.

While there are a variety of 2-in-1 devices available, Surface is unique in its design and incorporation of a stylus, Microsoft Surface Pen, on an advanced “touch” screen. Users can work in more detail on the screen with the Surface Pen, and enjoy the benefits of Windows.
Impact of Surface on learning

The future is not what older people think, but what younger people do.

(Nicholas Negroponte, 1990)

Living in the 21st century requires a regular recalibration of skills and knowledge as a result of innovations that seem to constantly appear in our lives (Yelland, 2007).

Technology enables and urges us to reconsider the ways in which we engage in everyday activities. There have been calls for a refocusing of curricula away from content to the acquisition of 21st century skills (Partnerships for the 21st century, 2008), which have been extended from the original four: creativity, critical thinking, collaborating and communicating (Trilling & Fadel, 2009) to include citizenship and character education (Fullan, 2012). Further, it is also recognised that fluency with new technologies will be an essential component of future employment across the range of opportunities (Cuban, 2001).

In her research, Oviatt (2011) recognised the impact of new technologies on the way that 21st century learners think and act. Oviatt proposes that the use of the stylus or pen interface, like that available with Surface, can be regarded as being more relevant for promoting thinking and adaptive learning than keyboards because they, “...provide a single focused input tool for expressing all representations (e.g. symbols, diagrams, numbers, language and shifting among them while working on a task)” (p.3).

This ability to use a stylus fluently on a screen has a distinct value for learning according to Professor Gordon Sanson, Director of e-Education Unit at Monash University, who claims that the value of a stylus-enabled computer for thinking is that it affords the integration of ‘high fidelity’ artefacts with the fluency of ‘low fidelity’ notations and annotation made with stylus (2009, Keynote presentation ATIEC).

The annotation on digital artefacts is also said to improve thinking and synthesis of ideas – both crucial skills not supported by non-stylus-enabled devices. This view resonates with the Microsoft pen value proposition that using Surface with a Surface pen and keyboard, which can be used with apps as well as more sophisticated software packages running on Windows, has far greater potential as a device for learning than devices without this combination of affordances.

Additionally, Oviatt (2011) contended that both the pen and multimodal interfaces support human-computer interactions more effectively than graphical interfaces.

Oviatt (2011) continued by stating that, “multimodal, pen and conversational interfaces are all capable of stimulating high levels of communicative activity, which is compatible with engagement in exploratory learning and constructivist views of learning” (p.3). If learning is about belonging and engagement (Yelland, 2007) this is an important statement because, when considered with multimodal learning experiences facilitated by new technologies, 2-in-1 devices like Surface seem to have the potential to be very powerful for learning.

New technologies facilitate exploration of ideas, creativity and the application of knowledge in new and dynamic ways. They connect students with authentic audiences, which previously they could not access. And they facilitate the use of 21st skills that will support students long after they leave school.

The case studies in this report were designed to explore the potential of the new technology and document the innovative ways in which Surface could be integrated in classroom across four levels of schooling.

The questions underpinning this research were:

1. How can Microsoft Surface’s 2-in-1 technology be integrated into Kindergarten, Primary and Secondary school settings in order to maximise new learning for the 21st century?

2. In what ways does a 2-in-1 device that has a stylus (Surface Pen), affect learning scenarios in educational contexts?

3. Do teachers and students think that learning with 2-in-1 devices, such as Surface, affect the quality of their learning and the ways in which they are able to represent their learning?

This report consists of case studies conducted in three Victorian schools in four different year levels (Kindergarten, 4-year-olds; Year 2, 7-year-olds; Years 7/8, 13-14 years). The teachers and students were supported by DET and Microsoft, with the provision of Microsoft’s Surface devices and professional learning opportunities. The data was collected in observation days spent in the classrooms and in discussion with school personnel.

Each case study consists of learning scenarios that exemplify subject focus and the 21st century skills of creativity, critical thinking, collaborations and communication in the context of new learning and becoming global citizens.

In practice the skills are not encountered in isolation but are interrelated and complement each other. However, in our findings we organise, present and discuss them under these headings, as well as highlighting the connections and relationships between the skills as we observed them occurring.

The findings presented in this report reveal the enthusiasm of the teachers for the use of new technologies in their classroom, and the support of the Principals who provide the essential positive leadership to encourage changes in practice.

It is apparent that the use of Surface encouraged the acquisition and use of 21st century skills in a range of engaging learning activities.
Two kindergarten classes consisting of 60 children participated in the case study, with seven Surface devices available to them. The children revealed high levels of engagement with ideas, skills and knowledge while using the devices in a play-based curriculum. The learning environments created contexts in which they could encounter, use and practise 21st century skills and build their capacity in literacy and numeracy in multimodal formats. Once these skills are established they can be built on as the children progress through the schooling system.

Findings

Originally the school was provided with Asus VivoTab Note 8 devices but the teachers observed that due to the size of some of the students’ fingers and their fine motor skills it was preferable to provide the students with Microsoft Surface devices. As explained by one teacher:

“Many students are struggling with control over the size of the working screen space (referring to the Asus device). Developmentally most early years students are still working in large motor format and use large sweeping motions rather than fine motor. Furthermore children at this age tend to anchor a piece of paper, or in this case the device, with their opposite hand. This means that for some children part of the screen is obscured.”

(Teacher A)

Surface devices provided an opportunity for teachers to investigate whether the larger screen size and easier-to-access buttons would support learning for younger students still developing their fine motor skills. The seven Surface devices were originally placed on a table in the Kindergarten rooms, just like any other activity planned by the teachers (e.g. collage, drawing, threading). However, after a while, one of the teachers thought that it would be more effective to incorporate them into the program by having them integrated into the various planned activities. So, for example, a Surface was added to a ‘Post Office’ play area as part of the props (Figure 1), while another might be used at the ‘learning about numbers’ play table. Additionally, the devices could be taken outside into the playground where the camera was often used.

The teachers were initially concerned about Surface devices being dropped or getting dirty or wet if they were used in the playground. However, they came to realise the durability of the device, and the learning benefits that accrued as a result of using it outside to document play and to facilitate environmental investigations.
Creativity

The opportunity to create art electronically gave the children the chance to play with different media for drawing and encounter multimodal representations.

The students enjoyed using the Surface Pen for creating electronic artwork, including drawing figures (Figure 2) with their fingers directly on the screen.

The children enjoyed creating abstract pieces with all the features (stamps, magic paintbrushes) that they could find in the apps.

The students discussed their art together explaining why they preferred one drawing to another, or highlighting the differences between the two formats. These are valuable early literacy moments that give children the opportunity to build their vocabulary, and become more confident in articulating their ideas orally when asked to explain what they have drawn using the different materials and tools.

Multimodality was also a feature of portrait drawing (Figure 3). The children observed their faces in a mirror and then drew themselves both in pencil and in Tux Paint, part of the eduSTAR suite of software provided on the device.

The children also used Microsoft Surface devices to take photos of themselves and each other while they were playing, usually outside (Figure 4).

One of the teachers noted: “... they were outside in the play area and they had Surface outside and they were actually photographing each other at play. And then I was fascinated because I was watching the kids and it was so interchangeable! They were using their fingers for the big sweeping motions that they needed and then picking up the stylus for the intricate aspects of what they were doing. So they were just interchanging. The seamless interchange between finger and stylus, finger, stylus.”

(Teacher B)

Using Kids Story Builder App students were able to create digital stories by choosing photos, adding text and audio to tell their story.

This was an exciting development and one that the teachers showed interest in pursuing since it related to the children, not only being creative in terms of photography, but also giving them opportunities to become autonomous in deciding what they recorded as being of interest to them, and having a permanent record of this that could be shared with parents and reflected upon at any time.

Critical thinking

Two of the most popular apps (Appendix 1) on Surface were a memory game, Animals Memory 2 and the School Writing App (free to all Australian schools) that helped students practise drawing numerals and letters (Figure 5).

The use of the stylus was vital in this activity since it enabled the children to form the numerals and letters accurately. It allowed students to develop dexterity with Surface Pen that would not have been possible if they had drawn the figures with their fingers.

The active digitised “Smart screen” with palm rejection was also beneficial for the students to practise their pencil grip with Surface Pen as they were able to rest their hand on the screen to write.

The use of apps and programs focused on skill building with young children has been shown to be valuable in terms of providing them with the opportunity to use skills in an enjoyable context (Yelland & Gilbert, 2013, 2014). It also encourages and facilitates critical thinking about scenes and using literacy and numeracy skills as students are encountering them in an engaging modality.
Using the camera also afforded the opportunity to introduce early mathematical language like the positional and relations terms (Yelland, Diezmann & Butler, 2014) so important for early numeracy activities. For example, when the children were in the playground they might be located on top of the ladder or digging in the sandpit or sitting on a block (Figure 6). Surface Pen can then be used to highlight aspects on the photo and record the corresponding language.

The class was also involved in watching chickens and plants grow. Although it is not specifically designed for use in the preschool years, this can be aligned with the Science curriculum outcomes because it provides a context for thinking about living things in our environment.

The teachers also indicated that they used Surface to support questioning and reflections when they were discussing a topic in group time. “We’ve used them in a couple of group times. So if we’re talking about a subject, instead of getting a laptop out we’ll just go on the internet so that they can see something. Like we were talking about circus tents and they wanted to know what a real circus tent looked like, so we looked up what it was on Surface. The teachers could use the Surface Pen to highlight key information identifying and discussing characteristics.” (Teacher A)

**Summary**

The kindergarten classes at Dallas Brooks are on the first step of their school journey. The school has a vision to “… have a cohort of students who are responsible global citizens, able to make decisions based on how that decision affects more than just the local context.” (Teacher B).

Having Surface devices as a resource for their learning has encouraged the students to encounter and use 21st century skills in contexts that are engaging and linked to their lived experiences. One teacher said that she “… noticed different strengths come out of the children when they’re using Surfaces.”

Engagement is an integral part of deep learning. The examples of this group of young children revealed their high levels of engagement with ideas. It also provided contexts in which they could encounter, use and practise 21st century skills and build their capacity in literacy and numeracy in multimodal formats that can be built on as they progress through the schooling system.

Feedback from the teachers also indicated that they used Surface to support questioning and reflections when they were discussing a topic in group time. “We’ve used them in a couple of group times. So if we’re talking about a subject, instead of getting a laptop out we’ll just go on the internet so that they can see something. Like we were talking about circus tents and they wanted to know what a real circus tent looked like, so we looked up what it was on Surface. The teachers could use the Surface Pen to highlight key information identifying and discussing characteristics.” (Teacher A)
The Inking your Thinking study involved 77 Year 2 children working in a new flexible learning space. Fifteen Surface devices were shared across three Year 2 classrooms – five in each classroom. Their portability meant that teachers and students could easily access them for use in small group rotations and collaboration.

Surface devices were used to support investigative approaches to learning in collaborative contexts characterised by whole class, small group and individual activities with shared outcomes and strategies for both peers and teachers. Incorporating Surface devices afforded opportunities to extend their proficiency in literacy and numeracy skills.

The topic of 'Living Things' was explored during the case study observation period. Students were excited by and thrived on challenges, using Surface devices with skill and ingenuity.

The following examples illustrate the ways in which the teachers designed learning experiences to encourage the development of 21st century skills.

**Creativity**

The creative examples provided here are located in story making (narrative) and art. The Year 2 children created eBooks by hand drawing illustrations (some used an App called Fresh Paint), adding photographs and graphics sourced on the internet. In their investigation of 'Living Things', the students examined life cycles and, based on the information they collected, designed and produced the eBooks in small groups of up to four children. The children decided which apps they wanted to use and what to say, and then worked together to summarise what they had learnt about life cycles (Figure 8). The range and scope of the books was exciting, as were the different approaches to the final products. The experiences provided the children with the opportunity to reflect on different modalities and select the one that they thought was most appropriate to tell their story. In terms of becoming digitally literate the use of Surfaces enabled them to create texts that were both linguistic and oral in content and also to mix the two elements in dynamic ways that would not have been possible without the technologies. The design process engaged them in the creative process, along with negotiating in small group contexts about what information was to be included and the format and presentation of the books.

**Critical thinking**

The Year 2 teachers worked collaboratively to foster the acquisition of literacy and numeracy skills in the context of authentic activity. This involved investigative explorations that encouraged both creativity and critical thinking.

There was an interesting mix of using Surface devices and manipulatives, so that the children could document their thinking for later discussion and reflection on the concept. This was only possible because the device was mobile, easy to use and thinking could be annotated readily. The two following examples highlight how it worked effectively.

In the first example the children were studying push and pull factors and were required to predict how far a toy vehicle could travel when pushed. They used the video on the device to record their estimates in their small group and then found out who was the closest.

In the second instance the children were studying arrays as an introductory activity in the concept of multiplication (Figure 9). They made various arrays and took photos of them. They then imported their photos into Explain Everything and recorded their thinking – bringing it to the surface and saving it for further discussion at a later date when it could be linked to new learning.

**Horsham West Primary School**

**Year 2 (7 years of age)**

The Horsham West Campus is located on the Western hinterland of Horsham in Victoria. It caters for 585 students with an extensive program.

Specialist facilities include a gym, music room and art room. More recently, the school also constructed a new building that has purpose-built classrooms for Years 2 and 3.

In addition to the Inking Your Thinking case study project the school has been part of the Microsoft Partners in Learning initiative that aims to build 21st century learning capabilities for students who use new technologies.
The use of Surface enabled the students to engage in “inking your thinking”. Surface Pen was the primary way students articulated and recorded their deliberations, investigations and findings.

The results of this work were learning outcomes that not only reflected what they had learnt but also how they had achieved it. Reflecting on the use of a stylus to interact with digital texts, Sanson (2009) argues that a computer is a tool for thinking and a stylus supports students to externalise that thinking through drawn annotations and visual processing. This was evident for the students at Horsham West and Haven Primary School.

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Collaboration

The teachers used whole class, small group and individual approaches to learning. Surface devices supported teaching and learning in each of these contexts. By Year 2 the children were used to collaborating on tasks and the examples provided thus far indicate that they completed these with a high level of success.

The teachers valued building collaborative skills with the children: “the collaborative work on Surface has been good for lots of reasons... they’ve had to learn to share and take turns. On top of that they’ve actually improved. They’ve had to learn to take on roles within a group. I’ve sort of appointed a captain who then made sure that everybody got a turn, so there have been responsibilities that have come out of it as well. (I said to the captain), you’re responsible for making sure that everybody in the group gets a turn and they’re quite happy to do that.” (Teacher C)

The graph was not only an example of the use of numbers in a relevant context but it also provided a context in which the children could use the operations to figure out the solution to addition problems; e.g. “There are 26 people in our class including our teacher!” and also the difference between numbers; e.g. “12 people recycle bottles and cans, two recycle water – so that means 10 more people recycle bottles and cans.”

Communication

All three Year 2 teachers valued the acquisition of foundational literacy and numeracy skills and encouraged an investigative approach to concepts and topics. As part of this process, time was always made to share information and findings with the whole class and also at the lower primary assemblies (Years Prep to 3). The children could do this via the interactive whiteboard and projector, and also directly from Surface for smaller groups. Sharing and communicating findings in these contexts provided valuable opportunities to learn about skills and processes from peers and teachers, and extend their knowledge base with additional information that had been explored by students individually or in groups. This was summarised by Teacher D:

“We’ve been using Explain Everything... where the kids have been able to draw on their screen and articulate their thinking verbally, by recording their voice in the program as well... it’s clear that as a class... so that’s been an interesting exercise.” (Teacher C)

The things we recycle the most

Summary

“The kids love Surface Pen and being able to write on the screen. That’s been valuable.”

(Teacher A)

The examples provided here illustrate the ways in which the use of Surface devices in this Year 2 classroom has afforded the opportunity for the children to gain proficiency in literacy and numeracy in applied contexts and supported an investigative approach to learning.

The learning activities shown illustrate the ways in which the teachers have designed learning experiences to encourage the use of 21st century skills. They have done this in collaborative contexts characterised by whole class, small group and individual activities and shared outcomes and strategies with both peers and teachers.

The learning experiences have engaged the children in multimodal learning that incorporate visual, oral, kinaesthetic and aural approaches and thus are much richer than if they were simply done with pen and paper.

Teachers reported that the stylus facilitated a wider range of learning activities for their students and that functionality has impacted on their lesson planning.

This is 21st century learning at its most effective.
Hawkesdale P-12 College
Years 7 and 8 (11 and 12 years of age)

Hawkesdale P-12 College is a small, rural school of 240 students. The school is small enough to foster a strong sense of community and create contexts for positive teacher-student relationships, and large enough to offer an extensive range of curriculum opportunities for students from Prep to Year 12.

As a result it has consistently achieved results that allow their graduating students access to a wide-ranging set of opportunities in life.

The school aims to develop a strong sense of community values that incorporate fair play, having a go, getting along with others, tolerance and being responsible.

Every student is a valued member of the cohesive school community of students, families and staff.

Forty-four Surface devices were provided to Hawkesdale P-12 College. These were distributed to 23 students in Year 7 and 20 in Year 8 students to create a 1-to-1 learning program. Twelve teachers also had access to Surface devices for their own teaching, assessment and planning purposes. Both students and teachers took the devices home, including Surface Pen and wedge Bluetooth mouse, to encourage ownership and exploration.

The school has developed opportunities for its students to meet and communicate with students of similar ages in Asia (e.g., Malaysia, Taiwan). This is an important part of the program. The Information and Communications Technology (ICT) teacher is a passionate advocate of the injection of technology into the classroom and rural and global education. She said, “...we’re culturally and geographically isolated... I try and link the students with the world so they learn beyond the text book.”

The examples provided in this report illustrate the ways in which Surface supported 21st century skills, particularly in Mathematics, Science, Art, Chinese and Humanities.

Findings
This research was facilitated by the 1-to-1 learning model in which each student had a personal Surface device. The students indicated that they thought this was fantastic because the device was light to carry and it enabled them to work wherever and whenever they needed to, while also being able to use it for out-of-school activities as well. Further, students were able to log on to DET’s eduSTAR standard operating system to access specific software, as directed by their teachers, and to search for information to incorporate into projects, as well as submit assessments in the school’s learning management system.

Teachers highlighted the use of Surface Pen as an extremely useful tool in supporting students to record their ideas and thoughts at home and at school.

When students were using Surface Pen, it was observed that some consistently preferred to use them to navigate the screen, rather than use their finger on the touch pad.

Teachers commented that several of these students appear to be highly visual in their learning approaches and that the more ‘creative’ students showed great skill, detail and precision in using the Surface Pen to annotate texts, create diagrams and images.

Creativity
Surface enabled Year 7 and 8 students to experiment and create art electronically and compare it with the more traditional materials they had been using. This gave them choices in how they represented their ideas, and independence in making selections about which modality to use in a specific context.

One of the early concepts they learnt about in Year 7 was colour. Figure 12 illustrates two examples of how this was considered and represented electronically and with traditional paper materials, to demonstrate the potential of each modality.

One student was interested in Manga (Japanese comics in a range of genres for both children and adults) and spent a lot of her time in and out of class drawing and creating designs (Figure 13). She had created examples with Fresh Paint on her Surface and with traditional materials (pencils) in her Art folio. She indicated that she did not have a preference for either modality but could see the potential of the electronic format for her Manga-inspired illustrations because “...it means I can constantly add and go back to change my work more easily.”

This would not have been possible without the use of the Surface Pen. Surface Pen has a smart, fine nib that is pressure sensitive so it can emulate real-world experiences with pens but also go beyond their capabilities so that the student can extend their range of media for creating artistic works.

This meant that students could doodle and draw with the same ease as they could with traditional materials with the added capacity to extend their ideas in the technological modality using all the affordances unique to that mode.

**Critical thinking**
Multimodal representations were also evident in Year 7 Science in another example of studying the topic of living things – cells. (Figure 14A and B)

Two apps (Sketch Touch and Explain Everything) allowed students to annotate images with arrows, shapes, and text to explain their thinking on a concept. Having Surface Pen facilitated this process since it was much easier to locate and create the text in the restricted spaces that imported maps and photographs imposed on the learner.
Using Surface Pen in these contexts created opportunities to discuss and annotate visual stimuli in new and dynamic ways that were not possible before this combination of technology. The apps encouraged the Year 7 and 8 students to reveal their thinking in a tangible way and share it with their teachers and peers. As with the Year 2 children, those in Years 7 and 8 were able to articulate mathematical and scientific ideas and record their thoughts easily for later discussions. In some instances having Surface Pen facilitated this process considerably as they were able to label items easily and clearly while moving around various learning locations (Figure 15).

Surface Pen was identified by students as being significant in enhancing their learning experiences. When students were working to understand complex symbolic algorithms in mathematics or chemical notations in science, the Surface Pen provided a beneficial way to write, draw, undo and redo their work and to reflect on their understanding.

In another lesson the students used Explain Everything to discuss and present the ways in which they figured out what 20% off $2 meant for customers in the $2 shop which was closing down in Warrnambool and whether it was better to have $20 off or 20% off specific items at an Airport shop.

The Year 7 mathematics teacher stated: “Surface Pen is an advantage, especially in Mathematics. Explain Everything is a really good App for Mathematics because they can record little videos with them talking... being able to write with the Surface Pen is especially good for fractions which are really hard to do on a netbook because you have to type them all in. So Mathematics is definitely more easily achieved on the touch device.”

(Teacher E)

In Year 8 Mathematics the class incorporated the use of Surface into their work on Transformations and for Cartesian Coordinates and Algebra (Figure 16). Surface Pen enabled students to plot the points easily and participate in a fun game (Battleships) to learn about coordinates in an engaging way.

The students were also beginning to explore the potential of specific apps and programs designed to complement secondary Mathematics teaching, such as Graphmatica, Motion Maths, Dragon Box (Algebra) and Geoboard, which they used for work in transformations when learning about reflection, rotation and translation (Figure 17).

In Chinese, while the focus was on the acquisition and use of oral language, there were opportunities to use Surface for written work and playing Chinese-English learning games. The teacher cited the example of Scattergames, which enabled the students to hear words and select the appropriate Chinese character that denoted it.

The teacher planned the lessons so that the students were engaged in a series of smaller activities, as he found this facilitated student learning and kept them engaged. Thus, having a range of activities, including those on Surface was very useful for him.

The teacher used Nearpod for assessment and indicated that he felt it was good example of formative assessment tasks. He highlighted how it provided him with vital statistics about the ways in which his students were performing in the different aspects of the language, so that he was clear about where he needed to focus specific attention for skill building in his teaching.

He was keen to explore the aspect of Nearpod that would enable him to incorporate video vignettes into this type of assessment as he thought it would allow the students to watch a short scene and then provide a short synopsis of what was occurring.

Nearpod can be accessed via Windows App Store and web browser. The App also integrates with Office 365 documents and other file types, which this teacher identified as a key benefit of using Surface in the classroom as it linked existing practice and resources to the new device and related pedagogies.

In the Humanities (History and Geography) having personal Surface devices was a particular asset, since the students were able to spontaneously look up various maps and information, make charts, and create spreadsheets to represent their findings, including annotations and to record videos to share their work in class time.
Collaboration and Communication

In the Year 7 and 8 classes, the students were used to working both individually and collaboratively, and the teachers indicated that they planned learning activities so that their experiences were varied. The examples cited above in creative and critical thinking illustrate the nature of the collaborations and the ways in which the students communicated their findings when the tasks were completed.

The ICT teacher at Hawkesdale had initiated partnerships with Asian schools and some schools within the state. In one Skype session, a group of Year 7 students had to guess which state. In one Skype session, a group of Year 7 students had to guess which state they had for breakfast that day, and this groups of students shared the food that they were talking to came from by asking a series of questions (Figure 18).

Collaborating online with another state school was demonstrated in an activity called ‘Friendship across the state’, where the teachers’ aim was to “successfully collaborate on and interest in documents, in pairs, with students from a school on the other side of Victoria.”

The participants were the two teachers, with 10 Year 7 ICT students at Hawkesdale and 10 Year 6 students and their teacher from Boneo Primary School. The teachers paired up students from each school and created and shared a document online.

A web conference was held via the Department’s Virtual Conference Centre so the students could be introduced to each other. The Primary School teacher shared photographs from each school, showed their locations and the distance between them. She also defined friendship, considered its meaning and identified books on the topic. These acted as catalysts for discussion and gave the students an opportunity to focus their interactions.

After the initial introductions between the students on the interactive whiteboard, the Hawkesdale students were invited to create their own documents in OneNote on their Surface and to share it with the Boneo students.

Each pair of students then wrote their thoughts regarding friendship. The collaborative functionality of Office 365 enabled students to document, annotate and share their thinking in a tangible way. The screen size of Surface also provided a larger screen that made detailed annotations clearer to read and comprehend.

The teachers indicated that they thought the students were very enthusiastic and engaged with this activity. They noted that the students started to improve the design and clarity of their collaborative documents as they proceeded and some pairs used the audio facility to create a multimodal document.

The teachers also said that the students’ reflections on the learning process were valuable to their planning of the next phase and they had generated ideas for extending the interactions with focused questions and the inclusion of photographs and additional audio stimulus possibilities.

Summary

The examples cited in this case study illustrate the ways in which Surface devices can support 21st century skills in Mathematics, Science, Art, Chinese and the Humanities, as well as for setting up Skype sessions with other schools.

They reveal that the use of Surface not only enriched student learning via the use of the technology but also enabled students to connect with ideas and other students at remote locations to set up communities of practice around themes and projects.

The unique nature of Surface meant that it was possible for the Year 7 and 8 students to personalise their work by logging on individually, as well as sharing their work with a broader audience.

According to teachers, student engagement levels were higher when using Surface than when using other digital or traditional resources.

Additionally, feedback from the teachers indicated that the quick start-up time, reliability and simple design of Surface devices were factors in fostering these higher engagement levels.

One teacher also pointed to the low level of breakages as indication of this engagement. The teacher felt that the students took great care of their Surface since it had become a valued resource to support their learning.

Figure 18: Year 7 Skype Session; ‘Friendship across the state’

“Surface pushed us into new learning directions, made us more accepting of risk-taking, and broadened our comfort zone. It inspired the older teachers, who are not as easily motivated and enthused as the younger ones in technology use, because of the opportunities it provides and the different learning styles that it caters for. It encouraged us to do further research. We can foresee great advantages in the mix of keyboard/screen entry, and the traditional freestyle that the Surface Pen can bring. There are so many more options for learning, creation, collaboration, connecting, communicating, and research.”

(Teacher F)
Conclusions

The data from this study provides a wide range of empirical examples to illustrate the ways in which Surface, an example of how 2-in-1 styles-enabled technology has the potential to provide contexts for deep learning and the acquisition and use of 21st century skills in a variety of ways.

For each year level studied, the learning scenarios illustrate the ways students are engaging in creative acts, critical thinking, collaborations and communicating their ideas to an audience.

These essential elements of 21st century schooling are enacted in the context of curriculum frameworks, which support knowledge creation and the exploration of existing knowledge that is interesting and useful.

The findings from the research indicated that:

- Surface Pen was a key point of indicated that:
  - The findings from the research provides a variety of new learning experiences for students across year levels.
  - Students demonstrated responsible behaviour using Surface both within and beyond the classroom.
  - Early years literacy skills were enhanced by maximising the multi-modal nature of Surface. Students wrote, drew and discussed their learning (Sheppard, 2011).
  - The built-in camera and microphone supported students to take photographs and make videos to explain their ideas, clarify their thinking and extend their vocabulary.
  - The built-in camera and software like One Note enabled teachers to annotate and collate artefacts that captured evidence of students’ learning.
  - Producing ePublications supported students to create content and enhance a range of skills including writing, spelling, reflection, audience awareness, collaboration and creativity.
  - Learning with Surface and the innovative and integrated use of specific applications helped students learn independently and express their ideas and thinking, reflect on their learning, make learning visible and present their understandings (Hattie, 2009). Surface Pen appeared significant in expanding these learning choices.
  - The examples presented here demonstrate how Surface enabled students to use apps and other programs for learning, while having the added benefit of Surface Pen, touch and keyboard inputs.
  - The new 2-in-1 devices, incorporating the use of a stylus, have been shown to optimise learning opportunities, enabling deeper thinking and problem solving (Oviatt, 2013).
  - The benefits of the stylus included completing artwork fluently and being able to annotate diagrams for deeper conceptual understandings.
  - Additionally, using the stylus to enable students to use the natural language and symbols associated with learning Mathematics was considered by the teacher as a major benefit of having a device such as Surface in the hands of learners.
  - The use of Surface in these sample schools highlights the significant role that this technology has in promoting new learning for students and innovative pedagogies by teachers.
  - The mobility and functionality of Surface means that it is easier to use to support a diverse range of students. This in turn affords contexts for deep learning; learning that encourages creativity, critical thinking, engagement with ideas and authentic audiences. In this way, the 2-in-1 Microsoft Surface supports 21st century learning in new and dynamic ways.

References


# Featured Apps, Programs and Online Services

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<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Link</th>
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<tbody>
<tr>
<td>Animals Memory 2</td>
<td>Classic card memory game with animal cards. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Chinese Learning Scatter Matching Games</td>
<td>Online games to match Chinese with English words for different categories including animals, food, colour, and numbers. <a href="http://www.softschools.com">www.softschools.com</a></td>
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<tr>
<td>DragonBox: Algebra</td>
<td>DragonBox Algebra 12+ is a must-have tool for students who wish to earn better grades and gain confidence in algebra and mathematics. It covers the same topics as the award-winning game DragonBox Algebra 5+, but moves on to cover more advanced topics in mathematics and algebra. It also includes practice tasks that allow students to practise specific types of algebraic operations. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<td>Explain Everything</td>
<td>Explain Everything is an easy-to-use design, screen-casting, and interactive whiteboard tool that lets you annotate, animate, narrate, import, and export almost anything to and from almost anywhere. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Fresh Paint</td>
<td>Fresh Paint is an easy-to-use app that includes oil, watercolours, pencils, and all the tools you need to create original masterpieces. Turn photos into beautiful paintings, choose a colouring page for your students, and even make a framed canvas print of your amazing creations. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Geoboard</td>
<td>A tool for exploring a variety of mathematical topics introduced in primary school. Learners stretch bands around pegs to form shapes. <a href="http://www.mathlearningcenter.org">www.mathlearningcenter.org</a></td>
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<td>Graphmatica</td>
<td>A powerful, easy-to-use, equation plotter with numerical and calculus features. <a href="http://www.graphmatica.com">www.graphmatica.com</a></td>
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<td>Kids Story Builder</td>
<td>Help young kids create their own personalised stories using real photos and voices. They’ll love using a webcam to get visuals, then let their imaginations run wild recording their interpretation of the photo with a microphone. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Microsoft Office</td>
<td>Office applications including: Word, Excel, PowerPoint, Outlook, OneNote, Lync. <a href="http://www.products.office.com">www.products.office.com</a></td>
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<td>Motion Math: Hungry Fish</td>
<td>Practise mental addition, subtraction and negatives with Motion Math: Hungry Fish, a learning game that’s fun for children and grownups. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<td>Nearpod</td>
<td>The Nearpod platform enables teachers to use their tablets to manage content on students’ devices. It combines presentation, collaboration, and real-time assessment tools in one integrated solution. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<td>Office 365</td>
<td>Empower students and teachers to succeed with the dynamic set of education tools included in Office 365 Education. Provide staff, faculty, and students with email, sites, online document editing and storage, IM, and web conferencing and familiar Office applications online and on PC, Mac, and mobile devices including Android, iPad and Windows tablets. <a href="http://www.products.office.com">www.products.office.com</a></td>
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<td>School Writing</td>
<td>Specifically designed by teachers, School Writing is one of the most popular education apps available today. School Writing helps students with their writing skills, and runs on all modern Windows devices, including tablets, touch laptops and PCs. It features approved education fonts including individual cursive letters. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Skitch Touch</td>
<td>Skitch Touch is a free tool for communicating visually with friends, co-workers, and the world. Annotate images with arrows, shapes, text, and more. Use Skitch to sketch something new, mark up maps, screen captures, or even a photo. <a href="http://www.apps.microsoft.com">www.apps.microsoft.com</a></td>
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<tr>
<td>Skype</td>
<td>There are amazing ways to use Skype in the classroom. For example, teachers can collaborate with other classes, no matter where they are, they can find guest speakers and invite them into the classroom or they can take a virtual field trip anywhere in the world – the possibilities are endless. <a href="http://www.skype.com">www.skype.com</a></td>
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<tr>
<td>Tux Paint</td>
<td>Graphics editing software designed for children as young as 3 years of age. The user interface is intuitive with icons, audible feedback and textual hints to help explain how it works. <a href="http://www.tuxpaint.org">www.tuxpaint.org</a></td>
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